CUSTOM SERIES UNDERGROUND PUMP STATION SECTION INDEX

CUSTOM SERIES UNDERGROUND CENTRIFUGAL NON-CLOG PUMP STATION

INTRODUCTION

The reliable Smith & Loveless, Inc. Custom Series pump station is recommended for 3" solids handling at flow rates equal to or greater than approximately 100 GPM. For such capacities, centrifugal pumps (unencumbered by grinding mechanisms) are more efficient, require less connected horsepower, consume less electrical power, and therefore, offer the lowest cost per gallon of pumping capacity. Centrifugal pumps may be conveniently selected to handle immediate increases in capacity by utilizing two-speed motors. With proper selection of pumps and single speed motor, future increased capacity requirements can be met by changing to larger impellers. Variable speed and other flow matching devices are also available. Reference the Smith & Loveless, Inc. sections Variable Frequency Pump Controls.

Over 10,000 installations attest to the reliability of the Custom Series station. However, one should consider the applicability of the Smith & Loveless, Inc. wet well mounted and recessed wet well mounted stations prior to selecting a completely buried pumping station. Wet well mounted type stations have been proven in over 10,000 installations also, and offer lower capital cost and lower installation cost. The recessed wet well mounted pump station offers comparable advantages to the completely buried station and has proven to be a very cost-effective alternative.

If it is believed a completely buried underground station will best serve your client's needs, Smith & Loveless, Inc. recommends the **DUO-DUCT®** station for low to medium capacities; for mid-ranges, the Custom Series is recommended and for larger capacities, we recommend the **CAPSULAR®** or **MODU-PLEX®** station designs.

Please let us know how we can be of assistance in selecting a Smith & Loveless, Inc. pumping station best suited for your particular needs.

SPECIFICATION
7' AND 8' DIAMETER CUSTOM SERIES UNDERGROUND PUMP STATION
(DRAWING: 28D986 AND 28D988)

GENERAL

The contractor shall furnish and install one factory-built, automatic Custom Series pumping station as manufactured by Smith & Loveless, Inc., Lenexa, Kansas. The station shall be complete with all needed equipment factory-installed in a welded steel chamber with welded steel entrance tube and with ladder to provide access.

The principal items of equipment shall include two vertical, close-coupled, motor driven, non-clog pumps; valves; internal piping; central control panel with circuit breakers, motor starters and automatic pumping level controls; lighting; sump pump; ventilating blower; dehumidifier and all internal wiring.

OPERATING CONDITIONS

The pump shall be capable of delivering ___ GPM of raw water or wastewater against a total dynamic head of __'. The minimum acceptable pump efficiency at this condition shall be __%. Due to the energy conservation requirements, the minimum efficiency will be enforced. The maximum allowable speed shall be ____ RPM. The minimum rated horsepower of each pump motor shall be __.

All openings and passages shall be large enough to permit the passage of a sphere 3" in diameter. The anticipated operating head range is from __' minimum to __' maximum.

PUMP CHAMBER

The station shall be built by the Manufacturer in two major sections, consisting of the pump chamber and the required section of entrance tube, for ease in shipment and handling. These sections shall be joined at the job site by welding.

The pump chamber shall contain all pumps and other equipment and shall be a vertical cylinder of circular cross-section. The top and bottom of the station shall be 3/8" thick. Steel plate shall meet or exceed ASTM A-36 specifications.

The exterior of the station shall be designed so all welds exposed to ground water after installation are continuous or sealed throughout their length so that water cannot seep between uncoated steel surfaces. In addition, the structure shall be designed so that sharp corners and similar difficult-to-coat conditions are held to an absolute minimum. The thickness of the steel cylinder shall be determined by the structural requirements for the depth of bury involved and shall be a minimum of 1/4". It shall be the responsibility of the Manufacturer to determine the structural requirements of the shell based on the external loads specified on the plans.

Lifting eyes adequate to support the entire weight of the pump station shall be provided and welded to the station head. Tie-down holes shall be provided for anchoring the discharge line at the point it leaves the station. Lifting loops shall be located on the ceiling of the pump station over each pump at an adequate height to permit a hoist to be used for pump disassembly. Minimum maintenance clearances shall be as shown on the drawings or specified herein.

A sump with walls of 1/4" structural-grade steel plate shall be provided. Where the steel discharge line passes through the station wall, it shall be welded to the station shell with a continuous weld.

ENTRANCE TUBE

The entrance tube shall be provided in one or more sections as required and the diameter shall be as shown on the drawings. The entrance tube shall be constructed of structural grade steel plate that meets or exceeds ASTM A-36 specifications. The length shall be adequate to place the cover above the surrounding ground as shown on the drawings. The entrance tube shall be adequately stiffened and the field joints arranged so that the joint may be welded from the outside of the tube with all welding being performed in a down-hand position. The bottom of the tube shall be attached to an angle, shop welded to the head of the pump station. This field joint shall also be weldable in the down-hand position. Two lifting loops shall be provided on each section of entrance tube for handling and installation.

A PVC ventilation duct with inlet vent shall extend from the top of the entrance tube into the station. The inlet vent shall be covered with a screen to exclude rodents and foreign objects.

The entrance tube cover shall be of fiberglass reinforced plastic and shall have a reflective color to reduce heat absorption. The cover shall have a suitable drip lip around the edge and shall be provided with a weatherproof lock of the pin tumbler type, which can be opened from the inside without a key. The lock shall be self-locking upon closing the lid.

The fiberglass cover shall have a rung, which forms an extension of the access ladder when the cover is latched in the open position. A latch mechanism shall be provided to keep the cover open under any normal load.

The access ladder shall be of heavy aluminum construction and have grooved non-slip rungs of 1-1/4" nominal outside diameter spaced on 12" centers. Neoprene rubber sleeves shall be provided to cover the joint between the adjoining ladder sections.

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 ground water, all welded joints on the exterior of the station shall be continuous throughout their length.

PROTECTION AGAINST CORROSION

All structural steel surfaces shall be factory blasted with steel grit 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. Immediately following cleaning, a single 6-mil dry film thickness of **VERSAPOX®** epoxy resin shall be Factory applied. This finish coating shall be as formulated by Smith & Loveless for abrasion and corrosion resistance.

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 dehumidifier 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 and shall be the same material as the original coating.

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 by the station Manufacturer for cathodic protection. The anode packs shall be provided with 15' long insulated copper leads. Copper lugs shall be provided by the Manufacturer on opposite sides of the station for anode connections.

CAUTION: *Purchasing Contractor shall thoroughly review specifications and Installation Instructions for special anode lead connections prior to backfilling station.*

MAIN PUMPS

The pumps shall be __" vertical, non-clog type of heavy cast-iron construction, especially designed for the use of mechanical seals. 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 325; and 3" for frame 365 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 linearly 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.

In order to reduce the number of registered fits required and minimize the possibility of unbalancing the motor rotor in relation to the impeller and mechanical seal, the motor shall be attached to the pump volute by a one-piece cast-iron adapter and backhead. Pump construction incorporating sandwiched parts, such as the backhead, will not be allowed.

The pump shall be arranged so that the rotating element can easily be removed from the volute 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 elbow. Volute or suction elbow clean-outs will not be an acceptable substitute.

The pump shaft shall be sealed against leakage by a double mechanical seal installed in a bronze seal housing constructed in two sections with registered fit. The housing shall be recessed into the pump backhead and securely fastened thereto with stainless steel capscrews. The inside of the seal housing shall be tapered to facilitate the replacement of the seal parts. The seals shall be of carbon and ceramic materials with the mating surfaces lapped to a flatness tolerance of one light band. The rotating ceramics shall be held in mating position with the stationary carbons by a stainless steel spring. The seal housing with assembled parts shall be so constructed as to be readily removable from the shaft as a unit and shall be provided with tapped jackscrew openings to assist in removing it from the backhead.

The seal shall be pressurized and lubricated by liquid taken directly from the pump backhead through a filter to the seal housing and introduced between the upper and lower sealing surfaces. The filter shall be of corrosion-resistant materials and shall screen out all solids larger than 50 microns. The seal system shall contain a brass valve connected near the top of the seal housing to permit the relief of any air trapped in the seal unit. A manually operated brass valve shall also be provided to vent the pump volute.

The pump volute shall be free from projections that might cause clogging or interfere with flow through the pump.

The pump shall be supported by a heavy cast-iron base with four (4) legs. The height of the base shall be sufficient to permit the use of an increasing suction elbow, which shall be provided when the nominal pump size is smaller than the suction line. The suction and discharge openings shall be flanged, faced and drilled 125-pound American Standard.

[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 capscrew 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 (4" & 6" OPTION)

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 in^2. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel capscrew 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, suitable for temperatures up to 105°C. Insulation temperature shall, however, be maintained below 80°C. 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 cast connection box and shall be clearly identified.

The motors shall have 1.15 service factor. The service factor shall be reserved for the owner's protection. The motors shall not be overloaded beyond their nameplate rating, at the design condition, 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 run-out shall be limited to .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.

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.

MINIMUM REQUIREMENTS: (Partial Listing)

Shaft thru seal:		_____" Dia. Solid Stainless Steel
Seal Housing:		Bronze
Lower Bearing to Impeller,	distance:	6" Maximum
Shaft Run-Out:		0.003" Maximum
Shaft End Play:		Limited to Bearing Shake
Shaft to Motor Base:		0.005" Maximum
Impeller to Shaft Fit:		Tapered
Impeller Shroud:		Untrimmed-Full Diameter
Upper Bearing:		Axially Free
Lower Bearing:		Locked in Place
Efficiency at Design:		_____ % Minimum
Efficiency at B.E.P.:		_____ % Minimum
Backhead & Motor Adapter:		One Piece
Motor Insulation:		Class F
Motor Temperature Rise:		Class B
Motor Service Factor:		1.15, Reserved for Owner

Pumps will only be considered if all items of the specifications are met. The stainless steel shaft with tapered impeller attachment is to be provided to minimize corrosion, extend seal life, and provide the ease of impeller removal and seal replacement. The impeller shall be removable in the field without the use of a "wheel puller". All items are specified for long life and ease of operator maintenance. Deviation from the pump specification will be cause for rejection.

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 ensure that the proper pumping system is provided to the Owner.

CONTROL

The control equipment shall be mounted within a NEMA Type 1 enclosure, fabricated of steel and reinforced as required. The circuit breaker, motor-starter section shall be provided with a hinged cover, complete with suitable latching devices. All circuit breakers and pump control switches shall be mounted so that they are operable without opening the high voltage cabinet. The pressure switches shall be mounted on the side of the cabinet. It shall not be necessary to open the front of the cabinet to make minor adjustments to the pressure switches, etc.

A grounding-type convenience duplex outlet shall be provided on the side of the cabinet for operation of 115-volt AC devices.

Thermal magnetic air circuit breakers shall be provided for branch disconnect service and over-current protection of all motor, control and auxiliary circuits. Magnetic across-the-line starters with under-voltage release and overload coils for each phase shall be provided for each pump motor to give positive protection. Each single-phase auxiliary motor shall be equipped with an over-current protection device, in addition to its branch circuit breaker, or shall be impedance protected.
All switches shall be labeled and a coded wiring diagram shall be provided.

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 sensitive pressure switch for each pump.

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 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.

The pressure switches shall be of the snap action type, with sensitive pressure elements and independent high and low adjustments for each pump capable of a minimum differential of 18" of water.

An automatic alternator with manual "On-Off" switch shall be provided to change the sequence of operation of the pumps on the completion of each pumping cycle. Provisions shall also 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.

HIGH WET WELL LEVEL ALARM

An adjustable pressure switch shall be provided to sense a high water level condition in the wet well. The switch shall be connected to the pressure transducer and shall activate a contact to indicate the high water condition.

DEHUMIDIFIER AND VENTILATING BLOWER

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 above the floor on a shelf and the condensate drained to the sump.

Fresh air shall be drawn into the station through the PVC air duct in the entrance tube. The squirrel-cage ventilating power shall have a minimum capacity of 160 CFM and shall be controlled by a 15-minute cycle timer with a range of 0-100% so as to provide essentially continuous ventilation without exceeding the capabilities of the dehumidifier.

Ventilation systems so arranged that intake air is not pulled into the station through an inlet duct will not be acceptable.

