

SECTION 333213A – PREPACKAGED WASTEWATER PUMP STATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 1 through 16 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. This section includes the furnishing and installation of raw sanitary wastewater pump station systems and wet wells as shown on the plan drawings and as described in this section.
- B. Pump station Manufacturer is to provide and Contractor is to install a complete, functional suction lift pump stations with complete pre-cast wet well to pump wastewater to other downstream manholes as shown on the plan drawings.
- C. Pump station Manufacturer is to provide and Contractor is to rehabilitate an existing submersible pump station to a complete, functional suction lift pump station with the existing wet well to pump wastewater to other downstream manholes as shown on the plan drawings.
- D. All material, equipment, products, incidentals and testing required and necessary to provide a complete and operational system. Install where noted on the drawings and as specified within these specifications.
- E. Coordinate all work with this equipment and any other associated equipment, installed and specified under other sections of these specifications.
- F. All work performed under this section shall be in accordance with all approved trade practices and Manufacturer's recommendations.
- ~~G.~~ The pump stations to be furnished in the Base Bid shall be a complete package, manufactured by Gorman-Rupp Company:-
- H. The contract drawings and specifications were prepared based on the named manufacturer in this item and the Contractor shall include in his Base Bid proposal, equipment by the specified manufacturer at the not to exceed pricing noted above.
- I. All work performed under this section shall be in accordance with all approved trade practices and Manufacturer's recommendations.

1.3 SUBMITTALS

- A. The Contractor shall submit manufacturer's technical data and application instruction in accordance with the General and Supplementary Conditions and Division 1 Specifications and any additional information listed herein.
- B. Product Data: Submit Manufacturer's technical data and application instructions.
- C. Shop drawings shall be presented to the Engineer for approval. Electronic submittal information is acceptable. All shop drawings shall clearly identify the specific equipment and material being supplied, the quantity being supplied, and all accessories, dimensions, descriptions, mounting and connection details, and any other information necessary to determine compliance with the plans and specifications. Shop drawings shall include plan and section layouts of the equipment, dimensions, clearances required, power requirements, and wiring diagrams.
- D. Sizes shown on Contract Drawings are typical. Individual Manufacturer's dimensions shall be as shown on the Contract Drawings. Any deviation from given dimensions may interfere with site characteristics. Manufacturer shall be responsible for providing Engineer with drawings showing proposed changes and/or equipment locations. Any additional engineering costs associated with these changes will be the sole responsibility of the Manufacturer with no additional cost to the Owner.
- E. Prior to or with the delivery of equipment, the Manufacturer shall provide copies of an operation and maintenance manual including storage, installation, startup, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O&M Manuals shall be in compliance with the General Requirements.
- F. O&M Manuals: Provide three (3) bound paper copies and one (1) digital electronic copy of operating and maintenance manuals containing copies of the approved shop drawings, operating and greasing instructions, and parts list.
- G. Operation Data: Provide description of system operation, adjusting and testing required.
- H. Maintenance Data: Provide system maintenance requirements, servicing cycles, lubrication requirements, and local sources for spare parts.

1.2 RESPONSIBILITY AND COORDINATION

- A. Under this Contract, the Contractor shall be responsible for the purchase, storage, and installation of all equipment required providing a complete operating facility. The Drawings and Specifications are intended to illustrate and define the equipment installation; however, the Contractor shall properly install, adjust, and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs which may result from unauthorized deviations from the Specifications.

