

CITY OF WOOSTER

ENGINEERING CONSTRUCTION STANDARDS

**STANDARD SANITARY SEWER
SUBMERSIBLE PUMP STATION
SPECIFICATIONS**

PREPARED BY
DIVISION OF ENGINEERING
August 2002
Revised December 2002

ENGINEERING CONSTRUCTION STANDARDS
STANDARD SANITARY SEWER SUBMERSIBLE PUMP STATION
SPECIFICATIONS

INDEX

<u>Item</u>	<u>Page</u>
Description	1
General Requirements	1
Accessibility	2
Pumps and Equipment	2
Pumps	2
Electric Motor	2
Mechanical Seal	3
Operating Conditions	3
Power and Control Cords	4
Lift-Out System	4
Corrosion Protection	4
Valves and Piping	5
Check Valves	5
Plug Valves	5
Emergency Bypass Pumping Connections	5
Piping	5
Sewage Flow Meter	6
Standby Power System	6
General	6
Generator Set	7
Transfer Switch	13
Electrical and Controls	20
System Power Characteristics	20
Electrical Work	20
Service Mast and Weatherhead	21
Control Panel	21
Control Components	22

Conduit	26
Pump Control and System Operation	27
Functional Description	27
Level Sensor	27
Operation	27
Sequence of Operation	27
Automatic Pump Operation	27
Display	28
Electronic Comparators	28
Quality Assurance	28
Independent Lag Pump	28
High Water Alarm with Silence	28
Telemetry System	28
General Description	28
System Components	29
System Operation	30
Wet Well	31
Construction	31
Floor Slope	31
Manhole Steps	31
Top Slab and Access	32
Size	32
Ventilation	32
Piping	32
Testing	32
Valve Vault	32
Construction	32
Floor Slope	33
Manhole Steps	33
Top Slab and Access	33
Size	33
Piping	33
Manufacturer's Responsibilities	33
Operational Test	33
Submittals	34

Installation Instructions	34
Operation and Maintenance Instructions	34
Manufacturer's Abilities	35
Delivery	35
Experience	35
Manufacturer's Qualifications	35
Manufacturer's Field Representative	35
Responsibility	35
Manufacturer's Warranty	36
Overall Pump Station	36
Equipment Warranty	36
Effective Date	36
Permits and Approvals	36
Standard Pump Station Drawing	38

**CITY OF WOOSTER
STANDARD SANITARY SEWER
SUBMERSIBLE PUMP STATION
SPECIFICATIONS**

DESCRIPTION:

Under these specifications, the contractor shall furnish all labor, materials, tools, and equipment required to install standard submersible pump stations as specified herein and as shown on the standard drawings. Sanitary pump stations shall be considered for installation in a proposed development *only* when there is no practical or physical way to serve the development and connect to City sewers by gravity. All work shall comply with current, applicable codes and standards including, but not limited to, the Ohio Basic Building Code, the National Electric Code, and Recommended Standards for Sewage Works (“Ten States Standards”).

GENERAL:

A. Pump Station Components:

1. The contractor shall furnish and install a submersible pumping system furnished by the pump manufacturer. The system shall be complete with all equipment specified herein. The principal items of equipment shall include two submersible, explosion-proof, centrifugal, sewage pumps with hydraulic sealing flanges; slide rail system, pump mounting plates with discharge elbow and rail supports, access frame with covers and slide rail supporters, pump lifting guides, discharge piping and valves, flow meter, emergency pump connections in the valve vault and the wet well with cam-lock connections, and any other necessary appurtenances. Pumping systems shall be as manufactured by Myers, Hydromatic, Flygt, or approved equal.
2. The contractor shall furnish and install a precast concrete valve vault and wet well of sufficient size and capacity for the application. The wet well shall support the modular pumping system and shall meet all requirements of “Recommended Standards For Wastewater Facilities”. The wet well shall be as manufactured by United Precast, Lindsay Concrete Products, or approved equal.
3. The contractor shall furnish and install a control and telemetry system in the pumping station compatible with the City of Wooster control and telemetry system located at the Water Pollution Control Plant. The system shall include all pump controls (PLC’s) and alarms, level control systems, alarm light, wiring, stainless steel panels, and any other necessary appurtenances. The telemetry system shall transmit pump station operation data and alarms via radio communication to the main computer and control system at the Wooster Water Pollution Control Plant.
4. The contractor shall furnish and install all electrical components and a standby power system including junction boxes, disconnects, wiring, power service connection (including meter), stand-by generator with automatic transfer switch, a fiberglass, steel or masonry enclosure with all louvers, drains, gas service connection (including meter), and any other necessary appurtenances.

ACCESSIBILITY:

The pump station and all associated facilities shall be readily accessible by maintenance vehicles during all weather conditions. The facility shall be located off the traffic way of streets and alleys, but not more than 100 feet from a publicly owned street or right-of-way. When the pump station will be publicly owned, operated and maintained, the developer shall provide the necessary easements. The minimum easement dimensions shall provide 20 feet around the entire pump station and associated facilities. A minimum 30-foot access easement shall also be provided from the publicly owned street or right-of-way to the pump station facilities. A paved or gravel access drive with a minimum width of 10 feet shall be provided within the access easement. The minimum pavement section shall be 8" of 304 limestone. If asphalt or concrete drive access is provided, it shall meet City of Wooster Standard specifications for residential streets.

PUMPS AND EQUIPMENT:

A. Pumps:

All pumps shall be explosion proof, submersible, non-clog pumps, specifically designed for pumping raw, unscreened, domestic sanitary sewage. Each pump shall have the necessary characteristics and be selected to perform in accordance with, and subject to, the specific operating conditions for each pump station. All pumps shall be able to run dry for extended periods of time without damage.

All areas of the pump casing and volute that are exposed to sewage shall be constructed of cast iron of no lesser grade than ASTM Class 30. The pump casing shall be fitted with a bronze wear ring. Each pump shall have two carbon-ceramic faced mechanical seals with oil chamber between the seals. Each pair shall be held in place with a double spring between the rotating faces. All metal parts of the seal, including spring, shall be 303 stainless steel. All exposed hardware, fasteners, nuts and bolts shall be stainless steel. The pump shall be painted with air-dry enamel.

The pump impeller shall be of the enclosed vane, non-clog design. The impeller shall be ductile iron, with pump-out vane in front and back chamber. The impeller shall be driven by a stainless steel key.

All pump openings and passages shall be large enough to permit the passage of a sphere 3 inches in diameter and any trash or stringy material that can pass through a 4-inch house collection system.

B. Electric Motor:

Motors shall be NEMA Type B, squirrel-cage, induction type motors. The motor shall be constructed with open windings operating in a sealed housing that contains clean dielectric oil for heat dissipation from the windings and for lubrication of the bearings and seals. The stator windings shall be the open type with Class H insulation rated for 180 degrees C maximum operating temperature. Air-filled motors that do not have the superior heat dissipating capabilities of oil-filled motors shall not be considered equal.

Protection against excessive temperature for motors shall be provided by a heat sensor thermostat attached to the stator windings and connected in series with the contactor coil in the control panel. The heat sensor shall stop the motor if the motor winding temperature reaches 130 degrees C. The high temperature shutoff will cause the pump to cease operation, should a prolonged dry wet well condition occur. The thermostat shall reset automatically when the motor cools to a safe operating temperature. Three heat sensors to be used on 3 phase motors.

C. Mechanical Seal:

Motors shall be equipped with double mechanical shaft seals to prevent leakage between the motor and pump. The seal assemblies shall consist of two Type 21 oil-lubricated rotary shaft seals in an oil-filled chamber. The materials of construction shall be carbon for the rotating faces and ceramic for the stationary faces, lapped and polished to a tolerance of one light band, with 300 stainless steel hardware, with all elastomer parts of Buna-N.

The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level consistency.

There shall be an electric probe or seal failure sensor installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants which enter the seal chamber shall be detected by the sensor and send a signal to operate the specified warning device.

