

SECTION 43 23 92.03

TRIPLEX SELF-PRIMING PUMP STATION – SPS3

PART 1 GENERAL

1.01 SUMMARY

- A. Work under this section includes, but is not limited to, furnishing and installing a factory built triplex pump station as indicated on the **Saluda Pump Station 3** project drawings, herein specified, as necessary for proper and complete performance.

1.02 REFERENCES

1. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.
 - a. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)
 - 1) ANSI B16.1 Cast iron pipe flanges and flanged fittings.
 - 2) ANSI/AWWA C115/A21.51 Cast/ductile iron pipe with threaded flanges.
 - 3) ANSI 253.1 Safety Color Code for Marking Physical Hazards.
 - 4) ANSI B40.1 Gages, Pressure and Vacuum.
 - 5) AWWA C508 Single Swing Check Valves.
 - b. American Society for Testing and Materials (ASTM)
 - 1) ASTM A48 Gray Iron Castings.
 - 2) ASTM A126 Valves, Flanges, and Pipe Fittings.
 - 3) ASTM A307 Carbon Steel Bolts and Studs.
 - 4) ASTM A36 Structural Steel.
 - c. Institute of Electrical and Electronics Engineers (IEEE)
 - 1) ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.
 - 2) ANSI/IEEE Std 112 Test Procedure for Polyphase Induction Motors.
 - 3) IEEE Std 242 Protection of Industrial and Control Power Systems.
 - d. National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA)
 - 1) NEC National Electric Code.
 - 2) NEC 701 National Electric Code article 701.
 - 3) NEMA Std MG1 Motors and Generators.
 - e. Miscellaneous References
 - 1) Ten-State Standards Recommended Standards for Sewage Works.
 - 2) Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.
 - 3) NMTBA and JIC Std National Machine Tool Builders Association and Joint Industrial Council Standards
 - 4) ISO 9001 International Organization for Standardization.

1.03 SYSTEM DESCRIPTION

- A. Contractor shall furnish and install one factory built base mounted, automatic pump station. The pump system shall be complete with all equipment specified herein, factory assembled on individual pump bases.
- B. Principal items of equipment shall include horizontal, self priming, centrifugal sewage pumps, V-belt drives, motors, piping, valves, motor control panel, and automatic liquid level control system.
- C. Factory built pump system design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 - PRODUCTS of this section.

1.04 PERFORMANCE CRITERIA

- A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have 10" suction connection, 10" header piping and 12" discharge connection from header to force main.
- B. Each pump shall be selected to perform under following operating conditions:
 - 1. Capacity (GPM)
 - a. 850
 - b. 1250
 - 2. Total Dynamic Head (FT)
 - a. 126.4
 - b. 132.6
 - 3. Total Dynamic Suction Lift (FT) 18.4
 - 4. Maximum Repriming Lift (FT) 23
 - 5. Total Discharge Static Head (FT) 120.4
- C. Duplex pumps shall be selected to perform under the following operating conditions:
 - 1. Capacity (GPM)
 - a. 1800
 - 2. Total Dynamic Head (FT)
 - a. 143.7
 - 3. Total Dynamic Suction Lift (FT) 18.4
 - 4. Maximum Repriming Lift (FT) 23
 - 5. Total Discharge Static Head (FT) 120.4
- D. Site power furnished to pump station shall be 3 phase, 60 hertz, 460 volts, 4 wire, maintained within industry standards. Voltage tolerance shall be plus or minus 10 percent. Phase-to-phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

1.05 SUBMITTALS

- A. Prior to fabrication, pump station manufacturer shall submit an electronic copy of submittal data for review and approval. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.
- B. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for pump bases. Contractor piping connections and access clearances shall be dimensioned relative to the pump centerline. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.
- C. Operations Maintenance Manuals
 - 1. Installation shall be in accordance with written instructions provided by the pump system manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.
 - 2. Documentation shall be specific to the pump system supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the pump system manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:
 - a. Functional description of each major component, complete with operating instructions.
 - b. Instructions for operating pumps and pump controls in all modes of operation.
 - c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
 - d. Support data for commercially available components not produced by the pump system manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
 - e. Electrical schematic diagram of the pump station circuits shall be in accordance with NMTBA and JIC standards. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the system operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

