STANDARD SPECIFICATIONS FOR
CONSTRUCTING SANITARY SEWER FACILITIES

DIVISION III - GENERAL CONDITIONS

SECTION 2

GENERAL SPECIFICATIONS FOR SEWAGE PUMPING STATION

2.01 SCOPE:

These Specifications form a part of the Contract Documents and shall govern for the construction of sewage pumping stations. The Work covered by this Section includes the furnishing of all labor, equipment, and materials, and performing all operations in connection with the construction and installation of Sewage Pumping Stations complete with pumps, piping, wet well, electrical work and all necessary auxiliary equipment. The station shall be complete and in strict accordance with this section of the specifications and the applicable plans, the standard practices and ordinances of the City of Saraland, Alabama, and subject to the terms and conditions of the Contract. Sewage pumping stations shall be designed to remain fully operational and accessible during a one hundred (100) year flood event.

2.02 MATERIALS:

Materials of this Section shall be as specified herein.

2.03 INTENT OF PLANS AND SPECIFICATIONS:

The intent of the plans and specifications associated with this Section is to provide a completed sewage pumping station which will function as intended and is ready for operation.

It shall be the responsibility of the Contractor as a part of this Work through careful quality control and coordination with the Engineer to avoid all conflicts occurring during construction such as available space, routings, mis-matched or otherwise incompatible component selection, incomplete systems, substitutions, etc.

Where inter-system components, devices, adapters, etc. are not specified or noted in the design, but required to complete the system, it shall be the responsibility of the Contractor to provide such items and material as a part of this Work.

Unless otherwise noted, items specified herein by manufacturer or trade name shall be used as a guide to quality and inherent features.

Special drawings and Specifications shall be submitted by the Contractor for the Engineer's evaluation covering all equipment, controls, material, and construction procedures.

The actual field installation shall reflect only that material and equipment submitted and approved by the Engineer. Any work performed without an approved submittal and considered not acceptable by the Engineer shall be removed and reworked at the Contractor's expense.

The plans and specifications included herein reflect single speed pumping. Where variable speed pumping is specified, all additional requirements associated therewith shall be met by the Contractor. Special drawings and specifications shall be submitted by the Contractor for the Owner’s evaluation covering all equipment, controls, material, and construction procedures for variable speed pumping.

2.04 SUBMITTALS AND TESTS:

A. Submittals:

Prior to installation of any material or equipment, the Contractor shall submit for approval of the Engineer, five sets of required submittal material indicating item identification, manufacturer, type, size, ratings, and other descriptive information required for adequate evaluation. Wiring diagrams shall be submitted where item function description necessitates, and as required by the Engineer. Submittals shall be conspicuously marked to denote departures from the design references shown on the plans or specified. Incomplete submittals will not be evaluated.

Submittal drawings shall provide layout of mechanical equipment and anchor bolt locations for station. Contractor piping connections 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. Wiring diagrams shall be submitted where item function description necessitates, and as required by the Owner. Submittals shall be conspicuously marked to denote departures from the design references shown on the plans or specified. Incomplete submittals will not be evaluated.

Submittals shall bear a stamp or specific written indication that the Contractor has satisfied his responsibilities under the Contract with respect to the Contractor's review of the submission.

Omissions and/or design revisions made in submittals shall not relieve the Contractor from the responsibility of providing the omitted item or required material as a part of this Work. Approval by the Engineer shall not constitute acceptance of an erroneous or incomplete system submittal.

1. Material submittals shall be manufacturer's catalog sheets or similar published data marked to denote only the item or items covered by the submittal. Materials of unique production shall have special submittal attention to give complete identification of the materials being proposed.

2. Equipment submittals shall present the equipment for evaluation as a unit piece including all component parts by manufacturer's designation. Submittals shall be marked to denote only the equipment being proposed and shall be complete including electrical, physical, and operational data. Additional supporting data shall be provided where necessary.

3. Fabrications, assemblies, and special productions shall have submittals of unique preparation to present the finished item completely identified. Such shop drawings shall include all material, components and assembly work.

4. Systems composed of multiple component parts or subsystems shall have submittals to denote the system as a completed composite. All component parts and subsystems shall be identified.

5. Documentation of the finished installation shall be made as a part of final acceptance and shall include corrected submittals, operation and maintenance publications, and other data necessary to accurately define the final field installation.

B. Tests, Instructions and Reports:

The following listed items shall be required in addition to other special requirements within these Specifications:

1. Written conductor insulation resistance test.
2. Written ground rod resistance test.
3. Local public electrical inspector's certificate.
4. Operational demonstration test.
5. Certified pump curves.
6. Operation and maintenance manuals.

2.05 SITE WORK:

In general, clearing shall consist of the removal and disposal of all undergrowth, brush, logs, trash and other objectionable obstructions. All materials cleared from the site shall be disposed of off the site by the Contractor. It is the intent that the entire area within the limits of the sewage pumping stations as shown on the plans shall be cleared, backfilled, and graded with four (4) inches of crushed stone surfacing for proper storm water drainage in accordance with the specifications contained herein. All areas surrounding the sewage pumping station shall be grassed.

A. Access Driveways: The Contractor shall include in the sewage pumping station construction a Bituminous Pavement Access Driveway including select backfill, eight (8) inches of crushed aggregate, and one and a half (1½) inches of Bituminous Wearing Surface Mix 416-A. These access driveways shall be constructed in accordance with the Alabama Department of Transportation Standard Specifications, latest edition.

B. Fencing: The Contractor shall include in the sewage pumping station construction a six (6) foot high wood privacy fence. The wood privacy fence shall be constructed of first class wood to the lines indicated on the plans and shall include treated 4" x 4" wood posts set a minimum of 36 inches deep in the ground in concrete and spaced no greater than 8 feet on center, three (3) treated 2" x 4" wood stringers between each set of posts, treated number 2 pine or better 6" x ¾" fence boards with dog eared tops, galvanized fasteners and hardware, 12 foot double leaf swing type heavy duty service traffic gate matching the fence, and a brass weatherproof padlock (4-pin tumbler type, minimum) and keys.

With approval from the City of Saraland, a brick/wooden or chain link fence may be installed. The chain link fence fabric shall be zinc-coated Class II steel chain link per ASTM A-392 with green coating, two inch mesh, number 9 gauge with three strands of galvanized barbed wire on 45 degree angle arms at top of galvanized steel line posts, of H Columns with nominal weight of not less than 4.1 pounds per foot. All corner, end, and pull posts shall be 2-7/8 inches OD (minimum) standard galvanized steel pipe or 3-½ inches by 3- ½ inches rolled formed sections with integral fabric loops, 5.14 pounds minimum per foot. Corner posts shall be braced in both directions and gate posts shall be braced to the nearest line or corner post. Pipe posts shall have tops which exclude moisture. Top rails shall be a minimum of 1-¼ inch (6.11 inch O.D.) standard weight galvanized steel pipe. Total height of fence shall be seven feet with the wire fabric being six feet. Spacing of posts shall be uniform and not exceed ten feet. Line posts shall be set in concrete bases 36 inches deep and ten inches in diameter, minimum. All corner, gate and brace posts shall be set in a foundation 36 inches deep minimum and 14 inches in diameter minimum. Traffic gate shall be double leaf swing type for a twelve foot opening. Both the travel gate and pedestrian gate shall be heavy duty service matching the fence. There shall be a furnished brass weatherproof padlock for the gate and keyed to math the City's system.

C. Water Service: One (1) each ¾" water service with hose bib shall be located within the fenced area.

D. Location and Orientation: Location and orientation of gates, hatches, control panels, and other appurtenances shall be field verified by the City of Saraland, Alabama prior to construction or installation regardless of the plans. Should the Contractor fail to verify the location and orientation of such items with the City of Saraland, he shall remove and relocate the item(s) at no additional expense to the Owner.

2.06 EXCAVATION FOR PIPES AND STRUCTURES:

A. General: The Contractor shall perform excavation of every description regardless of the nature of the materials encountered. Trenches or foundations for pipes or structures shall be excavated to the lines, grades, and elevations shown on the plans. Trench and structure excavations shall be of sufficient size to permit the placing of pipes and forms.

B. Overcuts: If at any point in excavating for structures, material is excavated beyond the neat lines upon or against which concrete is to be placed, the overcut shall be filled with reef shell, crushed slag or crushed stone fill properly compacted, or with concrete, as directed by the Engineer. The proposed elevations and positions for the different structures are shown on the plans. However, the Engineer reserves the right to make such modifications as in his opinion are necessary to carry out the intent of the plans or specifications. No payment will be made for overcuts or reef shell, crushed slag or crushed stone fill in overcuts. Reef shell, crushed slag or crushed stone shall be as specified in the City's Standard Specifications.

C. Dewatering: The Contractor shall remove any water which may be found or may accumulate in the trenches and shall perform all work necessary to keep them clear of water while the foundations are being laid, the masonry being constructed, or pipe laying is in progress. Such removal shall be accomplished by means of a well point system or other approved means. Comprehensive plans for dewatering operations, if used, shall be submitted prior to installation. No extra payment will be made for dewatering.

2.07 CONCRETE:

The minimum compressive strength required at 28 days is 3,000 pounds per square inch. Field specimens and laboratory tests shall be made in accordance with the standards of the American Society of Testing Materials. The minimum amount of water shall be used to produce a workable mix and shall not exceed six U.S. gallons per sack of cement. Concrete and associated materials shall also be in accordance with those specified for manhole structures.

2.08 WET WELL:

The foundation of the wet well shall consist of a reinforced concrete slab poured on undisturbed earth in accordance with details shown on the plans.

The barrel of the wet well shall be constructed of sections of reinforced concrete pipe conforming to ASTM 3 Specification Designation C76, Class II. Concrete for pipe shall be Type II Portland Cement with 100 percent calcareous aggregate.

The diameter, height, opening and other details shall be as shown on the plans. Minimum diameter shall be eight feet.

Joints shall be made with rubber gaskets or an approved equal.

The wet well concrete interior shall be coated with a coal tar epoxy with a minimum of 70% solids content by volume, to a minimum dry film thickness of 7.0 mils. Coating shall be equal to Indurall's Ruff Stuff 2100 Coal Tar Epoxy. Surface preparation shall be performed in accordance with the paint manufacturer's recommendation for the required application, but as a minimum shall be SSPC-SP-6 (Commercial Blast Cleaning).

2.09 PAINTING AND TOUCH-UP:

Unless the system component is stainless steel, all electrical equipment, cabinets, and items shall require protective painting shall be painted in accordance with the item manufacturer's standards except that this shall not be less than a three-coat system suitable for the exposure. After installation, items including welded seams shall be thoroughly cleaned of grease, dirt, rust, and foreign matter and repainted or touched-up as required with the same color paint applied at the factory.

Unless otherwise approved by the Engineer, and in addition to the normal approval action, all items with carbon steel enclosures installed out-of-doors, in corrosive areas, or in wet or damp areas shall be thoroughly cleaned of surface films after installation and given one coat of Indurall rapid-dry epoxy primer H-1175 and two final coats of Indurall two-part epoxy paint "Perma-Clean", or approved equal in color approved by the Owner.

2.10 CONTINUITY OF OPERATIONS:

The Contractor, as a part of this work, shall provide all stand-by facilities, power systems, etc. in order to maintain the operations of existing facilities throughout the construction phases of the new work. The Contractor shall schedule his work with that of the Owner in order to coordinate all interruptions of the existing facilities operations to suit the Owner's schedule. All temporary facilities and provisions shall be made after being submitted to the Owner and approved thereby.