D. Operating Conditions:

1. Each pump must have the necessary characteristics and be properly selected to perform under the required operating conditions. The following items shall constitute the minimum design conditions to be submitted by the Contractor/Developer:
 - a. Design Flow, gpm
 - b. Maximum Flow, gpm
 - c. Total dynamic head, ft (at max. flow)
 - d. Minimum Flow, gpm
 - e. Total dynamic head, ft (at min. flow)
 - f. Static Head, ft (max. and min.)
2. Each pump shall operate at the maximum and minimum flow rates and at all flows in between without cavitation or exceeding the normal recommended operating range of the selected pump.
3. The maximum allowable speed shall be 1800 RPM. The motor horsepower shall be the minimum capable of running the pump at the specified operating conditions, using 3 phase, 230/460 volt, 4 wire, 60 Hz power.

E. Power and Control Cords:

Power and control cords shall be triple sealed. Insulation of power and control cords shall be SO, SOW or SOWA type. Each cable shall be provided with a green ground wire to be accordance with local and national electric codes.

The power and control conductor shall be single strand sealed with epoxy potting compound and then clamped in place with a rubber seal bushing to seal outer jacket against leakage and to provide for strain pull. A third sealing area shall be provided by a terminal board to separate the cable entry chamber from the motor chamber. Cords shall be able to withstand a pull of 300 pounds to meet F.M. requirements. Pumps shall be furnished with 25 feet of power cord.

F. Lift-Out System:

Each lift-out system shall consist of: a ductile iron discharge base, brass pump attaching and sealing plate, brass pump guide plate, and cast iron elbow. All exposed hardware shall be 300 series stainless steel. No fabricated steel parts shall be used. Slide rail assemblies are to be F.M. listed for class 1, division 1, groups C & D hazardous location (explosion proof).

1. Discharge elbow shall be minimum 4" x 4". Elbow shall bolt onto base and have standard 125 lb. Flanges. Rail systems requiring piping increasers to attach larger discharge pipe, which might interfere with pump installation and removal will not be considered equal. The base elbow shall be painted with one coat of corrosion resistant zinc chromate base enamel.
2. Sealing plate shall be attached to the pump. A simple downward sliding motion of the pump and guide plate on the guide rails shall cause the unit to be automatically connected and sealed to the base. The open face of the sealing plate shall have a dovetailed groove machined into the face to hold a sealing O-ring. The O-ring shall provide a leak-proof seal at all operating pressures.
3. Two guide rail pipes shall be used to guide the pump from the surface to the discharge base connection. The guide rails shall be 2" schedule 40 pipe, made of 304 stainless steel. The weight of the pump shall bear solely on the discharge base and not on the guide rails. Rail systems that require the pump to be supported by legs that might interfere with the flow of solids into the pump suction will not be considered equal. The guide rail shall be firmly attached to the access hatch frame. Systems deeper than 21 feet shall require an intermediate guide for each 21 feet of wet well depth.
4. An adequate length of stainless steel lifting chain shall be supplied for removing the pump. The chain shall be of sufficient length and strength and shall include an adequate number of lifting rings for easy removal.

G. Corrosion Protection:

All corrosive metal surfaces shall be coated with self-priming, black, high-build, coal tar, amine cured epoxy enamel. The finished coating shall have a minimum dry film thickness of 16 mils, applied in two separate coats. Surface preparation for metal surfaces to be coated shall be

commercial grit blasting in accordance with SSPC-SP6-52T.

All concrete surfaces and piping exposed to corrosive environment (including the entire wet well interior) shall be coated with bitumastic material. The finished coating shall have a minimum dry thickness of 30 mil, applied in two separate coats. All dust, dirt, oil, grease, or other foreign matter must be removed prior to application of the protective coating.

All exposed valves shall be cleaned and touched up in the field with a manufacturer approved coating to repair any chips, scrapes or other damage to the shop applied coating.

VALVES AND PIPING:

A. Check valves

Check valves shall be the rubber flapper, swing check type with backflow device. Valve body shall be ductile iron and have a flow thru area greater than that of the connecting pipe. All check valves shall be capable of passing a 3" diameter solid. Flapper shall be Buna-N rubber molded over a steel disc with integral O-ring seal. Flapper shall be easily removed without removing valve from line. Backflow devices shall be constructed of bronze. Valves shall be furnished with shop primer. Check valves shall be rated for 175 psi working pressure, and shall be APCO Series 100 Rubber Flapper Swing Check Valves, or approved equal.

B. Plug valves

Plug valves shall be non-lubricated, 100% full port type with synthetic rubber-faced plugs. Valve body, plug and bonnet shall be cast iron. Stem shall have upper and lower bushings of non-corrosive material. All plug valves shall be capable of passing a 3" diameter solid. All valves shall be provided with limit stops and rotate 90° from fully open to fully shut. Maximum working pressure shall be 150 psi.

Valve operators shall be properly sized and assembled to the valve. Valves smaller than 6" shall be wrench operated, and valves 6" and larger shall be wheel operated. Plug valves shall be Dezurik Plug Valves.

C. Emergency bypass pumping connections

1. Provisions shall be made within the header piping and wet well of the pump station for connection of a 4" portable engine driven emergency bypass pump.
2. Piping modifications to accommodate the portable bypass pump shall include isolation plug valves and aluminum quick-disconnect fittings to match the existing hose sections of the City of Wooster Sewer Department. Connection fittings shall be 4" camlock fittings, type A or F, by Allen Machine Company, or equal.

D. Piping

1. Piping inside wet wells and valve vaults shall be flanged pipe, 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 AMSI 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 1/2-degree between flanges. Flanges shall be faced and a gasket finish applied that shall have concentric grooves a minimum of 0.01 Inch deep by approximately 0.03 Inch wide, with a minimum of three grooves on any given surface spaced a maximum of 1/4 inch apart.

2. All pipes connected to the pump station shall be supported according to good commercial practice to prevent piping loads from being transmitted to the pumps. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings. Buried force main piping shall be ductile iron pipe, Class 52 complying with AWWA C151; or PVC piping complying with AWWA C900. All force main piping shall have gasketed joints per AWWA C111.
3. All force main piping shall be a minimum of 4" in diameter.
4. All brackets for supporting piping and equipment shall be stainless steel and be mounted with stainless steel anchor bolts.

SEWAGE FLOW METER:

- A. The flow meter shall be the magnetic sensor type with interchangeable, modular sensors fully encapsulated in polyurethane. The flow meter shall have an accuracy of 0.5% over the full operating range of the meter. Flow meter shall be carbon steel, epoxy painted, with 316 stainless steel electrodes, Teflon flow tube liner and rubber o-rings. The flow meter shall be capable of sending a 4-20mA signal to the pump control panel. Flow meter shall be a UniMag Flow meter as manufactured by Isco, Inc., or approved equal. Unimag flowmeters shall be installed with a minimum of 5-pipe diameters straight pipe length upstream and 2-pipe diameters straight pipe length downstream.

STANDBY POWER SYSTEM:

A. General

1. It is the intent of this specification to secure an electrical power system that has been tested during design verification, production and at the final job site. All finished equipment shall be of the latest commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new and of current production of a national firm that manufactures generator sets and controls, transfer switches, switchgear, and assembles the generator sets as a complete and coordinated system. There will be one source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.
2. This section shall consist of providing a packaged electrical system and associated controls with all required accessories as specified and shown on the plans. The equipment supplier must be the authorized distributor for each component of the products specified herein. The work includes the furnishing of all labor, materials, equipment, test, and training to provide a complete and workable power system, including the generator set and generator set controls, and the transfer switch and transfer switch controls, and installation as shown on the plans, drawings, and specifications herein. It is the intent of these specifications to have a single source responsibility for the generator set, and transfer switch.
3. Any and all exceptions to the published specifications shall be subject to the approval of the engineer.

4. The power system shall be finished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.
5. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.
6. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production, installation, and service of the their complete product line.
7. It is the intent of this specification to secure an electrical power system that has been tested during design verification, production and at the final job site. All finished equipment shall be of the lasted commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new and of current production of a national firm that manufactures generator sets and controls, transfer switches, switchgear, and assembles the generator sets as a complete and coordinated system. There will be one source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

B. Generator Set

1) Submittal

- a) The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.