- f. Mechanical layout drawing of the pump system and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.
3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.06 QUALITY ASSURANCE

- A. The pumps and pump system manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.
- B. Upon request from the engineer, the pump system manufacturer shall prove financial stability and ability to produce the pump system 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.
- C. All internal passages, impeller vanes, and recirculation ports shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.
- D. 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.
- E. The term "pump manufacturer" or "pump system manufacturer" shall be defined as the entity which designs, machines, assembles, hydraulically tests and warrants the final product. Any entity that does not meet this definition will not be considered a "pump manufacturer" or "pump system 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.
- F. Reprime Performance
 1. Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.
 2. During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open

system. The need for a suction check valve or external priming device shall not be required.

3. Pump must reprime 17.3 vertical ft. at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition. Reprime performance must be confirmed with the following test set-up:
 - a. A check valve to be installed downstream from the pump discharge flange. The check valve size shall be equal (or greater than) the pump discharge diameter.
 - b. A length of air release pipe shall be installed between pump and the discharge check valve. This line shall be open to atmosphere at all times duplicating the air displacement rate anticipated at a typical pump station fitted with an air release valve.
 - c. The pump suction check valve shall be removed. No restrictions in the pump or suction piping will prevent the siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a 2 feet minimum horizontal run, a 90 degree elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.
 - d. Impeller clearances shall be set as recommended in the pump service manual.
 - e. Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle.
 - f. Liquid to be used for reprime test shall be water.
4. Upon request from the engineer, certified reprime performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

G. Certified Pump Performance Test

1. Tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4 Acceptance Grade 2B at the specified head, capacity, rated speed and horsepower. The performance tests will validate the correct performance of the equipment at the design head, capacity and speed.
2. For pumps utilizing up to (13 HP) motors; but larger than (1.3 HP), tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4.1, as the specified head, capacity, rated speed and horsepower.

H. Factory System Test

1. All components including the pumps, motors, and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete pump system.
2. Upon request from the engineer, the operational test may be witnessed by the engineer, and/or representatives of his choice, at the manufacturer's facility.

- I. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.07 MANUFACTURER'S WARRANTY

- A. The pump system 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 system manufacturer shall be solely responsible for warranty of the pump system.
- 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 pump system manufacturer.
- C. It is not intended that the pump system 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 system 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.

PART 2 PRODUCT

2.01 UNITARY RESPONSIBILITY

- A. In order to unify responsibility for proper operation of the complete pumping system, it is the intent of these Specifications that all system components be furnished by a single

supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the pump manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacturer's representative or distributor be accepted.

2.02 MANUFACTURER

- A. The pump station system integrator must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.
- B. The specifications and project drawings depict equipment and materials manufactured by The Gorman-Rupp Company which are deemed most suitable for the service anticipated. It is not intended, however, to eliminate other products of equal quality and performance. The contractor shall prepare his bid based on the specified equipment for purposes of determining low bid. Award of a contract shall constitute an obligation to furnish the specified equipment and materials.
- C. After execution of the contract, the contractor may offer substitutions to the specified equipment for consideration. The equipment proposed for substitution must be superior in construction and performance to that specified in the contract, and the higher quality must be demonstrated by a list of current users of the proposed equipment in similar installations.
- D. In event the contractor obtains engineer's approval for equipment substitution, the contractor shall, at his own expense, make all resulting changes to the enclosures, buildings, piping or electrical systems as required to accommodate the proposed equipment. Revised detail drawings illustrating the substituted equipment shall be submitted to the engineer prior to acceptance.
- E. It will be assumed that if the cost to the contractor is less for the proposed substitution, then the contract price shall be reduced by an amount equal to the savings.