The ventilating blower shall have a high velocity discharge directed across the station parallel to the floor such that vortexing and vigorous mixing will ensure adequate dehumidification and purging of the station air. It shall be positioned on the head of the station to prevent inadvertent damage by service personnel.

A switch shall be provided at the top of the entrance tube for operation of the lights and ventilating blower when entering the station. The air vent shall have a suitable screen to prevent the entrance of foreign objects.

LIGHTING

Minimum lighting shall consist of a twin 40-watt fluorescent lamp fixture provided for the convenience and safety of the Operator. The lighting shall provide illumination for all areas in the station.

SUMP PUMP

A submersible sump pump with close-coupled, vertical motor shall be installed in the sump. It shall have a minimum capacity of 1000 GPH at design head. The design head this pump will operate against is the static head from the sump to 3' below grade. A mechanical seal on the shaft shall exclude liquid from the motor housing.

The sump pump shall be controlled automatically by a built-in float switch. It shall discharge through double check valves and a gate valve.

MAIN PIPING

Pump suction lines shall be Schedule 40 steel, plain-end pipe terminating outside the pump chamber. Gate valves shall be provided inside the chamber on the suction and discharge sides of the pumps. The discharge line from each pump shall be fitted with a spring loaded, clapper type check valve. A special M.J. gasket shall be provided to adapt the plain-end steel pipe to cast-iron M.J. bells. The diameter of all pipe and valves shall be as shown on the drawings. The common discharge riser pipe and the discharge outlet shall be Schedule 40 steel, plain-end piping terminating outside the pump chamber.

The air bubbler line furnished by the station Manufacturer in the station shall be 1/2" nominal tubing, terminating in a 1/2" NPT fitting in the entrance tube to accept the 1/2" flexible bubbler line extending to the wet well.

A loop in the bubbler line shall be provided to protect the station from flooding.

WIRING

The pump station shall be completely wired at the Factory, except for the power feeder lines and entrance light switch. All wiring in the pump station shall meet the requirements of the National Electrical Code and shall be coded as indicated on the wiring diagram. All wiring outside the panel shall be in conduit, except for 115-volt accessory items, which are provided with connecting insulated service cord. The Manufacturer shall provide conduit from the control panel across the ceiling, and up the entrance tube to receive the feeder lines. The conduit shall terminate in a threaded conduit connection through the wall of the entrance tube above ground level.

Accessory items such as the sump pump, dehumidifier and air compressors shall be plugged into selectively polarized, grounded convenience outlets, located close to their installed position so that such items can be readily removed and serviced if necessary.

FACTORY TESTS

All components of the pump station shall be given an operational test at the pump station manufacturers facility to check for excessive vibration, for leaks in the piping or seals and for correct operation of the automatic control system and all auxiliary equipment. The pump suction and discharge lines shall be coupled to a reservoir and the pumps shall re-circulate water under simulated service conditions. The automatic controls shall be adjusted to start and stop the pumps at approximately the levels required by the job conditions. The control panel shall undergo both a dry logic test and full operational test with all systems operating.

Factory test instrumentation must 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 within the pump station. The spare seal container shall include complete installation instructions. A spare filter element for the seal filter shall also be provided, in the same container as the pump shaft seal. Spare volute gaskets for the main pumps shall also be furnished.

INSTALLATION AND OPERATING INSTRUCTIONS

Installation of the pump chamber, entrance tube and related appurtenances shall be done in accordance with written instructions provided by the Manufacturer.

CAUTION: *Purchasing Contractor shall inspect the interior of the station chamber prior to backfilling for possible special installation instructions.*

The Manufacturer shall further provide a complete and detailed Installation, Operation and Maintenance Manual. This manual shall cover, in addition to installation and general operating procedures, the operation, maintenance, and servicing procedures of the major individual components provided with the pump station.

STARTUP

The Manufacturer shall provide the services of a Factory-trained representative for a maximum period of one (1) 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.

WARRANTY

The manufacturer of the station shall guarantee for one (1) year from date of start-up, 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 guarantee of the station and all components.

In the event a component fails to perform as specified or is proven defective in service during the guarantee period, the Manufacture shall repair or replace, at this 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 start-up service has been performed, the labor to replace accessory items, such as the ventilating blower, dehumidifier, sump pump, alternator, etc., shall be the responsibility of others.

The repair or replacement of those items normally consumed in service, such as seals, grease, light bulbs, etc., shall be considered as part of routine maintenance and upkeep.

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, facilitate 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 treatment equipment. Equipment substitutions, since incompatible with the district's standardizations 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 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, manufacturer's 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 manufacturer's or manufacturer's representatives' services available at these locations, including addresses and phone numbers of the nearest parts warehouses capable of providing full parts replacement and/or repairs services.
F. A list of five (5) 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 specified 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 contractor's 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.

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 $_____.

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		
Pump shaft diameter of _____ minimum through seal		
Full diameter impeller shrouds		
Stainless steel pump shaft		
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		
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 pumping from a wet well		
Double mechanical seal with rotating ceramic elements and stationary carbon elements		
50 micron seal water filters		
Seal water taken from low pressure area of pump backhead		
All other items for the station, as specified with minimum sizes, capacities and materials indicated		
Product liability insurance, $5 million per specification		
Structure blasted with steel grit in environmentally controlled booth prior to coating with epoxy resin		

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

_____
Title

Corporate Seal
(Notarized)

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		
Pump shaft diameter of _____ minimum through seal		
Full diameter impeller shrouds		
Stainless steel pump shaft		
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		
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 pumping from a wet well		
Double mechanical seal with rotating ceramic elements and stationary carbon elements		
50 micron seal water filters		
Seal water taken from low pressure area of pump backhead		
All other items for the station, as specified with minimum sizes, capacities and materials indicated		
Product liability insurance, $5 million per specification		
Structure blasted with steel grit in environmentally controlled booth prior to coating with epoxy resin		

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

SPECIFICATION
9' - 12' DIAMETER CUSTOM SERIES UNDERGROUND PUMP STATION WITH (2) (3) PUMPS

GENERAL

The contractor shall furnish and install one factory-built, automatic Custom Series pumping station as manufactured by Smith & Loveless, Inc., Lenexa, Kansas. The station shall be complete with all needed equipment Factory-installed in a welded steel chamber with welded steel entrance tube and with ladder to provide access.

The principal items of equipment shall include ____ vertical, close-coupled, motor driven, non-clog pumps; valves; internal piping; central control panel with circuit breakers, motor starters and automatic pumping level controls; lighting; sump pump; ventilating blower; dehumidifier 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 minimum acceptable pump efficiency at this condition shall be _____%. Due to the energy conservation requirements, the minimum efficiency will be enforced. The maximum allowable speed shall be _____ RPM. The minimum rated horsepower of each pump motor shall be _____.

[THREE PUMP STATIONS ONLY]

Two pumps operating in parallel shall be capable of delivering _____ GPM at _____ feet TDH. The minimum pump efficiency at this operating point shall be _____%.

All openings and passages 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.

PUMP CHAMBER

The station shall be built by the Manufacturer in two major sections, consisting of the pump chamber and the required section(s) of entrance tube, for ease in shipment and handling. These sections shall be joined at the job site by welding.

The pump chamber shall contain all pumps and other equipment and shall be a vertical cylinder of circular cross-section. The top and bottom of the station shall be 3/8" thick. Steel plate shall meet or exceed ASTM A-36 specifications.

The exterior of the station shall be designed so all welds exposed to groundwater after installation are continuous or sealed throughout their length so that water cannot seep between non-coated steel surfaces. In addition, the structure shall be designed so that sharp corners and similar difficult-to-coat conditions are held to an absolute minimum. The thickness of the steel cylinder shall be determined by the structural requirements for the depth of bury involved and shall be a minimum of 1/4". It shall be the responsibility of the Manufacturer to determine the structural requirements of the shell based on the external loads specified on the plans.

Lifting eyes adequate to support the entire weight of the pump station shall be provided and welded to the station head. Tie-down holes shall be provided for anchoring the discharge line at the point it leaves the station. Lifting loops shall be located on the ceiling of the pump station over each pump at an adequate height to permit a hoist to be used for pump disassembly. Minimum maintenance clearances shall be as shown on the drawings or specified herein.

A sump with walls of 1/4" structural-grade steel plate shall be provided. Where the ductile iron suction and discharge lines pass through the station walls, they shall be reinforced with 1/4" thick steel sleeves, welded inside and out to the station wall. The space between the ductile iron pipes and the steel sleeves shall be packed tight with Portland cement grout containing Embeco aggregate to prevent leakage.

ENTRANCE TUBE

The entrance tube shall be provided in one or more sections as required and the diameter shall be as shown on the drawings. The entrance tube shall be constructed of structural grade steel plate that meets or exceeds ASTM A-36 specifications. The length shall be adequate to place the cover above the surrounding ground as shown on the drawings. The entrance tube shall be adequately stiffened and the field joints arranged so that the joint may be welded from the outside of the tube with all welding being performed in a down-hand position. The bottom of the tube shall be attached to an angle, shop welded to the head of the pump station. This field joint shall also be weldable in the down-hand position. Two lifting loops shall be provided on each section of entrance tube for handling and installation.

A PVC ventilation duct with inlet vent shall extend from the top of the entrance tube into the station. The inlet vent shall be covered with a screen to exclude rodents and foreign objects.

The entrance tube cover shall be of fiberglass reinforced plastic and shall have a reflective color to reduce heat absorption. The cover shall have a suitable drip lip around the edge and shall be provided with a weatherproof lock of the pin tumbler type that can be opened from the inside without a key. The lock shall be self-locking upon closing the lid.

The fiberglass cover shall have a rung that forms an extension of the access ladder when the cover is latched in the open position. A latch mechanism shall be provided to keep the cover open under any normal load.

The access ladder shall be of heavy aluminum construction and have grooved non-slip rungs of 1-1/4" nominal outside diameter spaced on 12" centers. Neoprene rubber sleeves shall be provided to cover the joint between the adjoining ladder sections.

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 ground water, all welded joints on the exterior of the station shall be continuous throughout their length.

PROTECTION AGAINST CORROSION

All structural steel surfaces shall be factory blasted with steel grit 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. Immediately following cleaning, a single 6-mil dry film thickness of **VERSAPOX®** epoxy resin shall be Factory applied. This finish coating shall be as formulated by Smith & Loveless for abrasion and corrosion resistance.

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 dehumidifier 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 touchup 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 and shall be the same material as the original coating.

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 by the station Manufacturer for cathodic protection. The anode packs shall be provided with 15' long insulated copper leads. Copper lugs shall be provided by the Manufacturer on opposite sides of the station for anode connections.

CAUTION: *Purchasing Contractor shall thoroughly review specifications and Installation Instructions for special anode lead connections prior to backfilling station.*

MAIN PUMPS

The pumps shall be _____" vertical, non-clog type of heavy cast-iron construction, especially designed for the use of mechanical seals. 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 water 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 linearly 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 impeller shall be of the enclosed type made of close-grained cast-iron and shall be balanced. 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 shroud. The shroud shall remain full diameter so that close minimum clearance from shroud 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.

In order to reduce the number of registered fits required and minimize the possibility of unbalancing the motor rotor in relation to the impeller and mechanical seal, the motor shall be attached to the pump volute by a one-piece cast-iron adapter and backhead. Pump construction incorporating sandwiched parts, such as the backhead, will not be allowed.

The pump shall be arranged so that the rotating element can easily be removed from the volute without disconnecting seal system or the electrical wiring or disassembling the motor, impeller, backhead or seal, so that any foreign object may be removed from the pump or suction elbow. Volute and/or suction elbow clean-outs are not acceptable substitutes.

The pump shaft shall be sealed against leakage by a double mechanical seal installed in a bronze seal housing constructed in two sections with registered fit. The housing shall be recessed into the pump backhead and securely fastened thereto with stainless steel cap screws. The inside of the seal housing shall be tapered to facilitate the replacement of the seal parts. The seals shall be of carbon and ceramic materials with the mating surfaces lapped to a flatness tolerance of one light band. The rotating ceramics shall be held in mating position with the stationary carbons by a stainless steel spring. The seal housing with assembled parts shall be so constructed as to be readily removable from the shaft as a unit and shall be provided with tapped jackscrew openings to assist in removing it from the backhead.