2.11 DEFINITION OF ACCEPTANCE:

System acceptance shall be defined as the point in time, in addition to the Contract requirements, when all of the following requirements have been fulfilled:

A. All submittals and documentation have been submitted, reviewed and approved.

B. Two (2) copies of all Operations and Maintenance Manuals shall have been submitted on all equipment items.

C. The complete system has successfully completed all testing requirements.

D. All fees, permits and reports have been satisfactorily completed.

E. All Owner's staff personnel training programs have been completed.

F. Beneficial use by the Owner has occurred and the two year warranty documentation has been accepted by the Owner including required bonds.

G. All warranty deeds/easements have been properly recorded.

2.12 CLEAN-UP:

After final operation tests, the interior and exterior of the station shall be cleared of all trash and debris and left in final operating condition. Final grading of the site and restoration of surfaces with grass shall be in strict accordance with the applicable drawings, standard specifications, and City of Saraland Public Works office.

2.13 PUMPS - GENERAL FOR BOTH SUCTION LIFT & SUBMERSIBLE:

A. All pumps of the same type, frame and size shall be of the same manufacturer and shall have interchangeable parts, and shall be a type and brand listed as approved by the City of Saraland, Alabama. All screws, small bolts, nuts, washers and miscellaneous items normally subjected to corrosion shall be constructed of stainless steel. All completed and installed operating pump units and accessories shall be suitable for the intended location and service shall be free of operating problems, unusual vibrations and noise throughout the entire operating range of the equipment. Undesirable operation, vibration, or noise in a pump unit or accessories shall be corrected, and if necessary, the entire unit shall be replaced at no additional cost to the Owner.

B. General: Motors shall be rated as to full load horsepower values and shall have electrical characteristics corresponding to the electrical power system at the installation. The motor shall be designed for continuous as well as intermittent operation and shall be non-overloading over the entire operational range of the pump.

Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase).

The motor shall have bearings designed for a minimum B-10 life of 15,000 hours and shall be equipped with moisture sensors located between two mechanical seals in an oil filled seal chamber for external seal failure alarm.

The motor shall be labeled by Underwriters Laboratory, Inc. or Factory Mutual as approved for use in Class I, Division I, Group D hazardous locations and rated as suitable for submergence in raw sewage.

Unless otherwise specifically noted, not less than 30 feet of heavy duty grease resistant submersible multi-conductor electrical power and pilot cable with grounding conductor shall be provided connected to the motor ready for operation for submersible pumps.

Provide not less than four copies of technical information and parts listing, including recommended maintenance, describing pumps and motors including pump performance curve, minimum submersion head for pumps and range of available impeller sizes and their power requirements.

Provide written guarantee for replacement of pump and motor for failure of satisfactory performance and for defective parts of assembly.

C. Pump Installation: Pumps shall be installed in accordance with the manufacturer's recommendations and as approved. Where guide bars are indicated, pumps shall be mounted on guide bars as shown on the plans. Coat bolt thread projections with lubricant to facilitate future nut removal.

D. The Contractor shall provide in a suitable substantial case any special tools or adjustment devices necessary for the proper maintenance and adjustment of the equipment furnished. This shall include all special or unusual items necessary for the dismantling and assembling of all furnished equipment.

E. Four instruction manuals, clean and unused, shall be delivered to the Owner for the pumps, motors and all accessories. Each instruction manual shall carry the serial number of the piece of equipment to which it applies, design data, operating instructions, lubricating instructions, maintenance instructions, assembly drawings showing location of parts and test curve. Each instruction manual shall be bound in a stiff black folder with the name of the pumping station and the unit numbers or name embossed on the outside.

F. The Contractor shall furnish and install all necessary break-in lubricants and all final lubricants as recommended by the manufacturer for all pumps, motors and accessories.

G. Supplier's/Manufacturer's Services: The Contractor shall furnish the services of qualified technical personnel representing the manufacturer or group of manufacturers for each equipment grouping or system within the project, for checking the installation, making the necessary adjustments, placing the equipment in operation, and during acceptance tests. The representatives shall be available and scheduled with the Owner to instruct operating personnel in the use, operation, and maintenance of the equipment during the initial on-line operating period. All components and equipment shall be installed in accordance with the recommendations of the manufacturer.

Operating tests shall be performed by the manufacturer's representative on all equipment in the presence of the Owner and the Engineer or their representatives in order to demonstrate the entire facility to be complete, functional, and ready to be placed in operation.

Operating instructions shall be given to the Owner's regular operating personnel by the equipment manufacturer's representative where complex equipment is provided and by the Contractor for other equipment in order to thoroughly familiarize the operators in the correct procedures and functions for operating and maintaining the facility.

H. Pump Identification Plate: A 16-gauge stainless steel identification plate shall be securely mounted on each pump in a readily visible location. The plate shall bear the ¼ inch die-stamped equipment identification number that is assigned each pump in the Pump Specification Sheets and shown on the plans.

I. Lifting Lugs: Equipment weighing over 100 pounds shall be provided with lifting lugs.

J. Performance Tests: The Contractor shall perform field tests on all completed pump and control system assemblies, as required by the Pump Specification Sheets, to demonstrate their conformance to the specifications to the satisfaction of the Engineer. A test log shall be presented to the Engineer upon the completion of each test that records the following:

1. Flow, in gallons per minute.

2. Pump discharge pressures as measured by calibrated gauges, converted to feet of the liquid pumped and corrected to pump datum as defined by Hydraulic Institute Standards, calculated velocity heads at the discharge flanges, and total head, all tabulated in feet.

3. Applied voltage and amperage measured for each phase.

4. Pump control and liquid level control.

5. Complete nameplate data.

6. Calibration of all instrumentation equipment.

7. Testing of manual and automated control devices.

8. Note any undue noise, vibrating or other operating problems.

K. Factory Tests:

1. Pumps: A factory test certified by the pump manufacturer's test representative shall be performed on all pumps actually furnished and written notice of the same shall be furnished to the Engineer. Information required to be furnished at the time of test is as necessary to show conformance to specified performance. Tests shall conform to the Hydraulic Institute Standards test code.

2. Motor Tests and Test Reports: As specified in Pump Specification Sheets, pump drivers shall not be overloaded within a 1.0 service factor rating at any point on the pump curve.

3. Balance of Vibration: The rotating parts of each pump and its driving unit shall be dynamically balanced before final assembly. The driving unit alone shall operate without vibration in excess of the limits stated in the latest revision of NEMA MG 1.

L. Functional Test: Prior to plant startup or field performance test, all equipment described in the Pump Specification Sheets following shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance by means of a functional test.

M. Spare Parts for pumps shall be furnished to provide 12 months of full time service and special tools required for that service shall be suitably boxed and marked for shipment and storage.

NOTE: See attached Pump Specification Sheets for pump system and performance warranty requirements. All pumps shall be on the City's list of materials and approved manufacturers.

2.14 VALVES AND PIPING:

Gate valves, check valves, and flanged ductile iron piping shall be in accordance with the City's accepted materials.

2.15 REMOTE MONITORING SYSTEM

A. General: A new radio telemetry system shall be provided to collection status and alarm conditions at the remote stations and transmit same to the mission communications central control station for displaying, alarming, annunciation, storing and processing into reports, and shall have the capability of “on-off” control of remote driven equipment. The system shall be Model M110 by Mission Communications.

The system shall be composed of the following basic components:

1. Unique field gathering devices and circuits.

2. RTU, including antenna.

The installer shall provide for the supply, installation certification, adjustment, and start-up of a complete, coordinated system which shall reliably perform the specified functions. The Installer shall coordinate his Work to ensure that:

1. All components of the various systems are installed.

2. Each system is complete including items not specifically addressed in these Specifications but required to achieve a fully complete system.

3. The proper type, size and number of wires with their conduits are provided for all components and systems.

4. Proper electric power circuits including wire and conduit are provided for all

components and systems.

5. Modifications to the system or inter system components are made to achieve the correct end function.

6. The finished systems have been coordinated to produce function and control installation stability and reliability.

7. All sensing and proper circuits have lightning and surge protection at each grouping connection within the system.

B. Scheduling: Where the Installer work involves the work of other subcontractors, it shall be the responsibility of the Installer to coordinate his work with that of the other subcontractors such as structures, excavation, supporting means, mechanical equipment, taps, connections, etc.

C. Design Basis:

1. The telemetry system specified herein is based on the Model M110 as manufactured by Mission Communications.

2. Major constituents of this system include, but are not limited to, all materials, equipment, component parts and devices, and work required to implement a complete and operating system. Like items of equipment hereunder shall be the end product of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

D. Responsibility and Scheduling: The Installer shall accept ultimate responsibility for completion and final acceptance of the overall Project including work done by subcontractors and material and equipment provided by vendors and suppliers. The Installer shall be responsible for coordination of Project execution in order to prevent duplication of work, omissions, and other inter-contract conflicts. References to duties and responsibilities of subcontractor, vendors, suppliers, etc. within these Specifications are intended to be addressed through the Installer's overall responsibility.

The Installer shall accept responsibility for providing all devices such as switches, relays, contacts, etc., and shall not be dependent upon the work of other subcontractors or the City of Saraland relative to the providing of devices, equipment, components, wiring, supporting means, etc.

E. Field Reconnaissance: The Installer shall visit each site involved in this Work in order to gather measured or observed data and shall verify field conditions in order to become eminently familiar with the installation details. The Pumping Station Installer shall schedule all visits with the City of Saraland in order to allow the City of Saraland to develop a schedule of supervised site visitation to suit the City of Saraland's schedule of operations.

F. Shop Drawing Submittals:

1. Hardware Submittals: Before any components are fabricated, and/or integrated into assemblies, or shipped to the site, furnish to the Engineer, and receive his approve review of require submittal copies of full details, Shop Drawings, catalog cuts, and such other descriptive matter and documentation as may be required to fully describe the equipment and to demonstrate its conformity to these Specifications. The decision of the City of Saraland/Engineer upon the acceptability of any submittal shall be final. Catalog information shall be submitted for all equipment, regardless of whether or not it is of the same manufacturer as that listed in the Specification.

All submittals shall be complete, neat, orderly, and indexed accordingly. Partial

submittals and "general information only" will not be accepted. All components shall be referenced by the instrument designations shown on the Plans.

If, in the opinion of the Engineer, a submittal is not clear, it will be returned to the Installer without approval to be revised accordingly and resubmitted within 30 days.

Specifically, Installer shall submit the following material:

a. Catalog data and published design data for each unit components manufactured for a specific duty.

b. Modifications required to be made to a unit component or assembly in order to perform a special function.

c. All special fabrication other than a published catalog item including but not limited to:

- Control panels
- Component assemblies
- Supporting or bracing apparatus
- Construction or modification of facilities

Submittals shall bear a stamp or specific written indication that the Installer has satisfied the Installer's responsibilities.

Omissions and/or design revisions made in submittals shall not relieve the Installer from the responsibility of providing the omitted item or required material as a part of this Work. Approval by the City of Saraland/Engineer shall not constitute acceptance of an erroneous or incomplete system submittal.

The Installer, at his option, may submit for evaluation two copies of submittal material, one of which will be marked and returned. The required number of copies corrected as marked, will then be submitted for approval stamping to the Engineer.

2. Interconnecting wiring diagrams showing all component and panel terminal board identification numbers and external wire numbers. This diagram shall include all intermediate terminations between field elements and panels (e.g., terminal junction boxes, motor control centers, etc.). Diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.