2) Codes and Standards

- a) The generator set shall conform to the requirements of the following codes and standards:
 - i) CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - ii) CSA 282, 1989 Emergency Electrical Power Supply for Buildings
 - iii) EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 - iv) EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - v) FCC Part 15, Subpart B.
 - vi) IEC8528 part 4. Control Systems for Generator Sets
 - vii) IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 - viii) IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - ix) IEEE587 for voltage surge resistance.
 - x) Mil Std 461D –1993. Military Standard, Electromagnetic Interference Characteristics.

- xi) Mil Std 462D - 1993. Military Standard, Measurement of Electromagnetic Interference Characteristics.
- xii) NEMA ICS10-1993 – AC Generator sets.
- xiii) NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
- xiv) NFPA99 – Essential Electrical Systems for Health Care Facilities
- xv) NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

3) Testing

- a) To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
 - i) Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and pre-production models, which will not be sold, shall have been used for the following tests.
 - (1) Maximum power (kW).
 - (2) Maximum motor starting (kVA) at 35% instantaneous voltage dip.
 - (3) Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-22.40 and 16.40.
 - (4) Governor speed regulation under steady-state and transient conditions.
 - (5) Voltage regulation and generator transient response.
 - (6) Fuel consumption at 1/4, 1/2, 3/4, and full load.
 - (7) Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 - (8) Three-phase short circuit tests.
 - (9) Alternator cooling air flow.
 - (10) Torsional analysis to verify that the generator set is free of harmful torsional stresses.
 - (11) Endurance testing.
- b) **Production Tests**
 - i) Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 - ii) Single-step load pickup.
 - iii) Transient and steady—state governing.

iv) Safety shutdown device testing.

v) Voltage regulation.

vi) Rated Power @ 0.8 PF

vii) Maximum Power.

viii) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

c) Site Tests

i) Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

ii) Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

iii) Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.

iv) Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.

v) Automatic start-up by means of simulated power outage to test remote- automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate kW rating.

4) Warranty & Maintenance

a) A one year warranty for the generator set shall be included to guaranteed against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.

b) The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

5) Equipment

a) The generator set shall be manufactured by Kohler or approved equal. The generator rating, kW and kVA provided when operating at 120/208 volts, .8 power factor, shall be designated on the standby power submittal. The generator set shall be capable of this rating while operating in an ambient condition of 85°F (67.2°C) and 500 feet above sea level.

- b) The generator set shall be capable of starting motor loads of 115 kVA inrush, with a maximum voltage dip of 35%.
- c) Vibration isolators shall be provided between the engine-generator and heavy-duty steel base

6) **Engine**

- a) The 262 cubic-inch-displacement engine shall deliver a minimum of 60 hp at a governed speed of 1800 rpm. The engine shall be equipped with the following:
 - i) An electronic isochronous governor capable of +0.5% steady-state frequency regulation.
 - ii) 12 Volt positive engagement solenoid shift-starting motor.
 - iii) 70-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.
 - iv) Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
 - v) Dry-type replaceable air cleaner elements for normal applications.
- b) The naturally aspirated engine shall be fueled with natural gas and be supplied with a unit-mounted electric solenoid fuel shut-off valve, flexible fuel line, and secondary fuel pressure regulator.
- c) The engine shall have a minimum of 6 cylinders, and be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5 inches H₂O static pressure on the fan in an ambient temperature up to 122F/50C.

7) **Generator**

- a) The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class F ratings. The excitation system shall be of brushless construction controlled by a solid- state voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.
- b) The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2 .
- c) The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.
- d) The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

8) **Controller**

- a) Set-mounted controller capable of facing right, left, or rear, shall be vibration isolated on the generator enclosure. The controller shall be capable of being remote-mounted. The microprocessor control board shall be moisture proof and capable of operation from -40°C to 85°C. Relays will only be

acceptable in high-current circuits.

- b) Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include the following features:
 - i) Fused DC circuit.
 - ii) Complete 2-wire start/stop control, which shall operate on closure of a remote contact.
 - iii) Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
 - iv) The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
 - v) Cranking cycler with 15-second ON and OFF cranking periods.
 - vi) Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
 - vii) Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
 - viii) Engine cooldown timer factory set at 5 minutes to permit unloaded running of the standby set after transfer of the load to normal.
 - ix) 3-position (Automatic-OFF-TEST) selector switch. In the TEST position, the engine shall start and run regardless of the position of the remote starting contacts. In the Automatic position, the engine shall start when contacts in the remote control circuit close and stop 5 minutes after those contacts open. In the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.
 - x) Alarm horn with silencer switch per NFPA 110.
- c) Standard indicating lights to signal the following shall be included:
 - i) Not-in-Auto (flashing red)
 - ii) Overcrank (red)
 - iii) Emergency Stop (red)
 - iv) High Engine Temperature (red)
 - v) Overspeed (red)
 - vi) Low Oil Pressure (red)
 - vii) Battery Charger Malfunction (red)
 - viii) Low Battery Voltage (red)
 - ix) Low Fuel (red)
 - x) Auxiliary Prealarm (yellow)
 - xi) Auxiliary Fault (red)
 - xii) System Ready (green)
- d) Test button for indicating lights.
- e) Terminals shall be provided for each indicating light above, plus additional terminals for common fault

and common prealarm.

9) Instrument Panel

- a) The instrument panel shall include the following:
 - i) Dual range voltmeter 3 1/2-inch, +/- 2% accuracy
 - ii) Dual range ammeter 3 1/2-inch, +/- 2% accuracy.
 - iii) Voltmeter-ammeter phase selector switch.
 - iv) Lights to indicate high or low meter scale.
 - v) Direct reading pointer-type frequency meter 3 1/2-inch, 0.5% accuracy, 45 to 65 Hz scale.
 - vi) Panel-illuminating lights.
 - vii) Battery charging voltmeter.
 - viii) Coolant temperature gauge.
 - ix) Oil pressure gauge.
 - x) Running-time meter.
 - xi) Voltage-adjust rheostat

10) Accessories

- a) Line circuit breaker of 150 amperes, 150 amps sensor, 600 volt rated, molded case type, generator mounted.
- b) Engine block heater. Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.
- c) A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability. This breaker shall not trip within the 10 seconds specified above to allow selective tripping of downstream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset, preventing restoration of voltage if maintenance is being performed. a field current-sensing breaker will not be acceptable.
- d) A sound attenuated weather housing shall be provided. The housing shall be constructed of 14-gauge prepainted coated steel. The maximum sound level shall not exceed 73 dba at 7 meters (23 feet) with the generator operating at full load.
- e) Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.
- f) 12-volt lead-antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0°F, per SAE Standard J-537, shall be supplied.
- g) 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from

no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.

- h) The engine exhaust silencer shall be coated to be temperature and rust resistance, rated for critical application. The silencer will reduce total engine exhaust noise by 25-35 dB(A).
- i) Two flexible fuel lines rated 300°F and 100 psi ending in pipe thread.
- j) A dry contact kit containing .
- k) Run Relay to provide a three-pole, double-throw relay with 10 amps at 250 VAC contacts for indicating that the generator is running.
- l) Common Failure relay to remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and overspeed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
- m) Generator prealarm senders.
- n) Generator rodent guards.

C. TRANSFER SWITCH

1) Submittal

- a) The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set and the transfer switch if it is included elsewhere in these specifications.

2) Testing

- a) To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
 - i) Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.

b) Production Tests

- i) Final Production Tests: Each transfer switch shall be tested under load with all guards in place. Tests shall include:
 - (1) The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.
 - (2) The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.

(3) The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI C37.90a-2978 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

ii) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

c) Site Tests

i) Site Tests: The manufacturer's local representative shall perform an installation check, start-up, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.

