

ENGINEERING DATA



Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 1

SPECIFICATION

FX RECTANGULAR RECESSED WET WELL MOUNTED 2-PUMP STATION 4" OR 6" PUMPS AND PROTRONIX® II PLC CONTROLLER

GENERAL

The contractor shall furnish and install one factory-built, automatic pumping station as manufactured by Smith & Loveless, Inc., Lenexa, Kansas. The station shall be complete with all needed equipment, factory-installed in a rectangular, dual compartment welded steel chamber consisting of a separate entrance to the wet well and an equipment chamber. The equipment chamber shall have two (2) separate fiberglass covers.

The principal items of equipment shall include two vertical, close-coupled, motor driven, vacuum primed, non-clog pumps; valves; internal piping; central three-phase power and control panel with circuit breakers, motor circuit protectors, motor starters, **PROTRONIX® II** PLC automatic digital pumping level controls, color touch screen HMI and auxiliaries; submersible level transducer; 24V control power transformer; lighting; sump pump; ventilating blower; priming pumps with **SONIC START®** pump prime detection system and appurtenances; and all internal wiring.

OPERATING CONDITIONS

Each pump shall be capable of delivering _____ GPM of raw water or wastewater against a total dynamic head of _____ feet. The maximum allowable speed shall be _____ RPM. The minimum rated horsepower of each pump motor shall be _____. The minimum pump efficiency at the design point shall be _____. Due to energy conservation requirements, the specified minimum efficiency shall be enforced. The maximum static suction lift shall be _____.

All openings and passages, in the pumps, piping, check valves and plug valve, shall be large enough to permit the passage of a sphere 3" in diameter. The anticipated operating head range is from _____ feet minimum to _____ feet maximum. The pump motors shall not be overloaded beyond their nameplate rating, at the design conditions, nor at any head in the operating range.

CONSTRUCTION

The station shall be constructed in one complete factory-built assembly. It shall be sized to rest on the top of the wet well as detailed in the construction drawings. The supporting floor shall be minimum 1/2" thick steel to prevent deflection and ensure an absolutely rigid support. The shell shall be of 1/4" minimum thickness steel plate formed and welded to create a minimum 6'-3" by 8'-0" equipment chamber with a minimum inside height of 6'-7" and a separate 3'-0" by 2'-1" manway for access to the wet well. All internal clearances shall meet or exceed N.E.C. requirements. Stations not meeting NEC requirements shall not be allowed. Steel plate shall meet or exceed ASTM A-36 specifications.

The pump casings and discharge piping shall be mounted in relation to the station floor as detailed in the construction drawings. All valves, piping and fittings shall be capable of passing a 3" diameter spherical solid. All pump components and station piping, including the suction pipe connections, shall be removable without having to enter the wet well. The suction and discharge connections, where they pass through the floor, shall be sealed by gaskets, rather than being welded, to allow adjustment, replacement and prevent pipe strain.

The equipment chamber shall be physically separated from the wet well. Wet well access shall be completely separate from the equipment chamber and shall be provided with the access manway exposed only to the atmosphere.

The equipment chamber shall be provided with two separate fiberglass covers, one over the pumps and the other over the control section, hinged at the center support channel. The fiberglass covers shall be formed with a drip lip around the edges. Lockable pneumatic shocks shall be provided to assist in opening the covers, support them in the open position and to restrain them under load. An aluminum ladder with a 3' safety extension bar shall be located in the station to provide easy access.

ENGINEERING DATA



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FX Rectangular RWWMP5
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 2

Only one segment of the fiberglass cover need be opened for personnel access into the equipment chamber, but either or both may be opened for equipment access. A single cover will not be acceptable due to weight.

The fiberglass two-piece cover shall be made of molded reinforced orthophthalic polyester resins with a minimum of 30% glass fibers with a minimum average length of 1-1/4". The outside of the enclosure shall be coated with a polyester protective in-mold coating for superior resistance to weathering, ultra-violet radiation, yellowing and chalking. The completed fiberglass enclosure shall be resistant to mold, mildew, fungus and corrosive liquids and gasses normally found in pump station environments.

A 1/4" hinged aluminum manway cover located exterior to the pump chamber shall be provided. The manway shall be 25" x 36" minimum and be an integral part of the station head plate and shall provide access into the wet well. Both equipment chamber and wet well access covers shall be provided with arrangements for padlocking.

The manway cover shall have a three color 7" x 10" (minimum size) corrosion-resistant sign permanently affixed to it, reading "DANGER – Before Entering, Test For Explosive Atmosphere. Test For Oxygen Deficiency. Supply Fresh Air To Work Area".

A lifting socket shall be welded to the wall for each pump. A stanchion with lifting arm shall be provided to support a hoist (provided by others) for removal of the motors, impellers and pumps.

Two (2) 10" by 36" steel shelves shall be mounted on the wall opposite the control panel, for the operator's use or for auxiliary equipment mounting.

DURO-LAST® Corrosion-Resistant Stainless Steel Baseplate **[Optional Item. Designer Check If Required]**

The baseplate of the pump station structure shall be fabricated of 1/2" thick corrosion-resistant lean duplex series 2100 stainless steel alloy, 316L stainless steel or equal. The stainless steel shall have a Pitting Resistance Equivalent Number (PRE_N) of 24.0 or greater and general corrosion resistance shall be less than or equal to 0.1 mm per year in 15% H₂SO₄ at 120 degrees F. Due to the corrosion resistance requirements, Grade 304-304L is not acceptable.

The stainless steel surfaces shall be glass bead blast cleaned to remove surface contamination and provide a uniform finish.

The manufacturer of the station shall warrant the stainless steel baseplate for twenty-five (25) years from date of shipment against structural failure and perforation due to corrosion.

WELDING

All steel in the station structure shall be joined by electric arc welding with fillets of adequate section for the joint involved. Where required to exclude groundwater, all welded joints on the exterior of the station shall be continuous throughout their length. Structural welding shall be performed in accordance with AWS standards and procedures.

PROTECTION AGAINST CORROSION

All structural steel surfaces shall be factory blasted with steel grit, in an environmentally controlled booth, to remove rust, mill scale, weld slag, etc. All weld spatter and surface roughness shall be removed by grinding. Surface preparation shall comply with SSPC-SP6 specifications. Sandblasting is specifically prohibited.

Immediately following cleaning, a single 6-8 mil dry film thickness coating of **VERSAPOX®**, a self-priming Cycloaliphatic Amine Epoxy shall be factory applied to the base. After curing, a 2-3 mil DFT top coating of **XTRATHANET™**, a moisture-cured Aliphatic Polyurethane protective finish, for abrasion resistance and weather protection, shall be applied to the top of the base and as a finish coating for all other structural, pump and piping assemblies. The bottom of the station base, exposed to the wet well, shall be further coated with an additional 6-8 mil coating of **XTRAGUARD™** epoxy for chemical and abrasion resistance. These coatings shall be as formulated by Smith & Loveless specifically for this type of application and service.

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FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 3

Stainless steel, aluminum and other corrosion-resistant surfaces shall not be coated. Carbon steel surfaces not otherwise protected shall be coated with a suitable non-hardening rust preventative compound. Auxiliary components such as the electrical enclosure, ventilating blower and vacuum pumps shall be furnished with the original manufacturer's coating.

Finish coating shall be accomplished prior to shipment of the station from the factory and shall comply fully with the intent of these specifications. A touch-up kit shall be provided by the pump station manufacturer for repair of any mars or scratches occurring during shipping and installation. This kit shall contain detailed instructions for use.

A heavy synthetic rubber mat shall be cemented to the station floor by the Manufacturer to protect the coating on the steel floor.

Two 17-pound magnesium anode packs shall be provided for cathodic protection. The anode packs shall be provided with 30' long insulated copper leads. Copper lugs shall be provided by the Manufacturer on opposite sides of the station for anode connections.