The seal shall be pressurized and lubricated by liquid taken directly from the pump backhead through a filter to the seal housing and introduced between the upper and lower sealing surfaces. The filter shall be of corrosion-resistant materials and shall screen out all solids larger than 50 microns. The seal system shall contain a brass valve connected near the top of the seal housing to permit the relief of any air trapped in the seal unit. A manually operated brass valve shall also be provided to vent the pump volute.

The pump volute shall be free from projections that might cause clogging or interfere with flow through the pump.

The pump shall be supported by a heavy cast-iron base with four (4) legs. The height of the base shall be sufficient to permit the use of an increasing suction elbow that shall be provided when the nominal pump size is smaller than the suction line. The suction and discharge openings shall be flanged, faced and drilled 125-pound American Standard.

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, suitable for temperatures up to 105°C. Insulation temperature shall, however, be maintained below 80°C. 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 cast connection box and shall be clearly identified.

The motors shall have a 1.15 service factor. The service factor shall be reserved for the Owner's protection. The motors shall not be overloaded beyond their nameplate rating, at the design condition, 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 run-out shall be limited to .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.

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.

Minimum Requirements: (Partial Listing)

Shaft thru seal:	_____" Dia. Solid Stainless Steel
Seal Housing:	Bronze
Lower Bearing to Impeller	6" Maximum
Shaft Run-Out:	0.003" Maximum
Shaft End Play:	Limited to Bearing Shake
Shaft to Motor Base:	0.005" Maximum
Impeller to Shaft Fit:	Tapered
Impeller Shroud:	Untrimmed-Full Diameter
Upper Bearing:	Axially Free
Lower Bearing:	Locked in Place
Efficiency at Design:	_____% Minimum
Efficiency at B.E.P.:	_____% Minimum
Backhead & Motor Adapter:	One Piece
Motor Insulation:	Class F
Motor Temperature Rise:	Class B
Motor Service Factor:	1.15, Reserved for Owner

Pumps will only be considered if all items of the specifications are met. The stainless steel shaft with tapered impeller attachment is to be provided to minimize corrosion, extend seal life, and provide the ease of impeller removal and seal replacement. The impeller shall be removable in the field without the use of a "wheel puller". All items are specified for long life and ease of operator maintenance. Deviation from the pump specification will be cause for rejection.

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 ensure that the proper pumping system is provided to the Owner.

CONTROL

The control equipment shall be mounted within a NEMA Type 1 enclosure, fabricated of steel and reinforced as required. The circuit breaker, motor-starter section shall be provided with a hinged cover, complete with suitable latching devices. All circuit breakers and pump control switches shall be mounted so that they are operable without opening the high voltage cabinet. The pressure switches shall be mounted on the side of the cabinet. It shall not be necessary to open the front of the cabinet to make minor adjustments to the blower timer, pressure switches, etc.

A grounding type convenience duplex outlet shall be provided on the side of the cabinet for operation of 115-volt AC devices.

Thermal magnetic air circuit breakers shall be provided for branch disconnect service and over-current protection of all motor, control and auxiliary circuits. Magnetic across-the-line starters with under-voltage release and overload coils for each phase shall be provided for each pump motor to give positive protection. Each single-phase auxiliary motor shall be equipped with an over-current protection device, in addition to its branch circuit breaker, or shall be impedance protected.

All switches shall be labeled and a coded wiring diagram shall be provided.

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 sensitive pressure switch for each pump.

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.

The pressure switches shall be of the snap action type, with sensitive pressure elements and independent high and low adjustments for each pump capable of a minimum differential of 18" of water.

An automatic alternator with manual "On-Off" switch shall be provided to change the sequence of operation of the pumps on the completion of each pumping cycle. Provisions shall also 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.

HIGH WET WELL LEVEL ALARM

❑ (OPTIONAL ITEM - CHECK IF REQUIRED)

An adjustable pressure switch shall be provided to sense a high water level condition in the wet well. The switch shall be connected to the bubbler line and shall activate a contact to indicate the high water condition.

DEHUMIDIFIER AND VENTILATING BLOWER

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 above the floor on a shelf and the condensate drained to the sump.

Fresh air shall be drawn into the station through the PVC air duct in the entrance tube. The squirrel-cage ventilating blower shall have a minimum capacity of 30 air changes per hour, and shall be controlled by a 15-minute cycle timer with a range of 0-100% so as to provide essentially continuous ventilation without exceeding the capabilities of the dehumidifier.

Ventilation systems so arranged that intake air is not pulled into the station through an inlet duct will not be acceptable.

The ventilating blower shall have a high velocity discharge directed across the station parallel to the floor such that vortexing and vigorous mixing will ensure adequate dehumidification and purging of the station air. It shall be positioned on the head of the station to prevent inadvertent damage by service personnel.

A switch shall be provided at the top of the entrance tube for operation of the lights and ventilating blower when entering the station. The air vent shall have a suitable screen to prevent the entrance of foreign objects.

LIGHTING

Minimum lighting shall consist of a twin 40-watt fluorescent lamp fixture provided for the convenience and safety of the Operator. The lighting shall provide illumination for all areas in the station.

SUMP PUMP

A submersible sump pump with close-coupled, vertical motor shall be installed in the sump. It shall have a minimum capacity of 1000 GPH at design head. The design head this pump will operate against is the static head from the sump to 3' below grade. A mechanical seal on the shaft shall exclude liquid from the motor housing.

The sump pump shall be controlled automatically by a built-in float switch. It shall discharge through double check valves and a gate valve.

MAIN PIPING

Pump suction lines shall be Class 53, plain-end, ductile iron pipe terminating outside the pump chamber. Gate valves shall be provided inside the chamber on the suction and discharge sides of the pumps. The discharge line from each pump shall be fitted with a spring loaded, clapper-type check valve. The diameter of all pipe and valves shall be as shown on the drawings.

The common discharge riser pipe and the discharge outlet shall be Class 53, plain-end, ductile iron pipe terminating outside the pump chamber.

The air bubbler line furnished by the station Manufacturer in the station shall be 1/2" nominal tubing, terminating in a 1/2" NPT fitting in the entrance tube to accept the 1/2" flexible bubbler line extending to the wet well.

A loop in the bubbler line shall be provided to protect the station from flooding.

WIRING

The pump station shall be completely wired at the Factory, except for the power feeder lines and entrance light switch. All wiring in the pump station shall meet the requirements of the National Electrical Code and shall be coded as indicated on the wiring diagram. All wiring outside the panel shall be in conduit, except for 115-volt accessory items, which are provided with connecting insulated service cord. The Manufacturer shall provide conduit from the control panel across the ceiling, and up the entrance tube to receive the feeder lines. The conduit shall terminate in a threaded conduit connection through the wall of the entrance tube above ground level.

Accessory items such as the sump pump, dehumidifier and air compressors shall be plugged into selectively polarized, grounded convenience outlets, located close to their installed position so that such items can be readily removed and serviced if necessary.

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 for correct operation of the automatic control system and all auxiliary equipment. The pump suction and discharge lines shall be coupled to a reservoir and the pumps shall re-circulate water under simulated service conditions. The automatic controls shall be adjusted to start and stop the pumps at approximately the levels required by the job conditions. The control panel shall undergo both a dry logic test and full operational test with all systems operating.

Factory test instrumentation must 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 within the pump station. The spare seal container shall include complete installation instructions. A spare filter element for the seal filter shall also be provided, in the same container as the pump shaft seal. Spare volute gaskets for the main pumps shall also be furnished.

INSTALLATION AND OPERATING INSTRUCTIONS

Installation of the pump chamber, entrance tube and related appurtenances shall be done in accordance with written instructions provided by the Manufacturer.

CAUTION: *Purchasing Contractor shall inspect the interior of the station chamber prior to backfilling for possible special Installation Instructions.*

The Manufacturer shall further provide a complete and detailed Installation, Operation and Maintenance Manual. This manual shall cover, in addition to installation and general operating procedures, the operation, maintenance, and servicing procedures of the major individual components provided with the pump station.

STARTUP

The Manufacturer shall provide the services of a factory-trained representative for a maximum period of one (1) 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.

WARRANTY

The Manufacturer of the station shall warranty for one (1) year from date of startup, not to exceed eighteen (18) months from date of shipment, that the structure and all equipment it provides will be free from defects in material and workmanship. Warranties 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 its discretion, such defective part. It 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 ventilating blower, dehumidifier, sump pump, alternator, etc. shall be the responsibility of others.

The repair or replacement of those items normally consumed in service, such as seals, grease, light bulbs, etc., shall be considered as part of routine maintenance and upkeep.

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.

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

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, facilitate 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 treatment equipment. Equipment substitutions, since incompatible with the district's standardizations program, will not be considered.

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 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.

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, manufacturer's 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 manufacturer's or manufacturer's representatives' services available at these locations, including addresses and phone numbers of the nearest parts warehouses capable of providing full parts replacement and/or repairs services.
F. A list of five (5) 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 specified 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 contractor's 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.

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 $_____.

PUMP STATION CERTIFICATION AFFIDAVIT

A submittal will be required to be submitted to the owner by manufacturers proposing alternate, unnamed pump stations with their bid. Included in the submittal shall be full-size drawings and detailed specifications on the proposed pump station. Copies of the Engineer's plans and specifications will not be acceptable. Included in the bid submittal shall be the following filled-out checklist. It shall be signed by an officer of the Company.

	YES	NO
Close-coupled pump design - no motor to pump shaft coupling		
Pump shaft diameter of _____ minimum through seal		
Full diameter impeller shrouds		
Stainless steel pump shaft		
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 _____ %		
_____% pump efficiency at best efficiency point for proposed impeller		
Class F motor insulation with Class B max motor temperature rise and 1.15 service factor		
Motor shaft run-out 0.003" max		
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 pumping from a wet well		
Double mechanical seal with rotating ceramic elements and stationary carbon elements		
50 micron seal water filters		
Seal water taken from low pressure area of pump backhead		
All other items for the station, as specified with minimum sizes, capacities and materials indicated		
Product liability insurance, $5 million per specification		
Structure blasted with steel grit in environmentally controlled booth prior to coating with epoxy resin		

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 an officer of the Company signing this affidavit, he has stated 100% compliance with the pump station 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. Generally, the amount of money shall be related to, but not limited to, a 20-year station design life.

_____
Signature of Company Officer

Corporate Seal
(Notarized)

_____
Title

CUSTOM SERIES 2-PUMP STATION SELECTION CHART (REFER TO PUMP SELECTION CURVES)