3) Warranty & Maintenance

a) A one year warranty for the automatic transfer switch shall be included to guaranteed against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.

b) The automatic transfer switch manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

4) Compliance With Codes and Standards

a) The ATS shall conform to the requirements of:

i) UL 1008--Standard for Automatic Transfer Switches

ii) NFPA 70--National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700

iii) NFPA 99--Essential Electrical Systems for Health Care Facilities

iv) NFPA 110--Standard for Emergency and Standby Power Systems

v) IEEE Standard 446--Recommended Practice for Emergency and Standby Power Systems (Orange Book)

vi) IEEE Standard 241--Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book)

vii) NEMA Standard IC10 (formerly ICS 2-447) Automatic Transfer Switches.

viii) UL 508 – Standard for industrial Control Equipment

ix) EN61000-4-5 Surge Immunity Class 4 (voltage sensing and programmable inputs only)

x) EN61000-4-4 Fast Transient Immunity Severity Level 4

xi) IEC Specifications for EMI/EMC Immunity as follows:

- (1) CISPR 1 Radiated Emissions
- (2) IEC 1000-4-2, Electrostatic Discharge
- (3) IEC 1000-4-3, Radiated Electromagnetic Fields
- (4) IEC 1000-4-4, Electrical Fast Transient (Bursts)
- (5) IEC 1000-4-5, Surge Voltage
- (6) IEC 1000-4-6, Conducted RF Disturbances
- (7) IEC 1000-4-8, Magnetic Fields
- (8) IEC 1000-4-11, Voltage Variations and Interruptions

5) **Electrical Requirements**

- a) Automatic transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.
- b) The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. Switches rated 400 amperes and below shall be suitable for 100% tungsten-filament lamp load. Switches rated above 400 amperes shall be suitable for 30% tungsten-filament load.
- c) The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans.

6) **Equipment**

- a) The automatic transfer switch shall be manufactured by Kohler, or approved equal of the same manufacturer as the generator set.
- b) The transfer switch shall have the following characteristics:
 - i) 225 amp current rating
 - ii) 3 Pole
 - iii) 4 wire, 3 phase
 - iv) 208 Volt-60Hz
 - v) Solid Neutral
 - vi) The withstand and closing ratings with a current-limiting fuse shall be 200,000 Amps
 - vii) The withstand and closing ratings with any overcurrent protective device shall be 35,000 Amps
- c) The ATS shall be furnished in a NEMA 4X enclosure.
- d) The switch shall be a 600 volt class.

7) **Mechanical Requirements**

- a) All main contacts shall be of silver composition. The main contacts shall be protected by arcing contacts in sizes 400 amperes and above. The main contacts shall be of the blow-on configuration

and of segmented construction in ratings 600 amperes and above.

- b) All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- c) The contact transfer time shall not exceed one-sixth of a second.
- d) All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.
- e) All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- f) The neutral conductor shall be solidly connected as shown on the plans, a neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

8) Transfer Switch Control System

- a) The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.
- b) The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.
- c) The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed:
 - i) Keypad pushbuttons:
 - (1) Start/end system test
 - (2) Set/end exercise
 - (3) End time delay
 - (4) Lamp test/service reset
 - ii) Light-emitting diode status indicators:
 - (1) Contactor Position: Normal, Off, Emergency
 - (2) Source Available: Normal, Emergency
 - (3) Service required: immediate, maintenance
 - (4) Not in automatic mode
 - (5) Four stage time delay remaining
 - (6) Exercise: load, no load, set/disabled
 - (7) Test: load, no load
 - (8) Load control active: peak shave, load shed, pre/post-transfer signal
 - (9) In-phase monitor active
- d) Outputs:
 - i) Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.
 - ii) Pre-transfer load control, one normally open contact rated 10 amps @ 30 VDC/250 VAC

iii) One Programmable output, factory-set to load bank control rated 2 amps @ 30 VDC/250 VAC.

9) Operation

- a) All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over- and under-frequency. In addition, the controller shall use anti-single phasing protection that detects regenerative voltage (using the phase angle of the source) to determine a failed source condition.
- b) Voltage and frequency sensing:
 - i) Undervoltage pick-up set at 90% of nominal voltage, adjustable 85% - 100% of nominal voltage.
 - ii) Undervoltage dropout set at 90% of pickup voltage, adjustable 75% - 98% of pickup voltage.
 - iii) Overvoltage dropout set at 110% of nominal voltage, adjustable 105% - 135% of nominal voltage.
 - iv) Overvoltage pick-up set at 95% of dropout voltage, adjustable 85% - 100% of nominal voltage.
 - v) Voltage dropout time set at 0.5 seconds adjustable 0.1 – 9.9 seconds.
 - vi) Voltage accuracy: 2%.
 - vii) Under frequency pick-up set at 90% of nominal frequency, adjustable 85% - 95% of nominal frequency.
 - viii) Under frequency dropout set at 99% of pick-up frequency, adjustable 95% - 99% of pick-up frequency.
 - ix) Over frequency dropout set at 101% of pick-up frequency, adjustable 101% - 105% of nominal frequency.
 - x) Over frequency pick-up set at 110% of nominal frequency, adjustable 105% - 120% of nominal frequency.
 - xi) Frequency accuracy: 1%
- c) Time Delays:
 - i) Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 3 seconds.
 - ii) Time delay for transfer to standby: Range 0-60 minutes. Factory set at 1 second.
 - iii) Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 15 minutes.
 - iv) Time delay for engine cool down: Range 0-60 minutes. Factory set at 0 minutes.
 - v) Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.
 - vi) Pre-transfer to normal signal: Range 0-60 minutes. Factory set at 3 second.

- vii) Pre-transfer to standby signal: Range 0-60 minutes. Factory set at 3 second.
- viii) Post-transfer to normal signal: Range 0-60 minutes. Factory set at 0 minute.
- ix) Post-transfer to standby signal: Range 0-60 minutes. Factory set at 0 minute.
- d) User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.
- e) The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.
 - i) Phase rotation sensing programmable ABC or CBA.
 - ii) In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED on the user interface panel shall indicate active in-phase monitoring.
 - iii) Plant Exerciser: Programmable seven-day or fourteen-day exerciser with user selectable load or no-load operation. An LED, on the user interface, shall indicate the type of exercise (load or no load). The time remaining on the exercise shall be indicated. The exercise time may be reset at any time with a single keystroke. The engine shall be allowed to run when the exercise period is terminated. The exerciser may be disabled for maintenance purposes. An amber LED shall flash on the user interface if the exerciser has been disabled. The exerciser shall have the capability of being programmed, using up to twenty-one (21) event for a calendar mode. The controller shall have provisions for disconnecting a load bank (during exercise) if there is a loss of normal power.
 - iv) The control module must be upgradable with the following options
 - (1) Supervised transfer control switch
 - (2) Provide four programmable input/output (I/O) modules with two inputs and six outputs each rated 2 amps @ 30 VDC/250 VAC

10) Monitoring, Programming and Communications:

- a) Modbus® link:
 - i) Industry standard Modbus® RTU communication shall be available with network and setup connections.
 - ii) A Modbus® master will be able to monitor controller data.
 - iii) A Modbus® master will be able to alter parameters.
 - iv) The Modbus® master must be capable of starting and stopping the generator.
 - v) The manufacturer shall provide a Modbus® communications protocol manual to facilitate communications with a Modbus® master by a third party developer.
 - vi) The Modbus® network shall communicate to the controller using a twisted pair of wire.

- b) Personal Computer Set-up/monitoring Software
 - i) The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows '9X or Windows NT through an RS-232 communication format (in addition to the Modbus® connection).
 - ii) The software shall be Windows® based
 - iii) The programming capability shall be password protected
- c) It shall be possible to start the generator and transfer the loads to the generator.
- d) Event monitoring shall be accessible using either a personal computer with the personal computer software or Modbus® link to view the following:
 - i) Historical data (total and resettable)
 - (1) Days in operation
 - (2) Hours in standby
 - (3) Hours not in preferred
 - (4) Switch transfers
 - (5) Failure to transfer
 - (6) Transfers due to loss of preferred
 - (7) Start up date
 - (8) Last maintenance date
 - (9) Switch transfer count since last maintenance
 - ii) Transfer switch information
 - (1) ATS serial number
 - (2) Controller serial number
 - (3) Contactor serial number
 - (4) Load description
 - (5) Location
 - (6) Branch
 - (7) Network connection ID
 - (8) Baud rate
 - (9) Parity bit
 - iii) System events (time and date stamped) of the last 100 events which include all failures of the sources, transfer switch and all functions of the controller and contactor:
 - iv) Line to line voltage
 - v) System frequency
 - vi) Time delay active
 - vii) Time delay remaining
 - viii) System status
 - ix) Source available