MAIN PUMPS

The pumps shall be (4") (6") vertical, centrifugal non-clog type of heavy cast-iron construction, especially designed for the use of mechanical seals and vacuum priming. In order to minimize seal wear caused by linear movement of the shaft, the shaft bearing nearest the pump impeller shall be locked in place so that end play is limited to the clearance within the bearing. To minimize seal wear resulting from shaft deflection caused by the radial thrust of the pump, the shaft from the top of the impeller to the lower bearing supporting the impeller shall have a minimum diameter of 1-7/8" for motor frame sizes 213 through 286; 2-1/8" for motor frame sizes 324 and 326; and 3" for frame 364 and larger. The dimension from the lowest bearing to the top of the impeller shall not exceed 6".

The oversized shaft incorporating oversized bearings and heavier bearing frame construction provides for extended mechanical seal, bearing and overall pump/motor life. Since the larger shaft with the specified minimum overhang is the key to heavier, more rigid construction throughout, no deviation from the specified shaft diameter or tolerances will be allowed.

The bearing nearest the impeller shall be designed for the combined thrust and radial load. The upper bearing shall be free to move in a linear direction with the thermal expansion of the shaft and shall carry only radial loads.

The shaft shall be solid stainless steel through the mechanical seal to eliminate corrosion and abrasive rust particles. Removable shaft sleeves will not be acceptable if the shaft under the sleeve does not meet the specified minimum diameter.

The pump shall have an adapter providing a large water reservoir above the impeller to provide for positive exclusion of air from the impeller. The seal shall be inside this area to assure lubrication. Pumps which do not use hollow priming adapters for positive lubrication of the seal will not be acceptable.

The pump shall be constructed so as to permit priming from the lower pressure area behind the impeller. Priming from high-pressure connections, which tends to cause solids to enter and clog the priming system, will not be acceptable. The priming bowl shall be transparent, enabling the operator to monitor the priming level.

The pump shall be arranged so that the rotating element can easily be removed from the casing without disconnecting the electrical wiring or disassembling the motor, impeller, backhead or seal, so that any foreign object may be removed from the pump or suction line.

The pump shaft shall be sealed against leakage by a single mechanical seal constructed so as to be automatically drained and primed each time the pump is drained and primed. Water which lubricates the mechanical seal shall be automatically drained from around the seal if the pump loses prime in order to allow both the pump and the seal to be drained, thereby preventing freezing and breakage of the seal during power outages in sub-freezing temperatures.

The seal shall be of carbon and ceramic materials with the mating surfaces lapped to a flatness tolerance of one light band. The rotating ceramic shall be held in mating position with the stationary carbon by a stainless steel spring. The entire seal assembly

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FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 4

shall be held in place by a bronze seal housing to prevent excessive heat build-up. Use of cast iron or other ferrous material for the seal housing, which will rust and damage the seal, shortening its life, will not be acceptable.

The pump volute shall be furnished with mounting lugs and bolted to the station floor plate, forming a gas-tight seal.

[NOTE TO DESIGNER: SELECT ONE OF THE FOLLOWING PUMP TYPE PARAGRAPHS, A OR B, AND DELETE THE OTHER. CHECK PUMP CURVES FOR PROPER APPLICATION]

A. NON-CLOG TWO-PORT IMPELLER

The pump impeller shall be of the enclosed two-port type made of close-grained cast iron and shall be balanced. The eye of the impeller as well as the ports shall be large enough to permit the passage of a sphere 3" in diameter in accordance with nationally recognized codes. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools.

To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

B. X-PELLER® SUPER CLOG-RESISTANT MONO-PORT IMPELLER

The pump impeller shall be of the enclosed mono-port type made of close-grained cast-iron and shall be in dynamic balance when pumping wastewater. Two port impellers are specifically disallowed. The dynamic balance shall be obtained without the use of balance weights or liquid filled chambers. The impeller shall be designed to allow for the trimming of the impeller to meet design condition changes without altering the balance. The eye of the impeller, as well as the port, shall be large enough to permit the passage of a sphere 3" in diameter in accordance with nationally recognized codes. To further prevent clogging, the impeller port shall have a minimum area of 10.6 in². The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

MOTORS

The pump motors shall be vertical, solid shaft, NEMA P-base, squirrel-cage induction-type, suitable for _____ phase, _____ cycle, _____ volt electric current. They shall have Class F insulation. Insulation temperature shall, however, be limited to Class B. The motors shall have normal starting torque and low-starting current, as specified by NEMA Design B characteristics. They shall be open drip-proof design with forced air circulation by integral fan. Openings for ventilation shall be uniformly spaced around the motor frame. Leads shall be terminated in a cast connection box and shall be clearly identified.

The motors shall have 1.15 service factor. The service factor shall be reserved for the owners protection. The motors shall not be overloaded beyond their nameplate rating, at the design conditions, nor at any head in the operating range as specified under Operating Conditions.

The motor-pump shaft shall be centered, in relation to the motor base, within .005". The shaft runout shall not exceed .003". The motor shaft shall equal or exceed the diameter specified under main pumps, at all points from immediately below the top bearing to the top of the impeller hub.

ENGINEERING DATA



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FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 5

A bearing cap shall be provided to hold the bottom motor bearing in a fixed position. Bearing housings shall be provided with fittings for lubrication as well as purging old lubricant.

The motor shall be fitted with heavy lifting eyes or lugs, each capable of supporting the entire weight of the pump and motor.

[NOTE TO DESIGNER: CHOOSE FROM THE FOLLOWING MOTOR OPTIONS, IF REQUIRED. DELETE IF NOT REQUIRED]

A. SUPER DUTY MOTORS

The pump motors shall be Premium Efficiency type, per NEMA MG-1 table 12-12, Inverter Ready per NEMA Part 31.4.4.2, with cast-iron frames, and be UL Recognized and CSA Approved. The motor windings shall be 200 C Inverter Spike-Resistant magnet wire and the rotors shall have an epoxy coating for corrosion protection.

B. IMMERSIBLE PUMP MOTORS

The pump motors shall be of special construction and fitted with special seals to enable the motor to be immersed in up to 30' of water for a period of up to three weeks, without water entering the motor cavity. As part of the immersible motor package, a float switch shall be provided in the station to provide indication of water approaching the level of the motors and another float switch shall shut down the motors when the water level reaches them. Each of these floats shall signal alarms and activate alarm lights on the control panel. The alarms shall remain activated until manually reset by switches on the panel. In addition, moisture detectors and high temperature thermostats shall be provided in each motor, as a backup, to shut down the associated pump and to signal alarm conditions and activate alarm lights on the control panel. All of these alarm contacts shall be wired to a terminal strip in the control panel for connection to the Owner's alarm system.

CONTROLS

The control equipment shall be mounted in a NEMA Type 4 steel enclosure with two hinged, lockable doors and a steel barrier partition down the middle. One side of the divider shall house the three-phase circuits (motor starters and circuit protectors, etc.), and the other shall house the single-phase control circuits and low voltage components. The microprocessor and low voltage controls shall be accessible without exposing the three-phase high voltage supply, and the pump station controller shall be operable without opening the enclosure door. The control panel shall be mounted to the station wall at a convenient height.

All components within the control panel shall be UL listed or recognized, and the complete station control panel itself shall be labeled as a UL 508A General Use Industrial Control Panel. The electrical equipment in the panel shall be protected by a surge protective device.

To facilitate wire tracing and servicing, the control wiring shall be run in enclosed wireways, with removable covers, rather than tied up in bundles.

Control relays up to 6-amp capacity shall be the modular, plug-in type, with integral LED indicating lights to show activation. Larger control relays, vacuum pump contactors and the **SONIC START**® operating modules shall be enclosed to be "finger safe".