See next page for (1) thru (5) numbered references

(1) Nominal S & L Pump Size	(2) Pump Suction Pipes	Discharge Gate Valves	Common Discharge Pipe	Station Shell Diameter	(3) Nominal Inside Height	Minimum Entrance Tube Diameter	(4) Maximum Motor Size				(5) Station Friction Loss
							1800 RPM	1200 RPM	900 RPM	600 RPM	
4B2 – 4C2 4B2Y – 4C2Y	4”, 6” 6”, 8” 8”	4” 6” 8”	4”, 6”, 8” 6”, 8”, 10” 8”10”	7’ - 0” 7’ – 0” 8’ – 0”	See DWG’s. 28D986 28D988 28D990	36” 36” 36”	30 30 30	10 10 10	5 5 5		75’ of 4” 115’ of 6” 150’ of 8”
4B2A – 4C2A	4”, 6” 6”, 8” 8”	4” 6” 8”	4”, 6”, 8” 6”, 8”, 10” 8”10”	7’ - 0” 7’ – 0” 8’ – 0”		36” 36” 36”	30 30 30	10 10 10	5 5 5		75’ of 4” 115’ of 6” 150’ of 8”
4B3 – 4D3	4”, 6” 6”, 8” 8”	4” 6” 8”	4”, 6”, 8” 6”, 8”, 10” 8”10”	7’ - 0” 7’ – 0” 8’ – 0”		36” 36” 36”	50 50 50	15 15 15	7 ½ 7 ½ 7 ½		75’ of 4” 115’ of 6” 150’ of 8”
4B4A - 4D4A	4”, 6” 6”, 8” 8”	4” 6” 8”	4”, 6”, 8” 6”, 8”, 10” 8”10”	8’ - 0” 8’ – 0” 8’ – 0”		36” 36” 36”	60 60 60	30 30 30	15 15 15		75’ of 4” 115’ of 6” 150’ of 8”
6B3 – 6D3 6B3Y – 6D3Y	6”, 8” 8”, 10” 10”	6” 8” 10”	6”, 8”, 10” 8”, 10”, 12” 10”, 12”	8’ - 0” 8’ – 0” 8’ – 0”		36” 36” 36”	60 60 60	20 20 20	7 ½ 7 ½ 7 ½		115’ of 6” 150’ of 8” 190’ of 10”
6B3A – 6D3A	6”, 8” 8”, 10” 10”	6” 8” 10”	6”, 8”, 10” 8”, 10”, 12” 10”, 12”	8’ - 0” 8’ – 0” 8’ – 0”		36” 36” 36”	60 60 60	20 20 20	7 ½ 7 ½ 7 ½		115’ of 6” 150’ of 8” 190’ of 10”
6B3C – 6D3C 6B3C – 6D3C	6”, 8” 8”, 10” 10” 12”	6” 8” 10” 10”	6”, 8”, 10” 8”, 10”, 12” 10”, 12” 10”, 12”, 14”	8’ - 0” 8’ – 0” 8’ – 0” 9’ – 0”	 28D905	36” 36” 36” 36”	60 60 60 60	20 20 20 20	10 10 10 10		115’ of 6” 150’ of 8” 190’ of 10” 200’ of 10”
6C4C – 6D4C	8”, 10” 10”	8” 10”	8”, 10”, 12” 10”, 12”, 14”	9’ – 0” 9’ – 0”	28D727	44” 44”	150 150	50 50	20 20		160’ of 8” 200’ of 10”
6C4C – 6D4C	8”, 10” 10”, 12”	8” 10”	8”, 10”, 12” 10”, 12”, 14”	9’ – 9” 9’ – 9”	28D728	44” 44”	150 150	50 50	20 20		160’ of 8” 200’ of 10”
8C4A – 8D4A or 8C4B – 8D4B	8”, 10” 10”, 12”	8” 10”	8”, 10”, 12” 10”, 12”, 14”	9’ – 9” 9’ – 9”	28D729	44” 44”	200 200	50 50	20 20		250’ of 12” 250’ of 12”
8C4A – 8D4A or 8C4B – 8D4B	12” 14”	12” 12”	12”, 14”, 16” 12”, 14”, 16”	9’ – 9” 11’ – 0”	28D729 28D888	44” 44”	200 200	50 50	20 20		250’ of 12” 250’ of 12”
8D4C	14”	12”	12”, 14”, 16”	11’ – 0”	28D883	44”	200	50	20		
8C5A – 8D5A	8”, 10”, 12” 10”, 12” 12”	8” 10” 12”	8”, 10”, 12” 10”, 12”, 14” 12”, 14”, 16”	9’ – 9” 9’ – 9” 9’ – 9”	28D882	44” 44” 44”	--- --- ---	150 150 150	60 60 60	20 20 20	160’ of 8” 200’ of 10” 250’ of 12”
10D5A	10”, 12” 12”, 14” 14”	10” 12” 14”	10”, 12”, 14” 12”, 14”, 16” 14”, 16”, 18”	11’ – 0” 11’ – 0” 11’ – 0”	28D884	44” 44” 44”	--- --- ---	150 150 150	60 60 60	20 20 20	200’ of 10” 250’ of 12” 300’ of 14”

Smith & Loveless, Inc.®
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Lenexa, Kansas 66215-1284

ENGINEERING DATA

Custom Series
Underground Pump Station
Selection Tables
June, 2012

CUSTOM SERIES
THREE PUMP STATION SELECTION CHART (REFER TO PUMP SELECTION CURVES)
4" PUMPS

(1) Nominal S& L Pump Size	(2) Pump Suction Pipe	Pump Discharge Pipe	Common Discharge Pipe	Station Shell Dia.	(3) Nominal Inside Height	Minimum Entrance Tube Dia.	(4) Maximum Motor Size			(5) Station Friction Loss
							1800 RPM	1200 RPM	900 RPM	
4B2 – 4B2A – 4B2Y	4"	4"	4", 6", or 8"	9' – 9"	See DWG. 28D1046 or 28B735	36"	30	10	5	75' of 4"
4B3 – 4C3	4"	4"	4", 6", or 8"	9' – 9"		36"	50	15	7 ½	75' of 4"
4B4A – 4D4A	4"	4"	4", 6", or 8"	10' – 6"		36"	75	30	15	75' of 4"
4B2 – 4B2A – 4B2Y	6"	6"	6", 8", 10"	9' – 9"		36"	30	10	5	115' of 6"
4B3 – 4C3	6"	6"	6", 8", 10"	9' – 9"		36"	50	15	7 ½	115' of 6"
4B4A – 4D4A	6"	6"	6", 8", 10"	10' – 6"		36"	75	30	15	115' of 6"
4B2 – 4B2A – 4B2Y	8"	8"	8", 10", 12"	9' – 9"		36"	30	10	5	150' of 8"
4B3 – 4C3	8"	8"	8", 10", 12"	9' – 9"		36"	50	15	7 ½	150' of 8"
4B4A – 4D4A	8"	8"	8", 10", 12"	10' – 6"		36"	75	30	15	150' of 8"

6" PUMPS

6B3(A) (Y) - 6D3(A) (Y)	6"	6"	6", 8", or 10"	10' – 6"	See DWG. 28B735	36"	60	20	7 ½	115' of 6"
6B3(A) (Y) – 6D3(A) (Y)	8"	8"	8", 10" or 12"	10' – 6"		36"	60	20	7 ½	150' of 8"
6B3(A) (Y)– 6D3(A) (Y)	10"	10"	10", 12", or 14"	10' – 6"		36"	60	20	7 1/2	190' of 10"

1. For correct shaft designation, refer to Pump Motor Data found in the Non-Clog Pumps Section.
2. For maximum and minimum piping velocities, consult factory.
3. The clear height inside the station from floor to ceiling.
4. For motor sizes greater than shown – consult factory.
5. Equivalent length of straight pipe which will give the same friction loss, based on Williams & Haze Formula, C = 120.
   CAUTION: Station Friction Loss is determined by using the capacity in GPM from one pump only and not from two pumps operating in parallel. Refer to Friction Table – General Information Section.

NOTE: Typical Information Only. Reference Drawings 28D1046 and 28B735 for complete details of current station designs.

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Lenexa, Kansas 66215-1284

ENGINEERING DATA

Smith & Loveless, Inc.®
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Lenexa, Kansas 66215-1284

PIPING VELOCITY

The following tables give maximum allowable and recommended maximum velocities applicable to Smith & Loveless, Inc. underground flooded suction centrifugal pump stations. Note that in most cases these velocities are considerably greater than the 2-1/2 to 6-1/2 feet per second used for economical force main selection, but are very appropriate for pump station design.

Recommended maximum velocities – these should be used when laying out the Smith & Loveless, Inc. underground pump station and are considered good engineering practice.

Maximum allowable velocities – these velocities should not be exceeded without consulting the factory.

TABLE I

RECOMMENDED MAXIMUM VELOCITIES FOR FLOODED-SUCTION PUMP STATIONS

Suction Gate Valves	Maximum Velocities	Maximum GPM	Discharge Gate Valve	Maximum Velocities	Maximum GPM
4”	7.02 fps	275	4”	7.02 fps	275
6”	7.94 fps	700	6”	7.94 fps	700
8”	8.94 fps	1400	8”	8.94 fps	1400
10”	8.99 fps	2200	10”	8.99 fps	2200
12”	9.65 fps	3400	12”	9.65 fps	3400
14”	10.00 fps	4800	14”	10.00 fps	4800
16”	10.37 fps	6500	16”	10.37 fps	6500
18”	10.72 fps	8500	18”	10.72 fps	8500

TABLE II

MAXIMUM ALLOWABLE VELOCITIES FOR FLOODED-SUCTION PUMP STATIONS

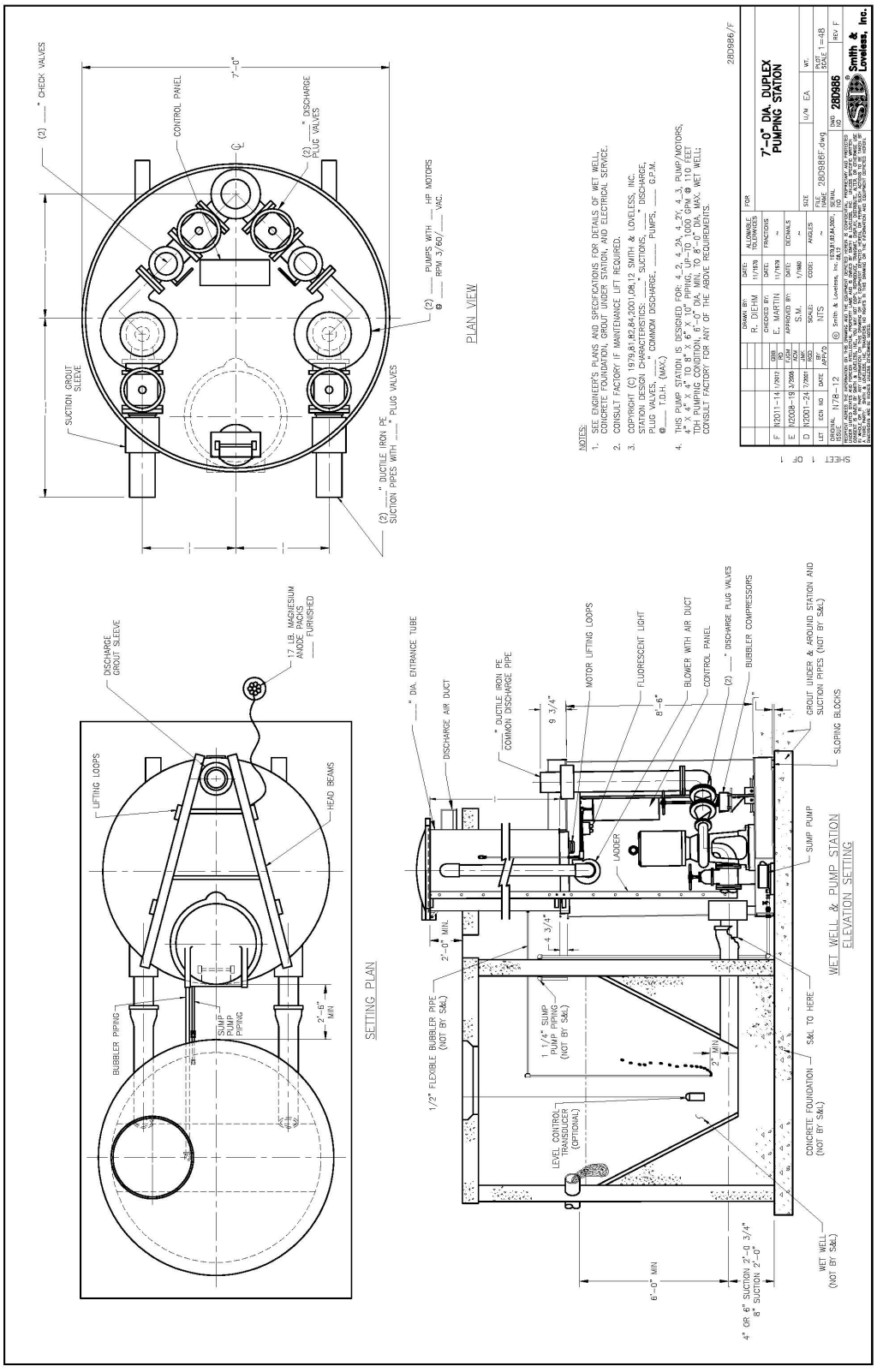
Suction Gate Valves	Maximum Velocities	Maximum GPM	Discharge Gate Valve	Maximum Velocities	Maximum GPM
4”	7.02 fps	275	4”	7.66 fps	300
6”	7.94 fps	700	6”	8.51 fps	750
8”	8.94 fps	1400	8”	9.57 fps	1500
10”	10.21 fps	2500	10”	10.62 fps	2600
12”	10.64 fps	3750	12”	11.35 fps	4000
14”	12.09 fps	5800	14”	12.51 fps	6000
16”	12.77 fps	8000	16”	12.77 fps	8000
18”	12.61 fps	10000	18”	12.61 fps	10000