- x) Contactor position
 - xi) Exerciser schedule, mode and time remaining on active exercise.
- e) Programmable features may be viewed, selected or adjusted as follows:
- i) System voltage
 - ii) System frequency
 - iii) Single/three-phase operation
 - iv) Open/closed-transition operation
 - v) ABC or CBA phase rotation
 - vi) In-phase monitor
 - vii) Commit/no commit transfer mode
 - viii) User defined password
- f) Programmable inputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
- i) End time delay input
 - ii) Inhibit transfer
 - iii) Low external battery fault
 - iv) Peak shave/area protection input
 - v) Remote common fault
 - vi) Remote test
- g) Programmable outputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
- i) Auxiliary switch fault
 - ii) Common fault
 - iii) Contactor position
 - iv) Exercise active
 - v) Failure to acquire standby source
 - vi) Failure to transfer fault
 - vii) Generator engine start
 - viii) Load bank control
 - ix) Loss of phase fault
 - x) Low backup battery
 - xi) No in automatic mode
 - xii) Non-emergency transfer
 - xiii) Over and undervoltage faults
 - xiv) Over and under frequency faults
 - xv) Peak shave/area protection active
 - xvi) Phase rotation error
 - xvii) Modbus®-controlled relay outputs
 - xviii) Source available
 - xix) Test active

ELECTRICAL AND CONTROLS:

A. System power characteristics

1. Electrical power to be furnished to the site will be 3 phase, 60 hertz, 4 wire, 240 or 480

volts, maintained within plus or minus 10 percent. Control voltage shall not exceed 132 volts.

B. Electrical work

1. Electrical work must be performed in strict accordance with all applicable laws, ordinances, rules, regulations and orders or any public body having jurisdiction over this type of work. All work shall be performed in accordance with the National Electric Code, latest revision, as published by the National Fire Protection Association.

C. Service Mast and Weatherhead

1. Service masts shall be rigid galvanized steel conduit meeting the requirements of the American National Standards Institute Specification C80.1, latest revision. Fittings shall be constructed of steel and shall have threaded joints. Weatherheads shall be threaded galvanized service entrance caps for heavywall rigid installations as manufactured by T & B or approved equal. All necessary accessories to complete service mast and weatherhead installations in accordance with the National Electrical Code shall be provided.

D. Control Panel

1. The electrical control panel shall be provided by the pump station manufacturer and shall be provided with the following features.

a. Panel enclosure

Enclosure shall be constructed in conformance with applicable section of national electrical manufacturers' association (NEMA) standards for type 4X electrical enclosures. Enclosure shall be fabricated of stainless steel having a minimum thickness of not less than 0.075 Inch (14 gauge). All seams shall be continuously welded, and shall be free of burrs and voids. Interior and exterior surfaces shall be polished or brushed finished. There shall be no holes through the external walls of the enclosure for mounting the enclosure or any components contained within the enclosure. Panel enclosure shall be suitable for wall or pole mounting by the installing contractor, and shall be supplied with all required mounting supports and hardware, fabricated of stainless steel.

b. Control Panel Door

Enclosure shall be equipped with a door mounted on a continuous stainless steel hinge, and sealed around its perimeter. Door shall be held closed with clamps that are quick and easy to operate. The door shall accommodate the mounting of switches and indicators.

c. Enclosure Back Panel

Enclosure shall be furnished with a removable back panel, fabricated of steel having a thickness of not less than 0.106 Inch (12 gauge), which shall be secured to the

enclosure with collar studs. Such panel shall be of adequate size to accommodate all basic components.

d. Mounting

All control components shall be securely fastened to a removable back panel with screws and lock washers. Switches, indicators and instruments shall be mounted through the control panel door. Self-tapping screws shall not be used to mount any components. All connections from the back panel to door mounted or remote devices shall be made through terminal blocks.

e. UL Listed Control Panel

The pump control panel shall be manufactured by a UL panel builder and the assembly shall bear a serialized UL label for "Enclosed Industrial Control Panels". Listing for open style industrial control panels or an assembly of listed or recognized components shall not be acceptable.

f. Alarm Light

The panel shall be fitted with a vandal resistant alarm light mounted on the side of the enclosure. The alarm light shall flash during high water condition and go out when the wet well level drops.

E. Control Components

1. Condensation Heater: A strip type heater shall be provided to control condensation and protect control components.
2. Receptacle – GFI: A GFI receptacle shall be provided in the control panel.
3. Intrinsically Safe Relays
4. Transfer Switch and Generator Connection
5. Low Voltage Circuitry
6. Motor Heat Sensor & Seal Leak Circuitry
7. Pump Delay Circuitry: Field adjustable time delay relays shall be provided for staggering the starting and stopping of the pumps.
8. Main connections: A main terminal block and ground lug shall be furnished for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the pump station loads. The main terminal block shall be mounted to allow incoming wire bending space in accordance with article 373 of the national electric code (NEC). A separate terminal strip shall be provided for 115 volt, single phase control power and shall be segregated from the main terminal block. Ten percent of the control terminals shall be furnished as spares.

All motor branch components shall be of the highest industrial quality. Operating coils of all ac control devices shall be rated for 120 volts, and shall be suitable for use in a voltage range of 108 to 132 volts, 60 hertz.

9. Circuit breakers and operating mechanisms: A properly sized heavy duty air circuit breaker shall be furnished for each pump motor, and shall have a symmetrical RMS interrupting rating of 14,000 amperes at 480 volts. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.

A padlocking operating mechanism shall be installed on each motor circuit breaker. Operator handles for the mechanisms shall be located on the exterior of the control compartment door, with interlocks which permit the door to be opened only when circuit breakers are in the "off" position.

10. Motor starters: An open frame, across-the-line, NEMA rated magnetic motor starter shall be furnished for each pump motor. Starters of NEMA size 1 and above shall be designed for addition of at least two auxiliary contacts. Starters rated "0", "00", or fractional sizes shall not be acceptable. Power contacts shall be double-break and made of cadmium oxide silver. All motor starters shall be equipped to provide undervoltage release and overload protection on all three phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position.

11. Overload relays: Overload relays shall be block-type, utilizing melting alloy type spindles, and shall have visual trip indication with trip-free operation. Pressing of the overload reset lever shall not actuate the control contact until such time as the overload spindle has reset. Resetting of the overload reset lever will cause a snap-action control contact to reset, thus re-establishing a control circuit. Overload relays shall be manual reset only and not convertible to automatic reset. Trip setting shall be determined by heater element only and not by adjustable settings.

Overload reset pushbuttons shall be mounted through the door of the control panel in such a manner as to permit resetting the overload relays without opening the control panel door.

12. Indicators: Indicating lights shall be oil tight type and equipped with integral step-down transformers for long lamp life. Lamps shall be incandescent type rated 14 volts or less with a minimum life of 15,000 hours. Lamps shall be replaceable from the front without opening the control panel door and without the use of tools.

Indicating lights will be provided for the following functions:

- a. Pump #1 and pump #2 high pump temperature shutdown
- b. High wet well level
- c. Alarm silenced
- d. Pump #1 and Pump #2 running
- e. Seal Failure for each pump

13. Switch controls: The manufacturer may use selector switches, pushbutton switches, or any combination thereof, to accomplish the switching tasks described below. Switches

shall be oil tight type with contacts rated Nema a-300 minimum.

Switches shall be furnished to accomplish the following minimum functions:

- a. Disconnect the control circuit.
- b. Select the mode of operation for each pump (H-O-A switches).
- c. Select the sequence of pump operation.
- d. Operate the level control system as described below.
- e. Override all controls except motor overload relays.
- f. Silence one of the 115 volt ac alarm circuits and reset the high water alarm circuit.

The control circuit shall be fused, and shall be provided with a disconnect switch connected in such a manner as to allow control power to be disconnected from all control circuits.

Pump mode selector switches shall be connected to permit manual start and manual stop of each pump motor individually. Each switch shall be connected to one or more indicators that shall be illuminated to indicate the selected mode of operation. Manual operation shall not override shutdown systems supplied with the level control system.

Pump sequence selector switch shall permit selection of automatic pump alternation, or selection of either pump to run as lead pump for each cycle.