A duplex GFI protected convenience outlet shall be provided in the station for operation of 120-volt AC devices.

Thermal magnetic air circuit breakers shall be provided for branch disconnect service and short-circuit protection of all auxiliary circuits, and motor circuit protectors with lockout capability shall be provided for each pump motor. Only instantaneous trip magnetic-type motor circuit protectors, matched to the motor inrush current, shall be used for the motor circuits, for added protection from low-level faults. Thermal magnetic circuit breakers will not be allowed for pump motor service.

Magnetic across-the-line starters with 24-volt coils and solid-state overload protection for each phase shall be provided for each pump motor to give positive protection against phase unbalance, thermal overload, phase loss and ground fault. To provide the

ENGINEERING DATA



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FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 6

fastest trip speed and for ground fault protection, only solid state overload protection will be used, and motor starters using heater coils will not be acceptable. Each single-phase auxiliary motor shall be equipped with an over-current protection device in addition to the branch circuit breaker, or shall be impedance protected. All switches shall be labeled and a coded wiring diagram shall be provided.

Individual NEMA 4 oil-tight Hand-Off-Automatic selector switches shall be provided for each pump. The switches shall be 3-position rotary-type with spring return on the Hand position, and mounted on the top of the station control panel for easy access from either the front or the top.

To control the operation of the pumps with variations of liquid level in the wet well, and monitor the station control, environmental and alarm functions, a specially preprogrammed, dedicated microprocessor-based control system shall be provided. The controller shall interface with the wet well level transducer, panel display unit, motor starters, environmental system, accessories and alarm functions through optically isolated digital and analog input and output ports as required. The digital controls shall operate on 24 volts or less, to eliminate shock hazard. The 24-volt power supply shall be overload protected to be "crowbar safe" and will return to operation when a short is removed. Program integrity shall be maintained by battery-backed RAM.

A NEMA 4 rated display unit shall be mounted through the front of the panel to provide operator input to and visual output from the microprocessor controller. This interface shall be a 5.7" graphic interface with DSTN 256-color Liquid Crystal Display with backlighting and resistive-type touch screen, with audible feedback on touch, for data input and programming. The display shall have a "sleep" feature to prolong screen life. A minimum of nine (9) menu screens shall be available for display and management of pump and station control functions including, but not limited to:

Display Functions:

- Pump running indication
- General alarm indication
- Individual alarm indicators for each alarm function
- Lead pump indication
- Alarm silencing
- Digital indication of air temperature in control panel
- Digital and graphical indication of wet well level
- Digital indication of elapsed run time for each pump
- Digital indication of elapsed run time for parallel pump operation
- Digital indication of level control and alarm settings
- Date & time indication
- Heater/blower running indication
- Alarm logging, coded for "current" or "cleared", last 17 events by date and time
- "Help" screens for each display
- Service contact information screen

Field Programming Functions:

- Reset wet well On, Off and alarm levels or return to default settings
- Reset heater or vent fan thermostat set points or return to default settings
- Select sequenced or timed pump alternation and select alternation time interval
- Select any pump to remain as lead pump
- Silence audible alarm
- Reset running time meters
- Set date/time
- Wet well level simulation from touch screen, overriding submersible pressure transducer signal
- Prime mode selection (On-demand or **CONSTANT PRIME**®)

ENGINEERING DATA



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Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 7

[NOTE TO DESIGNER: SELECT ONE OF THE FOLLOWING ACCESSORY PACKAGES, A OR B, IF REQUIRED OR DELETE BOTH]

A. PROTRONIX® II PLC PUMP MONITOR PACKAGE

Accessory Items:

Pump overload trip alarm from starter overload trip

B. PROTRONIX® II PLC STATION MONITORING PACKAGE

Accessory Items:

Pump overload trip alarm from starter overload trip

Time delay to prevent simultaneous pump starts

Phase failure/reversal monitor with pump motor shutdown on fault

Control power failure alarm

Digital flow rate indication panel display, based on cycle times and wet well levels

Four-inch (4") liquid filled compound pressure gauges with integral diaphragm isolators for each pump

The control system shall be designed to allow alternation of the pumps by either a time clock or alternation at the end of each pumping cycle. Selection of the alternation method and setting of the interval for timed alternation shall be easily done without opening the panel. The panel display shall indicate which pump is currently the lead pump.

The panel display shall be capable of indicating the total running time, in hours and tenths of an hour, of each pump individually, as well as the total time that both pumps have been running in parallel. Provision shall be made so that it is possible to reset the timers to zero, if necessary.

A resistance temperature device (RTD) shall be provided to monitor the ambient temperature in the pump station, and to control the operation of the ventilation blower. The RTD shall also provide a continuous readout of the station ambient temperature, which shall be indicated on the panel display unit in degrees Fahrenheit.

The liquid level in the wet well shall be monitored by a submersible hydrostatic pressure transducer with stainless steel sensor diaphragm, providing a 4-20 mA signal to the pump control unit. The body of the transducer shall be made of stainless steel. The pressure transducer shall have a permanent hermetically sealed connection to a polyethylene insulated cable, which shall support the transducer 6" from the bottom of the wet well, and shall pass through a cord grip seal in the station wall. The pressure transducer unit shall be rated for wastewater or potable water service, and for operation in explosion hazardous areas.

The digital pump controller shall take the signal from the level transducer and provide a continuous readout of the wet well level in feet and tenths of a foot, through the panel display unit. It shall also be the means of setting the pump on and off points and alarm levels. As a minimum, the controller shall be capable of digitally setting "On" levels for lead and lag pumps, an "Off" level, and alarm levels. Provisions shall be made for the pumps to operate in parallel should the level in the wet well continue to rise above the starting level for the low-level pump. A high water alarm setting shall also be provided for remote or local alarm indication.

Three (3) displacement switches shall be provided to automatically operate the pump in back-up mode, in case of failure of the digital control system or the submersible level transducer. The back-up system shall be entirely independent of the digital system. A 30' cord shall be provided with each switch. The cord shall have a corrosion-resistant vinyl jacket and be multi-stranded in order to prevent fatigue. The displacement switch cords and the cable for the submersible pressure transducer shall enter the wet well through cord grip seals mounted to a removable, gasketed wall plate. The wall plate shall allow the displacement switches and transducer to be adjusted or removed and replaced without having to enter or reach into the wet well.

ENGINEERING DATA



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FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 8

PUMP FAILURE TO PRIME OR FAILURE TO PUMP ALARM (CHECK VALVE SWITCH TYPE)

To sense failure to deliver normal flow for any reason, including failure to prime, each pump shall be provided with a sealed sensor switch mounted in a protective ABS enclosure. The enclosure shall be mounted with an adjustable universal mounting bracket to the external arm of each discharge check valve. The mounting bracket shall allow the adjustment of the sensor switch with a single locking pivot adjustment. A red LED indicating light shall be provided on each switch unit to facilitate accurate setting of the switch for proper operation. The sensor switch shall monitor the movement of the check valve arm and thereby detect failure of the pump to deliver normal operating flow when called on to run. An auxiliary time delay relay shall be provided to prevent an alarm signal during the pump priming and startup period.

[NOTE TO DESIGNER: CHOOSE ANY OF THE FOLLOWING OPTION PACKAGES. DELETE THOSE NOT REQUIRED]

ENHANCED ALARM PACKAGE [DESIGNER: SELECT IF REQUIRED]

An adjustable timer circuit shall be provided in the control panel to signal unauthorized entry into the pump station. The timer shall be activated whenever one of the fiberglass covers is opened. A key operated switch shall be provided on the station control panel to provide authorized personnel a means to deactivate the alarm before the timer completes its cycle. In addition to the High Water Alarm, the digital pump controller, in conjunction with the submersible hydrostatic pressure transducer, shall be capable of indicating the following alarm conditions: Low Water Alarm and Redundant High Water Alarm. The controller shall be capable of digitally setting the actuation levels for these alarms. The station controller shall also be provided with a momentary contact, manually operated, push switch to actuate an alarm signal when operated. This switch shall function as an emergency operator assist alarm, and provide means for testing the alarm system. In addition, the Enhanced Alarm Package shall include a sensor to indicate accumulation of water over 1" deep on the station floor (Station Flooding Alarm).