ENGINEERING DATA

Custom Series Pump Station
Outline Drawing 28D986
7'-0" Diameter
June, 2012

Smith &
Loveless, Inc.®

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

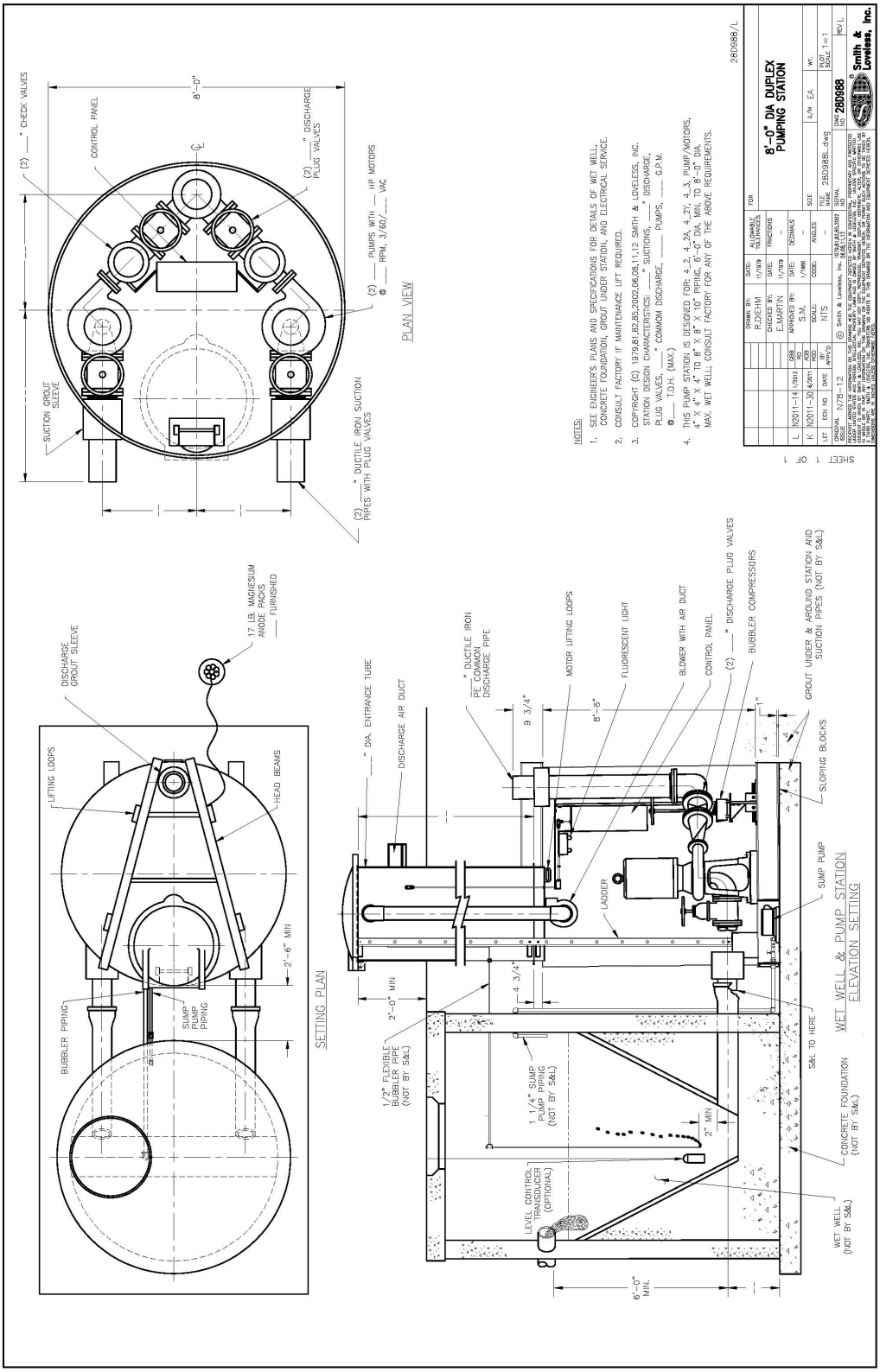


ENGINEERING DATA

Smith &
Loveless, Inc.®

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

Custom Series Pump Station
Outline Drawing 28D988
8'-0" Diameter
June, 2012

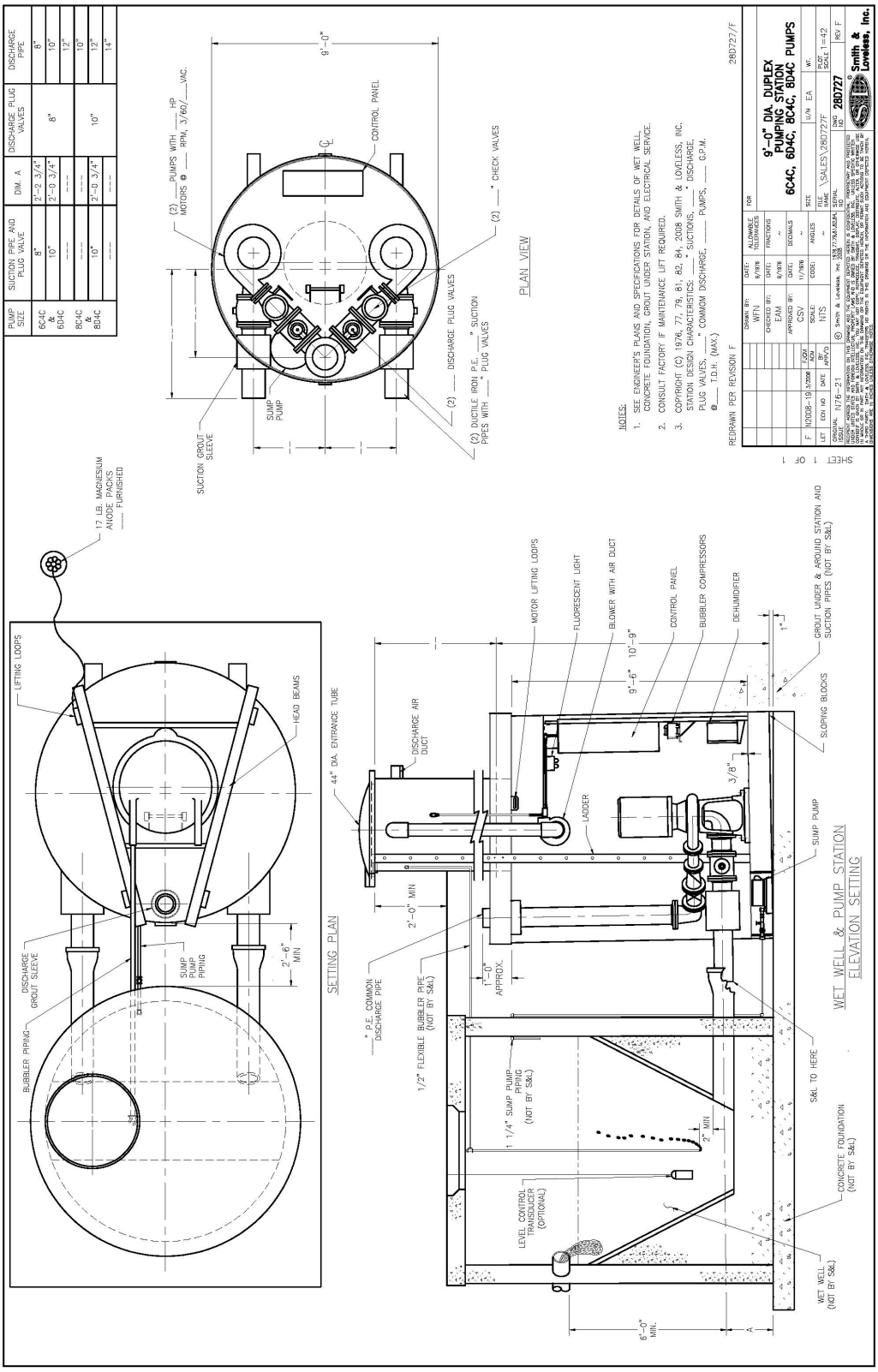


ENGINEERING DATA

Smith & Loveless, Inc.®

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

Custom Series Pump Station
Outline Drawing 28D727
10'-0" Diameter
6C4C / 6D4C / 8C4C / 8D4C
June, 2012

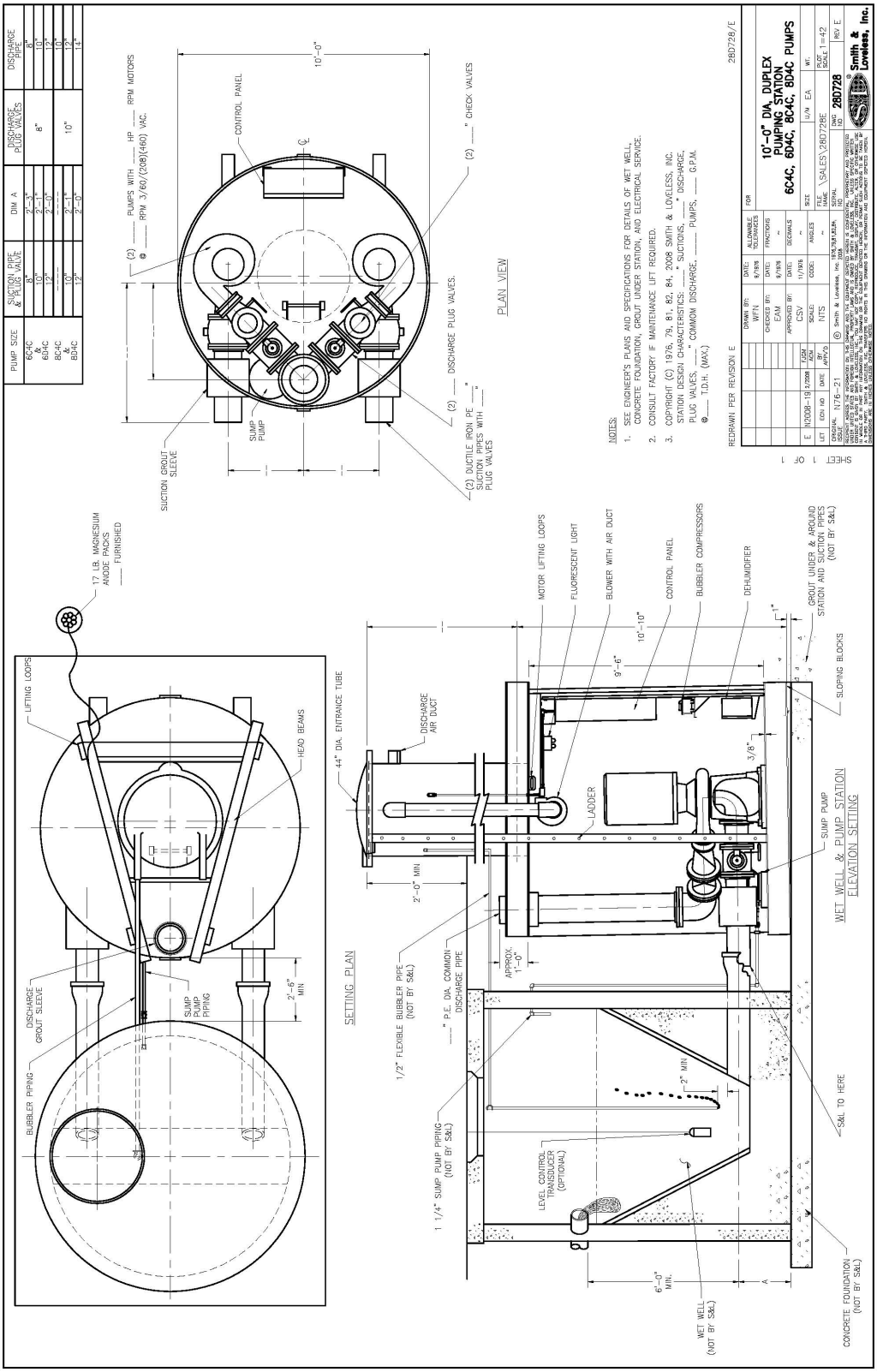


ENGINEERING DATA

Smith & Loveless, Inc.®

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

Custom Series Pump Station
Outline Drawing 28D728
10'-0" Diameter
6C4C / 6D4C / 8C4C / 8D4C
June, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®