3. Operation and Maintenance Manuals - The Installer shall provide seven complete sets of bound operating and maintenance manuals for the completed Project. These manuals shall not only include descriptive material, but also drawings and figures bound in appropriate places. The manuals shall include operation and maintenance literature for all components provided in this Section. The submittal literature shall be in sufficient detail to facilitate the operation, removal, installation, adjustment, calibration, and maintenance of each component provided under this Section.

G. Remote Terminal Units:

1. Remote Terminal Unit (RTU) shall be Mission Communications M110. It shall have battery back-up with charger for 8-hour full load running of RTU and radio. The RTU shall operate on 120 volt A.C. input power. Status diagnostic indicators shall be provided. Each RTU shall be designed and installed to provide "on-off" control capability of equipment from the Central Control Station.

2. Each status and alarm signal circuit shall be protected against electrical transient damage due to direct or indirect overvoltage at each transmitting and receiving device where field routed circuits are installed.

The radio system supplier shall provide the City of Saraland a 5-year parts and labor guarantee including lightning damage covering antennas, cables, and transceivers.

H. Tests:

1. General: All elements of the System shall be tested to demonstrate that the total system satisfies all of the requirements of this Specification. All testing materials and equipment shall be provided by the Installer. Where it is not practical to test with real process variables, the Installer shall provide suitable means of simulation. These simulation techniques shall be subject to review by the Engineer. The Installer shall coordinate all of this testing with all other associated subcontractors.

2. Operational Acceptance Test: The objective of these tests is to demonstrate that the system of instrumentation is ready for final operation. The Installer shall prepare check-off sheet(s) for each reporting station. These check-off and data sheets shall form the basis for these operational tests and this documentation.

2.16 ELECTRICAL - GENERAL ITEMS:

A. Electrical Service: Three phase power shall be required for all lift station sites. In unique circumstances where three phase power is not available and confirmed with Alabama Power and the Owner, a phase converter (PC) shall be supplied that will convert single phase power into three phase power to operate a pump or motor. The PC is a variable frequency drive (VFD) oversized to run a pump or motor at sixty hertz when the run command is received. The PC will be preprogrammed to match the electrical characteristics of each pump.

B. Emergency Standby Power: New sewage pumping stations shall be equipped with emergency standby power either generator or bypass pumps as determined by the City of Saraland, Alabama for each site. Supervisory control and data acquisition (SCADA) systems in accordance with the SCADA systems currently in use by the City of Saraland sewer system for monitoring operating conditions of the pump station from remote sites shall be installed at new sewage pumping

C. All electrical material and equipment provided by the Contractor shall be new and free of defects. All work performed under this section of the specifications shall be carried out by skilled workers regularly engaged in the performance of such duties. The entire electrical installation shall be not less than that required by the latest edition of the National Electrical Code, the Occupational Safety and Health Act, and all electrical codes locally enforced in the project area. The Contractor shall obtain all permits required by local ordinances and after completion of the work, shall give the Engineer a certificate of final inspection and approval from the local Electrical Inspection Office. Any expenses connected with such inspection and certificate shall be borne by the Contractor.

Electrical material and equipment shall be designed in accordance with the latest requirements of applicable standards such as NEMA, ANSI, IEEE, and where listings are available for such items, shall be approved by the Underwriters Laboratories, Inc. Equipment, components, material, etc., rated by other standards and agencies including but not limited to IEC, VDE, and DIN will not be considered equal to NEMA, ANSI, IEEE, and UL. Electrical items shall be standard cataloged products of manufacturers regularly engaged in the manufacture of such products, unless otherwise noted.

D. Grounding:

1. Non-current carrying metal parts of electrical items such as cabinets, enclosures, frames, etc., and the neutral conductor shall be grounded in accordance with the National Electrical Code unless additional grounding requirements are indicated. Grounding conductors shall be copper, sized as noted. Special grounding system features shall be provided as indicated.

2. All conduit runs installed for lighting and power loads shall contain a grounding conductor throughout the entire length of the run forming a part of the grounding system. The grounding system shall be electrically continuous throughout the electrical system and shall be connected to earth ground at the point of power service and as otherwise indicated.

3. Ground rods shall be copper welded steel type, ¾ inch diameter, 20'-0" length, minimum. Ground rods shall be driven to 1'-0" (minimum) below finished grade unless otherwise indicated and shall be electrically connected with suitable cast type ground clamps or exothermic welding.

4. Resistance to ground of each ground rod shall not exceed 10 ohms when measured during dry weather. In the event this value is not obtained, one additional rod or rod section equal to that tested shall be driven. Should the additional rod or section fail to achieve the required value, the Engineer shall be immediately notified. A written record of all resistance measurements and test dates shall be submitted to the Engineer prior to completion of the project.

E. Lightning and Surge Protection:

1. Lightning protector units shall be provided for power circuit protection at the main service connection point and elsewhere as noted on the plans. Lightning protectors shall be Joslyn J9200-9 or J9200-8 for three and single phase circuits respectively.

F. Insulation Tests:

1. Circuit insulation tests shall be performed to prove each circuit free of faults after all wiring is completed prior to equipment and fixture connections, and again after the installation is complete and ready for use.

2. Tests shall be made at the main electrical service connection between all conductors and between line conductors and ground. Tests shall be made with a 1,000 Vdc instrument capable of accurately measuring the resistance involved. Readings shall be taken in the presence of the Engineer or his representative for each test and the written results of each test shall be submitted to the Engineer.

G. Conductors:

1. Single conductors installed in raceways shall be copper with AWG sizes as noted and shall have 600 volt rated, type THW/THHN/THWN or XHHW, 75°C (minimum) insulation. Conductors requiring special consideration shall have insulation material and ratings noted on the plans and as required by the National Electrical Code. Type TW insulation shall not be used for any purpose in this contract except ground wire identification only.

2. Lighting and power conductors shall be minimum size No. 12 AWG, with AWG No. 8 and larger to be stranded, and AWG No. 10 and smaller to be solid unless otherwise noted. Conductors shall be stranded where movement, vibration, or other flexing occurs in order to prevent conductor fatigue. Control conductors may be AWG No. 14 stranded, unless otherwise noted.

3. Insulation colors shall be: green for ground; white for neutral; and black for single phase line conductor. "Stinger" phase conductor of 120/240 V systems shall be orange as per NEC 215.8. Unless otherwise noted, a uniform insulation color scheme for all new three phase systems shall be established as black for phase A, red for phase B, and blue for phase C. Control circuit insulation shall be yellow. Conductors size AWG 10 and larger may be black with entire exposed ends taped with "Scotch #35" or equal by Plymouth, in accordance with color schemes mentioned herein.

4. Direct buried grounding system conductors shall be bare copper, sized as noted.

H. Splices and Terminations:

1. 600 volt system conductors shall be spliced with "Ideal Wire-Nuts" or equal by T & B for AWG No. 10 and smaller for dry areas and machine crimped or bolted connectors with "Scotch 88" or equal by Plymouth, full coverage tape for all other splices. Soldered and taped splices will not be acceptable. Terminations shall be made with mechanical lugs or other acceptable termination features of the equipment supplied.

2. Control conductors shall terminate on box clamp, binding post screw, or set screws only. Soldered, taped and free-standing connections will not be acceptable.

I. Conduit:

1. Steel conduit shall be provided unless otherwise indicated and shall be heavy-wall, rigid galvanized type bearing the Underwriters Laboratories, Inc. label of approval. Conduit minimum size shall be ½ inch. Fittings for rigid steel conduit shall be threaded types made up with conductive waterproof compound. Seal-off fittings shall be provided as required by the National Electrical Code.

2. All conduit shall be clean and free from dents, scars, or other deformities. Connections shall be made watertight and bushings shall be provided where smooth hubs are not encountered. Changes in directions shall be made with symmetrical bends or conduit boxes. Field made bends shall be made with an approved hickey or conduit bending apparatus. Conduit runs shall be installed parallel or perpendicular to structural members. Conduit hangers and supports shall be provided at intervals recommended by the manufacturer and the National Electrical Code. Underground conduit runs shall be installed at least 1'-6" below finished grade unless other depths are indicated. Plain earth used for backfill shall be free from objectionable material such as rocks, glass, metal, wood, etc. and shall be tamped to surrounding earth density.

3. All conduits routed from the RTU/Control Panel to the wet-well shall include an expansion proof seal at the control box. Seals shall be poured with sealant as per the National Electrical Code.

J. Cable Connectors and Supports:

1. Conduit runs into the wet well for cable protection shall be positioned to suit field conditions to achieve an unobstructed passage for removal and installation of pumping units and shall provide close accessibility to allow removal of the cable connector by maintenance personnel from outside and above the wet well.

2. Cables entering conduit protection and as otherwise notified shall be fitted with connectors sized to suit the cable and conduit actually installed. Connectors shall be plastic body and threaded cap type with neoprene or equal internal gas-tight compression gland. Connectors shall be CGB type manufactured by Thomas & Betts, Hubbell or Daniel.

3. Cable grips shall be provided as strain relief for cables and shall be wire mesh offset eye, closed mesh type, all fabricated with 304 stainless steel and shall be sized to suit the cable actually installed. Cable grips shall be Kellems 024-01-XXX series or equal by Daniel Woodhead.

K. Receptacles:

1. Duplex convenience receptacles shall be rated 15 amps, 125 volts, two pole, three wire, grounding type, specification grade, GFI configuration unless otherwise noted. Receptacles shall be brown for unfinished areas and ivory for finished walls. Where installed in damp locations, receptacles shall be installed in weatherproof enclosures.

2. Special receptacles shall be provided as noted and shall have electrical ratings, pole configuration, and number of poles as shown or required. Enclosures, receptacle types, and other special features shall be suitable for the duty and conditions encountered.

L. Switches:

1. Safety switches shall be provided where indicated and elsewhere as required by the National Electrical Code. Safety switches shall be heavy-duty type, with voltage, current, fuses, number of poles, and enclosure types as noted. All switches requiring security including main power service, transfer, and switches installed out-of-doors shall be provided with padlocks as hereinafter specified. NEMA 4X switches shall be installed out-of-doors.

M. Fuses:

1. Unless otherwise noted, fuses provided for motor protection and other general purpose loads shall be dual-element type, "Buss Fusetron" or equal by Shawmut, with voltage and current ratings as required.

2. Control circuit fuses shall be "Buss FNM" for 120 volt circuits and "Buss KTK" for 480 volt circuits or equal by Shawmut. Unless otherwise noted, control circuit fuses shall be installed in terminal strip mounted switch action fuse blocks rated for 15 amps at 600 volts.

N. Circuit Breakers:

1. Branch and feeder circuit breakers shall be thermal-magnetic, molded case, industrial type, unless otherwise noted, and shall be listed by the Underwriters Laboratories, Inc. for not less than 14,000 amps symmetrical interrupting at 480 volts. Voltage, trip and frame current ratings, and number of poles shall be as indicated or required. Circuit breakers shall have trip-free operating handles with trip current rating permanently molded therein.

2. Circuit breakers provided as an integral part of combination motor starters may be as specified herein or may be magnetic only type manufactured specifically for motor protection duty and set for the actual motor nameplate data.

3. Circuit breakers provided to serve 120 volt lighting, receptacles, and other small loads shall be rated by Underwriters Laboratories, Inc. for not less than 10,000 amps symmetrical interrupting and otherwise shall be as specified herein. Multiple circuit breakers shall be factory assembled and sealed. Tandem type breakers and bailed tied handles of single unit breakers are not acceptable for this work.

