

SECTION 333200 - FACTORY-BUILT 7X10 ABOVE GROUND PUMP STATION WITH DUPLEX SELF-PRIMING PUMPS

1. PART 1 - GENERAL

1.1. Section Includes

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

1.2. References

- A. 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.

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

1.3. System Description

- A. 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.
- B. In addition to the station enclosure, principle items of equipment shall include two horizontal, self priming, centrifugal sewage pumps, V-belt drives, motors, internal piping, valves, motor control panel, automatic liquid level control system, and internal wiring.
- C. Factory built pump station 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.

1.4. Performance Criteria

- A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have 6" suction connection, and 6" discharge connection. Each pump shall be selected to perform under following operating conditions:
- a. Capacity (GPM) [redacted]
 - b. Total Dynamic Head (FT) [redacted]
 - c. Total Dynamic Suction Lift(FT) [redacted]
 - d. Maximum Repriming Lift (FT) [redacted]
 - e. Maximum Static Suction Lift(FT) [redacted]
 - f. Total Discharge Static Head(FT) [redacted]
 - g. Minimum Submergence Depth (FT) 2
- B. Site power furnished to pump station shall be 3 phase, 60 hertz, 230 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.

1.5. Submittals

A. Product Data

1. Prior to fabrication, pump station manufacturer shall submit 6 copies of submittal data for review and approval.
2. 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 (NPSH_{re}), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and liquid level control shall be fully described.
3. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for station. Pipe penetrations and station access clearances shall be dimensioned relative to the station 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.

B. Operations And Maintenance Manuals

1. Operation shall be in accordance with written instructions provided by the pump station 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 station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station 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 station 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 NFPA 79. 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 station 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 station 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.

1.6. Quality Assurance

- A. The manufacturer of the pump station shall have a quality management system in place and shall be ISO 9001 certified.
- B. 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.
- C. Pump Performance Certifications
 - 1. 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.
 - 2. Reprime Performance
 - a. 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.
 - b. 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.
 - c. Pump must be capable of repriming 25 vertical feet 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:
 - 1) A check valve to be installed down stream from the pump discharge flange. The check valve size shall be equal (or greater than) the pump discharge diameter.
 - 2) 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.

- 3) 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° elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.
 - 4) Impeller clearances shall be set as recommended in the pump service manual.
 - 5) 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.
 - 6) Liquid to be used for reprime test shall be water.
3. 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.

C. Factory System Test

1. All internal components including the pumps, motors, valves, piping 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 simulate actual performance anticipated for the complete station.
 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.
- D. 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.

1.7. Manufacturer's 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. Fiberglass components of the station enclosure shall be warranted for twenty (20) years to resist UV damage, corrosion from moisture or corrosive soils, or physical failures occurring in normal service, without the need for special protective coatings, when installed according to the manufacturer's recommendations.
 2. All other equipment, apparatus, and parts furnished shall be warranted for five (5) years, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, Orings, 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 without cost of parts or labor to the owner.
- 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. The warranty shall become effective upon the acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment, whichever occurs first.

2. PART 2 - PRODUCT

- 2.1. In order to unify responsibility for proper operation of the complete pumping station, 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 manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a manufacture's representative or distributor be accepted.
- 2.2. Manufacturer
- A. The pump station system integrator shall have a quality management system in place and shall be ISO 9001 certified.
- 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.
- 2.3. Station Enclosure
- A. The station enclosure shall provide sufficient inside area for maintenance personnel to perform normal operation and maintenance inside, sheltered, and free from foul weather. The enclosure shall consist of a base to support the pumps and a cover that can be moved without lifting. Minimum dimensions of the enclosure shall be seven feet by ten feet and six feet in height.
- B. The station enclosure shall be manufactured of molded fiberglass reinforced orthophthalic polyester resins with a minimum of 30% fiberglass, and a maximum of 70% resin. Glass fibers shall have a minimum average length of 1¼ inches. Resin fillers or extenders shall not be used. Major design considerations shall be given to structural stability, corrosion resistance, and water-tight properties. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to insure long maintenance free life. They must be impervious to micro-organisms, mildew, mold, fungus, corrosive liquids, and gases which can reasonably be expected to be present in the environment surrounding the wet well. Wood core type enclosures shall not be considered acceptable and shall be basis for equipment rejection. See manufacturer's requirements for enclosure warranty in these specifications.
- C. All interior surfaces of the housing shall be gel coated with a polyester resin. It shall be of suitable thickness and formulated to provide:
1. Maintenance-free service
 2. Abrasion resistance
 3. Protection from sewage, greases, oils, gasoline, and other common chemicals.
 4. Color fastness
 5. Gloss retention