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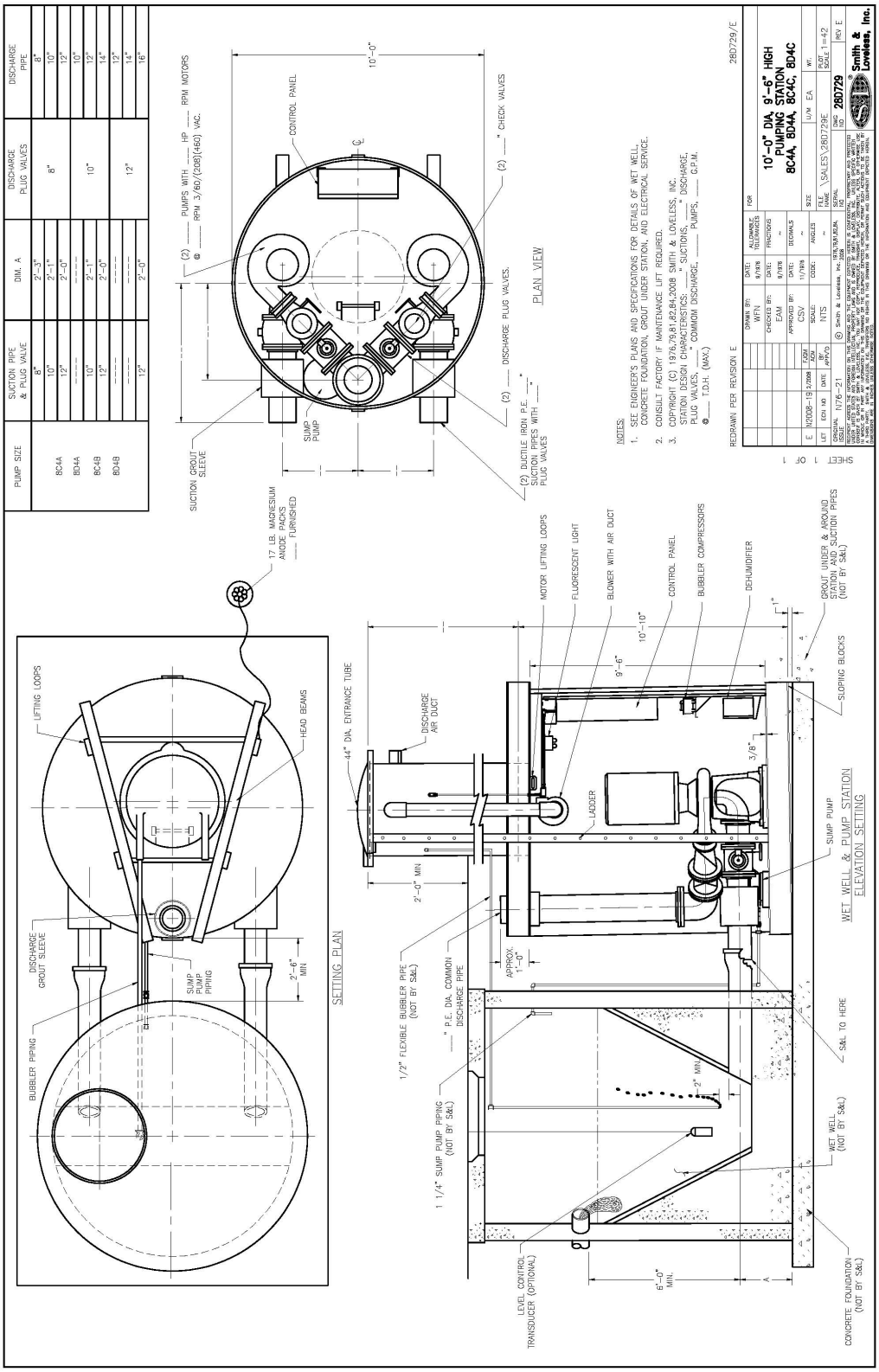
Lenexa, Kansas 66215-1284

Custom Series Pump Station
Outline Drawing 28D729
10'-0" Diameter 9'-6" High
8C4A / 8D4A / 8C4C / 8D4C
June, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®

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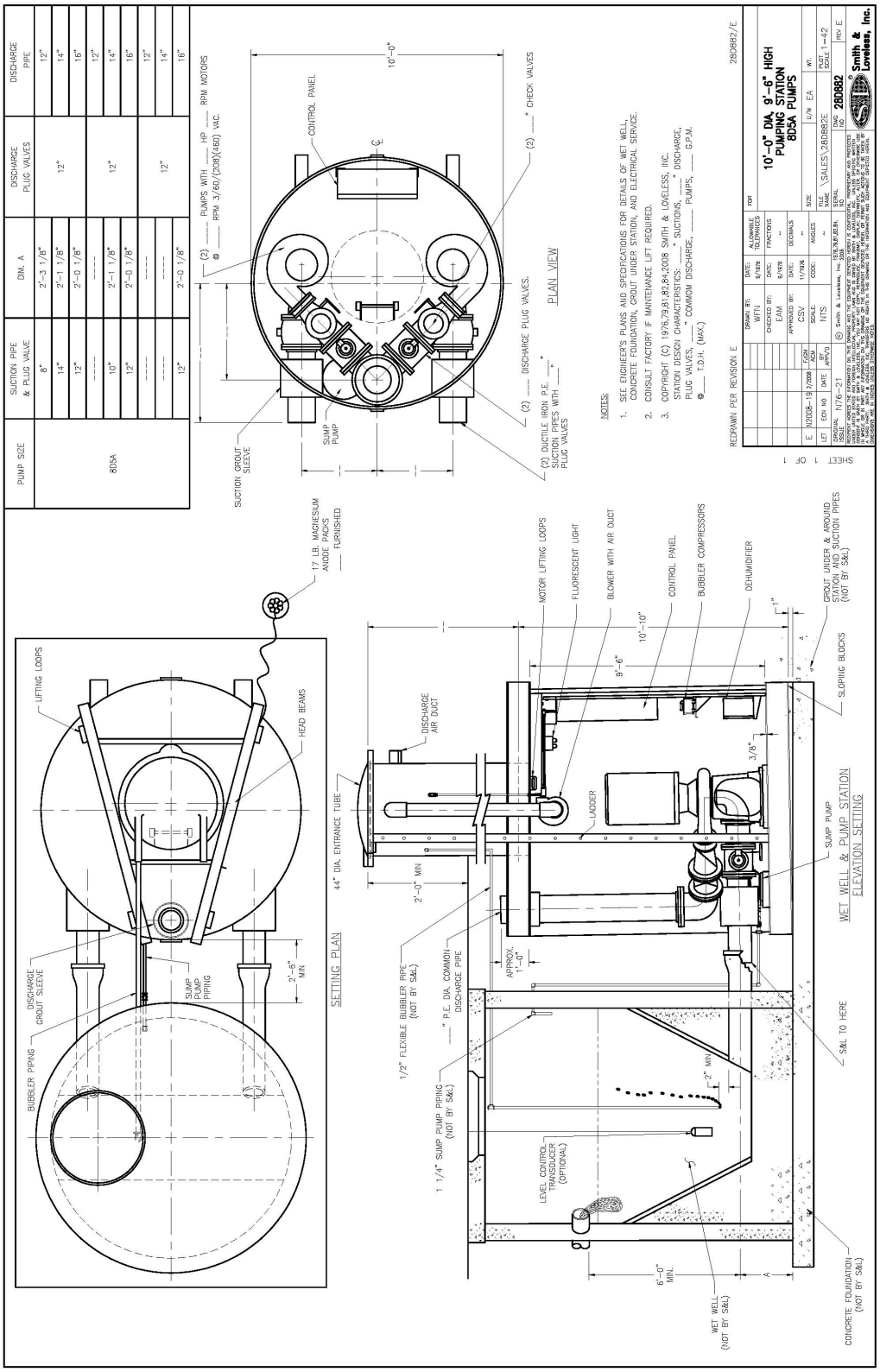
Lenexa, Kansas 66215-1284

Custom Series Pump Station
Outline Drawing 28D882
10'-0" Diameter 9'-6" High
8D5A
June, 2012



PUMP SIZE	SUCTION PIPE & PLUG VALVE	DIM. A	DISCHARGE PLUG VALVES	DISCHARGE PIPE
8D5A	8"	2'-3 1/8"	12"	12"
	14"	2'-1 1/8"		14"
	12"	2'-0 1/8"		16"
	-----	-----	12"	12"
	10"	2'-1 1/8"		14"
	12"	2'-0 1/8"		16"
	-----	-----	12"	12"
	-----	-----		14"
	12"	2'-0 1/8"		16"

ENGINEERING DATA

Smith &
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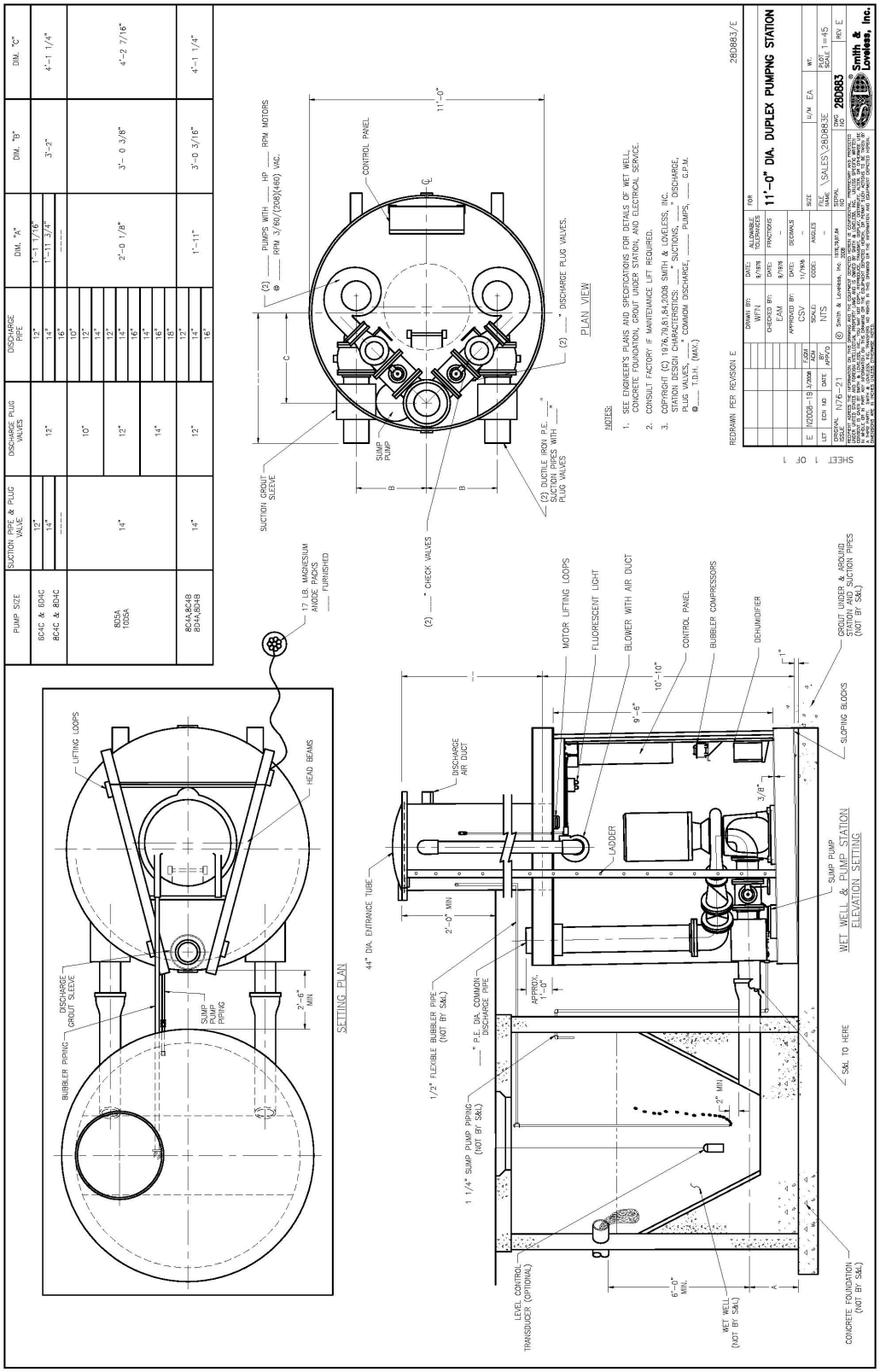
Custom Series Pump Station
Outline Drawing 28D883
11'-0" Diameter
June, 2012