Override switches shall be connected to bypass the level control system and all shutdown systems supplied with it, to provide manual start and manual stop of each pump individually in the event of level control system malfunction.

A pushbutton switch shall be provided to silence one of the 115 volt ac alarm circuits while corrective actions are underway. Depressing the alarm silence pushbutton shall also cause the high water alarm circuit to reset when the liquid level has been lowered.

14. High pump temperature shutdown: The control panel shall be equipped with circuitry to override the level control system and shut down the pump motor(s) when required to protect the pump from damage caused by excessive temperature.

A thermostat shall be mounted on each pump to detect its temperature, and a magnetic switch shall be supplied for each thermostat. If the pump temperature should rise to a level that could cause pump damage, the thermostat shall cause a magnetic switch to drop out the motor starter. An indicator, visible on the front of the control panel shall indicate that the pump motor has been stopped because of a high temperature condition. The pump shall remain locked out until the pump has cooled and the circuit has been manually reset. Automatic reset of such a circuit shall not be acceptable.

15. Elapsed time indicators: Six-digit elapsed time meters (non-reset type) shall be connected to each pump motor starter to indicate the total running time of each pump in "hours" and "tenths of hours".

16. Monitoring and Fault Contacts: Dry contacts will be provided and wired to terminal blocks for the following occurrences and connection to the telemetry unit:

- a. High water alarm
- b. High pump temperature shutdown #1, #2
- c. 3 phase voltage monitor general alarm relay (loss of any phase)
- d. Standby Generator Running
- e. Standby Generator Failure (general alarm relay)
- f. Pump run #1, #2
- g. Hand Position Pump #1, #2
- h. Auto Position Pump #1, #2
- i. Pump Motor Amp Draw (3 phase) via 4-20 mA signal, Pump #1, #2
- j. Seal Failure, Pump #1, #2
- k. Pump Motor Megger Reading – Ohm Meter
- l. Wet well level via 4-20 mA analog signal
- m. Sewage Flow via 4-20mA analog signal
- n. Unauthorized entry

The control panel shall accept 4-20 mA signals from the flow meter and level indicator and display these on a digital readout, and send signals to the Telemetry System.

- 17. Three Phase Voltage Monitor: A three phase voltage monitor will be provided to stop the pump motors in the event of the following conditions: Low voltage; voltage unbalance; phase loss; phase reversal. A general alarm relay will be provided and wired to terminal blocks. Power will automatically be restored to the pump motors upon restoration of normal power service.
- 18. Secondary Lightning Arrestor: A secondary lightning arrestor will be provided for use in preventing voltage surge and lightning damage to motors and control equipment.
- 19. Wiring: The pump station as furnished by the manufacturer shall be completely wired except for the power feeder lines and final connections to pump motors, engine, and remote alarm devices. The interconnecting wire, conduit, and other materials required shall be furnished and installed by the electrical contractor.

All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council (JIC), National Machine Tool Builders Association (NMTBA), and the National Electric Code (NEC).

All user serviceable wiring shall be type MTW or THW, 600 volts, and shall be 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 |

- 20. Wire identification and sizing: Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 16-gauge minimum, type MTW or

THW, 600 volts. Wiring in conduit shall be 14-gauge minimum. Motor branch wiring shall be 10-gauge minimum.

Motor branch conductors and other power conductors shall not be loaded above 60-degree c temperature rating, on circuits of 100 amperes or less, nor above 75-degree c on circuits over 100 amperes. Wires shall be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be of the 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 be terminated on a terminal block mounted on the back panel. All wiring outside the panel shall be installed in conduit.

21. Wire bundles: Control conductors connecting components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be allowed so that the door can swing to its full open position without undue mechanical stress or abrasion on the conductors or insulation. Bundles shall be clamped and held in place with mechanical fastening devices on each side of the hinge.
22. Auxiliary power transformer: The station shall be equipped with a (3) kVA stepdown transformer to supply 115 volts for the control and auxiliary circuits. The primary side of the transformer shall be protected by a thermal-magnetic air circuit breaker, specifically sized to meet the power requirements of the transformer. A mechanical operating mechanism shall be installed on the circuit breaker to provide a means of disconnecting power to the transformer. The operator handle for the operating mechanism shall be located on the exterior of the control panel with interlocks which permit the door to be opened only when the circuit breaker is in the "off" position.
23. A schematic diagram shall be permanently fastened to the inside of the enclosure door.

CONDUIT:

A. Conduit requirements are as follows:

1. All conduit and fittings shall be UL Listed
2. Liquid tight flexible metal conduit shall be constructed of a smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight, polyvinyl chloride cover.
3. Conduit shall 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.

B. Grounding

1. The pump station manufacturer shall ground all electrical equipment to the enclosure back panel. The mounting surface of all ground connections shall have any paint

removed before making final connections.

2. The contractor shall provide an earth driven ground connection to the control panel at the main ground lug in accordance with the national electric code (nec).

PUMP CONTROL SYSTEM OPERATION:

A. Functional Description:

1. The control system shall start and stop the pump motors in response to changes in wet well level as set forth herein. Control of pumps shall also be possible by signal from the telemetry system.

B. Level Sensor Type:

1. The level sensor shall be the Hydrostatic Type. The level sensor will continually sense the liquid level based on the hydrostatic pressure on the submerged sensor in the wet well. The sensor shall provide a 4-20mA signals representing wet well level for monitoring, display and control of the pumping system.
2. The sensor shall be housed in a Type 316 stainless steel housing, shall operate from 32-122 degrees F, shall have a four digit level indicator, and shall be provided with a NEMA 4X enclosure for the level transmitter, including strip heater.

C. Operation:

The pump control system shall be designed to accomplish the following tasks:

1. Continuously monitor the level of liquid in the wet well.
2. Start and stop pumps as required by the level of liquid in the wet well.
3. Select the operation of one pump or both pumps.
4. Select the sequence of pump operation upon operator command for automatic alternation.
5. Provide alarm indications upon occurrence of predetermined malfunctions.
6. Upon restoration of utility power after a power outage, the system shall delay the application of power to the pumps, by a length of time that has been preselected by the operator.
7. Shut down a pump motor when the temperature of that pump reaches a level that could cause pump damage.

D. Sequence of Operation

1. The control system shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the control system shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the lead pump shall stop. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the second pump shall start

when the liquid reaches the "lag pump start level" so that both pumps are operating. These levels shall be adjustable as described below.

E. Automatic Pump Alternation

1. The control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.

F. Display

1. The control system shall incorporate a digital panel meter, which, upon operation selection, shall display liquid level in the wet well, and the preset start and stop level for both lead and lag pump. The meter shall be a 3-1/2 digit display calibrated to read out directly in feet of water, accurate to within one-tenth foot (0.1 foot) with a full-scale indication of not less than 12 feet.

G. Independent Lag Pump

1. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.

H. High Water Alarm With Alarm Silence

1. The level system shall include an additional float switch and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. In the event that the wet well liquid reaches a preset high water alarm level, the high water output relay shall energize a magnetic switch. The magnetic switch shall complete a 115 volt AC circuit for an external alarm device. An electrical or mechanical indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The magnetic switch shall maintain the alarm signal until the wet well level has been lowered and the circuit has been manually reset.
2. An alarm silence switch and relay shall be provided to permit maintenance personnel to deenergize the external alarm device while corrective actions are underway. After silencing the alarm device, manual reset of the signal relay shall provide automatic reset of the alarm silence relay.

TELEMETRY SYSTEM

A. GENERAL DESCRIPTION

1. The contractor shall provide a digital communication system, mounted within the pump station enclosure, to transmit digital signals from the pump station to the City of Wooster Water Pollution Control Plant. The telemetry system shall be compatible with the existing City of Wooster system without any additional hardware or software. The new equipment shall be equipped with disconnects and fuses, interior lighting, terminal strips, lightning protection, radio, and battery back-up. The Telemetry System located at the pump station

shall be referred to as the RTU (remote telemetry unit).