O. Motor Starters:

1. Starters shall be sized in whole increment NEMA Designation with voltage rating poles and enclosure as noted or otherwise required. Starters shall be approved by the Underwriters Laboratories, Inc. Ambient temperature compensated overcurrent protection shall be provided in each ungrounded phase of the circuit and shall be sized to suit the motor provided. Auxiliary equipment including contacts, selector switches, pushbuttons, lights, control power transformer, fuses, etc. shall be provided as noted or otherwise required.

2. Starters shall be designed and rated in accordance with NEMA Table 2-321-1. Ratings by IEC, VDE, DIN, etc. will not be considered for this work. Terminal temperature rise rating shall not exceed 50°C. Operating coils and overcurrent sensors shall be readily and independently replaceable in the field without requiring complete starter exchange.

3. Starters indicated as being combination type shall be circuit breaker type motor circuit protector combination type set to suit the motor provided.

4. Starters shall be magnetic type, full voltage, non-reversing, NEMA Size 1 minimum with wiping style contacts, unless otherwise noted.

P. Special Control Panel:

1. Control panel shall be surface mounted NEMA 4X 304 stainless steel Hoffman style A-SSLP type construction. Control components shall be as indicated on the plans. Control panels shall be provided with padlocks as specified hereinafter. Dimensions shall be as shown on the plans. Stainless steel cabinets shall be brushed finished. All drilling and cutting shall be smooth and escutcheon plates or bezel rings shall be provided on all openings.

2. Control components and associated items shall be as shown on the plans and in accordance with other applicable paragraphs of this specification. Component arrangements shall be as shown on the plans. Panel manufacturer shall completely wire the panel using AWG No. 14 (minimum) conductors rated XHHW, 75° C (minimum). Each end of all conductors shall be identified with permanent type markers corresponding to shop drawing wiring diagram submitted for the control panel. All field wiring shall be connected to terminal strip or lugs of starters, contractors, or other larger components. Each conductor within the panel shall be labeled at each end for identification.

3. Shop drawings showing physical dimensions, component placement, and complete coordinated composite control diagrams and elementary diagrams shall be submitted to the Engineer for approval and shall show the individual control components by manufacturer's catalog number and the wire numbers actually connected in the completed installation. Complete coordinated drawings are to include all devices internal and external to the control panel.

2.17 CONTROLS:

It is the intention that this specification shall cover a complete Duplex Pump Lift Station Electrical Control System as hereinafter described and all necessary appurtenances which might normally be considered a part of the complete electrical system for this installation. All of the automatic control equipment is to be supplied by one manufacturer. It shall be factory assembled, wired and tested and covered by complete electrical drawings and instructions.

The control system described hereafter is a Bulletin LC150/(B300)/FP1 Control System as manufactured by Siemens Water Technologies of St. Paul, MN. The naming of a manufacturer of equipment in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence in the construction of and for the types of material used, and to indicate a principle of operation desired. The contractors bid shall be based on the use of Siemens Water Technologies equipment. Unless the bidder clearly indicates in his bid that he is offering an equal product approved by the engineer via a pre-bid submittal, his bid shall be considered as providing the brand name product referenced in the specifications above.

A. General Equipment Requirements:

1. U.L. Serialized Label:

The control panel(s) shall be constructed in compliance with Underwriter's Laboratories Categories 698A and 913 standards - “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” listing and following-up service. The control panel(s) shall bear the Underwriter's Laboratories serialized label for “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions”.

Prior to shipment from the manufacturer's facility to the jobsite for installation, an Underwriter’s Laboratories (U.L.) representative shall inspect the completed control panel(s). Upon successful completion of the inspection, the panel shall be assigned the required “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” serialized U.L. label, indicating the equipment is built in accordance with the practices and requirements of the Underwriter's Laboratories 698A and 913 categories.

While the use of U.L. listed components is encouraged, their use alone and/or the alternate use of a U.L. 508A - “Enclosed Industrial Control Panel” serialized label will not be considered an acceptable or satisfactory alternate to the “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” serialized label specified above. Upon request from the Engineer, the panel manufacturer shall supply documentation to the owner proving they are a U.L. recognized manufacturing facility for the type of equipment required. Only the labeled products of U.L.698A and 913 “Enclosed Industrial Control Panel Relating to Hazardous Locations with Intrinsically Safe Circuit Extensions” recognized panel manufacturer shall be considered acceptable for use on this project.

2. Wiring:

All wiring shall be minimum 600 volt UL type MTW or AWM and have a current-carrying capacity of not less than 125% of the full load current. The conductors shall be in complete conformity with the national electric codes, state, local and NEMA electrical standards. For ease of servicing and maintenance, all wiring shall be color coded. The wire color code shall be clearly shown on the drawings, with each wire's color indicated.

In addition, the equipment wiring shall be permanently marked with wire numbers that correspond to the system schematics. The numbering convention shall comply with the municipal industry standard.

All control wiring shall be contained within plastic/PVC wiring duct with covers. Where dimensional constraints prevent the use of wiring duct, wires shall be trained to panel components in groupings. The wire groupings shall be bundled and tied not less than every 3 inches with nylon self-locking cable ties as manufactured by Panduit or equal.

Every other cable tie shall be fastened to the enclosure door or inner device panel with a cable tie mounting plate with pressure tape. Where wiring crosses hinged areas such as when trained from the inner device panel to the enclosure door, spiral wrap shall be used.

3. Incoming Service and Lightning Arrestor:

The service pole and metering will be done ahead of the lift station control panel as provided by the local electrical utility company. The lift station control panel shall be service entrance rated. Conduit and wiring between the power company termination and the lift station shall be furnished and installed by the contractor. The utility power will be 480 volts, 3 phase, 3 wire, 60 Hertz.

A lightning arrestor shall be supplied in the control system and connected to each line of the load side of main power disconnect. The arrestor shall protect the control system against damage as the result of transient voltage surges caused by lightning interference, switching loads and power line interference's. It shall begin shunting to ground at 1000 volts maximum.

All metering shall be done ahead of the main disconnect and control panel. The meter shall be installed by the Contractor in accordance with local power company requirements.

Each panel shall be supplied with a properly sized control power circuit breaker and control power transformer (where necessary). The breaker shall supply power to all control wiring within the enclosure.

4. Nameplates:

All major components and sub-assemblies shall be identified as to function with laminated, engraved bakelite nameplates, or similar approved means.

B. Control System and Control Panel:

1. Enclosure:

The described equipment shall be housed in a NEMA Type 3R, 304 stainless steel, 48" high, 36" wide, 12" deep enclosure. The enclosure door shall be provided with a 3 point padlock-able latch and aluminum deadfront operator's inner door. This weatherproof, rain-tight enclosure shall be designed specifically for mounting in an unprotected outdoor location. It shall have a gasketed, hinged, front weather door with locking capability, and an internally mounted hinged dead front panel so that all the components normally actuated by Operating Personnel are accessible without opening the dead front and yet are not exposed to the elements or to unauthorized personnel.

The enclosure shall be supplied with 18" floor stand kit and louvered skirts made of the same material as the enclosure to cover incoming conduit.

2. Incoming Power Circuit Interrupts:

The control panel shall include a thermal magnetic main circuit breaker to provide an incoming power disconnect means and short circuit/overcurrent protection for the control panel equipment

The circuit breaker must have a minimum ampere interrupting capacity of (25,000 @ 240 volt) (18,000 @ 480 volt) symmetrical RMS amps. The circuit breaker shall be operable through the operator's door of the enclosure and shall have a trip rating to allow full voltage starting and continuous operation of the motors. The circuit breaker shall be a Square-D FAL Line.

The commercial power input to the control panel/main breaker shall be UL service entrance rated and labeled.

C. Control Power Transformer:

The control panel shall include a control power transformer for converting the high voltage incoming three phase service to 120 VAC single phase power. The 120 VAC power shall be used to power internal control components. The control power transformer shall be rated for 230/460-120 VAC single phase at 500VA with Class 105 Deg. C insulation and shall be UL Listed. The control power transformer shall be supplied with primary and secondary fusing.

The control power transformer shall be of single epoxy resin impregnated construction to eliminate the possibility of moisture, dust, dirt, and industrial contaminants from affecting operation and shortening transformer life. The unit shall have integrally molded barriers between terminals and transformer to protect against electrical creepage.

D. Phase Failure/Undervoltage Pump Protection:

Independent power monitors shall be provided on the load side of the pump disconnects to monitor incoming voltage and provide protection to the motors. These power monitors shall detect incoming service abnormalities including phase-loss, unbalance, reversal, over voltage, under-voltage and rapid cycling protection and provide automatic cutout of pumps and provide local alarm. Upon detection that incoming power has returned to normal, the unit will restore pump operation and discontinue alarm. This device shall have a nominal 2-4 second dropout delay and (2-300 second) adjustable restoration time delay.

The power monitor shall have built in dual color LED indicator. The indicator shall be green when system is normal and shall turn red upon detection of improper single or three phase power. The unit shall protect itself from voltage spikes and transients with internal transient protection meeting IEEE 587 standards.

The power monitor system shall also include a stagger time delay function providing time delay between lead and lag pump start to eliminate simultaneous starting of motors upon return of system power. This feature shall be in operation in all modes of pump operation.

E. Branch Circuit Breakers and Motor Starters:

A thermal magnetic circuit breaker shall be supplied as branch circuit protection for each pump motor. The circuit breaker must have a minimum ampere interrupting capacity of (25,000 @ 240 volt) (18,000 @ 480 volt) symmetrical RMS amps. The circuit breakers shall be operable through the operator's door of the enclosure and shall have a trip rating to allow full voltage starting and continuous operation of the motors. The circuit breaker shall be a Square-D FAL Line.

A NEMA rated, full-voltage, across-the-line magnetic motor starter with ambient-compensated, quick-trip class 10 overload sensing for submersible pumps in each phase to provide over current and running protection shall be provided for each pump motor. The overload trip setting shall be operator adjustable within normal pump operating ranges. Operator's door mounted, electronic overload reset push-buttons shall be provided (Mechanical O.L. operators are not acceptable). Motor Starters shall be of the same manufacture as the circuit breaker provided for the pumps.

120 VAC control power for each motor starter coil and H-O-A selector switch shall be provided.

A control power circuit breaker shall be provided and operable through the operators door of the control panel to provide a disconnect means and short circuit protection for any 120 VAC (or less) devices not powered from motor starter circuits.

F. Pump Control Selector Switches and "Run" Lights:

The control panel shall have three position selector switches mounted on the front door for Hand-Off-Auto operation of each pump. In the Hand position the motor shall be called to operate. In the Off mode the motor shall not be allowed to operate. In the Auto mode, the motor shall operate in response to control signals from the controller.

An operator's door mounted, 30.5mm diameter, NEMA Type 4X selector switch(s) shall be industrial rated heavy duty NEMA Type 4X with modular contact block assemblies. Contact Blocks shall be stacking scew together type with parallel double break contacts with wiping action. Contact blocks shall be rated NEMA A600, 600 Volt, 10A continuous duty, 7200VA make, 720VA break AC. Contacts shall have compression type screw terminals with self lifting spring washers to insure that the wire remains secure even under sever vibration. Snap together contact blocks are not acceptable. All pilot devices specified herein are to be Square D Class 9001 Type SK Line.

Unless specified otherwise, Selector Switch(s) shall be of the maintained position.

An operator's door mounted, 30.5mm diameter, NEMA Type 4X, pilot light with a "Green" lens and a replaceable bulb shall be provided for each pump to indicate a "pump running" condition. All pilot devices specified herein are to be Square D Class 9001 Type SK Line.

G. Pump Running Time Meters:

An operator's door mounted, 120 VAC powered running time meter measuring hours and tenths and hundredths of hours of operation up to 99999.99 hours shall be furnished for each pump motor indicated.