WIRELESS REMOTE COMMUNICATION SYSTEM [OPTIONAL - DESIGNER: CHECK IF REQUIRED]

The pumping station manufacturer shall provide and install a 2-Way Wireless Remote Communication System (**StationComm™** by Smith & Loveless) as an integral part of the pump station control system.

The Wireless Remote Communication System shall interface with the pump station controller to provide remote monitoring and alarm indication, communicated by means of text messages to and from cellular telephones. One year of cellular service, covering up to 400 texts a month, shall be included with the Wireless Remote Communication System, provided through the manufacturer of the pumping station. The service shall be renewable on an annual basis. Obtaining and maintaining the contract for cellular service for, and providing, the remote phones shall be the responsibility of the station owner.

As a minimum, the station-mounted unit shall be capable of storing ten phone numbers, and the list shall be capable of being modified through the pump station's human-machine interface or remotely by text message and the use of a password. In the event of an alarm indication in the station, the Wireless Remote Communication System shall attempt to contact the first number on the list, and, if necessary, shall continue down the list until the alarm becomes inactive or is acknowledged. Provisions shall be made to allow the unit to simultaneously call a Supervisory number, with the same message.

Specific text messages shall be automatically sent to the user defined phone numbers when any of the following events occur:

- Pump 1 Failure
- Pump 2 Failure
- Pump 1 Fail to Prime
- Pump 2 Fail to Prime
- High Water in Wet Well
- Pump 1 Overload
- Pump 2 Overload

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FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 9

(Optional) Power Failure
(Optional) Unauthorized Entry

The system shall log all alarm messages, including date, time and event.

A suitably sized Uninterruptable Power Supply shall be provided to allow the communication system to function long enough to send out the alarm in the event of commercial power failure.

Users shall be able to send text messages requesting the status or value of specific station data, including current wet well level, each pump's H-O-A status, each pump's accumulated running time and station temperature, as well as the current pumping flow rate and the motor amperage draw, if those two functions are part of the station control package. Replies shall be automatically sent by return text message. Users shall also be able to start and run each pump through the remote connection (but this command shall be over-ridden by the low wet well level setting, to prevent pumping the suction line dry, or the manual selector switch, if not in the automatic operation mode).

The Wireless Remote Communication System with antenna, power supply and all necessary interfaces, shall be factory installed in the pumping station control panel, and tested, with the station, at the factory before shipment.

NOTE: Suitable cellular service shall be confirmed to be available at the site prior to placing the order for the equipment.

(OPTIONAL ITEM – CHECK IF REQUIRED)

SINGLE-PHASE 120-VOLT POWER TRANSFORMER [DESIGNER: A STATION MOUNTED CONTROL POWER TRANSFORMER IS REQUIRED FOR ALL STATIONS UNLESS A SEPARATE 1/60/120 SUPPLY FROM A SEPARATE TRANSFORMER (NOT A PHASE-TO-NEUTRAL TAP FROM THE 3-PHASE SUPPLY) IS AVAILABLE. SELECT FROM FOLLOWING CHART:]

<u>SUCTION PIPE SIZE</u>	<u>AUX. HEATER</u>	<u>MIN. TRANSFORMER SIZE</u>
4"	NO	3 KVA 208/230/460V
4"	YES	5 KVA 208/230/460V
6" OR 8"	NO	5 KVA 208/203/460V
6" OR 8"	YES	7.5 KVA 208/230/460V

A (3) (5) (7.5) KVA insulating-type transformer shall be provided to supply power for lights, controls and auxiliary devices. The transformer shall have 208/240/480 volt primary, 120/240 volt secondary, Class F insulation, with temperature rise not to exceed 115°C above 40°C ambient. The core and coil assembly shall be given a double dip and bake. The coil shall be protected by a metal housing to prevent damage. The transformer shall be protected by a separate circuit breaker on the supply side.

VACUUM-PRIMING SYSTEM

A vacuum priming system shall be furnished to prime the main pumps. The system shall be as shown on the vacuum priming schematic and shall include two vacuum pumps, providing 100 percent standby. Vacuum pumps shall have corrosion-resistant internal components. The vacuum priming system shall be complete with large port vacuum control solenoid valves, **SONIC START**® prime level sensor, float-operated check valves to protect the vacuum pumps and all necessary shut-off valves as shown on the piping schematic. The float-operated check valves shall have a transparent body for visual inspection. All hoses and tubing used in the priming system shall be at least 3/8" nominal diameter. The air discharged from the vacuum pumps shall be piped into the wet well.

ENGINEERING DATA



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Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 10

The solenoid valves used in the vacuum priming system shall be of the high flow, direct acting brass body type, with threaded ports, NBR seals and 300 Series stainless steel plunger, rod, plate and springs. The minimum orifice diameter shall be 5/16". The solenoid valves shall be UL Listed, with Class F coil rating and of suitable voltage and thermal capacity for the application.

Liquid level in the pump priming chamber shall be monitored by a **SONIC START**® resonant frequency liquid level probe. The probe shall be equipped with a piezoelectric drive and sensitive circuits to detect frequency shifts when the probe is covered by liquid. The probe shall be completely sealed and have a 316L stainless steel housing for corrosion resistance. It shall be provided with a wiring connector molded of PolyPhenylSulfone, an amorphous high performance thermoplastic for impact and chemical resistance. The probe shall have a plug-in connector to facilitate easy removal.

The **SONIC START**® probe shall be provided with light emitting diodes. This diagnostic tool shall indicate connectivity, prime status or a fault condition. Systems utilizing an electrode, mechanical means such as a float, or that require any type of electrical or moving parts inside the priming chamber, which may accumulate debris, short out, bind or fail will not be acceptable.

The priming system shall automatically provide positive lubrication of the mechanical seal each time a main pump is primed. To prevent excessive stoppage due to grease accumulation, no passageway in the priming system through which the pumped liquid must pass shall be smaller than the equivalent of a 2-1/2" opening.

The vacuum priming system shall have two field selectable modes of operation. In the "On-Demand" mode, the priming system will operate only after a pump is called on to run, and if it is not primed. Once primed, the pump will be allowed to run. In the "Constant Prime" mode, both pumps are kept primed continuously, and ready to start immediately when called for.

LIGHTING

A low profile four tube fluorescent light fixture, with diffuser cover shall be provided to give adequate illumination for all areas within the equipment chamber. The fixture shall be equipped with quick start bulbs and low temperature ballast. A manual switch located in the equipment chamber shall be provided to turn the lights and ventilating blower on when the cover is closed.

VENTILATING BLOWER

A ventilating blower shall be provided, capable of delivering a minimum of 30 air changes per hour of outside air into the equipment chamber. The blower shall be rigidly mounted to the chamber shell and shall discharge into the station as shown on the plans. It shall be controlled by a percentage timer to provide essentially continuous ventilation. The air intake and exhaust ports shall be 6" pipe with a gooseneck for weather protection and shall be screened to keep out debris and rodents.

SUMP PUMP

A submersible sump pump with close-coupled motor shall be installed in the sump. It shall be rated 1000 GPH at design head. A mechanical seal on the shaft shall exclude water from the motor housing. The sump pump shall be controlled automatically by a float switch. It shall discharge into the wet well through steel piping with two check valves with a 90 degree axial offset between them, as shown on the plans.