2.03 UNIT BASE

- A. The pump base shall comprise a base plate, perimeter flange, and reinforcements. Base plate shall be fabricated of steel not less than 1/4" thick. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Base plate and/or flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

2.04 PUMP DESIGN

- A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw unscreened domestic sanitary sewage or industrial waste. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this section.
- B. The pump manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

C. Materials and Construction Features

1. Pump casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
 - a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
 - b. Fill port cover plate, 3 1/2" diameter, shall be opened after loosening a positive lock clamp bar assembly. In consideration for safety, cap screw threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A non-metallic gasket shall prevent adhesion of the fill port cover to the casing while assuring a reliable seal.
 - c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.
 - d. Liquid volume and recirculation port design shall be consistent with performance criteria listed under PART 1 - GENERAL of this section.
2. Cover plate shall be cast iron Class 30. Design must incorporate the following maintenance features:
 - a. Retained by hand nuts for complete access to pump interior. Cover plate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wear plate or check valve without removing suction or discharge piping.
 - b. A replaceable wear plate secured to the cover plate by weld studs and nuts shall be AISI 1015 HRS.
 - c. Wear plate shall be self-cleaning design ensuring that debris is cleared away and does not collect on the impeller vanes.
 - d. In consideration for safety, a pressure relief valve shall be supplied in the cover plate. Relief valve shall open at 75-200 PSI.
 - e. Two O-rings of Buna-N material shall seal cover plate to pump casing.
 - f. Pusher bolt capability to assist in removal of cover plate. Pusher bolt threaded holes shall be sized to accept same retaining cap screws as used in rotating assembly.
 - g. Easy-grip handle shall be mounted to face of cover plate.
3. Integral series connection features should include the following:
 - a. Pump shall be vertically staged incorporating a lower and upper volute casing united by a ductile iron transition chamber, allowing for a direct and smooth flow path to the impeller in the upper casing.
 - b. Pump suction and discharge connections of the lower casing shall be vertically in line with one another.
 - c. The cover plates and rotating assemblies shall be interchangeable between both casings.
 - d. The discharge port of the upper casing shall be capable of being rotated to allow for multiple pipe connection orientations.
4. 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 the following features:

- a. Seal plate and bearing housing shall be cast iron Class 30. Anti-rotation ribs shall be cast into the seal plate to reduce internal wear and maximize component life. 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.
 - 1) 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.
 - 2) 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.
 - 3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.
 - b. Impeller shall be ductile iron, two vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall be statically or dynamically balanced. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.
 - c. Shaft shall be AISI 4140 alloy steel.
 - d. 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.
 - e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be silicon 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. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this section.
 - f. 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.
5. Adjustment of the impeller face clearance (distance between impeller and wear plate) shall be accomplished by external means.
- a. Clearances shall be maintained by a four point external shimless cover plate adjustment system, utilizing a four collar and four adjusting screw designs allowing for incremental adjustment of clearances by hand as required. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four point system also allows for equal clearance gaps at all points between the

impeller and wear plate. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Cover plate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that utilize less than four points will not be considered.

- b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the cover plate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above
 - c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.
6. An externally removable 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 from the top of pump without disturbing the suction piping or completely draining the casing. 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.
 7. Pump shall include flange kit consisting of two ASA spool flanges that shall be one piece cast iron class 30 suitable for attachment to suction and discharge ports. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

D. Serviceability

1. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.
2. No special tools shall be required for replacement of any components within the pump.

E. Pumps to be supplied with a drain kit for ease of maintenance. The kit to contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a stainless-steel pipe nipple, stainless steel bushing, stainless steel ball valve and aluminum male quick connect fitting.

F. 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 140/230 feet water column minimum. 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.

G. Spare Parts Kit

1. The following minimum spare parts shall be furnished with the pump station:
 - a. One spare pump mechanical seal (complete with shaft sleeve).

- b. One cover plate O-Ring.
- c. One rotating assembly O-Ring.
- d. One set of impeller clearance adjustment shims.
- e. One complete rotating assembly including impeller, impeller shaft, bearing housing, bearings, mechanical seal, o-rings and shim set that are required to replace original assembly installed in pump.