ENGINEERING DATA

Smith &
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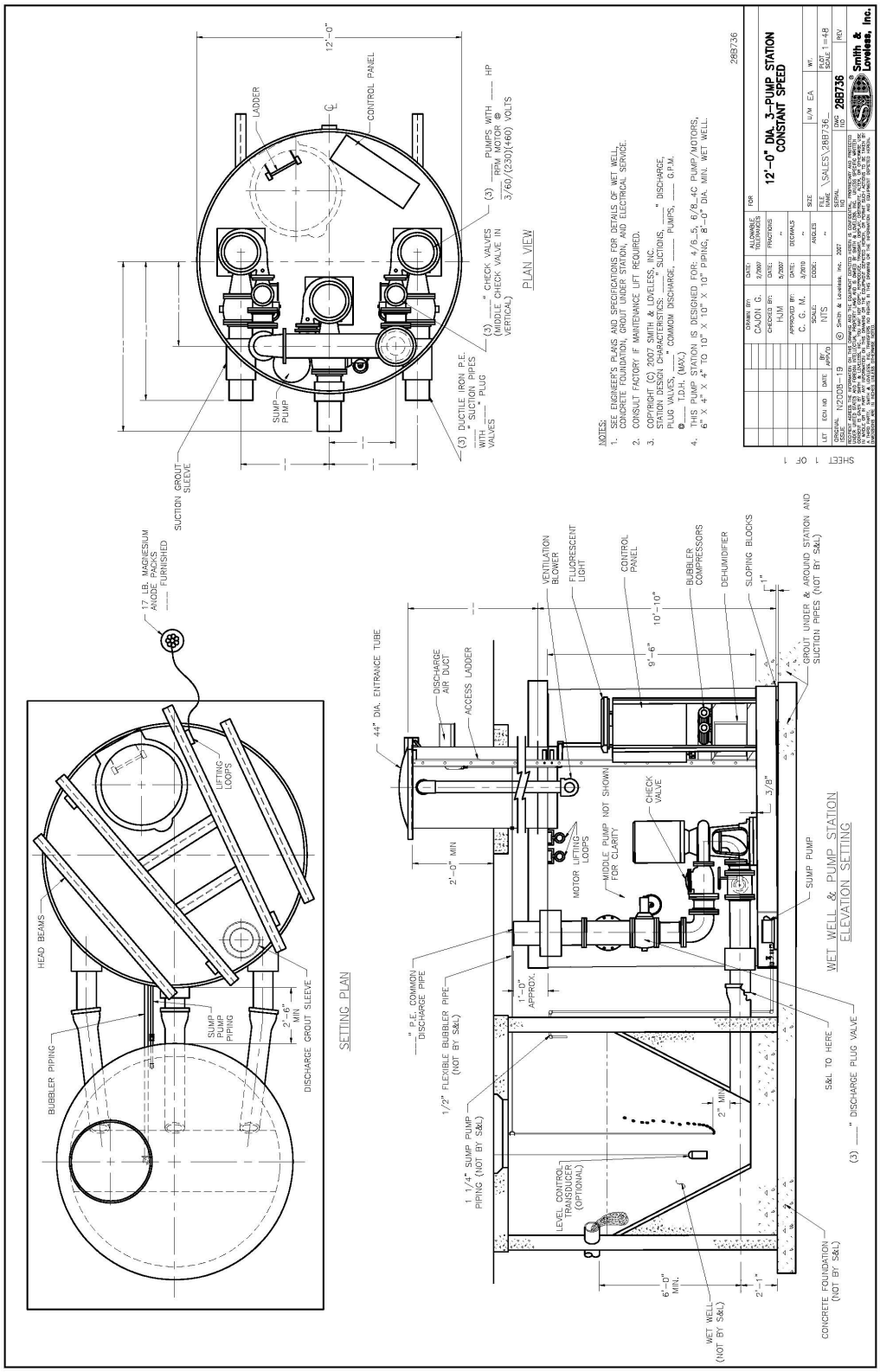
Custom Series Pump Station
Outline Drawing 28B736
12'-0" Diameter 3-Pump
Constant Speed
June, 2012



ENGINEERING DATA

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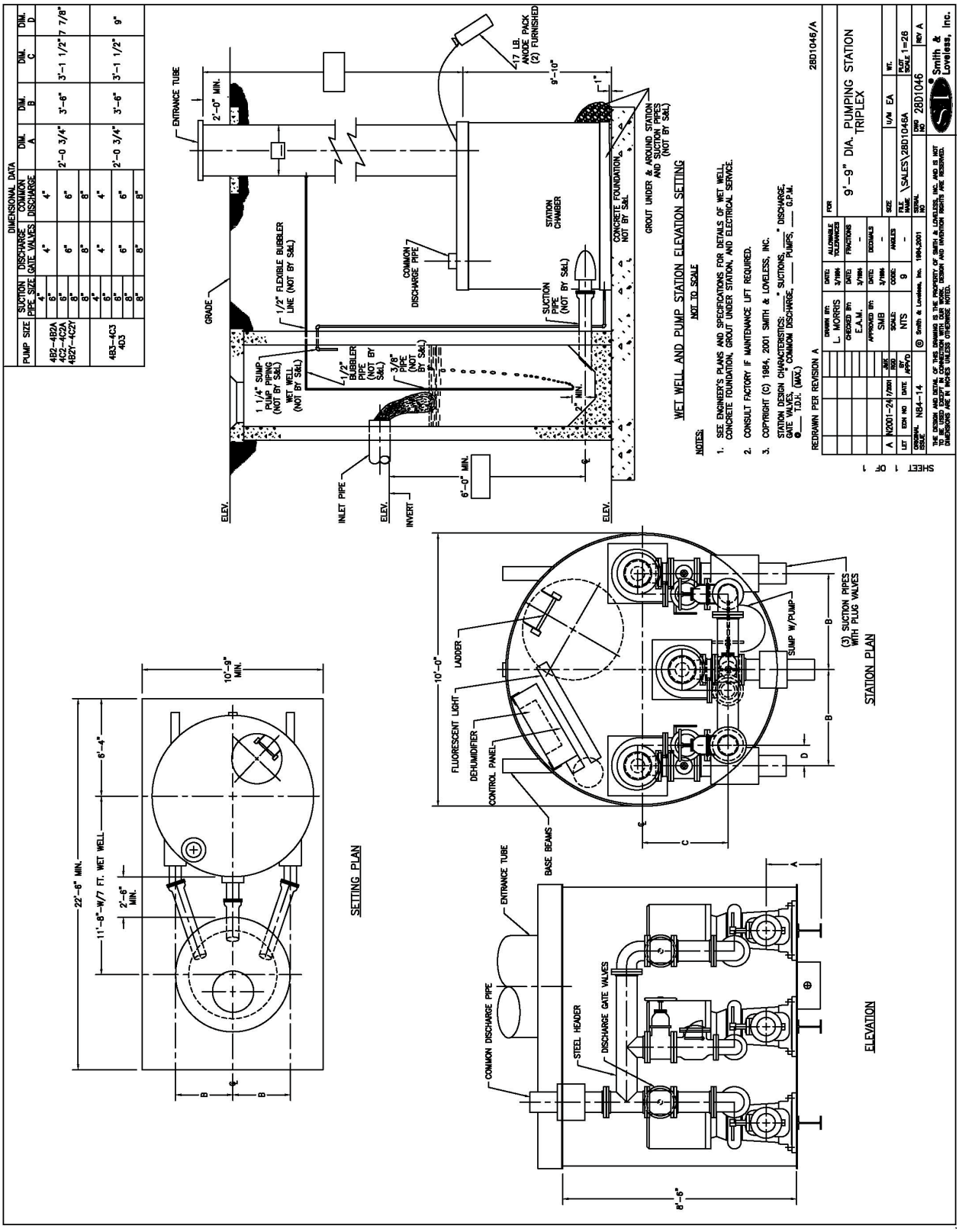
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Custom Series Pump Station
Outline Drawing 28D1046
9'-9" Diameter
June 2012

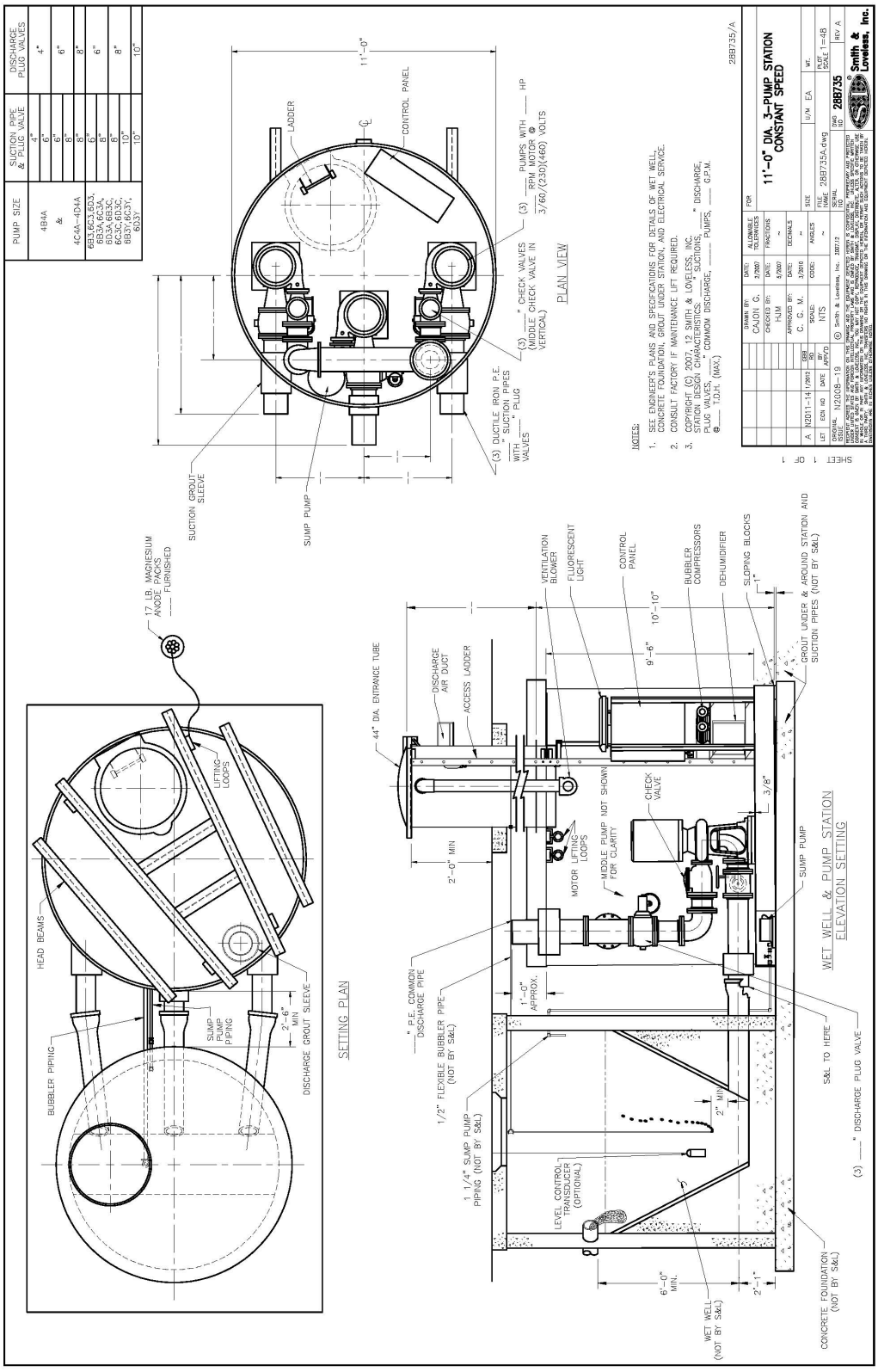


ENGINEERING DATA

Smith & Loveless, Inc.®

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

Custom Series Pump Station
Outline Drawing 28B735
11'-0" Diameter 3-Pump
Constant Speed
June, 2012



TYPICAL INSTALLATION INSTRUCTIONS
FACTORY-BUILT NON-CLOG PUMPING STATIONS

Your Smith & Loveless, Inc. pump station is a complete factory-built unit, including all equipment ready to operate. It has been thoroughly tested at the factory by actual operation on our test floor. Every item of mechanical and electrical equipment has been operated and found free of defects.