MAIN PIPING

The pump suction shall be drilled and tapped for a 125-pound American Standard flange for ready connection of the suction riser. The discharge line from each pump shall be fitted with a clapper-type check valve and eccentric plug valve. Size, location and quantity of check valves and plug valves shall be as shown on the plans. All passageways through the pumps and piping shall be capable of passing a 3" sphere.

The check valve shall be of the spring-loaded type with external lever arm and an easily replaced resilient seat for added assurance against vacuum leaks. Check valves shall have stainless steel shaft with replaceable bronze shaft bushings and shall be sealed with O-rings or an adjustable Teflon seal. Ball-type check valves without an external lever arm are not acceptable. An operating wrench shall be provided for the plug valve.

ENGINEERING DATA



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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 11

Protrusions through the station floor shall be sealed where necessary to effect sealing between the equipment chamber and the wet well. The suction and discharge connections, where they pass through the floor, shall be sealed by gaskets in order to prevent corrosive, noxious fumes from entering the station. Welded joints that do not allow adjustment or replacement will not be considered for this application. The pump station manufacturer shall extend the suction and discharge connections below the floor at the factory so that field connections can be made without disturbing the gas-tight seals. Once the station is installed, however, it shall be possible to remove the entire 4" or 6" suction pipes through the station floor without having to enter the wet well to unbolt them.

The manufacturer of the pump station shall provide a compression-type sleeve coupling for installation on the common discharge pipe. A minimum of two (2) anchoring points shall be provided on the bottom of the station baseplate for attachment of coupling joint restraints, which shall be provided by the installing contractor.

MINIMUM REQUIREMENTS

The attached pump specification and checklist must be met in total. There are many reasons for incorporating a good pump specification. For example, the stainless steel shaft with tapered impeller attachment is provided to minimize corrosion, extend seal life, and provide ease of impeller removal and seal replacement without the use of a wheel puller. All items specified are for long life, durability and maintainability of the pumping equipment. Deviations from the pump specifications will not be allowed.

A checklist is also provided to insure that the proper pumping system is provided to the owner.

FACTORY TESTS

All components of the pump station shall be given an operational test at the pump station manufacturer's facility to check for excessive vibration, for leaks in the piping or seals and correct operation of the automatic control and vacuum priming systems and all auxiliary equipment. Installed pumps shall take suction from a deep wet well, simulating actual service conditions. Testing of uninstalled pumps or individual components shall not be an acceptable alternate to testing the complete, assembled system.

The control panel shall undergo both a dry logic test and a full operational test with all systems operating. Factory test instrumentation shall include flow measuring with indicator; compound suction gauge; Bourdon tube-type discharge pressure gauge; electrical meters to measure amperes, volts, kilowatts and power factor; speed indicator and a vibrometer capable of measuring both amplitude and frequency.

SPARE PARTS

A complete replacement pump shaft seal assembly shall be furnished with each pump station. The spare seal shall be packed in a suitable container and shall include complete installation instructions. A spare volute gasket and seal gasket shall be provided.

A spare 24v DC control power supply unit shall be provided to be available as an emergency replacement.

An instructional video presentation on the pump mechanical seal system in DVD format shall be included. The DVD shall contain a presentation on the following subjects: purpose and location of the mechanical seal, signs of a defective mechanical seal, how to remove the mechanical seal, troubleshooting seal failure causes, seal components, required tools, how to reinstall the seal, and how to place the pump back into service. The video shall include footage of an actual seal replacement.

INSTALLATION AND OPERATING INSTRUCTIONS

Installation of the pump chamber shall be done in accordance with the written instructions provided by the manufacturer. Operation and maintenance manuals shall be furnished, which cover service procedures for all of the pumping station.

STARTUP

The manufacturer shall provide the services of a factory-trained representative for a maximum period of one day on-site to perform initial startup of the pump station and to instruct the owner's operating personnel in the operation and maintenance of the equipment.

ENGINEERING DATA



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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPS
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 12

STANDARD WARRANTY

The manufacturer of the station shall warrant for one (1) year from date of startup, not to exceed eighteen (18) months from date of shipment, that the structure and all equipment he provides will be free from defects in material and workmanship. Warranties and guarantees of the suppliers of various components in lieu of a single source responsibility by the Manufacturer will not be accepted. The Manufacturer shall assume prime responsibility for the warranty of the station and all components.

In the event a component fails to perform as specified or is proven defective in service during the warranty period, the Manufacturer shall repair or replace, at his discretion, such defective part. He shall further provide, without cost, such labor as may be required to replace, repair or modify major components such as the steel structure, main pumps, main pump motors and main piping manifold. After startup service has been performed, the labor to replace accessory items, such as the blower, priming pumps, alternator, etc., shall be the responsibility of others.

It is not intended that the Manufacturer assume responsibility for contingent liabilities or consequential damages of any nature resulting from defects in design, material, workmanship or delays in delivery, replacement or otherwise.

FORMULA X® WARRANTY

The motor, motor adapter, volute, impeller, frontheads, fiberglass enclosure and steel base shall be covered by a 10-year pro-rated warranty. The fiberglass covers shall be warranted against failure of the fiberglass components. The steel base shall be warranted against structural failure and perforation due to corrosion. The mechanical seal, microprocessor controller, panel display unit and submersible level transducer shall be covered by a 5-year pro-rated warranty. The pro-rated warranties shall be computed on a monthly basis starting at shipment, and shall cover replacement parts only.

The repair or replacement of those items normally consumed in service, such as grease, light bulbs, etc., shall be considered as part of routine maintenance and upkeep. The manufacturer shall provide a warranty certificate covering specific details.

MANUFACTURER'S INSURANCE

All equipment manufacturers, either direct or subcontractors to the general or mechanical contractors, SHALL HAVE in effect at TIME OF BID, CONTRACT AWARD, CONTRACT PERFORMANCE, and WARRANTY TERM, PRODUCT AND COMPREHENSIVE LIABILITY INSURANCE, INCLUDING SUDDEN AND ACCIDENTAL POLLUTION COVERAGE in the amount of FIVE MILLION DOLLARS, \$5,000,000 through an insurance company with a minimum rating of A+ (SUPERIOR) XV according to the BEST'S INSURANCE REPORTS. All policies must be written on an OCCURRENCE BASIS. Policies written on a CLAIMS MADE BASIS are not acceptable. A typical CERTIFICATE OF INSURANCE attesting to the specified coverage issued by the responsible carrier naming the ENGINEER OF RECORD and the OWNER as ADDITIONAL INSURED, must be presented to the named additional insured prior to contract award. A FAILURE TO COMPLY with this requirement BY THE BIDDER will require DISQUALIFICATION of the BID and CONTRACT AWARD.

MANUFACTURED EQUIPMENT

OPTION 1 (STANDARDIZATION) [DELETE THIS LINE FROM FINAL SPEC TEXT]

The specifications and drawings detail Smith & Loveless equipment and represent the minimum standard of quality for both equipment and materials of construction. The contractor shall prepare his bid on the basis of the particular equipment and materials specified for the purpose of determining the low bid.

The owner has standardized on the named equipment in order to optimize their operation, maintenance, and safety programs, provide for interchangeability of costly equipment items, reduce stocking levels required for necessary spare parts and provide increased flexibility in the utilization of their pumping stations. Equipment substitutions, since incompatible with the districts standardization program, will not be considered.

OPTION 2 (BASE BID WITH BID SUBMITTAL) [DELETE THIS LINE FROM FINAL SPEC]

The specifications and drawings detail Smith & Loveless equipment and represent the minimum standard of quality for both

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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 13

equipment and materials of construction. The contractor shall prepare his bid on the basis of this equipment for the purpose of determining the low bid without consideration of a possible substitute.

Substitution of other makes may be considered if the equipment proposed for substitution is superior or equal in quality and efficiency to the standards of quality named in the specifications and this is demonstrated to the satisfaction of the engineer. Contractors wishing to offer a deduct for substitute equipment shall include the following submittal information with their proposal.