2.05 VALVES AND PIPING

- A. Each pump shall be equipped with a full flow type check valve, capable of passing a 3" spherical solid, with flanged ends and be fitted with an external lever and spring. 316 stainless steel body rings shall be threaded into the valve port. Valve clapper shall be cast iron, rubber face, and shall swing completely clear of waterway when valve is full open. The seating shall be by a resilient field replaceable ring on the valve disc contacting a bronze or stainless seat ring in the valve body. Hinge pin shall be of 18 8 stainless steel construction and shall be utilized with bronze bushings and o-ring type seal. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve shall be rated at 175 psi water working pressure, 350 psi hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.
- B. A plug valve must shall be provided for each pump to isolate pump from the force main. Valve shall pass 3" spherical solids. The plug valve shall be non lubricated, tapered type. Valve body shall be semi steel with flanged end connections drilled to 125 pound standard. The drip tight shutoff plug shall be mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a hand wheel actuator.
- C. An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material. Valves shall be field adjustable for varying discharge heads. Connection of the air release valves to the station piping shall include stainless steel fittings. Contractor to install independent air release lines into wet well and extend 6" below pump off level.
- D. The contractor shall supply a magnetic flow meter when shown on the plans. The flow meter shall be provided with ANSI 150 flanged ends, 316 stainless steel electrodes, 316 stainless steel ground ring material, NSF approved polyurethane liner, and require a remote convertor provided within a NEMA 4X enclosure. Flow meter shall be Toshiba LF654 series with LF622 remote converter or engineered approved equal. Flow meter shall be provided with adequate length of signal cable for contractor to mount the remote unit on pump station wall.

- E. The contractor shall furnish a 4" surge relief valve, GA figure 625D, or engineered approved equal, when show on the plans.
- F. Piping
 - 1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.
 - 2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.
 - 3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.
 - 4. Bolt holes shall be in angular alignment within 1/2 degrees between flanges. Flanges shall be faced with a gasket finish having concentric grooves a minimum of 0.01inch deep by approximately 0.03inch wide, with a minimum of three grooves on any given surface spaced a maximum of 1/4 inch apart.
- G. Supports and Thrust Blocks
 - 1. Contractor must insure all pipes connected to the pumps are supported to prevent piping loads from being transmitted to pumps or station piping. Pump discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.06 DRIVE UNIT

- A. Pump motors shall be 75 HP, horizontal ODP, 1800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.
- B. Drive Transmission
 - 1. Power to pumps transmitted V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.
 - 2. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.
 - 3. Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch. Guards must be completely removal without interference from any unit component, and shall be securely fastened and braced to the unit base.

2.07 FRP ENCLOSURE

- A. Enclosure Construction and Design:
 - 1. The FRP enclosure shall be manufactured by Shelter Works, Inc, St Louis, Mo, or engineered pre-approved equal. A minimum of 10 FRP enclosures shall have been installed in the State of South Carolina and North Carolina in similar applications in the last 60 months.

2. The modular pump enclosure is to be rectangular with outside dimensions of 22' long by 15'-10" wide and having a wall height of 10'.
3. A minimum of (4) four lifting eyes arranged on the corners shall be provided to ease handling and installation onto a concrete pad furnished by the contractor.
4. Enclosure walls and roof shall be seamless, one-piece sprayed fiber-glass panels laminated to form a structural composite as follows: 1/8" thick fiberglass outside surface, 3/4" thick urea foam polyurethane core, 1/2" marine grade plywood, and 3/32" thick fiberglass inside surface. Marine grade plywood shall be installed in the walls to increase the structural integrity of the FRP structure.
5. Each wall panel shall overlap at the corner and form an internal connection joint using stainless steel hardware. All panel joints shall be thoroughly sealed with silicone caulk. The enclosure shall have a minimum R 10 insulation factor and shall be capable of withstanding 100 mph wind loads.
6. All exterior surfaces shall be stucco textured tan isophthalic gel coat finish incorporating ultra violet inhibitors.
7. All interior surfaces shall be sprayed white isophthalic gel coat finish offering the same characteristics as the exterior surfaces.
8. The roof panel shall be an arched, one-piece design incorporating the same materials of construction as the side walls. The roof shall be removable as a unit, allowing for complete access to the pumping equipment with a crane. The pitch of the roof shall be sufficient for good moisture drainage, and withstand a minimum snow load of 30 pounds per square foot.
9. A 3'0" wide x 6'8" high single entrance door or a 6'0" wide x 6'8" high double door shall be constructed of the same laminated fiberglass and foam core materials as the remainder of the station. Door shall be hung with (3) three stainless steel ball bearing type hinges. A three-point closure system incorporating a lockable door handle and interior override lever shall allow emergency exits even if the door is padlocked from the outside. An adjustable door positioner and holder shall be mounted at the top of the door. A gasket consisting of solid rubber and sponge shall seal the door while closed. The door and all hardware shall be mounted to withstand 100 MPH winds. A wall mounted drip molding will be installed above each door. Door(s) shall be as located per the plans.
10. After the pumping equipment is installed, the fully assembled station enclosure shall be positioned on the concrete mounting pad and sealed with butyl auto glass tape as furnished by the enclosure manufacturer. The interior base flange shall be drilled positioning and fastened to the pad using expansion anchors on 24" maximum centers furnished and installed by the contractor.