1.3 WARRANTY

- A. The pump station manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.
 - 1. In addition to defects in material and workmanship, fiberglass reinforced polyester station enclosures (where applicable) are warranted for sixty (60) months to be resistant to rust, corrosion, corrosive soils, effects of airborne contamination or physical failures occurring in normal service for the period of the pump station warranty.
 - 2. All other equipment, apparatus, and parts furnished shall be warranted for sixty (60) months, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.
- B. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.
- C. It is not intended that the station manufacturer assume liability for consequential damages or contingent liabilities arising from failure of any vendor supplied product or part which fails to properly operate, however caused. Consequential damages resulting from defects in design or delays in delivery are also beyond the manufacturer's scope of liability.
- D. Equipment supplied by others and incorporated into a pump station or enclosure is not covered by this limited warranty. Any warranty applicable to equipment selected or supplied by others will be limited solely to the warranty, if any, provided by the manufacturer of the equipment.
- E. This limited warranty shall be valid only when installation is made and use and maintenance is performed in accordance with manufacturer recommendations. A start-up report completed by an authorized manufacturer's representative must be received by manufacturer within thirty (30) days of the initial date the unit is placed into service. The warranty shall become effective on the date of acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment from the factory, whichever occurs first.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Five (5) years demonstrated experience in providing packaged pump stations.
- B. The pumps and pump station manufacturer must be ISO 9001:2008 certified, with scope of registration including design control and service after sales activities.
- C. All equipment and materials shall be new and of the best quality.
- D. The term "pump manufacturer" or "pump station manufacturer" shall be defined as the entity which designs, machines, assembles, hydraulically tests and warranties the final product. Any entity that does not meet this definition will not be considered a "pump

manufacturer” or “pump station manufacturer” and is not an acceptable supplier. For quality control reasons and future pump and parts availability, all major castings of the pump shall be sourced and machined in North America.

- E. Upon request from the engineer, the pump station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.
- F. Manufacturer must show proof of original product design and testing. Products violating intellectual property regulations shall not be allowed, as they may violate international law and expose the user or engineer to unintended liabilities. “Reverse-engineered” products fabricated to substantially duplicate the design of original product shall not be allowed, as they may contain substantial differences in tolerances and material applications addressed in the original design, which may contribute to product failure.
- G. Contractor Qualifications. Contractor shall have experience installing prepackaged wastewater pump stations on at least ten (10) projects.

PART 2 - PRODUCTS

2.1 PRE-PACKAGED PUMP STATIONS

A. General

1. Contractor shall furnish and install one factory built above ground, automatic pump station. The station shall be complete with all equipment specified herein, factory assembled in a fiberglass reinforced polyester resin enclosure.
2. For each station, the principal items of equipment shall include a municipal wastewater pumping system furnished with self-priming centrifugal suction lift pumps supplied within a pre-engineered above ground station enclosure with integral concrete base. Discharge piping supplied includes check valves, three-way plug valves, a common header with discharge bypass connection for use with a portable pump and wet well recirculating piping with throttling valve. Also includes a pump control panel with full voltage NEMA rated starters, as well as independent primary and backup level control systems.

B. Construction

1. The station shall be constructed in one complete, factory-built assembly. It shall be sized to be placed over the new or existing wet well as detailed in the construction drawings.
2. The pump casings and discharge piping shall be mounted in relation to the station top slab as detailed in the construction drawings. All installed valves, piping and fittings shall be capable of passing a 3” diameter spherical solid. All pump components and station piping, including the suction pipe connections, shall be removable without having to enter the wet well. The suction and discharge connections, where they pass through the floor, shall be sealed by gaskets and will

transition through a recessed piping dam that will be filled with non-shrink grout after installation of the station.

3. Enclosures utilized to house the valve train and/or controls, which are defined under OSHA Article 29CFR, Parts 1910 as a Confined Space shall not be acceptable.

2.2 PUMPS AND MOTOR

A. Horizontal Self-Priming Centrifugal Pumps

1. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed further below.
2. Materials and Construction Features
 - a. Pump casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
 - b. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
 - c. Fill port cover plate, 3 1/2" diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, a clamp bar screw must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.
 - d. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.
 - e. Liquid volume and recirculation port design shall be consistent with performance criteria listed below.
3. Suction Head shall be Class 30 cast iron. Its design must incorporate following maintenance features:
4. The suction head will be secured to the pump casing by using hex head cap screws and lock washers. Access to the impeller and mechanical seal shall be accomplished by removing the suction head.
 - a. Removal of any blockages in the impeller shall be accomplished by removing the suction head, or through a cleanout cover on the suction head. In consideration of safety, two clamp bar screws must provide slow release of pressure on two clamp bars securing the cleanout cover. A Teflon gasket shall prevent adhesion of the cleanout cover to the suction head casing.
 - b. Removal of the suction check valve shall be accomplished through the removable cleanout cover on the suction head.
 - c. In consideration for safety, a pressure relief valve shall be supplied in the suction head. The relief valve shall open at 75-200 PSI.
 - d. A replaceable wear plate constructed of G-R hard iron (Brinell 400) shall be secured up against the pump casing by the suction head. Measurement of the clearance between this wear plate and impeller shall be accomplished through the cleanout cover plate. The wear plate shall be supplied with the Eradicator solids management feature.

5. Rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:
 - a. Seal plate shall be G-R hard iron (Brinell 400) and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.
 - b. The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
 - c. The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.
 - d. Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.
 - e. Impeller shall be G-R hard iron (Brinell 400), two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.
 - f. Impeller shaft shall be AISI 4140 alloy steel.
 - g. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.
 - h. Shaft seal shall be cartridge oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the seal plate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton; cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings.
 - i. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same cap screws as used for retaining rotating assembly.
 - j. Pressurized water seals will not be accepted for horizontal self-priming centrifugal pumps.
6. Adjustment of the impeller face clearance (distance between impeller and wear plate) shall be accomplished by external means.
 - a. Clearances shall be maintained by using external shims between the casing ring of the rotation assembly and the pump casing itself. Shims will be of various sizes to allow precise adjustment of this clearance. The clearance can be measured by removing the cleanout cover on the suction head.

- b. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.
7. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the cleanout cover on the suction head without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.
8. Removal of the rotating assembly will be accomplished through the front or the back of the pump casing.
9. Serviceability
 - a. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.
 - b. No special tools shall be required for replacement of any components within the pump.
10. Each pump shall have a v-belt drive system and a cast iron or steel frame with anchor bolts. The pump and driver shall be mounted on this common frame.
11. Each pump shall be provided with a safety guard around each pump drive shaft and v-belt drive system conforming to OSHA requirements.
12. Motors
 - a. Unless otherwise specified in the Equipment Schedule, each pump shall be provided with a horizontal squirrel cage induction type motor of sufficient power such that no point on the pump curve requires more than the nameplate horsepower of the motor furnished.
 - b. The motors shall be NEMA Design B, with Class F insulation for a 60 degree C maximum temperature rise above 40 degree C ambient, and a 1.15 service factor. The motor enclosure shall be of the total enclosed fan cooled type.
 - c. The motors shall be in conformance with the latest recommendations of IEEE and NEMA, including noise requirements.
 - d. Motors to be totally enclosed fan cooled (TEFC) and of premium efficiency.

B. The Pump Schedule is provided at end of this section.

2.3 VALVES AND PIPING

- A. Piping components to include the following:
1. Suction elbows (90 degree standard radius) supplied for each pump.
 2. Discharge check valves for each pump, with clean out ports.
 3. Three-way discharge plug valves with manual lever operator as required.
 4. Common header piping.
 5. Automatic Air Release Valves (AARV), one (1) for each pump with stainless steel fittings.
 6. Isolation ball valves (1" SST) supplied for each AARV.
 7. Pump drain kits with valves for each pump.
 8. Drain hose supplied (10 ft.) with mating camlock fitting, one for each station.
 9. Gauge kit:

- a. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.
- b. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

2.4 ELECTRICAL CONTROL COMPONENTS

- A. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.
- B. Panel Enclosure
 1. Electrical control equipment shall be mounted within a common NEMA 1 stainless steel, dead front type control enclosures. Doors shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on removable steel back panels secured to enclosure with collar studs.
 2. All control devices and instruments shall be secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount and component. All control devices shall be clearly labeled to indicate function.
- C. Control Panel UL Label Requirement
 1. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.
- D. Branch Components
 1. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. the lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.

2. Circuit Breakers and Operating Mechanisms
 - a. A properly sized heavy duty circuit breaker shall be furnished for each pump motor. The circuit breakers must be sealed by the manufacturer after calibration to prevent tampering.
 - b. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.
3. Motor Starters
 - a. An open frame, across-the-line, NEMA rated magnetic starter with under-voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "O", "OO", or fractional size are not acceptable. Power contacts to be double-break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.
4. Overload Relays
 - a. Overload relays shall be solid-state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one (1) normally open and one (1) normally closed isolated alarm/control contact to reset, thus re-establishing a control circuit. Trip setting shall be governed by solid-state circuitry and adjustable current setting. Trip classes shall be 10, 15 and 20. Additional features to include phase loss protection, selectable jam/stall protection and selectable ground fault protection.
 - b. A reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the door.
5. Three Phase Monitor
 - a. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, voltage unbalance, high voltage, and low voltage. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.
6. Transient Voltage Surge Suppressor