Minimum installation expense can be realized by reading carefully these installation instructions before performing any work. Installation of a Smith & Loveless, Inc. pump station is very simple. However, it is highly important that this station be installed properly, because certain errors that could be made can be corrected only at a very considerable, almost prohibitive expense.

ELECTRICAL POWER

Lack of electrical services can create long delays in completing an installation. Therefore, it is advisable to notify the electrical contractor and/or the local Power Company well in advance of the actual installation, of the requirements for the electrical service.

ELECTRICAL SERVICE REQUIREMENTS

The station requires a power supply for the pumps and a **120-volt AC single-phase, 60-cycle supply at 40 amperes** for lights, controls, and auxiliaries.

A weatherproof fused disconnect switch must be provided for the pump power service and a separate weatherproof fused disconnect switch for the single-phase service except where 3-phase, 4-wire, 120-volt phase to ground service is provided, or the station is supplied with a single-phase transformer for the auxiliary supply.

Where a single-phase transformer or 1-phase leg of a 3-phase, 4-wire service is used for the auxiliary single-phase potential, the fuse and wire size of that phase leg should be checked and increased to compensate for the auxiliary load, if necessary.

SYSTEM GROUND

The system must be ground at the service entrance switch in accordance with the National Electrical Code and/or any local codes, and a suitable ground conductor carried to the ground connect in the pump station control panel.

A conduit or direct buried cable installed in accordance with the National Electrical Code and/or local codes must be supplied from the disconnect switch, or switches, to the connection on the station entrance tube. Wire of adequate size and insulation must be supplied from the fused disconnect switch to solderless connectors in the control panel.

The following table is provided to assist you in selecting the proper switch, fuse, conduit and wire sizes for the electrical service to the station. Selections should be verified by the local regulatory authority before installation of the station.

ELECTRICAL SERVICE DATA
STANDARD CUSTOM SERIES PUMP STATIONS

TWO-PUMP STATIONS				THREE-PUMP STATIONS			
MAIN PUMP MOTOR SIZE RATED HP (EACH)	TOTAL STATION FULL LOAD AMPS 208-VOLT	230-VOLT	460-VOLT	MAIN PUMP MOTOR SIZE RATED HP (EACH)	TOTAL STATION FULL LOAD AMPS 208-VOLT	230-VOLT	460-VOLT
1	24	21	11	1	38	33	17
1-1/2	28	24	12	1-1/2	44	38	20
2	32	28	14	2	50	44	22
3	39	34	17	3	60	53	27
5	53	47	24	5	80	71	36
7-1/2	70	62	31	7-1/2	104	93	47
10	85	75	38	10	125	112	57
15	119	107	54	15	175	158	80
20	149	134	67	20	219	197	99
25	174	165	83	25	269	242	122
30	213	192	96	30	311	287	141
40	---	---	123	40	---	---	180
50	---	---	153	50	---	---	223

NOTE: *Refer to the Smith & Loveless, Inc. Engineering Order for size of electrical conduit connections at the pump station.*

EXCAVATION AND CONCRETE PAD

Excavation should be made in accordance with the plans, using methods suitable for the local ground conditions.

Pour the concrete pad on undisturbed earth as shown on the plans and rough-finish the surface true and level.

WET WELL OR RECEIVING MANHOLE

Before installing the pump station, construct the wet well as shown on the plans. If a block or brick wet well is specified, it is generally easier to locate and knock out the openings for the various pipes after the station is in position.

SETTING PUMP STATION

Depending upon the contractual terms, your Smith & Loveless, Inc. pump station normally is delivered to the job site by truck. You must furnish a crane for unloading. See table below for maximum weight of main chamber. For your convenience, lifting "eyes" are provided on top of the station and on the separate entrance tube. When ready, you can use the same crane to install the station.

Station Diameter	Max. Weight Chamber
7'-0"	12,000 lbs.
8'-0"	14,000 lbs.
9'-9"	22,000 lbs.
10'-6"	24,000 lbs.

Refer to factory order for weight of stations larger than 10'-6" in diameter.

Lower the pump station to the slab and set according to the plans. The station is furnished with one-inch elevating blocks welded to the bottom of the base beams. The elevating blocks are to insure that any water accumulation on the station floor will drain to the sump.

CAUTION: *As shipped from the factory, all main valves in the station are closed. Flanged piping may loosen during shipment. Check inside of station for leaks while filling wet well and force main.*

Suction lines through the pump station wall terminate in Class 150 plain end cast-iron or steel pipe outside the station wall. Be sure to remove the closure installed on the suction lines to protect the station during shipment. You must furnish plain end to mechanical joint Class 150 cast-iron pipe, or flexible-coupled steel pipe, of size and length as shown on the plans for the exterior suction lines. Slip these pipes through the holes in the wet well wall and clamp then to the suction pipes on the station. These should be reasonably level. Close the openings in the wet well with cement mortar containing "Embeco."

Special gaskets are provided to adapt the plain end steel pipe from the station to Class 150 mechanical joint cast-iron pipe from the wet well.

Fill up the bottom of the wet well with concrete to the invert of the two suction lines. After this concrete has set, make a hopper bottom by stacking rubble with a sloping surface as shown on the plans. Fill and cover the rubble with mortar to make a smooth surface on which solids will not cling.

The main discharge line from the pump station terminates in a Class 150 plain end cast-iron or steel pipe outside the pump chamber. When terminated in plain end steel pipe, special gaskets are provided to adapt the plain end steel pipe to Class 150 mechanical joint cast-iron pipe. This connection is usually on top of the unit, but may be on the side. **Be sure to remove the closure installed on the discharge line at the factory for protection during shipment.** You must furnish the discharge force main from this point. **Be sure that proper bedding is provided for the force main and that settlement of the backfill cannot cause pipe breakage or stress on the pump station discharge line.**

Be sure to provide anchorage at all elbows in the force main since the discharge pressure of the pump will tend to separate an elbow from the adjacent pipe. This can be done at the station by tying the elbow to the loops provided near the discharge pipe or to the holes provided in the roof beams of flat-head stations. Adequate tie rods must be used. A concrete block should be provided at the edge of the excavation on firm, original soil and the force main elbow tied to this block also. Failure to do this can result in rupture of the force main and require re-excavation for repair.

You must furnish and install 1-1/4" galvanized pipe for the sump pump line from the coupling welded in the wall of the sump to the wet well. This pipe should run horizontally to the wet well wall, at the same level as it leaves the sump. Concrete block or brick blocking should be placed under this line to support it during backfilling. The line should then run vertically along the wall of the wet well to about 6" below the normal

maximum depth of frost in your area. The line should be anchored adequately to the side of the wet well so that it may not be forced down if the backfill earth should settle. The line is run up the side of the wet well to just below frost line to prevent liquid backing up through the line to the sump pump. We have provided two check valves inside the station for added protection against flooding.

WELDING

The entrance tube should be lifted by the lugs near the top and positioned on the supporting flange on the pump chamber. Make certain the ladder in the two sections is properly aligned.

The neoprene joint sleeves must be on the ladder before assembly. After the ladder is aligned, pull the sleeves over the joint. The mating flanges outside the tube must be joined with a continuous watertight weld. An inside weld is not required. Wire brush and touch up the weld with **VERSAPOX®** before backfilling.

ANCHORING THE PUMP STATION

To secure the station, pour concrete on top of the slab and force it beneath the pump station and between the base beams to completely fill the void. The void under the station floor must be completely filled to prevent pump vibration. Fill out to the ends of the I-beams and level the material. This concrete forms both a dead weight and a flange on which the backfill is piled to protect the station against uplift. In saturated soil, it may be desirable to place reinforcing rods projecting up from the base slab alongside the I-beams which form the pump station base. Bend the rods over the I-beams before pouring the concrete anchorage. Do not cover the sump pump coupling with concrete before installing the sump pump discharge line to the wet well.

In backfilling around the bottom of the station with concrete, it is desirable that sufficient concrete be placed between the station and the wet well so that the sump pump line is completely encased in concrete and so that the suction lines are at least supported by concrete. This will eliminate any damage to any of these lines by earth settlement.

Since local conditions and ground water affect the amount of concrete required to prevent flotation of the station, this must be determined by the contractor or engineer.

ELECTRICAL WORK

Install the 1/2" thin wall conduit (provided with station) from the manual switch located at the top of the entrance tube to the 1/2" LB fitting at the top of the station in the entrance tube area. Provide and connect the wiring to the manual switch located at the top of the entrance tube and to the proper terminals in the control panel located in the station, in accordance with the National Electrical Code and/or any local codes.

CORROSION PROTECTION

Every Smith & Loveless, Inc. pump station is finish painted, inside and out. However, before backfilling, it is important to paint over all field welds, steel pipe, conduit and all nicks and scratches on the outside with Smith & Loveless, Inc. **VERSAPOX®**. A container of this material is shipped inside of the pump chamber. Instructions for its use are in the maintenance manual.

Two or more magnesium anodes are shipped inside the pump station. These have long insulated copper leads connected to magnesium blocks inside the packs. Cut the insulation off the first 1" of each lead. Clamp one wire in the solderless connector provided. Connectors are located at the top of the station, either on the ends of the main reinforcing members or on the lifting loops. One anode should be place on each side of the chamber in the back fill as far out as possible. Coat the solderless connectors heavily with Smith & Loveless, Inc. **VERSAPOX®**.

CAUTION: *The above paragraph does not apply when special cathodic protection is specified. See special instructions inside the pump station for anodes requiring wire connections to be made to test boxes within or near the pump chamber.*

BUBBLER LINE

You must furnish and install a flexible bubbler line from the coupling welded in the entrance tube to the wet well. This line should be Boston Perfection 300 hose or equal with 1/2 NPT male fitting on the entrance tube end. The other end should be as required to fit the 3/4" pipe in the wet well. The bubbler line should be at least 2 feet longer than the distance between the entrance tube and wet well. When installing the flexible bubbler hose, it must slope continuously toward the wet well to allow condensation to drain into the wet well. Use a thread compound to insure that the bubbler line is airtight.

Inside the wet well use a 1/2" x 3/8" x 1/2" tee and extend a 3/8" pipe straight down terminating 6" above the top of the suction lines. The 1/2" run of the tee pointing upward must be plugged. This is required so the bubbler line can be rodded out if it plugs.

IMPORTANT: The air bubbler line and the sump pump lines must be tight. All joints should be thoroughly sealed with suitable thread compound. After installation, and before backfill, both of these lines should be checked to insure their tightness.

BACKFILLING

CAUTION: *Do not backfill the station without entering the pump chamber and checking for possible special installation instructions.*

Backfill must be done with great care to avoid damaging the magnesium anodes and wiring, as well as the piping and conduit. The backfill should be of sand or carefully compacted earth to prevent settlement, which may result in pipe breakage.

The sump pump lines and suction lines should be installed before any backfilling is done. Backfilling may be completed to an elevation near the top of the station before installing the air bubbler line, entrance tube or force main, to provide a work surface for doing these operations. Be sure to touch up the station with **VERSAPOX®** before backfilling.

Upon completion of the final backfilling and leveling, it is recommended that the raw earth area be seeded with a good grass blend, favorable to the local area, to prevent soil erosion.
It is also recommended that a crushed stone walkway be installed around the station entrance and an access walk to the nearest roadway be provided to help maintain cleanliness in the station during inclement weather.

FINAL CHECK OF STATION

Before leaving the station, the following procedures should be followed:

1. Check operation of entrance cover and lock mechanism.
2. Have an electrician place the dehumidifier, blower fan, and sump pump in operation as outlined in the instructions for Initial Start-Up in the maintenance manual.

   If electrical service has not been provided to the station at this time, have an electrician provide a temporary connection for these three items (approximately 15 amperes at 115 VAC) from the nearest source of electrical supply.

   It has been found that where a station sits without the function of these items, harmful corrosion may occur to the electrical components within the control panel from condensation and/or the station may become flooded through accidentally opened valves if the sump pump is unable to remove infiltration water.

3. Leave these instructions in the station at completion of the job.

4. Notify the Smith & Loveless, Inc. representative when the station is ready for startup.

   The Smith & Loveless, Inc. warranty is contingent upon start-up of the pump station by Smith & Loveless, Inc. authorized personnel, and the guarantee will be voided if start-up is performed by anyone else.