B. Enclosure Functional Equipment:

1. The interior of the station shall be illuminated by factory installed 120-volt, LED lamp fixtures providing two (2) watts illumination per square foot. All lights will be prewired and run through PVC conduit and a weatherproof switch shall be installed adjacent to each enclosure entrance. The lighting circuit shall be protected by a thermal-magnetic circuit breaker.
2. A thermostatically controlled 120 VAC exhaust fan with screen and weatherproof shutters shall be installed in the wall approximately opposite the fresh air intake vent. The fan shall have a minimum capacity of 1800 CFM at free air and be capable

of changing the air in the enclosure a minimum of six times per hour. The exhaust fan shall be protected by a thermal-magnetic circuit breaker. A fresh air intake vent shall be provided and located opposite the vent fan. Each wall penetration shall be provided with a FRP rain hood.

3. A high capacity 7.5 KW electric station heater shall be provided for the protection of the pumping equipment. The heater shall maintain an inside/outside differential temperature of 60 degrees F. The heater shall be provided with an adjustable thermostat.
4. Two wall mounted duplex GFI utility receptacles providing 120-volt AC power shall be installed and prewired through PVC conduit with the station lighting. The receptacle shall be protected by thermal magnetic circuit breaker.
5. The enclosure shall be provided with a junction box to have all electrical devices prewired to terminal blocks. The pump control panel shall be provided with circuit protection devices for the enclosure electrical items. Contractor shall provide conduit and wiring from junction box to pump control panel.

2.08 FINISH

- A. Pumps, piping, and exposed steel framework shall be cleaned prior to coating using an approved solvent wipe or phosphatizing cleaner. The part must thoroughly dry before paint application. Open joints shall be caulked with an approved polyurethane sealant. Exposed surfaces shall be applied with one coat of Tnemec Series 69 Polyimide Epoxy Primer and one finish coat of Series 73 Aliphatic Acrylic Polyurethane for a total dry film thickness of 4-6 mils. Finish coat shall be semi-gloss white for optimum illumination and enhancement. The coating shall be corrosion, moisture, oil, and solvent resistant when completely dry. The factory finish shall allow for over-coating and touch-up for 6 months after coating.

2.09 ELECTRICAL CONTROL COMPONENTS

- A. The pump control panel will be tested as an integral unit by the pump system manufacturer. The control panel shall also be tested with the pumps as a complete working system at the pump manufacturer's facility.
- B. Electrical control equipment shall be mounted within a NEMA 1 steel, dead front type, control enclosure. Door shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on a removable steel back panel secured to enclosure with collar studs. All control devices and instruments shall be secured to the sub-plate with machine screws and lock washers. 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. Pump 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. 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. 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. In addition to all breakers needed for equipment on the interior of the pump station, provide one (1) 20 Amp, 2 Pole, 480 breaker for transformer / panelboard located on the exterior of the pump station.
3. Motor Starter
 - a. A Square D model Altistart 48 (RVSS) or Altivar 61 (VFDs) motor starter shall be provided for each pump.
 - b. Starting Modes: Starting modes shall be selectable soft start, current limit, or full voltage. Soft starting the pump shall include an adjustable initial torque value of 0 to 90 %. The acceleration ramp shall be adjustable from 0 to 30 seconds. The starter shall include a selectable kick start providing a current pulse at start. Kick start level shall be adjustable from 0 to 90% of locked rotor torque. Kick start time shall be adjustable from 0 to 2 seconds. Current limit mode shall provide means for limiting the starting current to a programmable value between 50 and 600% of full load current. Full voltage start shall provide across the line starting with a ramp time of less than 0.25 seconds.
 - c. Bypass: When the start ramp time is complete, the starter shall energize an integral bypass contactor. When in the bypass mode, the bypass contactor shall carry the motor load to minimize internal heating in the electrical enclosure.
 - d. Door Mounted Display: Each starter shall be furnished with a display and keypad mounted to the door of the control panel. The door mounted display will duplicate the functions of the starter display and allow the operator to monitor or change parameters without opening the control panel door.
- E. 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, low voltage, and voltage unbalance. An integral time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart when power conditions return to normal.
- F. The control panel shall be equipped with a modular surge arrester 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.