H. Liquid Level Responsive Pump/Alarm Controller:

The Pump Control - Telemetry Unit shall be furnished for monitoring and automatically controlling the lift station pumps in a pump down mode of operation in response to a Level process variable as based on preconfigured setpoints. Unit shall be capable of communicating station status and alarms to a master station via (Dedicated Leased Voice Grade Phone Line/VHF/UHF/Spread Spectrum) communications. The master station will be future.

The Pump Controller - Telemetry Unit shall be a standard, catalogued product of a water and wastewater pumping automation equipment manufacturer regularly engaged in the design and manufacture of such equipment. The Pump Controller - Telemetry Unit shall be specifically designed for water and wastewater pumping automation utilizing built-in preconfigured control and telemetry strategies allowing pump up or down mode pump control of 1 to 3 pumps. "One of a kind" systems using custom software with a generic programmable controller will not be acceptable.

The operating program shall be resident in non-volatile FLASH memory and include full-scale ranging and pump-up/down determination. The controller shall be arranged to operate up to three (3) pumps plus high and low (analog) alarms. The ON and OFF adjustments of each pump and alarm setpoint shall be full-range adjustable through use of an authorized operator access code and a keypad. The controller display shall show the operation of each control stage.

The controller shall include keypad adjustable on-delay timing logic to provide staggered pump starting following a power failure condition. Keypad adjustable off delay timing for each pump control stage shall provide smooth transition between control stages.

The Pump Controller - Telemetry Unit shall be able to operate on either 120 AC or 10-30 VDC power sources. The unit shall be battery backed to provide continued system monitoring and alarm annunciation in the event of primary power failure. Unit shall have built in battery charging circuitry to maintain and charge battery. Battery shall be sized to provide a minimum of 4 hours of back up power. Back up battery power will extend to necessary process sensors, local alarm lights, horns and telemetry equipment. A power on LED shall be built on board providing local indication that power is available to the unit.

The Pump Controller - Telemetry Unit shall be furnished with a user friendly “View-At-A-Glance™” operator interface allowing adjustment and viewing of all system parameters and status. The operator interface shall be suitable for front door mounting including locations requiring wash-down and moisture protection.

- The process variable signal, Pump 1, 2, & 3 On/Off and High & Low Setpoints, shall be displayed simultaneously via front panel mounted long lasting Ultra Bright LED bar graphs. These bar graphs shall be vertically mounted in parallel fashion to provide relational viewing of all setpoints vs. the measured process. Each display column shall have a minimum of 40 segments of resolution. Each setpoint column shall have a status LED mounted on top of the associated setpoint providing indication of setpoint activation status. Units that require operator action to view the above parameters are not acceptable.

- To assure the highest resolution and accuracy, the process display shall be configured to display the full range of the actual measured process. Range can also be offset allowing display of a pressure or level range that does not start at zero. The display ranges shall be field configurable.

- System Pump On/Off and Alarm setpoint parameters shall be easily adjustable via individual up and down pushbutton arrows located next to the associated setpoint display column(s).

- The unit shall have a built in process simulation capability allowing the operator to verify system operation by forcing the process variable up or down via pushbutton arrows located next to the process display. To prevent accidentally leaving the unit in simulation mode, the Pump Controller shall be configured to automatically restore monitored process display within 2 minutes after last keypad usage or immediately upon operator initiated restore.

- The display unit shall incorporate a high contrast LCD panel allowing for viewing of higher level functions including the following:

    - o Process display to XX.X of the full scale process range.
    - o Time and Date Stamped Alarms & Events
    - o Pump Statistics (Including Run Time, Number Of Starts, Daily Average Number Of Starts)
    - o System diagnostics
    - o Controller Security
    - o Unauthorized Station Entry Detection

The Pump Controller - Telemetry Unit shall provide on board 24 VDC loop power output for external loop powered sensor. A built-in Analog Supply Voltage Status LED shall indicate availability of loop power. Unit shall be able to monitor a user selectable - 4-20 mA or 0-10 Volt analog input representing the process to be controlled. The analog digital conversion shall not be less than 16 bit to allow accurate measurement of the process variable. The analog input circuitry shall provide optical isolation from the main board to the field device. A minimum of 1000 volts electrical isolation shall be required. The Analog process signal shall be displayed locally via 40 segment vertical LED display and the LCD digital display as specified above. This signal shall also be available for telemetry transmission.

The Pump Controller - Telemetry Unit shall have the ability to monitor up to 16 digital inputs to be used to provide monitoring of local station status. Each discrete input shall provide optical isolation from the main board to the field device. A minimum of 1500 volts electrical isolation shall be required. An on board LED shall be provided indicating that digital Input isolation is not compromised. All discrete inputs shall be available for telemetry transmission. The following inputs shall be monitored:

- Pump 1, 2, 3 Run: This signal shall be used to provide local display of pump run status, pump total run time, pump average daily starts. For each pump.
- Pump 1, 2, 3 In Auto: This signal shall be used by the controller to determine pump availability. A pump in this mode cannot be called into operation.
- Pump 1, 2, 3 High: Temperature/Seal Failure - This signal shall be used by the controller to disable the pump required when a High Temperature is the cause of the failure, and provide local alarm display. Controller shall be able to differentiate alarm. A Seal Failure shall not disable pump operation.
- High & Low Float/Pressure: This signal shall be used by the controller to provide back up control of the pumps in the event of primary (analog) sensor failure.
- Pump Inhibit: This signal shall be used by the controller to inhibit pumps from operating.
- Power Quality: This signal shall be used by the controller to disable pumps in the event incoming station power is unsuitable for use as determined by an optional external power monitoring device.
- Door Switch & Door Acknowledge: These signals shall be used by the controller to monitor station access as detected by an optional external door/limit switch an optional external alarm disabling switch.

- Alarm Silence: This signal shall be used by the controller to monitor an optional external silence push button and will temporarily disable the alarm horn output.

The Pump Controller - Telemetry Unit LCD shall operate in a manual scrolling menu mode with the various displays shown in sequence as selected by the keypad's up/down arrow keys. The display shall indicate the specific function entered on the keypad to confirm that selection of a particular output or other function from the keypad during adjustment or review routines.

The Pump Controller - Telemetry Unit shall be protected from unauthorized changes via built-in system security. The unit shall support 3 levels of security in a hierarchical structure allowing different levels of access to the Pump Controller for differentiation of desired assess levels to include Operator, Maintenance, & Supervisory access levels.

The Pump Controller - Telemetry Unit shall provide outputs for interface to local pumps and alarm annunciation equipment. Relay isolated contact outputs for activation of Pump 1, Pump 2, Pump 3, Common Alarm and Alarm Horn shall be provided. Each contact shall be rated for a minimum of 10 amps at 120 VAC or 5 Amps at 240 VAC. Open collector outputs for Low and High Level Alarm shall be provided for interface to off board monitoring equipment. Open collector outputs shall have a minimum operating range of 5-30 VDC @ 100 mA.

The Pump Controller - Telemetry Unit shall provide s 4-20 mA output signal for interface to external equipment including VFDs, Chart Recorders or other monitoring devices. Analog output can be configured to provide output representing process variable for retransmission or as a process control output for interface to VFDs, Valves, or other process controlled device.

The Pump Controller - Telemetry Unit shall support contact closure inputs from float or pressure switches representing high and low (*Level/Pressure*). The Pump Controller - Telemetry Unit shall annunciate these inputs as alarms and use them to provide back up control in the event the primary (analog) sensor fails. Unit will provide local alarm indication and utilize the inputs to cycle pumps on and off to maintain system operation.

The Pump Controller - Telemetry Unit shall have built-in standard operator adjustable alternation functions allowing for sequencing and equalizing wear of the pumps. The following alternation sequences shall be supported:

- Fixed
- Rotary
- First On First Off (FOFO)
- Utilize One Favor Others (UOFO)
- Emergency Mode

The Pump Controller - Telemetry Unit shall include built-in Pump Failure detection logic. In the event the pump has been called into operation and the pump run signal is not received within a pre-adjustable time period. A motor failure shall be produced. The failed motor shall be disabled, an alarm shall be displayed and the next available pump based on the selected alternation sequence shall be requested to start.

The controller shall include built in site intrusion detection logic that will monitor an external sensor (motion sensor, door switch, etc.) and allow authorized access to the station via controller keypad entry of proper security code or access level. The intrusion system upon detection of entry, will allow a preset amount of time for the operator to go the controller keypad and enter the proper code. When the operator logs out and leaves the facility, the controller shall allow a preset amount of time for the operator to get out before re-arming.

In addition to the pump and alarm control capability, the controller shall provide alarm annunciation. The controller shall, upon the occurrence of an alarm, sound an audible device and flash the alpha-numeric display. The display will indicate the alarm description, complete with the time and date of the alarm occurrence. An acknowledge pushbutton shall be provided to allow silencing of the audible device while the digital display will continue to show the alarm function, complete with time and date information, until the condition has cleared. A built-in alarm and status historian shall retain the last 100 time and date stamped events providing a historical record of recent activity.

The Pump Controller - Telemetry Unit shall include a volumetric lift station flow and pump performance monitoring capability allowing station flow measurement without the use of an in line flow meter. In addition to flow measurement, the Pump Controller shall provide pump performance related information. Pump station flow and pump performance data shall be viewable locally through built in LCD or available for telemetry transmission to master station. The following information is to be provided:

- Average Station Influent Flow Rate
- Maximum Station Influent Rate (K Gal) w/Date & Time
- Current Day Total Effluent Flow (K Gal)
- Previous Days Total Effluent Flow (K Gal)
- Average Daily Effluent Flow (K Gal)
- Maximum Daily Effluent Flow (K Gal) w/Date & Time
- Total Station Effluent Flow (K Gal)
- Average Flow Rate Pump 1, 2, 3 Over All Cycles (GPM) – Each Pump
- Average Flow Rate Pump 1, 2, 3 Over Last Three Cycles (GPM) – Each Pump
- Total Flow Pump 1, 2, 3 (K Gal) – Each Pump
- Flow Rate Pumps 1, 2 (K Gal)
- Flow Rate Pumps 1, 3 (K Gal)
- Flow Rate Pumps 2, 3 (K Gal)
- Flow Rate Pumps 1, 2, 3 (K Gal)
- Pump 1, 2, 3 Low Flow Rate Alarm (Setpoint) – Each Pump
- Pump 1, 2, 3 Run Time – Each Pump
- Pump 1, 2, 3 Number Of Starts – Each Pump
- Pump 1, 2, 3 Average Number Of Starts – Each Pump

The Pump Controller - Telemetry Unit shall have one (1) RS-232C serial communications port that shall be available for telemetry communications. The RS-232 serial port shall support open communication standards including as a minimum, MODBUS RTU or ASCII and USFilter Open. Unit shall support communication data rates of 1,200 to 38,800 baud rates. On board communication diagnostic LEDs shall be available to provide indication of communications activity for verification and troubleshooting.

Unit shall be constructed for industrial applications for use in harsh environments. Unit shall have a Temperature Operating range of -40 to + 85 Deg C, and be able to operate in environments with 10-90% non condensing humidity. Unit shall be UL Listed and in compliance with FCC part 15 Class A emissions and CE IEC61000 Surge Withstand certifications.

All connections shall be made via plug-in terminal blocks with a minimal rating of 10 Amps, 300 Volts and capable of accepting 30-12 AWG wire.

It is the intention of this specification that a standard controller/transceiver be provided, with all of the control and communications features described as a fully-integrated assembly. The controller shall be a U.S. Filter Control Systems LC150.