BID SUBMITTAL

This submittal shall include all necessary information for the proper determination of the acceptability of the proposed substitution and shall not necessarily be limited to the following.

- A. Complete description of the equipment, system, process, or function, including a list of system components and features, drawings, catalog information and cuts, manufacturers specifications, including materials description.
- B. Performance data and curves, and horsepower requirements.
- C. Outside utility requirements, such as water, power, air, etc.
- D. Functional description of any internal instrumentation and control supplied including list of parameters monitored, controlled or alarmed.
- E. Addresses and phone numbers of nearest service centers and a listing of the manufacturers or manufacturers representatives services available at these locations, including addresses and phone numbers of the nearest parts warehouses capable of providing full parts replacement and/or repair services.
- F. A list of five installations in the states where similar equipment by the manufacturer is currently in similar service; include contact name, telephone number, mailing address of the municipality or installation, engineer, owner and installation contractor; if five installations do not exist, the list shall include all that do exist, if any.
- G. Detailed information on site, architectural, structural, mechanical, plumbing, electrical, and control, and all other changes or modifications to the design and construction work necessary to adapt the equipment or systems to the arrangement shown and/or functions described on the drawings and in the technical specifications. This shall include plan view and section sketches illustrating any additional space requirements necessary to provide the minimum adequate clear space within and around the equipment for operation and maintenance, as shown on the Drawings and specified.
- H. All differences between the specifications and the proposed substitute equipment shall be clearly stated in writing under a heading of "differences".
- I. Other specific submittal requirements listed in the detailed equipment and material specifications.
- J. A completed and signed copy of the "Pump Station Certification Affidavit" which follows.

EVALUATION

Approval of the substitution to bid as an alternate shall in no way relieve the contractor from submitting the specified shop drawings for approval or complying fully with all provisions of the specifications and drawings.

If substituted equipment is accepted, the contractor shall, at his own expense, make any changes in the structures, piping, electrical, etc. necessary to accommodate the equipment. If engineering is required due to substitution of alternate equipment, the contractor shall pay for all engineering charges.

To receive final consideration, copies of the manufacturers quotations for the equipment may be required to document the savings to the satisfaction of the engineer. It is the intent that the owner shall receive the full benefit of the savings in cost of equipment and the contractors bid price shall be reduced by an amount equal to the savings. In all technical and other evaluations, the decision of the engineer is final.

ENGINEERING DATA



Smith &
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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 14

TYPICAL BID FORM

[ADD TO BID FORM AS APPLICABLE TO ABOVE SELECTED OPTION]

OPTION 1

For reasons of standardization, bids shall be based on the named equipment. Alternate bids will not be allowed.

OPTION 2

The bid shall be based on the named equipment. Alternate/substitute equipment may be offered as a deduct, provided all conditions of the manufactured equipment section are met.

Alternate/substitute manufacturer _____

Deduct \$ _____

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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 15

PUMP STATION CERTIFICATION AFFIDAVIT (Two-Port Impeller)

A submittal to the owner by manufacturers proposing alternate, unnamed pump stations will be required with their bid. Included in the submittal shall be detailed drawings and specifications on the proposed pump station. The bid submittal shall include the following completed checklist signed by an officer of the company.

	YES	NO
Close-coupled pump design - no motor to pump shaft coupling or drive belts		
Pump shaft diameter of _____ minimum through seal		
Full diameter impeller shrouds, top and bottom		
Stainless steel pump shaft with tapered shaft to impeller fit		
Maximum pump shaft overhang of 6" - lower bearing to impeller		
Bronze seal housing		
Minimum pump efficiency at design point of _____ GPM of ____ %		
Impeller eye and ports pass a 3" sphere		
Class F motor insulation with Class B max motor temperature rise and 1.15 service factor		
Motor shaft run-out 0.003" max at end of shaft with motor shaft centered to motor base with 0.005"		
Locked lower bearing and floating upper bearing		
One-piece motor adapter/backhead		
Motor HP of _____ at _____ RPM		
Complete pump station factory tested on a wet well		
Minimum 50 sq. ft. floor area in equipment chamber		
Vacuum priming from low pressure area behind the impeller		
Transparent priming bowl for operator monitoring		
Resonant frequency prime detection system		
Hollow priming adapter for positive seal lubrication		
Completely separate priming system for each pump		
Minimum 2-1/2" equivalent opening in priming passageways		
1/2" thick base with XTRAGUARD™ epoxy coating on bottom		
Two piece fiberglass cover with pneumatic lift assist		
Structure blasted with steel grit in environmentally controlled booth prior to coating with epoxy resin		
UL 508A labeled control panel		
NEMA 4 control panel		
Digital, microprocessor based station controller		
Submersible level transducer		
4" or 6" suction pipes removable from above without entering wet well		
5 year pro-rated warranty on mechanical seal, microprocessor, display unit and submersible level transducer		
10-year pro-rated warranty on main pumps, fiberglass enclosure and steel base		
Product liability insurance, \$5 million per specification		
All other items for the station, as specified with minimum sizes, capacities and materials indicated		

The consulting engineer shall be the sole judge of whether the proposed equipment is acceptable. The manufacturer shall have the responsibility of submitting sufficient information in one submission. Incomplete or inaccurate submittal data shall be cause for rejection of the proposed equipment.

By signing this affidavit, the officer of the company has stated 100% compliance with the plans and specifications and further states he will supply or pay for all deficiencies found in the job submittals or after the unit is installed. The consulting engineer shall be the sole judge regarding compliance with the plans and specifications and shall be sole judge on the amount of moneys required if any deficiencies are found, related to, but not limited to, a 20-year station design life.

Signature of Company Officer

Corporate Seal
(Notarized)

Title

ENGINEERING DATA



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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 16

PUMP STATION CERTIFICATION AFFIDAVIT (X-PELLER® Mono-Port Impeller)

A submittal to the owner by manufacturers proposing alternate, unnamed pump stations will be required with their bid. Included in the submittal shall be detailed drawings and specifications on the proposed pump station. The bid submittal shall include the following completed checklist signed by an officer of the company.

	YES	NO
Close-coupled pump design - no motor to pump shaft coupling or drive belts		
Pump shaft diameter of _____ minimum through seal		
Full diameter impeller shrouds, top and bottom		
Stainless steel pump shaft with tapered shaft to impeller fit		
Maximum pump shaft overhang of 6"- lower bearing to impeller		
Bronze seal housing		
Minimum pump efficiency at design point of _____ GPM of _____ %		
Impeller eye and port pass a 3" sphere		
Impeller of mono-port design with a minimum area of 10.6 square inches		
Trimming of impeller vane does not alter dynamic balance		
Impeller dynamically balanced without use of weights or liquid filled chambers		
Class F motor insulation with Class B max motor temperature rise and 1.15 service factor		
Motor shaft run-out 0.003" max at end of shaft and motor shaft centered to motor base with 0.005"		
Locked lower bearing and floating upper bearing		
One-piece motor adapter/backhead		
Motor HP of _____ at _____ RPM		
Minimum of 50 sq. ft. floor area in equipment chamber		
Complete pump station factory tested on a wet well		
Vacuum priming from low pressure area behind the impeller		
Transparent priming bowl for operator monitoring		
Resonant frequency pump prime detection system		
Hollow priming adapter for positive seal lubrication		
Completely separate priming system for each pump		
Minimum 2-1/2" equivalent opening in priming passageways		
1/2" thick base with XTRAGUARD™ epoxy coating on bottom		
Two piece fiberglass cover with pneumatic lift assist		
Structure blasted with steel grit in environmentally controlled booth prior to coating with epoxy resin		
UL 508A labeled control panel		
NEMA 4 control panel		
Digital, microprocessor based station controller		
Submersible level transducer		
4" or 6" suction pipes removable from above without entering wet well		
5 year pro-rated warranty on mechanical seal, microprocessor, display unit and submersible level transducer		
10-year pro-rated warranty on main pumps, fiberglass enclosure and steel base		
Product liability insurance, \$5 million per specification		
All other items for the station, as specified with minimum sizes, capacities and materials indicated		

The consulting engineer shall be the sole judge of whether the proposed equipment is acceptable. The manufacturer shall have the responsibility of submitting sufficient information in one submission. Incomplete or inaccurate submittal data shall be cause for rejection of the proposed equipment.