- D. Interior surfaces of the enclosure cover and end panels shall be white for maximum light reflectivity. The base shall be of a darker color to de-emphasize the presence of dirt, grease, etc. Colors used for both portions shall result in a pleasing looking structure.
- E. The outside of the enclosure shall be coated with a suitable pigmented resin compound to insure long, maintenance-free life. The fiberglass enclosure shall be a regular product of the pump station manufacturer.
- F. Station base shall be constructed with a completely encapsulated structural steel frame for corrosion protection. Frame shall provide adequate structural support for pumps, motors, and piping. The encapsulated frame shall extend to lift points provided and assure adequate strength to resist deformation of structure during shipping, lifting, or handling. The structural steel base shall be completely encapsulated within a molded fiberglass reinforced polyester base shell. Wall thickness shall be a minimum of 3/16 inch and base height a minimum of 5 inches to provide natural drainage of pump station floor to concrete pad. Interior of base shall be filled with a foamed in place rigid polyurethane structural foam. Foam shall be of closed cell type with a minimum density of 2.5 Pounds/cubic feet to give adequate floor support for maintenance personnel and for handling of equipment.
- G. Holes through the base shall be provided for suction and discharge lines, air release lines, and level control line. Holes for the suction and discharge lines shall be provided with a grout dam incorporated in a grout retention cavity which the contractor shall fill at installation with suitable grout to seal each pipe-to-base joint against the entrance of hazardous gases from the wet well.
- H. Station base shall incorporate a suitable flange designed for securing the pump station to the concrete pad in accordance with the station plans.
- I. The enclosure cover shall be movable without lifting to permit overhead access to either half of the station interior and shall be completely removable. A hasp and staple locking device shall be provided to secure the enclosure over the station base. Suitable gasketing shall be provided between the enclosure cover and end panels and base for protection from the elements.
- J. The enclosure cover shall be provided with a hinged fiberglass reinforced access door. Minimum dimensions of the door shall be 27 inches wide by 56 inches high for access by maintenance personnel to station interior. Door shall be a minimum 5/8 inch thick and shall be hinged with a full-length stainless steel piano hinge to a full perimeter aluminum door casing secured to the enclosure cover. Such door casing shall incorporate a suitable drip shield over the opening. Door shall be furnished with a locking handle connected to a three-point latching mechanism. Latch shall engage door casing at top, side and bottom for maximum security against vandalism. All mounting hardware for door casing and door must be concealed or of such type as to prevent vandalism with ordinary tools.
- K. A duplex ground fault indicating utility receptacle providing 115 volts, single phase, 60 hertz shall be mounted inside the pump station. Receptacle shall be NEMA 5-15r configuration, heavy duty, specification grade and fitted with a weatherproof cover. The receptacle shall be protected by normal duty circuit breaker.
- L. A shuttered exhaust fan with a minimum capacity of 500 CFM to change the air in the enclosure once every minute, shall be mounted in one end wall. In the wall approximately opposite to this end panel shall be mounted an air intake. Both intake and exhaust opening shall be equipped with a screen and cowl suitably designed to prevent the entrance of rain, snow, rocks, and other foreign material. Fan circuit shall be protected by a normal duty circuit breaker.
- M. An enclosed and gasketed 200-watt light fixture shall be provided. The fixture shall be vapor-tight, universal type. The fixture shall be centrally located to provide adequate light to all parts of the station and shall not constitute a physical hazard to inspection or service personnel. Light circuit shall be protected by a normal duty circuit breaker and shall be provided with a disconnect switch.
- N. Station Heater:

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

2.4. Pump Design

- A. 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 under PART 1 - GENERAL of this section.
- B. The manufacturer of the pumps shall have a quality management system in place and shall be ISO 9001 certified.
- C. Materials and Construction Features
 - 1. Pump casing: 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 coverplate, 3 1/2" diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads 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.
 - 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. Coverplate: Coverplate shall be cast iron Class 30. Design must incorporate following maintenance features:
 - a. Retained by hand nuts for complete access to pump interior. Coverplate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.
 - b. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS.
 - c. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.
 - d. Two O-rings of Buna-N material shall seal coverplate to pump casing.
 - e. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.
 - f. Easy-grip handle shall be mounted to face of coverplate.
 - 3. Rotating Assembly: A rotating assembly, which includes impeller, stainless steel shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:
 - a. Sealplate 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.

- 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 thread onto the pump shaft and be secured with a lockscrew and conical washer.
 - c. Shaft shall be stainless steel shall be supplied.
 - 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 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 sealplate, 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 AISI 316 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 capscrews as used for retaining rotating assembly.
4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.
 - a. Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings.
 - b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate 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.
 5. 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 coverplate opening, 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.
 6. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or 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 by incorporating the following features.
2. No special tools shall be required for replacement of any components within the pump.

E. Drain Kit:

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. Spare Parts Kit:

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.

2.5. Valves and Piping:

- A. Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O-ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean-out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O-rings which shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. 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.

C. Automatic air release valves:

1. 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.
2. 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.
3. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.
4. Valves shall be field adjustable for varying discharge heads.
5. Connection of the air release valves to the station piping shall include stainless steel fittings.

D. Gauge Kit

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.

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.

E. 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 $1/2^\circ$ between flanges. Flanges shall be faced with a gasket finish.

F. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.6. Drive Unit

A. Motors (Note; Maximum motor frame size is 326T open drip-proof.)

1. Pump motors shall be [redacted] HP, 3 phase, 60 hertz, 230 VAC, horizontal ODP, 1,800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with Class F insulation and 1.15 service factor for 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.
2. Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

2.7. Drive Transmission

- A. 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.
- B. 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.
- C. The pump manufacturer shall submit power transmission calculations which document the following:
 1. Ratio of pump/motor speed.
 2. Pitch diameter of driver and driven sheaves.
 3. Number of belts required per drive.
 4. Theoretical horsepower transmitted per belt, based on vendor's data.
 5. Center distance between pump and motor shafts.

6. Arc-length correction factor applied to theoretical horsepower transmitted.
 7. Service factor applied to established design horsepower.
 8. Safety factor ratio of power transmitted/brake horsepower required.
- D. 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.
1. Guards must be completely removal without interference from any unit component, and shall be securely fastened and braced to the unit base.
 2. Metal to be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches. Tack welds shall not exceed four inch spacing.
 3. The guard shall be finished in accordance with Section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.
- 2.8. Pumps, piping, and exposed steel framework shall be cleaned prior to painting. Exposed surfaces to be coated with one coat gray W.R. non-lift primer and one coat white acrylic alkyd W.R. enamel. Paint shall be low VOC, alkyd based, high solids, semi-gloss white enamel for optimum illumination enhancement, incorporating rust inhibitive additives. The finish coat shall be 1.0 to 1.2 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.
- 2.9. 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 mounted using threaded fasteners, and shall be clearly labeled to indicate function.
- C. Branch Components
1. Motor branch components to be of highest industrial quality, 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 any component.
 2. Circuit Breakers and Operating Mechanisms
 - a. A properly sized heavy duty circuit breaker, with RMS interrupting rating of 14000 amperes at 230 volts, 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.
 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.
- b. 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.
- c. A reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the door.
- d. Transient Voltage Surge Suppressor:

A transient voltage surge suppressor shall be furnished to minimize damage to pump motors and control as result of transient voltage surges. The suppressor shall utilize metal-oxide varistors encapsulated in a non-conductive housing. The arrester shall be rated 480 volts RMS nominal with a discharge capability of 2000 amps.

- e. Phase Monitor:

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.

D. 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 alternator relay to be electro-mechanical industrial design. Relay contacts to be rated 10 amperes minimum at 120 volts non-inductive. A switch shall permit the station operator to select automatic alternation of pumps, to select pump number one to be "lead" for each pumping cycle, or to select pump number two to be "lead" pump for each pumping cycle.
4. 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". Separate pilot lights shall be provided to indicate which motor is energized and should be running.
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. If casing temperature rises to a level sufficient to cause pump damage, the high pump temperature protection circuit shall interrupt power to the pump motor. A visible indicator, mounted through 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.

6. 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.

7. **Auxiliary Power Transformer:**

The lift station 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 shall be protected by a thermal magnetic circuit breakers, 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 primary circuit breaker is in "OFF" position.

Note: usually only supplied on 480V service.

8. Wiring

- a. The pump station, as furnished by the manufacturer, shall be completely wired, except for power feed lines to the main entrance terminal blocks 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 60°C temperature rating, on circuits of 100 amperes or less, nor above 75°C on circuits over 100 amperes. 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. Factory installed conduit shall conform to following requirements:
- a. All conduit and fittings to be UL listed.
- b. Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
- c. Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electric Code.
- d. 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) Supply voltage, phase and frequency
 - 3) Current rating of the minimum main conductor
 - 4) Electrical wiring diagram number
 - 5) Motor horsepower and full load current
 - 6) Motor overload heater element
 - 7) Motor circuit breaker trip current rating
 - 8) 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 (EPS Air Bubbler Type)

- A. The manufacturer of the liquid level control system shall have a quality management system in place and shall be ISO 9001 certified.
 - 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 the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.
 - 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 pump when the liquid reaches the "lag pump start level" so that both 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 12VDC in an ambient temperature range of -10 degrees C (14 degrees F) through 55 degrees C (131 degrees F). Control range shall be 0 to 12.0 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be retained using a non-volatile lithium battery back-up.
3. The electronic pressure switch shall consist of the following integral components: pressure sensor, display, electronic comparators and 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 0-15 PSI, temperature compensated from -40 degrees C (-40 degrees F) through 85 degrees C (185 degrees F), with a repeat accuracy of (plus/minus) 0.25% 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 the preset start and stop level for both lead and lag pump. The display shall include twenty (20), 0.19" high alpha-numeric characters calibrated 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 and lag 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 output relay in the electronic pressure switch shall be solid state. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. The "ON" state of each relay shall be indicated by illumination of a light emitting diode. The output of each relay shall be individually fused providing overload and short circuit protection. Each output relay shall have an inductive load rating equivalent to one NEMA size 4 contactor. A pilot relay shall be incorporated for loads greater than a size 4 contactor.
4. The electronic pressure switch shall be equipped with an output board which shall include LED status indicators and a connector with cable for connection to the main unit.
5. The electronic pressure switch shall be equipped with pump start delay(s) preset at a fixed delay time of five (5) seconds.
6. 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.
7. The electronic pressure switch shall be equipped with a simulator system capable of performing system cycle testing functions.
8. The electronic pressure switch shall be capable of controlling liquid levels in either a pump up or pump down application.
9. 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.
10. 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, 0-10VDC, or 4-20mA, and one (1) 4-20mA scalable output. Output is powered by 10VDC supply. Load resistance for 4-20mA output shall be 100-400 ohms.
11. The electronic pressure switch shall include a DC power supply to convert 120VAC control power to 12VDC EPS power. The power supply shall be 500 mA (6W) minimum and be UL listed Class II power limited power supply.