I. Submersible Level Transducer:

The liquid level of the wet well shall be sensed by a submersible level transducer. The transducer shall be a 3-wire type to operate from the level controller's regulated supply voltage and produce an instrumentation signal in direct proportion to the measured level excursion over a factory-calibrated range of zero to the specified wet well depth, but a minimum of (20) feet of water.

The transducer shall be of the solid-state head-pressure sensing type, suitable for continuous submergence and operation and shall be installed in accordance with manufacturer's instructions. The bottom diaphragm face of the sensor shall be installed approximately 6 inches above the wet well floor. The sensor shall be mounted using a stainless steel cable suspension system in a location and as shown on the job plans.

The transducer housing shall be fabricated of type 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon (TM) bonded to a synthetic rubber back/seal.

A hydraulic fill liquid behind the diaphragm shall transmit the sensed pressure to a solid-state variable-capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm that flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between the two surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser-trimmed, temperature compensated, high quality components and construction to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factory-calibrated range.

The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures five times the full-scale range being sensed. Metallic diaphragms shall not be acceptable in that they are subject to damage or distortion. Sensing principles employing LVDTs, resistive or pneumatic elements shall not be acceptable.

The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly and a slack PVC bellows mounted in the control panel. The sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements.

The transducer assembly shall be installed where directed by the Engineer and connected with other system elements and placed in successful operation.

The sensor shall be suspension-mounted using a US Filter Control Systems Stainless Steel Cable Suspension Mounting Kit. The mounting kit shall consist of a 2' long one-inch NPT type 316 stainless steel pipe with coupling, bolt, cable clamps and hardware. The required length of 1/8 inch diameter 7 x 19 stainless steel cable shall also be provided.

The control panel shall include a UL Listed intrinsic safety barrier that has been UL tested with the specific submersible transducer furnished for this application to render the transducer suitable for use in Class 1, Division 1 or 2, Groups A, B, C and D; Class II, Division 1 or 2, Groups E, F and G; and Class III, hazardous locations (which includes a sewage wet well).

J. Redundant Liquid Level Responsive High Level Alarm/Pump Control:

An independent high level alarm and redundant pump control capability with features as hereinafter listed shall be provided in addition to the specified primary control system. It shall be powered by a 120 VAC circuit breaker.

The independent alarm/control panel equipment shall be designed to UL Industrial Control Panel standards and shall incorporate 120 VAC input power transient protection, a fused primary and a DC power supply with limited 12 VDC to power the intrinsic safety barrier level sensing float circuit(s). The front face of the controller accessible through the operator's door and shall incorporate four red LED indicators; a "control hold" LED, a redundant control "turn on" LED, a high level alarm/monitor LED, a "control contacts" energized LED and a pump "off delay" time control adjustment with a 0-5 minute range.

The redundant controller shall operate in conjunction with necessary direct-acting float switches (as specified elsewhere) to provide back up control of lift pumps, detection of high level and to protect the pumps from damage that may result from low wet well levels. The system shall monitor the float switch inputs and provide local indication of system operation via LEDs. Built in relay contacts shall be interfaced to alarm circuitry and pump motor starter pilot circuitry. The back up system shall not interfere with primary controller operation when wet well levels are within normal operating range. The back up system will only become active, and bypass the primary control and sensor system and assume full control, in the event wet well levels go outside of normal operating range. Back up sensors shall be mounted and configured to operate outside primary controller setpoint settings.

Upon detection of abnormally high wet well level the back up system shall provide independent dedicated high level alarm indication and contact closure output for activation of common alarm system. The back up system shall also provide independent dedicated control output active indication and dual isolated outputs suitable for direct interface to motor starter pilot circuits to activate both lift pumps. The high level alarm signal shall be deactivated upon lowering of wet well level below the high alarm sensor. The pumps will remain on until wet well level drops below a separate pump off sensor. Pump off sensor shall be mounted at a level that is below the normal operating range of the primary controller setpoint setting.

The back up control system shall also provide a wet well low level/suction function that disables the lift pumps upon detection that wet well level has reached a level that could cause damage to the pumps. The pumps shall be locked out of operation until wet well level has reached an elevation above the pump off sensor.

The redundant control/alarm capability shall be completely integrated in the specified control panel and system as described and in accordance with all applicable codes and job requirements.

The contractor shall furnish, install, and wire the float switches as shown on the drawings. Each float shall have molded polyethylene body, internal redundant polyurethane foam flotation, potted switch and cable connections and fine-stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the control panel. The floats shall include internal weight allowing suspended operation without the use of special pipe or suspension mounting systems.

The redundant high level alarm/pump control module shall connect to the float switch level sensors through a control panel mounted UL Listed intrinsic safety barrier. The module shall provide an intrinsically safe interface for up to six sensors located in a hazardous area (the wet well) rated Class I, Division 1 or 2, Groups A, B, C and D, and Class II, Division 1 or 2, Groups E, F, and G. The module shall contain an LED indicator for each of the six sensor inputs providing visible indication of sensor actuation as well as an LED to indicate barrier "Power On" status.

Float switches shall be provided by the control panel supplier. They are to be a cataloged item of the control panel manufacture.

K. USFCS Model LS Float Switch:

The liquid level shall be sensed by (3) three direct acting float switches. The float switches shall be Bulletin B100, Model LS Floats as manufactured by Siemens Water Technologies.

The contractor shall furnish, install, and wire the float switches as shown on the drawings. Each float shall have molded polyethylene body, internal redundant polyurethane foam flotation, potted switch and cable connections and fine-stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the control panel. The floats shall operate on (24/120) volts and used with a pump/alarm controller providing differential pump operation, float indicating LED's and test switches and alarm circuitry as required.

L. Model 9GCL3 Stainless Steel Mounting Clamp:

The float switches shall be mounted to a 1" pipe utilizing all stainless steel float switch mounting hardware and secured in place by US Filter Control Systems/Consolidated Electric Model 9GCL3 stainless steel mounting clamps.

M. Convenience Receptacle:

An operator's door mounted 120 VAC duplex ground fault interrupter (GFI) type, convenience receptacle rated at 15 amperes shall be supplied for the operation of a trouble light, drill, etc. It shall be protected by a separate 15 ampere trip rated circuit breaker accessible from the operator's door.

N. Local Alarm System:

A top mounted weatherproof, strobe alarm indication light assembly with shatter resistant polycarbonate red lens mounted on a polycarbonate/ABS blend case shall be provided. The alarm light shall be NEMA 4X rated, suitable for indoor or outdoor mounting and operate on 120 VAC and be PLC rated. The strobe tube shall provide a minimum of 300,000 peak candela output and shall be rated for 3,000 hour life.

The alarm light shall flash upon occurrence of an alarm condition.

O. Condensation Protective Heater:

A 100 watt, 120 VAC condensation protective heater and adjustable high temperature cutout thermoswitch shall be supplied in the control panel. The heater's surface area for heat dissipation shall be large enough to prevent a skin burn (if an operator's hand should inadvertently come in contact with the unit when energized).

P. Over-Temperature Pump Protection & Pump Seal Failure Alarm:

Over-temperature protection shall be provided in the control panel to operate in conjunction with the over-temperature switch in each pump motor. The control shall provide pump operation lockout upon the occurrence of high temperature.

The circuitry shall also include a 30.5mm diameter, NEMA Type 4X, red "pump overtemp" shutdown alarm indicating light (with front replaceable bulb) and a 30.5mm diameter, NEMA Type 4X, manual reset push-button on the operator's door for each pump motor. All pilot devices specified herein are to be Square D Class 9001 Type SK Line.

An operator's door mounted 30.5mm diameter, NEMA Type 4X, red seal fail alarm light (with front replaceable bulb) and a panel mounted seal leakage relay (to operate with the pump seal leak sensor) shall be provided to indicate a pump seal failure alarm condition for each sewage pump. The seal leakage relay shall be of solid state design incorporating LED for visual indication of sensor activation. Unit shall include built in low voltage sensor and electrical surge protection. Unit shall be CSA approved and UL recognized. All pilot devices specified herein are to be Square D Class 9001 Type SK Line.

2.18 CONTINUITY OF OPERATIONS:

The Contractor, as a part of this work, shall provide all stand-by facilities, power systems, etc. in order to maintain the operations of existing facilities throughout the construction phases of the new work. The Contractor shall schedule his work with that of the Owner in order to coordinate all interruptions of the existing facilities operations to suit the Owner's schedule. All temporary facilities and provisions shall be made after being submitted to the Owner and approved thereby.

2.19 ELECTRIC POWER METERING:

The Contractor shall provide all labor and materials required for a complete installation to meter electrical power usage in accordance with the power company's detailed requirements. Meter location shall be as shown on the plans.

The Contractor, at his own expense, shall provide power and all necessary temporary wiring as required to perform his work. After completion of the permanent electrical connections, the Contractor shall be required as a part of this work to secure all utility services from the respective utility companies and shall pay all monthly bills until such time as acceptance of the equipment is made by the Owner. Upon acceptance, the Contractor can have the respective utility companies transfer their billing to the Owner's name.

2.22 CLEAN-UP:

After final operation tests, the interior and exterior of the station shall be cleared of all trash and debris and left in final operating condition. Final grading of the site and restoration of surfaces with grass shall be in strict accordance with the applicable drawings.

2.23 SUBMERSIBLE PUMPS:

A. Saraland Pump Specifications for Submersible Pumps:

1. Requirements: Furnish and install two (2) submersible non-clog wastewater pump(s). Each pump shall be equipped with a submersible electric motor connected for operation on 230/460 volts, 3 phase, 60 hertz service, with 50 feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval.

2. Pump Design Configuration: The pump shall be supplied with a mating cast iron discharge connection. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with a lifting chain or stainless steel cable of adequate length. The working load of the lifting system shall be 50% greater than the pump unit weight.

3. Pump Construction: Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

   Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

   Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

4. Cooling System: Motors ranging for 3hp to 10hp shall be sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required. 15Hp motors and above shall be provided with an adequately designed cooling system. A motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. Pumps with an integral cooling system shall have an impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. Pumps may have a water jacket and shall encircle the stator housing; thus, providing heat dissipation for the motor regardless of the type of installation. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F. (40°C.). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

5. Cable Entry Seal: The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

6. Motor: The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31.The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not

acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

7. Bearings: The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

8. Mechanical Seal: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

Each pump shall be provided with an lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

Seal lubricant shall be FDA Approved, nontoxic.

9. Pump Shaft: Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel - ASTM A479 S43100-T.

   If a shaft material of lower quality than stainless steel - ASTM A479 S43100-T is used, a shaft sleeve of stainless steel - ASTM A479 S43100-T is used to protect the shaft material. However, shaft sleeves only protect the shaft around the lower mechanical seal. No protection is provided in the oil housing and above. Therefore, the use of stainless steel sleeves will not be considered equal to stainless steel shafts.

10. N - Impeller: The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction which shall keep them clear of debris, maintaining an unobstructed leading edge. The impeller(s) vanes shall have screw-shaped leading edges that are hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. Impellers shall be locked to the shaft and held by an impeller bolt.

11. Volute Bottom/Insert Ring: The pump volute shall be of A48 Class 35B gray cast iron and shall have (an) integral spiral shaped cast groove(s) at the suction of the volute. The internal volute bottom or insert ring shall provide effective sealing between the pump volute and the multi-vane, semi-open impeller. The sharp spiral groove(s) shall provide the shearing edge(s) across which each impeller vane leading edge shall cross during its rotation in order to remain unobstructed. The clearance between the internal volute bottom and the impeller leading edges shall be adjustable.