- a. The control panel shall be equipped with a modular surge arrestor to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall utilize thermally protected by heavy duty zinc-oxide varistors encapsulated in a non-conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. The suppressor shall have a short circuit current rating of 200,000 Amps and a Maximum Discharge current rating [I_{max}] of 40,000 Amperes. Nominal discharge current [I_n] is 20,000 Amperes. Surge arrester according to UL 1449 3rd Edition, Type 2 component assembly.
7. Voltage Alert Indication
 - a. The control panel shall include a voltage alert indicator to reduce the risk of electrical arc flash by pre-verifying the electrical isolation from outside of the control panel. Hardwired to the main incoming point of termination, the indicator shall be powered by the same voltage that it indicates utilizing redundant circuitry, thereby flashing whenever voltage is present. An eight detector display shall visually alert the presence of dangerous AC or DC potentials occurring between any combination of the monitored input lines.
 8. Pump Start Delay
 - a. The control circuit for pump #2 shall be equipped with a time delay to prevent simultaneous motor starts.
 9. Panel Heater
 - a. The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.
 10. Fault/Status monitoring signals wired to terminal blocks and includes:
 - a. High Water Alarm (Primary Level Control)
 - b. Low Water Alarm (Primary Level Control)
 - c. Pump Fault No. 1
 - d. Pump Fault No. 2
 - e. Pump Run No. 1
 - f. Pump Run No. 2
 - g. Low Station Enclosure Temperature
 - h. Three Phase Voltage Monitor Fault
 - i. Backup Float Switch Control System Activated
 - j. Wet Well Level Sensed By Analog Signal
 - k. Flow Meter Reading (analog) as applicable
 - l. Low Temperature Fault (Remote Hot Box)

E. Control Circuit

1. A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.

2. Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be oil-tight design with contacts rated NEMA A300 minimum.
3. Pump alternation shall be integral to the liquid level controller. Provisions for automatic alternation or manual selection shall also be integral to the liquid level controller.
4. Six digit elapsed time meter shall be shall be displayed on the Integrinex™ Standard operator interface to indicate total running time of each pump in "hours" and "tenths of hours". Pump runtime shall be adjustable and password protected.
5. A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected to the Integrinex™ Standard. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the Integrinex™ Standard to interrupt power to the motor. The Integrinex™ Standard will display an alarm banner indicating the motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.
6. The lift station shall be equipped with a 5 KVA step-down transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door. and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.
7. Two spare 20 amp circuit breakers shall be supplied.
8. Wiring
 - a. The pump station, as furnished by the manufacturer, shall be completely wired, except for power feed lines to the branch circuit breakers and final connections to remote alarm devices.
 - b. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).
 - c. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:
 - 1) Line and Load Circuits, AC or DC power.....Black
 - 2) AC Control Circuit Less Than Line Voltage.....Red
 - 3) DC Control Circuit.....Blue

- 4) Interlock Control Circuit, from External Source.....Yellow
- 5) Equipment Grounding Conductor.....Green
- 6) Current Carrying Ground.....White
- 7) Hot With Circuit Breaker Open.....Orange

- d. Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 volts. Power wiring to be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.
- e. Motor branch and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel. All wiring outside the panel shall be routed through conduit.
- f. Control wires connected to door mounted components must be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.

9. Conduit

- a. Factory installed conduit shall conform to following requirements:
 - 1) All conduit and fittings to be UL listed.
 - 2) Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
 - 3) Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electric Code.
 - 4) Conduit shall be sized according to the National Electric Code.

10. Grounding

- a. Station manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection.
- b. The contractor shall provide an earth driven ground connection to the pump station at the main grounding lug in accordance with the National Electric Code (NEC).