12. The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. An indicator, visible on the front of the control panel, 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.

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.

5. Alarm Light (External):

Station manufacturer will supply one 115 VAC alarm light (with flasher) 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.

6. Alarm Horn (External):

Station manufacturer will supply one 115 VAC 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 dialer shall be a solid state component capable of dialing up to 16 phone numbers, each up to 24 digits in length. Phone numbers and standard pulse dialing of Touch Tone DTMF dialing are user programmable via the system's keyboard or touch tone phone.
- B. Solid State Voice Message Recording and Playback
 1. The unit shall have two different categories of speech message capability, all implemented with permanent nonvolatile solid state circuitry with no mechanical tape mechanisms. The unit shall allow for message recording from a remote telephone as well as from the front panel.
 2. User Field Recorded Messages: The user may record and re-record his own voice messages for each input channel and for the station ID.

3. There shall be no limit on the length of any particular message, within the overall available message recording time; which shall be 40 seconds for 4 channel units, 80 seconds for 8 channel units, and 160 seconds for 16 or more channels.
 4. The unit shall allow selective recording of both Normal and Alarm advisory messages for each input channel.
 5. The unit shall provide for automatic setting of the optimum speech memory usage rate for the total set of messages recorded in order to achieve optimum recording sound quality.
 6. Circuit board switches or jumper straps shall not be acceptable means of manipulating message length or recording rates.
 7. Permanent Resident Non-Recorded Messages: Permanent built-in messages shall be included to support user programming operations, to provide supplemental warning messages such as advising that the alarms have been disabled, and to allow the unit to be fully functional even when the installer has not recorded any messages of his own.
- C. Local & Remote Programming Capabilities
1. The user may optionally elect to alter the following parameters from their standard normal default values via keyboard entry or remotely from any touch tone phone.
 2. Alarm Call Grouping: Upon alarm activation, the system shall selectively call the correct phone numbers according to the current alarm(s).
 3. Alarm Response Delay: .1 to 999.9 seconds.
 4. Delay Between Alarm Call Outs: .1 to 99.9 minutes.
 5. Alarm Reset Time: .1 to 99 hours or "NO RESET."
 6. Incoming Ring Response (Answer) Delay: 1 to 20 rings.
 7. Number of Message Repetitions: 1 to 20 repetitions.
 8. Input Alarm Criteria: Each channel shall be independently configured for "Alarm On Open Circuit", "Alarm On Closed Circuit", and "No Alarm."
 9. Autocall Test: When enabled, the unit shall place a single round of test calls, both at the time this function is enabled and also at regular subsequent intervals until this function is disabled at the keyboard.
 10. Run Time Meter: Selected inputs shall accumulate and report the number of hours that its input contacts have been closed.
 11. Remote System Microphone Activation.
 12. Remote and Local Arming and Disarming of System.
 13. Pulse Totalizer Function.
- D. User entered programming and voice messages shall be kept intact even during power failures or when all power is removed for up to ten years.
- E. Acknowledgement of an alarm phone call is to be accomplished by pressing a touch tone "9" as the alarm call is being received, and/or by returning a phone call to the unit after having received an alarm call.
- F. The unit shall continuously monitor the presence of AC power and the status of four contact closure inputs. The unit shall optionally be field upgradeable to incorporate a total of 8, 16, 24, or 32 dry contact inputs. AC power failure, or violation of the

alarm criteria at any input, shall cause the unit to go into alarm status and begin dial outs. The unit shall, upon a single program entry, automatically accept all input states as the normal non-alarm state; eliminating possible confusion about Normally Open versus Normally Closed inputs. Further, as a diagnostic aid, the unit shall have the capability of directly announcing the state of any given input as currently "Open Circuit" or "Closed Circuit", without disturbing any message programming. Each input channel shall also be independently programmable, without the need to manipulate circuit board switches or jumpers, as Normally Open or Normally Closed, or for No Alarm (Status Only), or for Pulse Totalizing, or for Run Time Metering.