G. 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. Control logic shall be accomplished using a programmable logic controller (PLC).
4. Electromechanical relays and timers shall be equipped with 120VAC coils and contacts rated Nema A-300 minimum. Timers shall be pneumatic or synchronous motor driven.
5. PLC shall be an Allen-Bradley CompactLogix 5370 L2 Control System. The PLC shall be equipped with a CPU with 384KB [1769-L16ER] or 512KB [1769-L18ERM] of user memory, and two EtherNet/IP communication ports supporting ring topologies and 1 USB port for firmware download and programming. The Controller shall utilize the small applications 1734 I/O modules. The Controller shall be designed to implement consumed tag, event instruction, embedded inputs, remote I/O, axis, and motion event triggers. The controller shall be equipped to handle up to 32 Controller Tasks and 100 programs/task. The PLC shall operate on 24VDC power and be equipped with a 24VDC embedded power supply. A 1784-SD1 (1GB) Memory Module shall be shipped with the controller. The controller will contain, at least but not limited to, embedded digital I/O [16DC Inputs, 16DC Outputs]. The controller shall accept all digital and analog I/O necessary to accomplish the specified operation. A minimum of 10% spare of the I/O used shall be supplied. The program logic shall be stored on the processor as well as on a programmable, read only 1 GB SD card [shipped with controller]. The memory module shall auto load and run when installed in the programmable control processor and is included to facilitate field repair or replacement of the programmable control hardware without the use of programming terminals or personal computers. The PLC shall communicate with the drive using a EtherNet/IP, but can also support other communication protocols such as ControlNet, or DeviceNet networks. The PLC shall issue drive start/stop and speed commands. Drive status shall also be communicated to the PLC using EtherNet/IP. The drive shall be configured to operate manually without the use of the PLC.
6. An Allen-Bradley PanelView Plus 6 1000 electronic operator interface shall be provided for data entry and display. The Operator Interface Display size will be at least 10 inches with Color active matrix, thin film transistor (TFT), liquid crystal display (LCD). The operator interface shall have an 18-Bit color graphic resolution with backlight CCFL of 50,000 hours minimum. The operator interface shall be mounted on the front of the control panel with other operator controls and shall be compatible with the PLC communication protocol. The operator interface shall be a backlit, touch-screen terminal. The operator interface program shall be stored externally on a Secure Digital (SD) card.