12. Impeller (For C - Pumps): The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be keyed to the shaft, retained with an Allen head bolt and shall be capable of passing a minimum inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

13. Wear Rings (For C - Pumps): A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet.

14. Volute (For C - Pumps): Pump volute(s) shall be single-piece grey cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

15. Protection: All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.

A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.

The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

B. Pump Test: The pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory:

1. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.

2. A motor and cable insulation test for moisture content or insulation defects shall be made.

3. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

4. The pump shall be run for 30 minutes submerged, a minimum of six (6) feet under water.

5. After operational test No. 4, the insulation test (No. 2) is to be performed again.

A written report stating the foregoing steps have been done shall be supplied with each pump at the time of shipment upon request.

The pump cable end will be sealed with a high quality protective covering, to make it impervious to moisture or water seepage prior to electrical installation.

C. Site Test: The pump shall be tested at start-up and voltage, current, and other significant parameters recorded. The manufacturer shall provide a formal test procedure and forms for recording data. Only factory certified service personnel shall perform start-up service. Proof of certification shall be required prior to equipment approval.

D. Pump Warranty: The pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and material for a period of five (5) years or 10,000 hours.

E. Documentation: Manufacturer will supply five (5) sets of detailed standard submittal drawings, Operation and Maintenance instruction manuals and parts list. Standard submittals will consist of:

1. Pump Outline Drawing
2. Control Data
3. Access Frame Data
4. Typical Installation Guides

Parts Lists and Technical Manuals shall be supplied after start- up has been completed.

F. Experience Clause: The pump manufacturer shall have a minimum of 1,000 units of similar type pumps, installed and operating for no less than five (5) years in the United States.

G. Service: The pump supplier shall employ factory trained service personnel. These persons shall be authorized by the manufacturer to perform all maintenance and repair work on the above pumps. Factory certification of service personnel shall be provided to the engineer prior to approval of pumps. Only factory certified personnel shall perform start up on the specified material. The supplier shall also maintain a factory trained service personnel within 30 miles of the jobsite. Suppliers which cannot perform factory warranty work in their own service facility shall not be considered. Proof of such facilities shall be furnished to the engineer.

H. Contractual Obligations:

1. Intent of Specifications: These specifications and accompanying drawings specify and show equipment and materials deemed most suitable for the service anticipated. This is not done, however, to eliminate other products equally as good and efficient. The contractor shall prepare his bid on the basis of the particular equipment and materials specified for the purpose of determining the low bid. The awarding of the contract shall constitute a contractual obligation to furnish the specified equipment and materials.

2. Substitutions: After the execution of the contract, should the contractor desire to substitute equipment other than that specified in the contract, such substitution will be considered for one reason only: the equipment proposed for substitution is superior in construction and efficiency to that specified in the contract, and higher quality has been demonstrated by service in a similar installation.

   In the event the contractor obtains engineer's approval of equipment other than that for which the station was originally laid out, the contractor shall, at his own expense, make any changes in the structures, buildings, or piping necessary to accommodate the equipment, and shall furnish as-built drawings to engineer.

   It will be assumed that the cost to the contractor of the equipment proposed for substitution is less that of the equipment specified in the contract and if the substitution is approved, the contract price shall be reduced by an amount equal to the savings.

I. Safety Hatch:

A “Safe Hatch” shall be supplied with the access cover for all submersible pumps. Each “Safe Hatch” shall be designed to combine covering of the hole per OSHA standard 1910.23 and shall include fall through protection and controlled confine space entry.

The safety grate shall be made of 6061-T6 aluminum with a minimum ultimate strength of 38,000 p.s.i. and a minimum yield strength of 35,000 p.s.i., as per A.S.T.M. B221. Grate design shall use safety factors as defined in the “Specifications for Aluminum Structures”, by the Aluminum Association, Inc., 5^{th} addition, December 1986 for “Bridge Type Structures”.

Aluminum grating shall be designed to withstand a minimum live load of 300 pounds per square foot. Deflection shall not exceed $1/150^{th}$ of the span.

Aluminum grate openings shall be 5” x 5”, which will allow for visual inspection of the pit and float adjustment, once the access hatch is open.

Each aluminum grate shall be provided with a permanent hinging system, which will lock the grate in the 90 degree position once opened.

Design of the system must assure fall through protection is in place after the door has been closed, thereby protecting the next operator.

Each grate shall have an opening arm, with a red vinyl grip handle, which will allow opening of the grate, while providing the grate as a barrier between the operator and the pit. The opening arm shall also be equipped with a controlled confined space entry locking device (lock provided by others). This locking device will prevent unauthorized entry to the confined space. The grating system will allow anyone to make visual inspection and float adjustments without entering the confined space.

Grate shall be painted with O.S.H.A. type safety orange paint.

Welding shall be in accordance with ANSI/AWS d1.2-90 Structural Welding Code for Aluminum.

2.25 SUCTION LIFT PUMPS:

A. System Description: The suction lift pump lift station systems shall be a duplex self priming pumps with a above ground enclosure as manufactured by the Gorman Rupp Company. The factory built above ground, automatic pump station shall be complete with all equipment specified herein, factory assembled in a fiberglass reinforced polyester resin enclosure. 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. Factory built pump station design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed herein.

B. Performance Criteria: Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have a minimum 3" suction connection, and a minimum 4" discharge connection. Each pump shall be selected to perform under the same operating conditions necessary to meet the project conditions. Site power furnished to pump station shall be 3 phase. 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.

C. Submittals: Prior to fabrication, pump station manufacturer shall submit eight copies 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.

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.

D. Operations And Maintenance Manuals: 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.

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:

1. Functional description of each major component, complete with operating instructions.

2. Instructions for operating pumps and pump controls in all modes of operation.

3. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

4. 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.

5. 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.

6. 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.

   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.

E. Quality Assurance: The pumps, pump station manufacturer, and pump station system integrator shall be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

Upon request from the engineer, the pump station manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.

F. Pump Performance Certifications: All internal passages, impeller vanes, and recirculation ports shall pass a 2½" spherical solid for T3 pumps and 3” spherical solid for all other sizes. 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.

Reprime Performance shall meet the following items:

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 be capable of repriming per the manufacturer's requirements 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 down stream 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^{o} 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. Factory System Test: 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. 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. 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 herein.

H. Manufacturer's Warranty: 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, O-rings, etc. The pump station manufacturer shall be solely responsible for warranty of the station and all components.

3. 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.

4. 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.

I. Product: 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.

J. Station Enclosure: 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.

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.

All interior surfaces of the housing shall be gel coated with a polyester resin. It shall be of suitable thickness and formulated to provide maintenance-free service, abrasion resistance, protection from sewage, greases, oils, gasoline, and other common chemicals, color fastness, and gloss retention.

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.

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.

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.

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.

Station base shall incorporate a suitable flange designed for securing the pump station to the concrete pad in accordance with the station plans.

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.

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.

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.

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.

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.

K. Station Heater: The 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.

2.25 PUMP DESIGN FOR SUCTION LIFT PUMPS:

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 herein.

The manufacturer of the pumps must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

A. Pump Casing: Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:

1. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

2. Fill port coverplate, 3½" 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.

3. Casing drain plug shall be at least 1¼" NPT to insure complete and rapid draining.

4. Liquid volume and recirculation port design shall be consistent with performance criteria listed herein.

B. Coverplate: Coverplate shall be cast iron Class 30. Design must incorporate following maintenance features:

1. 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.

2. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS.

3. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.

4. Two O-rings of Buna-N material shall seal coverplate to pump casing.

5. 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.

6. Easy-grip handle shall be mounted to face of coverplate.

C. Rotating Assembly: A rotating assembly, which includes impeller, 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:

1. 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.

2. 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.

3. 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.

4. Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

5. 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.

6. Shaft shall be AISI 4140 alloy steel unless otherwise specified by the engineer, in which case AISI 17-4 pH stainless steel shall be supplied.

7. 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.

8. 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 herein.

9. 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.

   Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

10. 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.

11. 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

12. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

D. 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.

E. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports. Each spool shall have one 1-¼" NPT and one ¼" NPT tapped hole with pipe plugs for mounting gauges or other equipment

F. Serviceability: The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs by incorporating the following features.

No special tools shall be required for replacement of any components within the pump.

G. 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.

H. Spare Parts Kit: The following minimum spare parts shall be furnished with the pump station:

- One spare pump mechanical seal (complete with shaft sleeve)
- One cover plate O-Ring
- One rotating assembly O-Ring
- One set of rotating assembly spacers

I. Valves and Piping: 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 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.

Plug valves shall be of the non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connection drilled to ANSI 125 lb. Standard. Valves shall have ports designed to pass spherical solids equal to the pumps capability. Valves shall be furnished with a drip-tight shutoff plug mounted in stainless steel or teflon over phenolic bearings, and shall have a resilient facing bonded to the sealing surface.

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

J. 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.

K. Piping: Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe. Bolt holes shall be in angular alignment within ½^{o} between flanges. Flanges shall be faced with a gasket finish. 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.

L. Drive Unit: Pump motors shall 3 phase, 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. Motors shall be tested in accordance with provisions of ANSI/IEEE Std 112.

M. Drive Transmission: 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. 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. 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.

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 ½ inch.

Guards must be completely removal without interference from any unit component, and shall be securely fastened and braced to the unit base.

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.

The guard shall be finished in accordance with Section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

N. 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.

O. Electrical Control Components: 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.

P. 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.

Q. 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, 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.

4. Transient Voltage Surge Suppressor:

a. 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.

5. Phase Monitor:

a. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, high voltage, low voltage, and voltage unbalance. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.

R. Control Circuit:

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

2. Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be oil-tight design with contacts rated NEMA A300 minimum.

3. Pump alternation shall be integral to the liquid level controller. Provisions for automatic alternation or manual selection shall also be integral to the liquid level controller.

4. Six digit elapsed time meter (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. 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.

S. Wiring:

1. 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.

2. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).

3. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:

a.	Line and Load Circuits, AC or DC power	Black
b.	AC Control Circuit Less Than Line Voltage	Red
c.	DC Control Circuit	Blue
d.	Interlock Control Circuit, from External Source	Yellow
e.	Equipment Grounding Conductor	Green
f.	Current Carrying Ground	White
g.	Hot With Circuit Breaker Open	Orange

4. 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.

5. Motor branch and other power conductors shall not be loaded above the temperature 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.

6. 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.

T. Factory installed conduit shall conform to following requirements:

1. All conduit and fittings to be UL listed.

2. Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.

3. Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electric Code.

4. Conduit shall be sized according to the National Electric Code.

U. Grounding:

1. 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.

2. 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).

V. Equipment Marking:

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

a. Equipment serial number
b. Supply voltage, phase and frequency
c. Current rating of the minimum main conductor
d. Electrical wiring diagram number
e. Motor horsepower and full load current
f. Motor overload heater element
g. Motor circuit breaker trip current rating
h. Name and location of equipment manufacturer

2. 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.

3. 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.

2.26 EXECUTION FOR SUCTION LIFT PUMPS:

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 manufacturers representative of any unacceptable conditions noted with shipper.

A. Installation: 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. 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. 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. 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. After all anchor bolts, piping and control connections are installed, completely fill the grout dam in the pump station base with non-shrink grout.

B. Field Quality Control:

1. Operational Test: 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. 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.

2. 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.

3. 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.