By signing this affidavit, the officer of the company has stated 100% compliance with the plans and specifications and further states he will supply or pay for all deficiencies found in the job submittals or after the unit is installed. The consulting engineer shall be the sole judge regarding compliance with the plans and specifications and shall be sole judge on the amount of moneys required if any deficiencies are found, related to, but not limited to, a 20-year station design life.

Signature of Company Officer

Corporate Seal
(Notarized)

Title

ENGINEERING DATA



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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 17

ADDITIONAL ACCESSORY OPTIONS

[DESIGNER: SELECT AS REQUIRED. NOTE THAT THESE ARE THE ONLY OPTIONS AVAILABLE ON THE PROTRONIX® II PLC VERSION]

120V ALARM LIGHT

A vapor-proof light fixture with 50-watt lamp for outdoor pole mounting shall be provided with a red globe and guard.

120V ALARM LIGHT WITH FLASHER

A vapor-proof light fixture with 50-watt flashing lamp for outdoor pole mounting shall be provided. The light shall flash during alarm conditions. The fixture shall be complete with a red globe and guard.

120V ALARM BELL

A vibratone-type bell mounted on a weather-tight box suitable for pole mounting shall be provided.

120V ALARM HORN

A vibratone-type horn mounted on a weather-tight box suitable for pole mounting shall be provided.

12V TRICKLE CHARGER

Storage batteries and charger shall be supplied to furnish power for operating alarm annunciators in cases of power failure. The storage batteries (Two 3 cell, 6-volt) shall be maintenance-free lead-calcium battery concealed in high impact, heat-resistant and permanently sealed containers. The battery charger shall be solid state, capable of restoring battery to full charge within 12 hours after a discharge, not exceeding 1.5 hours. Brownout protection is standard, and will activate the unit when AC line voltage drops below 85 volts.

12V ALARM LIGHT

A vapor-proof light fixture with 50-watt lamp for outdoor pole mounting shall be provided with a red globe and guard.

12V ALARM BELL

A vibratone-type bell mounted on a weather-tight box suitable for pole mounting shall be provided.

12V ALARM HORN

A vibratone-type horn mounted on a weather-tight box suitable for pole mounting shall be provided.

REMOTE MOUNTED MANUAL RESET ALARM SILENCE SWITCH

An On-Off switch mounted in a weatherproof box suitable for pole mounting shall be provided.

8-CHANNEL DISCRETE CONTACT ALARM DIALER INTERFACE (DIALER NOT INCLUDED)

Provisions shall be made within the pump station to facilitate the field installation of an alarm dialer, which is to be furnished and installed by others. The alarm dialer shall be described elsewhere in these specifications. The factory built pump station shall be provided with a mounting bracket approximately 12 inches by 10-5/8 inches to attach and support the alarm dialer, near the station control panel. In addition, openings for conduit connections shall be provided in the bottom of the station control panel and through the station shell, to facilitate wiring of the alarm dialer input, output and power connections. The station control panel shall have terminal strip connections for fault-opening alarm contacts to provide up to 8 discrete alarm input signals to the dialer, and terminal strip connections for a 1/60/120 volt power source, on a separate 15 amp circuit, to power the dialer. Installation and wiring of the dialer shall be done by others during installation of the station in the field.

ENGINEERING DATA



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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 18

MAIN CIRCUIT BREAKER

A main circuit breaker shall be installed in the control panel to provide over-current protection for the station, and shall be capable of being used to disconnect the three-phase power to the pump station. The breaker shall be operable without opening the panel, and shall be interlocked with the panel door. It shall be capable of being padlocked in the "Off" position.

MAIN DISCONNECT SWITCH

A main disconnect switch shall be provided to disconnect the three phase power to the pump station. The switch shall be operable without opening the panel, and shall be interlocked with the panel door. It shall be capable of being padlocked in the "Off" position.

TIME DELAY

The microprocessor-based digital control system shall provide for a time delay to prevent simultaneously starting the pump motors after power failure.

GENERATOR INTERLOCK

Provisions shall be made in the control circuit of the lift station to facilitate locking out the standby pump when the emergency generator set is powering the station. An interlock consisting of a normally closed auxiliary contact shall be supplied with the emergency generator controls by the generator manufacturer. This normally closed contact shall be wired to the terminal blocks provided in the lift station control panel by the lift station manufacturer. The interconnecting wiring shall be supplied and connected by the installing contractor.

ADD-A-PHASE INTERFACE

Terminals shall be provided in the lift station control panel to facilitate connection to an external phase converter unit.

INTRINSICALLY SAFE CONTROL

Intrinsically safe relays to provide low current isolated switching for the float switches shall be provided.

SOLID-STATE STARTERS

UL listed, solid-state reduced voltage starters shall be supplied. The starters shall be capable of a soft start and soft stop. The starters shall have built in overload protection as well as built in bypass contactors. One set of form C auxiliary contacts shall be supplied on the starter. The starters shall be powered by 24V DC and shall have a built-in Digital Signal Processor utilizing a low impedance run circuit. The starters shall be easily programmable by using a standard screwdriver.

PHASE MONITOR

A relay with double pole, double throw contacts shall be provided to monitor and protect against phase loss (single phasing), under voltage (brownouts) and phase reversal (improper sequence). It shall automatically reset when three-phase service returns to normal.

<u>Adjustable Operating Voltage</u>	<u>Drop Out Voltage</u>
-------------------------------------	-------------------------

158 – 224	171 – 243
430 – 480	387 – 432

NEMA STARTERS

NEMA rated magnetic across-the-line starters with 24-volt coils and solid state overload protection for each phase shall be provided for each pump motor to give positive protection against phase unbalance, thermal overload, phase loss and ground fault. Motor starters using heater coils are not acceptable.

ENGINEERING DATA



Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 19

AUXILIARY STATION HEATER

A 1300/1500-watt, dual range, electric heater with automatic circulating fan, thermostat control and an On/Off switch is to be provided. The heater is to be operated by connection to the station convenience receptacle.

STAINLESS STEEL PANEL

The control equipment shall be mounted in duplex NEMA type 4X stainless steel enclosures with piano hinged, lockable doors.

LEVEL CONTROL – DUPLEX DIRECT AIR BUBBLER SYSTEM

To control the operation of the pumps with variations of liquid level in the wet well, an air bubbler system shall be provided, complete with two air compressors, flow indicator, bubbler line, and a pressure transducer to supply a 4-20 mA signal to the station microprocessor control unit.

The two air compressors shall be of the close-coupled, oil-less type. Each compressor shall have a minimum capacity of 0.2 cubic feet of free air per minute at 10 PSI. It shall incorporate a single-phase, 60 cycle, 115-volt, drip-proof, brushless-type, electric motor. A motor driven timer shall be provided to automatically alternate the compressors every five (5) minutes. Wiring and piping of the air compressors shall be so arranged that one compressor may be removed without removing the other compressor from service.

To simulate various sewage levels in the wet well, a valve shall be provided in the bubbler line, near the control panel, to restrict air flow. A similar valve shall be provided to bleed off air pressure to simulate wet well levels lower than actual. The valves shall facilitate checking and adjustment of the pump control settings.