2. The pump control panel shall be provided with a separate 15-amp breaker for the Telemetry System.

B. SYSTEM COMPONENTS

1. Each RTU shall be housed in a 24"W x 36"H x 8"D 316 stainless steel enclosure. The RTU shall include at a minimum:
 - a) A programmable logic controller (PLC), which shall meet or exceed the quality, reliability, performance and versatility of a Direct Logic DL205 series with a DL250 CPU. Port 2 of this module will have a DB15F connector and be configured as a Modbus Slave. The primary communication protocol of any "or equivalent" equipment will be Modbus RTU. The PLC rack and I/O modules will be sized based on the desired I/O points. A minimum of 20 analog and 10 digital I/O points shall be provided, with the capability for expansion. 20% spare I/O points will be provided.
 - i. Input points monitored at the time of installation shall be:
 - 1) Pump run indicator for each pump.
 - 2) High level condition.
 - 3) Low level condition.
 - 4) Power status.
 - 5) Communication status.
 - 6) Flow out put.
 - 7) Continuous level monitoring from level sensor.
 - 8) Amp draw on operating pump motor(s).
 - 9) Megohm meter reading on non powered pump motor(s)
 - 10) Manual switch position indicators.
 - 11) Seal failure indicator (if submersible pumps installed) on each pump.
 - 12) Overtemp monitor on each pump motor.
 - b) A radio modem, which shall meet or exceed the quality, reliability, performance and versatility of a Freewave DGR-115R. The radio modem will be capable of the following specifications:

<u>Frequency:</u>	902 to 928 MHz
<u>Transmitter:</u>	
Output Power:	1 W (+30dBm) at 9.5 to 14.0 V, 400mW (+26dBm) at 7.5 to 9.5V
Range, Line of Sight	20 miles (with unity gain antenna)
Modulation	GFSK, 120kBs – 170 kBs
Occupied Bandwidth	230 kHz
RF connector	Type N female
<u>Receiver:</u>	
Sensitivity	-108 dBm at 10 ⁻⁶ raw BER
Selectivity	40 dB at fc +/- 230 kHz, 60 dB at fc +/- 460 kHz

Data Transmission:

Error Detection	32 Bit CRC, resend on error
Data Encryption	Substitution, dynamic key
Link Throughput	115 Kbaud
Interface	RS-232 1200 Baud to 115.2 Kbaud
Connector	Standard DB9 (DGR-115R)

Power Requirements:

Transmit Current	650 ma at 12V for 1W, 600 ma at 8.5V for 400 mV
Receive Current	100 ma at 12V
Idle Current	65 ma at 12V
Sleep Mode Current	5 ma at 12V

Operating Modes:

- Point-to-Point
- Point-to-Multipoint
- Peer-to-Peer
- Store and Forward Repeater

Operating Environment: -40°C to +75°C

Enclosure: Extruded Aluminum

The Radio modems will operate in Modbus RTU mode, ensuring that messages are kept contiguous in order to prevent protocol timing problems for the devices communicating over the radio link.

All RTU locations should use directional antennas, which may be mounted on available utility poles and/or bidder supplied antenna masts (depending upon location). Antennas must be mounted a minimum of fifteen (15) feet above the ground. Repeater stations shall use omni-directional antennas to be mounted on the water towers. In addition, the main receiving point shall also have an omni-directional antenna mounted at least 40 feet above the ground.

- c) A Polyphaser coax surge suppressor shall be installed on all antenna leads.
- d) A UPS sized with enough battery-supplied power shall be provided to operate the system for at least 4 hours. The UPS shall meet the same specification as outlined in section C above.

C. SYSTEM OPERATION

1. The contractor shall be responsible for properly installing the telemetry components, and for proper antenna height for acceptable communication paths. All inputs required shall be wired to the telemetry equipment. Status inputs to be connected are as follows.
 - a. Pump #1 Running
 - b. Pump #2 Running
 - c. Pump #1 Hand Position

- d. Pump #2 Hand Position
- e. Pump #1 Auto Position
- f. Pump #2 Auto Position
- g. Power Failure
- h. Enclosure Door open
- i. High Wet Well Level
- j. Standby Engine Running
- k. Standby Engine Failure
- l. Pump #1 Motor High Amp Draw
- m. Pump #2 Motor High Amp Draw

Analog inputs shall be as follows;

- n. Wet Well Level
- o. Sewage Flow

2. The status input signals shall come from the pump control panel. A limit switch shall be furnished and installed on the pump station enclosure door to provide a signal for Enclosure Door Open. The sewage flow and wet well level inputs shall read the 4-20 mA signals in series from the flow meter and pressure transducer to the digital read-outs on the pump control panel. The status signal for Power Failure shall come from the transfer switch, and the status input signal for Standby Engine Running shall come from contacts supplied for this purpose.
3. Status outputs shall be provided for providing control signals from the telemetry system to the pump control panel. Status outputs shall be as follows:
 - a. Pump #1 Run
 - b. Pump #1 Stop
 - c. Pump #2 Run
 - d. Pump #2 Stop

WET WELL:

A. Construction:

1. Wet wells shall be constructed of reinforced, precast concrete sections having a 4,000-psi, 28-day compressive strength, and shall conform to ODOT 511, Class "C" concrete. Precast, concrete sections shall conform to ASTM C478, with "O" ring joints per ASTM C443. Walls shall be sized to adequately function for the intended purpose and shall withstand all loadings when full or empty. All walls and joints shall be watertight. The entire wet well shall be coated inside and out with coal tar epoxy or approved equal, and all joints shall be sealed with a butyl sealant sheet around the outside perimeter of the joint, extending 9" on either side of the joint.
2. All reinforcing steel used in wet well construction shall conform to ODOT item 509 and ACI 301-84. All reinforcing bars shall be epoxy coated and have a yield stress of $F_y = 60,000$ psi. All reinforcing fabric shall be epoxy coated and shall conform to ASTM A 185.

- B. Floor Slope: The wet well floor shall have a minimum slope of 1:1 from the walls to the hopper bottom. The horizontal area of the hopper bottom shall be not greater than that necessary for proper installation and function of the suction pipe inlets.
- C. Standard manhole steps shall be installed as indicated on the drawings and shall meet applicable OSHA and D.O.E.S. standards. Steps shall be plastic coated type per M.A. Industries, Inc., PS-1-PF or approved equal.

D. Top Slab and Access:

The top slab of the pump station wet well shall be designed to support the personnel and equipment needed for maintenance and equipment removal and shall be reinforced concrete, 8" thick minimum. The slab shall be provided with a minimum 24" square wet well access hatch. Access hatch frame and cover shall be aluminum with 300 series stainless steel hinges and hardware. The frame and cover shall be flush with the slab top when closed, have a slip resistant, diamond pattern texture, and be designed for heavy-duty service. The cover shall be provided with a lifting handle and safety latch to hold the cover in an open position, shall have safety grating for fall protection when the doors are open, and shall have recessed padlock hasps with hinged covers. Contractor shall provide two (2) padlocks. Access hatch shall be Bilco Type KD or approved equal.

E. Size:

The wet well size (volume) and control settings for pumps shall be appropriate to avoid excessive on/off cycles and shall also avoid septic conditions due to excessive detention time. As much as is practical, wet well size and pumping rates shall be designed to deliver as uniform a flow as possible. The effective volume of the wet well shall be based on design average flow and filling time not to exceed 30 minutes. In no case shall the well diameter be less than five (5) feet.

F. Ventilation:

Air displacement shall be accomplished using an inverted "j" tube or other means. Ventilation for maintenance safety purposes shall provide at least 12 complete air changes per hour if continuous, or 30 complete air changes per hour if intermittent. Air shall be forced into the wet well by mechanical means. Switches for operation of ventilation equipment shall be marked and located conveniently and/or automatic controls installed for intermittent usage.

G. Piping:

All piping in wet wells shall be ductile iron pipe, Class 52, per ANSI/AWWA C151/A21.51 with flanged or mechanical joints, and of the size shown on the drawings.

H. Testing:

Wet wells shall be vacuum tested in accordance with the City of Wooster, Engineering Construction Standards, General Notes for Manhole Testing (GN-9.1).

VALVE VAULT:

A. Construction:

1. Valve Vaults shall be constructed of reinforced, precast concrete sections having a 4,000-psi, 28-day compressive strength, and shall conform to ODOT 511, Class "C" concrete. Precast, concrete sections shall conform to ASTM C478, with "O" ring joints per ASTM C443. Walls shall be sized to adequately function for the intended purpose and shall withstand all loadings. All walls and joints shall be watertight. The entire vault shall be coated inside and out with coal tar epoxy or approved equal, and all joints shall be sealed with a butyl sealant sheet around the outside perimeter of the joint, extending 9" on either side of the joint.