11. Equipment Marking

- a. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:

- 1) Equipment serial number
 - 2) Control panel short circuit rating
 - 3) Supply voltage, phase and frequency
 - 4) Current rating of the minimum main conductor
 - 5) Electrical wiring diagram number
 - 6) Motor horsepower and full load current
 - 7) Motor overload heater element
 - 8) Motor circuit breaker trip current rating
 - 9) Name and location of equipment manufacturer
- b. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.
- c. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

2.5 LIQUID LEVEL CONTROL

- A. The manufacturer of the liquid level control system must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.
- B. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.
- C. The level control system shall be capable of operating as either an air bubbler type level control system, submersible transducer type system, or ultrasonic transmitter type system.
- D. The level control system shall utilize alternation to select first one pump, then the second pump, then the third pump (if required), to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle, or in the event of excessive run time.
- E. The level control system shall utilize an electronic pressure switch which shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second and/or third pump (if required) when the liquid reaches the "lag pump start level", or "standby pump start level" so that all pumps are operating. These levels shall be adjustable as described below.
1. The electronic pressure switch shall include integral components to perform all pressure sensing, signal conditioning, EMI and RFI suppression, DC power supply and 120 volt outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below.

2. The electronic pressure switch shall be capable of operating on a supply voltage of 12-24Vdc in an ambient temperature range of -10 degrees C (14 degrees F) through 55 degrees C (131 degrees F). Ingress Protection of IP56 for indoor use with closed cell neoprene blend gasket material. Evaluated by Underwriters Laboratories for Pollution Degree 2 device for U.L. and cU.L. Control range shall be 0 to 33.3 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be non-volatile. A Battery backed real time clock shall be standard.
3. Eleven optically isolated, user defined digital inputs for pump and alarm status. Rated at 10mA at 24Vdc. Eight digital output relays (mechanical contacts), configurable for pump start/stop or alarms. Three relays rated at 12 Amp @ 28Vdc and 120Vac, five relays rated at 3 Amp @ 30Vdc and 120Vac. The electronic pressure switch shall consist of the following integral components: pressure sensor, display, electronic comparators, digital inputs and digital output relays.
 - a. The internal pressure sensor shall be a strain gauge transducer and shall receive an input pressure from the air bubbler system. The transducer shall convert the input to a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. The transducer range shall be 0-14.5 PSI, temperature compensated from -40 degrees C (-40 degrees F) through 85 degrees C (185 degrees F), with a repeat accuracy of (plus/minus) 2.5% full scale about a fixed temperature. Transducer overpressure rating shall be 3 times full scale.
 - b. The electronic pressure switch shall incorporate a digital back lighted LCD panel display which, upon operator selection, shall indicate liquid level in the wet well, and pump status indication for up to 3 pumps. The display shall include a 128 x 64 bit resolution LCD to read out directly in feet of water, accurate to within one-tenth foot (0.1 foot), with a full scale indication of not less than 12 feet. The display shall be easily convertible to indicate English or metric units.
 - c. Level adjustments shall be electronic comparator set-points to control the levels at which the lead, lag and standby pumps start and stop. Each of the level settings shall be easily adjustable with the use of membrane type switches, and accessible to the operator without opening any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.
 - d. Each digital input can be programmed as pump run, pump HOA, pump high temp, pump moisture/thermal, starter failure (FVNR, RVSS, VFD), and phase failure. Inputs are used for status and alarm indication.
 - e. Each output relay in the electronic pressure switch shall be hard contact mechanical style. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. Each output relay shall have an inductive load rating equivalent to one NEMA

size 3 contactor. A pilot relay shall be incorporated for loads greater than a size 3 contactor.

4. The electronic pressure switch shall be equipped with alarm banners with time and date history for displaying alarm input notification. Alarm history will retain a 16 of the most recent alarm events.
5. The electronic pressure switch shall be equipped with pump start/stop and alarm input delay(s) that have an adjustable delay set points.
6. An Antiseptic function with a built in timer shall be incorporated in the electronic pressure switch to prevent the well from becoming septic.
7. The electronic pressure switch shall be capable of jumping to next available pump if current pump is out of service due to pump failure or manual selection. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.
8. The electronic pressure switch shall be equipped with a simulator system capable of performing system cycle testing functions.
9. The electronic pressure switch shall be capable of calculating and displaying pump elapse run time. The elapse run time is resettable and adjustable.
10. The electronic pressure switch shall have internal capability of providing automatic simplex, duplex, and triplex alternation, manual selection of pump sequence operation, and alternation in the event of 1-24 hours of excessive run time.
11. The electronic pressure switch shall be equipped with a security access code to prevent accidental set-up changes and provide liquid level set-point lock-out. The supervisor access code is adjustable.
12. The electronic pressure switch shall be equipped with one (1) 0-33 ft. W.C. input, one (1) scalable analog input of either 0-5Vdc, or 4-20mA, and one (1) scalable analog output of either 0-5Vdc, 0-10Vdc or 4-20mA. Output is powered by 10-24Vdc supply. Load resistance for 4-20mA output shall be 100-1000 ohms.
13. The electronic pressure switch shall include a DC power supply to convert 120Vac control power to 12 or 24Vdc power. The power supply shall be 500 mA (6W) minimum and be UL listed Class II power limited power supply.
14. The electronic pressure switch shall be equipped with an electronic comparator and mechanical output relay to alert maintenance personnel to a high liquid level in the wet well. An alarm banner, visible on the front of the controller, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.