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

2.27 SUBMERSIBLE PUMP SPECIFICATION SHEET:

SUBMERSIBLE PUMP SPECIFICATION SHEET

Service:	Sewage	
Type of Pump:	Submersible Sewage Pump	
Solids Handling Capability:	Discharge connection 4" (min) diameter.	
Materials of Construction:	Casing	Cast iron, Class 35
	All exposed bolts & nuts	304 stainless steel
	Pump exterior	Spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish
	Shaft	Stainless steel ANSI 420
	Upper bearing	Single row deep groove ball bearing
	Lower bearing	Two row angular contact ball bearing
	Mechanical seal	Tungsten carbide lower faces
	Guide rails	Stainless steel, 2" (min.) diameter, or Engineer approved pump removal system

Installation: The pump shall have a discharge connection elbow connected to a vertical discharge pipe. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically aligned and connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service without a need for personnel to enter the wet well.

Drive Motor:

1. _____Horsepower (max.)
2. Design: Squirrel-cage, induction, air-filled
3. NEMA Design - Type B
4. Windings: Copper, Class F Insulated
5. Service Factor: 1.15 continuous
6. Design Temperature: 40° C ambient (max.)
7. Non-overloading at any point on pump curve
8. Explosion Proof
9. Motor Terminal Board
10. Stator shall be heat-shrink fitted
11. Motor Winding Over-temperature Thermostats (3)
12. Seal Failure Moisture Probe

Guaranteed Performance:

	GPM	TDH	RPM	EFF	HP
Design	____	____	____ (max.)	____	____ (max.)
High Head	____	____			
Low Head	____	____			

SUBMERSIBLE PUMP SPECIFICATION SHEET

Warranty:	The pump manufacturer shall warrant the unit being supplied to the Owner against defects in workmanship and material for a period of five (5) years or 10,000 hours.
Experience:	Pump manufacturer's direct sales and service representative shall have local experience directly related to the proposed pumps and adjoining equipment.
Manufacturer(s):	Pumps complying with the specified parameters and as included on the Owner's list of approved pump manufacturers shall be acceptable. Acceptable manufacturer is Flygt.
Model No.:	_____or approved equal.

2.28 SUCTION LIFT PUMP SPECIFICATION SHEET:

SUCTION LIFT PUMP SPECIFICATION SHEET

Service:	Sewage	
Type of Pump:	Suction Lift Sewage Pump	
Solids Handling Capability:	Discharge connection 3" (min)diameter.	
Materials of Construction:	Casing	Cast iron, Class 30
	Pump exterior	Machinery enamel paint finish
	Shaft	Alloy steel ANSI 4140
	Radial bearing	Open ball, oil lubricated
	Thrust bearing	Open ball with snap rings, oil lubricated
	Mechanical seal	Tungsten titanium carbide face

Installation: The pumps shall be mounted above the wet well in a FRP enclosure (minimum size of six (6) feet by six (6) feet). All controls, piping, testing, and required appurtenances shall be installed be the manufacturer. Controls shall include submersible transducer for wet well level detection. Pumps must be capable of providing 25 feet of “re-prime” lift.

Drive Motor:

1. _____Horsepower (max.)
2. Design: Squirrel-cage, induction
3. NEMA Design - Type B
4. Windings: Copper, Class F Insulated
5. Service Factor: 1.15 continuous
6. Design Temperature: 40° C ambient (max.)
7. Non-overloading at any point on pump curve

Guaranteed Performance:

	GPM	TDH	RPM	EFF	HP
Design	____	____	____ (max.)	____	____ (max.)
High Head	____	____			
Low Head	____	____			

Warranty: The pump manufacturer shall warrant the pumps and controls being supplied to the Owner against defects in workmanship and material for a period of one (1) year.

Experience: Pump manufacturer's direct sales and service representative shall have local experience directly related to the proposed pumps and adjoining equipment.

Manufacturer(s): Pumps complying with the specified parameters and as included on the Owner's list of approved pump manufacturers shall be acceptable. Acceptable manufacturer is Gorman-Rupp.

Model No.: _____

2.29 GENERATORS:

Note: The applicant may submit bypass pumps in lieu of a generator.

A. General:

1. The standard for generators shall be natural gas unless natural gas is not available.

2. The Supplier shall be a company specializing in packaged engine generator system with minimum three years experience. The Supplier shall be an authorized distributor of an engine generator manufacturer with service facilities within 100 miles of project site at time of delivery. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24 hours and 95% within 48 hours. If, within the two-year warranty period of the unit, spare parts are not available within the time frame described herein, the manufacturer shall provide and connect a portable unit to be used until the parts are received and installed and the original unit is again operational. If warranty work is necessary, the Supplier shall supply all parts and labor required to restore the engine generator system to operational condition.

3. Supplier shall provide a two-year warranty for all major parts and equipment.

4. Furnish service and maintenance of packaged engine generator system for two years from date of delivery. Maintenance shall include a 6-month inspection and annual PM each year with oil and filter changes, and oil testing. Manufacturer shall provide the owner the option to extend the maintenance contract at the end of the two-year period.

B. Submittals and Tests:

1. Submittals:

a. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, enclosure, vibration isolators, fuel system, tank and radiator.

b. Submit manufacturer's installation instructions. Include instructions for normal operation, routine maintenance requirements, service manuals for engine, oil sampling and analysis for engine wear, and emergency maintenance procedures.

c. Submit manufacturer's certification stating that "This is to certify that we have examined the Plans and Specifications for this Project and have ascertained that this generator and accessories are suitable for the purpose and use intended."

d. Submit manufacturer's operation and maintenance data.

e. Furnish one set of tools per generator for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox with provisions for storage within the unit enclosure.

f. Provide two additional sets of each fuel, oil, and air filter element required for each engine generator system.

C. Warranty:

1. Engine and generator set shall carry a standard two (2) year warranty for standby power systems. Contractor shall provide a scheduled maintenance agreement with a local generator manufacturer's authorized Dealer. Contractor shall provide a startup inspection by the authorized dealer and act as Owner's agent in obtaining warranty service.

D. Design and Construction:

1. Manufacturer:

a. Engine and generator set shall be manufactured by one of the following manufacturers:

- Generac Power Systems
- Katolight Corporation
- Kohler Power Systems

2. Engine:

a. The engine shall be of a water cooled inline or V-type, four stroke cycle, Natural Gas internal combustion engine.

b. The engine shall be sufficient to operate at 100 percent rated load for the duration of any power outage at specified elevation and ambient limits.

c. The engine speed shall be rated at 1800 rpm.

d. The engine governor shall be a mechanical type (under 200 KW) and isochronous type (200 KW and larger) to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. (Governor shall be capable of providing regulation when the load has a high reactive/capacitive component)

e. The engine safety devices shall shutdown the engine on low water level, high water temperature, low oil pressure, over speed, and engine overcrank. Limits shall be selected by manufacturer. All safety devices shall be connected to a common fault output for future connection.

f. The DC starting system with positive engagement, number and voltage of starter motors shall be in accordance with manufacturer's instructions. Remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel shall be included. When this switch is not in "REMOTE" (Auto), it shall output a fault signal to the common fault alarm.

g. The Engine Block Heater shall be suitable for operation at 120 volts.

h. The radiator shall use glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F (43 degrees C). Radiator airflow restriction shall be 0.5 inches of water (9.34 mm of mercury), maximum.

i. Engine Accessories shall include fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-drive water pump, water temperature gauge, and lube oil pressure gage on engine-generator

control panel.

j. Mounting shall provide unit with suitable vibration isolators for mounting on structural concrete base.

3. Generator:

a. The generator shall be an ANSI/NEMA MG 1 three phase, four pole, reconnectible brushless synchronous generator with brushless exciter.

b. The generator shall have a unit capacity suitable to run all pumps at the lift station.

c. The generator insulation shall be ANSI/NEMA MG 1, Class F.

d. The generator shall have a 150 degree C standby temperature rise.

e. The generator enclosure shall be ANSI/NEMA MG 1 rated and shall be open drip proof.

f. Voltage Regulation shall include generator-mounted volts per Hertz exciter-regulator to match engine and generator characteristics, with voltage regulation +/- two percent from no load to full load and shall include manual controls to adjust voltage drop +/- 5 percent voltage level and voltage gain.

g. The generator shall be capable of delivering full load amps with up to 5% total harmonic distortion.

h. The generators shall have PMG (permanent magnet generator) exciters.

i. The manufacturer shall provide computer generated analysis of the generator showing that the proposed generator is capable of starting and operating electrical loads of the wattage ratings necessary. The system should be design to accommodate loads starting at the same time.

4. Accessories:

a. Fuel System: Natural Gas.

b. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions.

c. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, with cold cranking amps and ampere-hour rating as required by the manufacturer. Match battery voltage to starting system. Include necessary cables and clamps.

d. Battery Tray: Plastic coated metal, constructed to contain spillage of electrolyte.

e. Battery Charger: Ten ampere, float-type, current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide enclosure to meet ANSI/NEMA 250, Type 1 requirements. Battery chargers shall be mounted within the generator enclosure.

f. Line Circuit Breaker: NEMA AB 1 molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole; sized in accordance with ANSI/NFPA 70. Include battery-voltage operated shunt trip, connection to open circuit breaker on engine failure. Mount unit in enclosure to meet ANSI/NEMA 250, Type 1 requirements. The breakers shall be clearly and appropriately marked in 2-inch high numbers and letters.

g. Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:

1. Frequency Meter: 45-65 Hz range, 3-½ inch (89 mm) dial.

2. AC Output Voltmeter: 3-½ inch (89 mm) dial, 2 percent accuracy, with phase selector switch.

3. AC Outlet Ammeter: 3-½ inch (89 mm) dial, 2 percent accuracy, with phase selector switch.

4. Output voltage adjustment.

5. Push-to-test- indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.

6. Engine start/stop selector switch.

7. Engine running time meter.

8. Oil pressure gage.

9. Water temperature gage.

10. Auxiliary Relay: 3 PDT, operates when engine runs, with contact terminals prewired to terminal strip.

11. Remote Alarm Contacts: Pre-wire SPCT contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99. Also included in this alarm shall be a “Not in Automatic” signal.

12. Provision for regularly scheduled starting and operation of engine generator for maintenance purposes.

13. Overvoltage shutdown.

14. Microprocessor control panel which shall include a common fault contact for connection to existing or future SCADA systems by others.

h. Sound Attenuating Enclosure: Reinforced steel housing allowing access to control panel and service points, with lockable doors, fixed louvers, and panels. Enclosure shall be sized large enough to house battery rack, battery charger, and silencer.

i. Enclosure to be in Engineer's Choice of Color which may not be the Manufacturers standard color. The Owner’s selected color shall be provided at no additional costs to the Owner.

j. The generator shall be made in the United States of America.

k. The generator shall have an isolated neutral bus installed in an easily accessible location adjacent to or near the line circuit breaker.

E. Tests, Instructions, and Reports:

1. Factory Test: Prior to delivery to the job site, the genset shall be load bank tested at 100% of rated load for a minimum of two hours to verify that each component functions properly as a part of the assembly.

2. Functional Test: Prior to facility startup or final acceptance, all equipment described herein shall be inspected for proper connection and satisfactory performance by means of a functional test. The Contractor shall demonstrate to the satisfaction of the Owner that the new generator and all associated components function properly as intended.

3. Field Quality Control Test: Field inspection and testing will be performed in accordance with the manufacturer's recommendations. After installation, the manufacturer shall provide full load test utilizing portable test bank, for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, automatic shutdown, and return to normal.

During test, record the following at 20-minute intervals:

a. Kilowatts.
b. Amperes.
c. Voltage.
d. Coolant temperature.
e. Room temperature
f. Frequency.
g. Oil pressure.

F. Training:

1. Provide service and operational training to the Owner.