- G. Any dry contact input can be programmed to accumulate and report the number of hours their respective input circuits have been closed. Any such channels will never cause an alarm, but on inquiry will recite the channel's message according to the status of the input and then report the closed circuit time to the tenth of an hour. The input will accumulate and report in tenths of hours up to a total accumulated running time of 99,999.9 hours. The initial value of the Run Time Meter shall be programmable in order to agree with existing electromechanical Run Time Meters. Up to a total of 8 Run Time Meters may be programmed.
- H. Any dry contact input can be programmed to accumulate the number of pulses (momentary contact closures) occurring at the input.
- I. Upon initiating an alarm phone call, the system is to "speak" only those channels that are currently in "alarm status."
- J. The unit shall provide a complete verbal report of all programmable functions and their programmed values on command from any remote touch tone phone.
- K. The unit shall be capable of dialing any phone number on command and function as a speakerphone.
- L. Inquiry phone calls can be made directly to the unit at any time from any telephone, locally or long distance, for a complete status report of all variables being monitored; including power status.
- M. Normal power shall be 105-135 VAC, 15 watts nominal. The product is to contain its own gel cell rechargeable battery which is automatically kept charged when AC power is present. The system shall operate on battery power for a minimum of 20 continuous hours in the event of AC power failure. A shorter backup time shall not be acceptable. The built-in charger shall be precision voltage controlled, not a "trickle charger", in order to minimize recharge time and maximize battery life available.
- N. The dialer is to use a standard rotary pulse or touch tone "dial-up" phone line (direct leased line not to be required) and is to be F.C.C. approved. Connection to the telephone is through a 4-pin modular jack (RJ-11.)
- O. All power, phone line, dry contact, and analog signal inputs shall be protected at the circuit board to IEEE Standard 587, Category B (6,000 volts open circuit/3,000 amps closed circuit.) Gas tubes followed by solid state protectors shall be integral to the circuit board for each such line. Protectors mounted external to the main circuit board shall not be an acceptable substitute. The installer shall provide a good electrical ground connection point near the unit to maximize the effectiveness of the surge protection.
- P. The dialer shall be supplied and under warranty by the lift station manufacturer covered by a three (3) year warranty covering parts and labor performed at the factory.
- Q. The system shall include expansion connectors to accommodate field upgrades for additional dry contact inputs, remote supervisory control outputs, analog inputs and communication with remote printers and computers.
- R. All keyboard and front panel switches shall be sealed to prevent contamination. Front panel LED's shall indicate: Normal Operation, Program Mode, Phone Call in Progress, Status for each channel, AC Power Present, AC Power Failure, and Discharging or Recharging Battery. On any inquiry telephone call or on site status check, the voice shall provide specific warning if no dial out phone numbers are entered, or if the unit is in the "alarm disable" mode, or if AC power is off or has been off since last reset. A built-in microphone shall allow anyone at a remote phone to listen to local sounds and have a two-way conversation with personnel at the dialer.

3. PART - EXECUTION

3.1 Examination

- A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station manufacture 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.

3.2. 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 manufacture at time of delivery.
- B. Suction pipe connections must be 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.
- E. After all anchor bolts, piping and control connections are installed, completely fill the grout dam in the pump station base with non-shrink grout.

3.3. 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 water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gauge readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems.
- B. Co-ordinate station start-up with manufactures technical representative. The representative or factory service technician will inspect the completed installation. The technician will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.
 - C. 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.

- D. The pump station should be placed into service immediately. If operation is delayed, station is to be stored and maintained per manufactures written instructions.

END OF SECTION