LEVEL CONTROL – SIMPLEX STORED AIR BUBBLER SYSTEM

To control the operation of the pumps with variations of liquid level in the wet well, an air bubbler system shall be provided, complete with air compressor, flow indicator, bubbler line, and a pressure transducer to supply a 4-20 mA signal to the station microprocessor control unit.

The air compressor shall be of the close-coupled, oil-less type. The compressor shall have a minimum capacity of 1.43 cubic feet of free air per minute. It shall incorporate a single-phase, 60 cycle, 115-volt, drip-proof, brushless type, electric motor.

To simulate various sewage levels in the wet well, a valve shall be provided in the bubbler line, near the control panel, to restrict air flow. A similar valve shall be provided to bleed off air pressure to simulate wet well levels lower than actual. The valves shall facilitate checking and adjustment of the pump control settings.

A manual valve shall be furnished to first isolate the sensitive pressure controls and then to apply full storage tank pressure to the bubbler line for purging. The valve shall be of the momentary operating type.

LEVEL CONTROL – DUPLEX STORED AIR BUBBLER SYSTEM

To control the operation of the pumps with variations of liquid level in the wet well, an air bubbler system shall be provided, complete with two air compressors, a 0.28 cubic feet air storage tank, flow indicator, bubbler line and a pressure transducer to supply a 4-20 mA signal to the station microprocessor control unit.

The two air compressors shall be of the close-coupled, oil-less type. Each compressor shall have a minimum capacity of 1.43 cubic feet of free air per minute. It shall incorporate a single phase, 60 cycle, 115-volt, drip-proof, brushless type, electric motor. A motor driven timer shall be provided to automatically alternate the compressors every five (5) minutes. Wiring and piping of the air compressors shall be so arranged that one compressor may be removed without removing the other compressor from service.

To simulate various sewage levels in the wet well, a valve shall be provided in the bubbler line, near the control panel, to restrict airflow. A similar valve shall be provided to bleed off air pressure to simulate wet well levels lower than actual. The valves shall facilitate checking and adjustment of the pump control settings.

ENGINEERING DATA



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14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

FX Rectangular RWWMPs
2-Pump Station
4" or 6" Pumps
Specification
May, 2012
Page 20

A manual valve shall be furnished to first isolate the sensitive pressure controls and then to apply full storage tank pressure to the bubbler line for purging. The valve shall be of the momentary operating type.

HIGH WET WELL LEVEL ALARM BACK-UP FLOAT

An adjustable displacement switch shall be provided to sense a high water level condition. The switch shall hang into the wet well and shall activate a contact to indicate the high water condition.

LOW WET WELL LEVEL ALARM BACK-UP FLOAT

An adjustable displacement switch shall be provided to sense a low water level condition. The switch shall hang into the wet well and shall activate a contact to indicate the low water condition.

ADDITIONAL SPARE MECHANICAL SEALS

In addition to the one standard spare mechanical seal, ____ additional spare mechanical seal(s) shall be provided. The spare seal(s) shall be packed in a suitable container and shall include complete installation instructions.

CERTIFIED CURVES

Factory certified performance test curves shall be provided for the pumps, tested after installation in the station, to simulate actual operating conditions. Copies of these curves, showing head, flow, BHP and efficiency, and the back-up data, shall be provided with the station. Typical data or curves from a similar pump are not acceptable. Data and curves must be for the actual pumps provided, and while mounted in the station.

WET WELL BLOWER

A ventilating blower capable of delivering 100 CFM shall be provided for ventilation of the wet well. The wet well blower shall be enclosed in an above grade NEMA 3R rain-tight cabinet with a louvered cover and shall be mounted on a 4" duct adjacent to the manway access hatch. A manual switch on the control panel shall operate the blower.

TOOLKIT

A metal toolbox complete with the following tools shall be provided. This complement of tools shall include all tools necessary to replace the pump mechanical seal.

1. 9/16" x 1/2" Box End Wrench
2. 3/4" x 5/8" Open End Wrench
3. 15/16" x 1" Open End Wrench
4. 1-1/8" Socket
5. 8" T-Handle 11" x 1/2" Drive
6. 1/2" x 5-1/2" Drive Extension
7. 6" Pipe Wrench
8. #3 Rawhide Mallet
9. Ratchet-Type Hoist
10. Motor Lifting Bar
11. Lint-Free Cloth
12. Multi-Purpose Grease

PROTECTED LIQUID FILLED COMPOUND PRESSURE GAUGES

A four-inch (4") Bourdon tube-type compound vacuum/pressure gauge with 3-1/2" dial, fitted with a brass stop valve and a manual air relief valve shall be provided for each pump. The gauges shall be mounted apart from the pumps, on a bracket attached to the control panel support structure, and connected to the pump discharge taps by flexible tubing, to minimize vibration. The range of each gauge shall be selected to place the normal operating discharge pressure reading in the middle one-third of the scale and the gauge shall also be capable of measuring up to 30" HG of vacuum. The dial shall be white with

ENGINEERING DATA



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Page 21

black markings and the gauge itself shall have an accuracy of 1% of scale. The gauge shall be American made, with a Zytel Nylon case with ½" blow-out plug, stainless steel bezel, acrylic lens and phosphorus bronze tube with brass socket. Each compound gauge shall be filled with a viscous fluid to dampen vibration and pulsation effects on the needle reading. Temperature compensation shall be provided by an internal compensating diaphragm. Gauges shall be protected from the service fluid by a Buna-N elastomer "boot" diaphragm within the stem, and the Bourdon tube and the space between the Bourdon tube and the internal isolating diaphragm shall be filled with low temperature instrument oil, completely isolating the gauge components from the fluid being measured.

STATION FLOODING ALARM

A float-operated switch shall be mounted near the station floor to detect accumulation of liquid above the normal sump pump operating level, and send an alarm signal.

DEHUMIDIFIER

A dehumidifier assembly with hermetically sealed Freon refrigeration-type compressor, expansion coil, fan and condenser coil shall be furnished to maintain the relative humidity of the air in the pump chamber low enough to keep the electrical equipment dry and to prevent condensation on the walls.

The moisture removing capability of the dehumidifier will vary with the temperature and relative humidity within the station. The minimum capacity rating at 80°F and 68% relative humidity shall be 15.5 pints per day. The maximum capacity of 80°F and 90% relative humidity shall be 25 pints per day. The dehumidifier shall be controlled automatically by an adjustable humidistat. The dehumidifier shall be located on the station floor and the condensate drained to the sump.

MANWAY LADDER

An aluminum ladder shall be provided in the manway portion of the station, to facilitate access.

MANWAY LADDER SAFETY DEVICE

A 36" extendable bar shall be fitted to the manway ladder, to provide easier entry, when raised.

ADDITIONAL ANODES

___ Additional magnesium anodes (for a total of ___) shall be provided with the station for cathodic protection.

EMERGENCY PUMPING CONNECTION

The common discharge pipe of the pump station shall be fitted with a branch with a plug valve and male quick-connect fitting, with cap, as shown on the drawings, to facilitate connection of a portable emergency pump to the force main, to bypass the pump station. The emergency pumping connection shall be housed within the station.

SHADE-AIDE™

An aluminum hood to shade the HMI display from direct sunlight shall be mounted on the face of the control panel. The metal shade shall cover the entire display, shield the top and sides of the display, and shall be hinged to fold over the display and stow against the front of the panel. It shall be lockable with a padlock in the closed position to prevent unauthorized access to the controls.

WET WELL LEVEL ANALOG SIGNAL

The controller shall provide one 4-20 mA output signal, matching the signal from the wet well level transducer, to connection points on the terminal strip of the panel for the Owner's use.

MOTOR CURRENT MONITORS

Motor current readings shall be displayed on separate panel mounted analog meters for each pump. Current transformers and associated circuitry shall be provided in the panel.