7. The control shall be pre-programmed or wired to provide the following routines:
 - a. Pump alternation at lead stop
 - b. Excessive pump run time alternation (1-9999 minutes)
 - c. Jump to idle pump/drive on lead failure
 - d. Pump start delays after power restoration
 - e. Flashing alarm/steady acknowledge on all alarm pilot lights
 - f. Station trouble alarm (115vac and normally open dry contact)
 - g. High and low level alarms
 - h. Pump high temperature shutdown
 - i. Pump start/stop level control
 - j. Drive fault alarm
8. The operator interface shall be equipped with the following displays and functions:
 - a. Main Menu
 - b. Wet Well Level
 - c. Wet Well Level Simulation
 - d. Low Water Alarm Status
 - e. High Water Alarm Status
 - f. Pump High Temperature Status #1, #2,
 - g. Drive Fault Status #1, #2,
 - h. Pump Sequence Selection
 - i. Alarm Silence
 - j. Alarm Reset
 - k. General Alarm Lamp Test
 - l. Lead Level Start/Stop Setpoints
 - m. Lag Level Start/Stop Setpoints
 - n. Low Water Alarm Setpoints
 - o. High Water Alarm Setpoints
 - p. Power-up Delay Setpoint
 - q. Alarm Delay Setpoint
 - r. Pump Start Delay Setpoint
 - s. Alternation Time Interval Setpoint
 - t. Level Transmitter Calibration
 - u. Discharge Pressure Indication
9. The control system shall be equipped with the following dry contacts wired to the terminal blocks:
 - a. Pump run - (1) N.O. each pump
 - b. Drive fault - (1) N.O. each pump
 - c. High pump temperature shutdown - (1) N.O. each pump
 - d. High motor temperature - (1) N.O. each pump
 - e. Three phase voltage monitor - (1) N.C.

- f. High water alarm - (1) N.O. (from level controller)
 - g. High-High wet well level from float – (1) N.O.
 - h. Low water alarm- (1) N.O.
10. Six-digit elapsed time meter (non- reset type) shall be connected to each motor starter to indicate total running time of each pump in "hours" and "tenths of hours". An integral pilot light shall be wired in parallel to indicate that the motor is energized and should be running.
 11. The O&M manual shall be provided with complete ladder logic program documentation including English names, rung comments, and coil/contact cross-references.
 12. 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 a high pump temperature shutdown circuit. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the pump shutdown circuit to interrupt power to the motor. A visible indicator located on the control panel door shall indicate 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.
 13. A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, will be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15-ampere thermal magnetic circuit breaker.
 14. The pump control panel shall be equipped with a 3 KVA stepdown 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.
 15. 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.
16. Pump control manufacturer shall ground all electrical equipment inside the pump control to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection. 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).
17. 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.

2.10 LIQUID LEVEL CONTROL

- A. The level control system shall be provided by a Pulsar Ultra 5 Ultrasonic level control system. The level controller shall interface with the pump control PLC to provide pump start/stop set points.

- 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 utilize an ultrasonic level transmitter housed in a NEMA 4X electrical enclosure with a sensor designed to mount at the top of the wet well. The transmitter shall provide a proportional level signal for distribution to the display and remainder of the level control system. The transmitter shall be a microprocessor based unit capable of easy calibration, and provided with a minimum of 50' cable.
- D. Pump control manufacturer shall supply one 115-volt AC LED alarm light fixture with vapor-tight red globe, guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be shipped loose for installation by the contractor.
- E. Pump control manufacturer will supply one 115-volt AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rain water from collecting in any part of the horn. The alarm horn will be shipped loose for installation by the contractor.

2.11 AUTOMATIC TELEPHONE DIALER

- A. The contractor shall provide a Mission auto-dialer, model 800 with 8 dry contacts and six (6) analog inputs, for remote monitoring by the owner's personnel. Contractor shall provide wiring from pump control panel and shall install a float switch in wet well to provide a redundant high wet well level alarm to the unit.

2.12 GAUGE PRESSURE INDICATING TRANSMITTERS

- A. Requirements:
 1. Pressure Transmitter Type: Capacitance or piezoresistive.
 2. Wetted Parts: Type 316 stainless steel.
 3. Range: 100:1.
 4. Accuracy: 0.075 percent of calibrated span.
 5. Static Pressure Rating: 2,000 psi.
 6. Indicator: LCD display.
 7. HART standard data communication protocol.
 8. Acceptable Manufacturer: Rosemount 3051T.
 9. Install in accordance with manufacturer's instructions and the Engineer's installation detail.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Pump system manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any

damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

- A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.
- B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.
- C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.
- D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.03 FIELD QUALITY CONTROL

- A. Operational Test
 - 1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.
 - 2. After construction debris and foreign material has been removed from the wet well, contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.
- B. Manufacturer's Start-up Services
 - 1. Co-ordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation. He will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

3.04 CLEANING

- A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

3.05 PROTECTION

- A. The pump station should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect station controls and interior equipment from cold and moisture.

END OF SECTION