15. The electronic pressure switch shall be equipped with an electronic comparator and mechanical output relay to alert maintenance personnel to a low liquid level in the wet well. An alarm banner, visible on the front of the controller, shall indicate that a low wet well level exists. The alarm signal shall be maintained until the cause for the low wet well level has been corrected and the circuit has been manually reset. A low liquid level condition shall disable all pump motors. When the wet well rises above the low level point, all pump motors shall be automatically enabled. Low water alarm shall be furnished with a dry contact wired to terminal blocks.

16. Integrinex Standard Analog Output circuit will be furnished with transient voltage surge suppression to protect related equipment from induced voltage spike from lighting.

F. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be a membrane style button integral to the Integrinex Standard level controller.

G. Air Bubbler System

1. The level control system shall be the air bubbler type, containing air bubbler piping which extends into the wet well. A pressure sensor contained within the electronic pressure switch shall sense the air pressure in this piping to provide wet well level signals for the remainder of the level control system.

2. Two vibrating reed, industrial rated, air pumps shall be furnished to deliver free air at a rate of approximately 5 cubic feet per hour and a pressure not to exceed 7 psi. Liquid level control systems utilizing air compressors delivering greater quantities of air at higher pressures, requiring pressure reducing valves, air storage reservoirs, and other maintenance nuisance items will not be acceptable. A selector switch shall be furnished to provide manual alternation of the air pumps. The switch shall be connected in such a manner that either pump may be selected to operate continuously. The selector switch shall be oil-tight design with contacts rated NEMA A300 minimum.

3. An air bell constructed of PVC 3 inches in diameter shall be provided for installation at the outlet of the air bubbler line in the wet well. The air bell shall have a 3/8" NPT tapped fitting for connection to the bubbler line.

4. An air flow indicator gauge shall be provided and connected to the air bubbler piping to provide a visual indication of rate of flow in standard cubic feet per hour.

2.6 BACKUP LIQUID LEVEL CONTORL

A. A backup level control system shall be provided to operate the pumps, in the event of a failure of the primary solid state level control system. This backup level control will allow for a redundant pump off switch to turn the pump motors off in the event of a primary level control failure.

- B. The backup level control system shall start and stop pump motors in response to changes in wet well level. It shall be the mercury float switch type, incorporating intrinsically safe relays. Rising and falling liquid level in the wet well causes switches within the floats to open and close, providing start and stop signals to the remainder of the level control system.
- C. The backup level control system shall start and stop the pumps in accordance to the wet well level. The pump start and stop float switches shall be set above and below the normal pump start and stop level settings utilized for the primary level control. Upon operator selection of automatic operation, a float switch shall start one pump motor when water rises to the “pump start level”. When the water is lowered to the “pump stop level”, the system shall stop the pump. These actions shall constitute one pumping cycle.
- D. The backup level control system shall work in conjunction with an alternator relay to select first one pump, then the second pump, to run as “Lead” pump. Alternation will occur at the end of each pumping cycle.
- E. Two (2) float switches shall be supplied for installation by the contractor. Each float shall contain a mercury switch sealed in a polypropylene housing, with 50 feet of power cord, and polypropylene mounting hardware. A stainless steel chain with weight shall be furnished to secure the switches in the wet well.
- F. Two intrinsically safe relays shall be supplied in a separate level control enclosure. Relays must be recognized and listed as intrinsically safe by a nationally recognized testing laboratory. Installing contractor shall make connections from relays to motor controls.