2. All reinforcing steel used in valve vault construction shall conform to ODOT item 509 and ACI 301-84. All reinforcing bars shall be epoxy coated and have a yield stress of $F_y = 60,000$ psi. All reinforcing fabric shall be epoxy coated and shall conform to ASTM A 185.

B. Floor Slope: The valve vault floor shall have a minimum slope of $\frac{1}{4}$ " per ft. from the far wall to the drain line. A minimum 2" diameter drain line shall be installed from the valve vault bottom to the wet well with a check valve in the wet well to prevent reverse flow.

C. Standard manhole steps shall be installed as indicated on the drawings and shall meet applicable OSHA and D.O.E.S. standards. Steps shall be plastic coated type per M.A. Industries, Inc., PS-1-PF or approved equal.

D. Top Slab and Access:

The top slab of the valve vault shall be designed to support the personnel and equipment needed for maintenance and equipment removal and shall be reinforced concrete, 8" thick minimum. The slab shall be provided with a minimum 24" square wet well access hatch. Access hatch frame and cover shall be aluminum with 300 series stainless steel hinges and hardware. The frame and cover shall be flush with the slab top when closed, have a slip resistant, diamond pattern texture, and be designed for heavy-duty service. The cover shall be provided with a lifting handle and safety latch to hold the cover in an open position, shall have safety grating for fall protection when the doors are open, and shall have recessed padlock hasps with hinged covers. Contractor shall provide two (2) padlocks. Access hatch shall be Bilco Type KD or approved equal.

E. Size:

The valve vault size shall be appropriate to facilitate operation and maintenance of all valves and piping. In no case shall the well diameter be less than five (5) feet.

F. Piping:

All piping in valve vaults shall be ductile iron pipe, Class 52, per ANSI/AWWA C151/A21.51 with flanged or mechanical joints, and of the size shown on the drawings.

MANUFACTURER'S RESPONSIBILITIES:

A. OPERATIONAL TEST

1. The pumps, motors, and controls shall be given an operational test in accordance with the standards of the hydraulic institute. Recordings of the test shall substantiate the correct performance of the equipment at the design head, capacity, suction lift, speed and horsepower as herein specified.
2. Upon request from the engineer, the engineer or his representative shall be invited to witness the operational test at the manufacturer's facility or other location designated by the manufacturer.

B. SUBMITTALS

1. The manufacturer of the pump station shall be responsible for delivery to the engineer of (4) copies of the support literature required herein.

C. INSTALLATION INSTRUCTIONS

1. Installation of the pump station and related appurtenances shall be performed in accordance with written instructions by the manufacturer.

D. OPERATION AND MAINTENANCE INSTRUCTIONS

1. The pump station manufacturer shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator to operate and maintain the pump station and all equipment supplied by the station manufacturer. Said instructions shall assume that the operator is familiar with pumps, motors, piping, and valves, but that he has not previously operated and/or maintained the exact equipment supplied.
2. The instructions shall include, but not limited to, the following:
 - a. Descriptions of, and operating instructions for, each major component of the pump station as supplied.
 - b. Instructions for operation of the pump station in all intended modes of operation.
 - c. Instruction for all adjustments that must be performed at initial start-up of the pump station, adjustments that must be performed after the replacement of the level control system components, and adjustments that must be performed in the course of preventative maintenance as specified by the manufacturer.
 - d. Service instructions for major components not manufactured by the pump station manufacturer but which are supplied by him in accordance with these specifications. The incorporation of literature produced by the actual component manufacturer shall be acceptable.
 - e. Electrical schematic diagram of the pump station as supplied, prepared in accordance with NMTBA and JIC standards. Schematics shall show, to the extent of authorized repair, pump motor branch, control, and alarm system circuits, and interconnections among these circuits. Wire numbers shall be shown on the schematic. Schematic diagrams for individual components, the detail parts of which are not normally repairable by the station by the station operator, need not be included, and shall not be substituted for an overall

- schematic diagram. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of overall schematic diagram.
- f. Layout drawing of the pump station as supplied, prepared in accordance with good commercial practice, showing the locations of all pumps, motors, valves, and piping.
3. Operation and maintenance instructions which are limited to a collection of component manufacturer literature without overall pump station instructions shall not be acceptable.
 4. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and pump stations, and which require the operator to selectively read portions of the instructions shall not be acceptable.

MANUFACTURER'S ABILITIES:

A. DELIVERY

1. Upon request from the engineer, the pump station manufacturer shall demonstrate proof of financial responsibility with respect to performance and delivery date.

B. EXPERIENCE

1. Upon request from the engineer, the pump station manufacturer shall demonstrate proof or evidence of facilities, equipment, and skills required to produce the equipment specified herein.

C. MANUFACTURER'S QUALIFICATIONS

1. The Manufacturer of Equipment of this Section shall have five years minimum proven experience in such Equipment and shall have satisfactorily completed three jobs of similar size and type within the last year.

D. MANUFACTURER'S FIELD REPRESENTATIVE

1. The Manufacturer of the Equipment of this Section shall provide a qualified field representative at the Site.
2. Such Manufacturer's field representative shall instruct the Owner's personnel in the proper handling, installation, start-up, and operation of the equipment.
3. Such Manufacturer's field representative shall instruct the Owner's personnel in the proper start-up, operation, and maintenance of the equipment. The instruction period shall be a minimum of eight hours.

E. RESPONSIBILITY

1. It shall be the responsibility of the Manufacturer of the pumps specified in this Section to provide the pumps/motors, level control systems, complete motor control center and all ancillary equipment for the correct operation and performance of each pump. The pump manufacturer shall test the pumps and controls as a system at the factory.

MANUFACTURER'S WARRANTY:

A. MATERIAL AND WORKMANSHIP

1. The manufacturer of the pump station shall warrant it to be of quality construction, free from defects in material and workmanship. This warranty shall include specific details described below.

OVERALL PUMP STATION:

A. EQUIPMENT WARRANTY

1. The contractor shall furnish a Maintenance and Guaranty Bond to the City upon completion of the pump station and force main. The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year, excepting only those items that are normally consumed in service, such as light bulbs, oil, grease, packing, gaskets, o-rings, etc. The contractor shall be solely responsible for the warranty of the station and all components.
2. Components failing to perform as specified by the engineers, 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.

EFFECTIVE DATE:

A. INITIAL DATE

1. The warranty shall become effective upon the acceptance by the City of Wooster of the entire pumping system. Acceptance shall be made only after all testing is complete and passed, all punch list items addressed by the contractor and/or manufacturer, and all equipment functioning as designed.

PERMITS AND APPROVALS:

- A. The contractor shall obtain and pay for any and all permits and inspections required for the execution of this work. Permits, approvals and other requirements included in this work shall be as follows.
1. Electrical Service
 - a. Contractor shall pay initial installation charges as well as monthly charges until the pump station is accepted by the City of Wooster.
 2. Natural Gas Service (If Required)
 - a. Contractor shall pay initial installation charges as well as monthly charges until the pump station is accepted by the City of Wooster.

3. Ohio Environmental Protection Agency
 - a. Contractor shall pay all plan review fees and other associated fees.
 - b. Contractor shall submit a copy of the EPA Plan Approval Letter to the City.
4. FCC License for Telemetry System Radio
5. Building Department
 - a. Contractor shall pay all plan review fees and other associated fees.
6. Planning Department
 - a. Contractor shall pay all plan review fees and other associated fees.
7. Engineering Department
 - a. Contractor shall pay for any inspection fees associated with the work.
 - b. Contractor shall pay a Pump Station Review fee of \$200.00.
 - c. Contractor shall pay a Pump Station Installation Fee to cover the cost of programming and telemetry system coordination at the Water Pollution Control Plant, which shall be the actual cost of such work, but not to exceed \$1500.00. The full \$1500 shall be paid up front as a deposit, and any unused portion refunded to the contractor following successful pump station start-up.