2.7 FLOW METER

- A. Provide flow meter(s) and display(s) as shown on the project drawings and as specified elsewhere in Division 11.
- B. Display mounted within the packaged station enclosure and strap on transducers mounted in/on final discharge piping as shown on the project drawings.
- C. Flow meter signal to be connected to main pump control panel. Analog output from the pump control panel to the fault monitoring system is by the Electrical Contractor and as shown on project instrumentation and control drawings.

2.8 STATION ENCLOSURE

- A. The station enclosure shall contain and protect all pumps, interior piping, valves and associated controls. Enclosure shall incorporate the following design and service features:
 1. Access panels must be supplied on all sides. Location and size shall permit access for routine maintenance functions such as pump and motor inspection, drive belt adjustment, and pump clean-out. Non-hinged panels shall be secured with stainless steel tamper-proof hardware.
 2. A continuous hinge and latch shall be installed on at least two access panels. The hinged panels shall allow easy access to the electrical controls for frequent

adjustments and inspections. A two-point mechanical latch assembly shall secure the panel at top and bottom. Latch handle locks shall be match keyed, requiring only one key to open all access panels.

3. A vent in one access panel shall allow free air flow for enclosure ventilation.
 4. The complete station enclosure, less base, must be completely removable after disengaging reusable hardware. After disassembly, no portion of the enclosure (except electrical service entrance) shall project above the base surface to interfere with maintenance or endanger personnel.
 5. Disassembly and removal of the enclosure shall require no more than two people working without assistance of lifting equipment.
- B. Station enclosure shall be manufactured of molded reinforced orthophthalic polyester resins with a minimum of 30% fiberglass, and a maximum of 70% resin. Resin fillers or extenders shall not be used.
1. Chopped glass fibers of 1 1/4 inch average length shall be sprayed and rolled. Major design consideration shall be given to structural stability, corrosion resistance, and watertight integrity. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to insure long life. They must be impervious to micro-organisms, mildew, mold, fungus, corrosive liquids, and gases which are expected to be present in the environment surrounding the wet well.
 2. All interior surfaces of the housing shall be coated with a polyester resin-rich finish providing maintenance-free service, abrasion resistance, and protection from sewage, greases, oils, gasoline, and other common chemicals.
 3. Outside surfaces of the enclosure shall be coated with gel-coat pigmented resin to insure long maintenance-free life and UV protection. Color used shall de-emphasize the presence of dirt, grease, etc.
- C. Station base shall be constructed of pre-cast, reinforced concrete encapsulated in a fiberglass mold. The design shall resist deformation of the structure during shipping, lifting, or handling. Base shall incorporate drainage provisions, and an opening sized to permit installation of piping and service connections to the wet well. After installation, the opening shall serve as a grout dam to be utilized by the contractor. The base shall incorporate anchor bolt recesses for securing the complete station to a concrete pad (supplied by the station installer) in accordance with the project plans.
- D. A blower mounted in the station roof shall be sized to exchange station air volume at least once every two minutes. Blower motor shall energize automatically at approximately 70 degrees F, and turn off at 55 degrees F. The blower motor control circuit shall incorporate a thermal-magnetic circuit breaker providing overcurrent and overload protection. Exhaust and inlet locations shall prevent the entrance of rain, snow, or debris.
- E. Tall Enclosure with Split Doors
1. The station shall be equipped with a 91 inch tall fiberglass enclosure. The control panel side and suction side of the fiberglass enclosure shall have split doors with the upper section of the doors raised vertically and the lower section of the doors

opening horizontally outward. The upward portion of the split doors shall have additional equipment installed to prevent premature closing of the door.

F. Station Insulation Package

1. The pump station shall be furnished with 1" thick spray foam insulation, which shall be applied to the roof, doors, and corner panels.

G. Station Heater

1. Pump station shall be provided with a 1300/1500 watt, 115 volt electric heater with cord and grounding plug. Ungrounded heaters shall not be acceptable.

2.9 PUMP STATION CERTIFICATION AFFIDAVIT

- A. A Pump Station Certification Affidavit must be completed in total. Failure to furnish the completed affidavit with bids for alternate, unnamed equipment shall be cause for rejection.
- B. The affidavit is also provided to insure that the proper pumping system is supplied to the owner.

2.10 FACTORY TESTS

- A. All components of the pump station shall be given an operational test at the pump station Manufacturer's facility to check for excessive vibration or leaks in the piping or seals, and to correct operation of the automatic control and vacuum priming systems and all auxiliary equipment. Installed pumps shall take suction from a deep wet well, simulating actual service conditions. The control panel shall undergo both a dry logic test and a full operational test with all systems operating.
- B. Each pump shall be capable of achieving the operating reprime lift while operating at the selected speed and the selected impeller diameter. Reprime test report(s) shall be prepared and certified by the factory's registered Professional Engineer.
- C. Factory test instrumentation must include flow measuring with indicator; compound suction gauge; Bourdon tube-type discharge pressure gauge; electrical meters to measure amperes, volts, kilowatts and power factor; speed indicator.

2.11 SPARE PARTS

- A. A complete replacement pump shaft seal assembly shall be furnished with each pump station. The spare seal shall be packed in a suitable container and shall include complete installation instructions. An o-ring kit shall also be supplied.
- B. An instructional video presentation on the pump mechanical seal system in DVD format shall be included. The DVD shall contain a presentation on the following subjects: purpose and location of the mechanical seal, signs of a defective mechanical seal, how to remove the mechanical seal, troubleshooting seal failure causes, seal components, required tools, how to reinstall the seal, and how to place the pump back into service. The video shall include footage of an actual seal replacement.

2.12 INSTALLATION AND OPERATING INSTRUCTIONS

- A. Installation of the pump station shall be done in accordance with the written instructions provided by the Manufacturer.
- B. Operation and maintenance manuals shall be furnished which will include parts lists of components and complete service procedures and troubleshooting guide.

PART 3 - EXECUTION

3.1 MANUFACTURER'S SERVICES

- A. The Manufacturer shall provide the services of a factory-trained representative for a period of not less than one (1) total working day, which shall be broken down into one or two trips as necessary on-site to perform initial startup of the pump station, make final adjustments, supervise initial startup of each pump, and prepare a written test report thereof for the Owner, and to instruct the owner's operating personnel in the operation and maintenance of the equipment.
- B. If there are difficulties in operation of the equipment due to the pump station Manufacturer's fabrication and programming, additional service shall be provided at no extra cost to the Owner.

3.2 HANDLING AND STORAGE

- A. During loading, unloading and storage care shall be exercised to insure that the equipment is not dropped or otherwise damaged through impacting with solid surface. The process equipment shall be stored on a smooth surface, free of sharp objects, and if laid horizontally, shall be placed in such a way to avoid structural damage to the inlet and outlet channels. Slings will be accomplished using nylon or other fabric material. Under no circumstances shall cable or chain slings be used.

3.3 ELECTRICAL

- A. All motor starters, fusible safety switches, selector switches, pushbuttons, indicating lights, and all other pilot devices to form a complete operating electrical system will be supplied according to drawings.
- B. All electrical equipment, conduit and wiring not indicated on the Drawings, but necessary to provide a complete operating system shall be provided in this item at no additional cost to the Owner.
- C. Electrical Wiring: The external conduit and wiring required for power supply and control to electrical equipment supplied in this Section will be furnished according to drawings under Section 16.
- D. Motor size: Any deviation in motor size must be approved by the Engineer. Any electrical equipment or wiring that must change to accommodate a different size motor will be at no additional cost to the Owner.

3.4 FIELD QUALITY CONTROL

A. Pumps

1. The pumps provided shall be factory tested at three points to verify the pump performs at the design points and tested in the field at start-up to assure proper performance.
2. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve.
3. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

3.5 OPERATION AND MAINTENANCE MANUALS

- #### A.
- Prior or with the delivery of equipment, the Manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O&M Manuals shall be in compliance with the General Requirements.

3.6 DEMONSTRATION AND INSTRUCTIONS

- #### A.
- Demonstration and Instruction: The Manufacturer of each piece of equipment shall furnish the services of a qualified representative for a period of not less than one (1) day to inspect and adjust the equipment furnished by the Manufacturer. This qualified representative shall also conduct such tests as necessary to demonstrate satisfactory operation and to instruct the Owner's personnel in the care and operation of the equipment.

3.7 PUMP SCHEDULE – AS SHOWN ON THE PLAN DRAWINGS

END OF SECTION 333213