DUO-DUCT® UNDERGROUND NON-CLOG PUMP STATION SECTION INDEX

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DUO-DUCT® NON-CLOG PUMP STATIONS

INTRODUCTION

In the fifty plus years since Smith & Loveless, Inc. pioneered the factory-built steel underground pumping station, many innovations have evolved through research that are now considered the standard of the industry. In the very early stage of development, it was recognized that in order to be the leader it was necessary to offer a quality product superior in every way to job site constructed stations and later, to competitive factory built units. This lead to the development of the Smith & Loveless, Inc. pump and our pioneering the use of a mechanical seal in this type of pump. The Smith & Loveless, Inc. pump is now clearly recognized as the best pump of its type on the market.

Throughout the life of the Company, Smith & Loveless, Inc. has introduced numerous design improvements that are now accepted as the standard of the industry. Some of the first for Smith & Loveless, Inc. included the largest factory-built lift station in the world. Our current **CAPSULAR®** and **MODU-PLEX®** multi-cell designs evolved from basic rectangular and elliptical configurations. We provided more economical arrangements through development of reliable vacuum-primed pumps, and the wet well mounted and recessed piping arrangements were developed for small flows. Later, the **CAPSULAR®** design evolved for larger flows. We were the first to introduce steel piping to prevent cracking and grout leakage.

It is our intention to remain the leader in this field and the **DUO-DUCT®** station described in the Notes on Design is the natural progression representing the higher technology of the present day.

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FEATURES

1. Smith & Loveless Non-Clog Pump and Single Mechanical Seal.
2. Integral **DUO-DUCT®** Base Beam Suctions.
3. Static/Dynamic Pump Control.
4. Smith & Loveless Check Valves.
5. Optional Maintenance Lift.
6. Optional Oversized Shell.

BENEFITS

1. Smith & Loveless Non-Clog Pump and Single Mechanical Seal

a. **Oversized Shaft** – The oversized shaft minimizes shaft deflection, thus extending mechanical seal and bearing life.

b. **Solid Stainless Steel Shaft** – Having a stainless steel shaft through the mechanical seal eliminates abrasive rust particles that can shorten seal life, as well as eliminating corrosion that can weaken the shaft.

c. **Oversized Bearings** – Because of the oversized shaft, oversized bearings can be applied. Bearings in the Smith & Loveless, Inc. pumps typically have a design bearing life of 30 years.

d. **Close Impeller/Front Head Tolerance** – To prevent re-circulation of the pumped liquid, minimum clearance between impeller and front head must be maintained. The Smith & Loveless, Inc. pump has a tight 0.015" clearance.

e. **Bottom Thrust Bearings** – The locked thrust bearing located at the bottom of the shaft prevents shaft expansion affecting clearances through the wet end of the pump – eliminating the need for shims to maintain minimum clearance between impeller and front head.

f. **Shaft Movement** – Shaft endplay is limited to bearing shake. Shaft runout is limited to 0.003". These close tolerances are, in all cases, tighter than NEMA specifications, and significantly increase both pump efficiency and mechanical seal life.

g. **Minimum Shaft Overhang** – Minimizing the canti-levered portion of the shaft reduces pump height and provides the rigid construction necessary to prevent vibration and deflection from reducing seal life. Measurement from the lower bearing to the top of the impeller hub is less than 6" on all Smith & Loveless, Inc. pumps.

h. **Bronze Seal Housing** – The heavy bronze seal housing provides the best heat dissipation, as well as preventing the formation of abrasive rust particles in the seal.

i. **Seal Cooling and Lubrication** – The Smith & Loveless, Inc. pump, with single mechanical seal, is lubricated and cooled directly from the liquid pumped. Proven in over 10,000 installations, the single mechanical seal has successfully eliminated filtering systems and potential dry seal operation.

j. **Easy Maintenance** – Full access to the pump is possible by merely removing eight capscrews and raising the entire rotating assembly. This design eliminates the necessity for cleanout ports. Hand cleanouts are normally not large enough to remove most objects that would clog a pump and, in addition, can cause raw sewage spillage or station flooding.

k. **Impellers Trimmed Inside Shrouds** – Impellers are designed for maximum efficiency and, by trimming the impellers inside the shrouds, the Smith & Loveless, Inc. pump leaves the back shroud full diameter to prevent stringy material from winding around the shaft and leaves the front shroud full diameter to prevent re-circulation of pumped liquid.

l. **Class "F" Motor Insulation** – Although Smith & Loveless, Inc. limits motor temperature to a maximum of 80° C, all motors use Class F insulation which is suitable for a temperature of 105° C. This conservative design criterion translates directly into extended motor life.

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m. **Motor Frames and Cooling** – The vast majority of the motors used on Smith & Loveless, Inc. pumps are not the re-rated "hot frame" motors. Consequently, these motors have heavier frames and larger separate fans. The larger frame and fans more effectively cool the motor, providing extended motor insulation life.

n. **Tapered Impeller Fit** – The shaft and impeller bores are tapered, allowing easy removal of the impeller. A non-tapered shaft and impeller requires a wheel puller for removal, often resulting in broken impeller shrouds.

o. **One Piece Back Head/Motor Adapter** – The one piece back head and motor adapter provides a more rigid construction, reduces the number of registered fits required, and minimizes the possibility of unbalancing the motor rotor in relation to the impeller and mechanical seal. By reducing the amount of vibration, the seal and bearing life are increased.

p. **Minimum Height** – A minimum height pump provides a compact design that reduces vibration, extending seal and bearing life, and provides more free floor area for maintenance than horizontal pump alternatives.

2. Integral DUO-DUCT® Base Beam Suctions

In addition to serving as conduits to the wet well, the Smith & Loveless, Inc. **DUO-DUCT®** suctions are designed to reinforce the station, prevent piping strains, and eliminate this potential source of resonant frequency vibration. Suction lines are shipped as an integral part of the station. This eliminates the necessity for suction connections immediately outside the station and potential damage to these connections during backfilling. The section modulus for the steel suction tubes is designed for the structural support of the lift station and, consequently, cracking as experienced with past cast iron designs due to earth settling has been eliminated.

There has always been a problem associated with the fact that the suction lines laying across the floor of the machinery chamber required the operator to climb over this piping. Valuable floor space was greatly reduced with past designs. The under-the-baseplate concept incorporated in the **DUO-DUCT®** design provides more free floor space for maintenance than any design on the market to date. Further, grout sleeves and subsequent leaking has been totally eliminated.

Integral base beam suctions generally provide for the lift station and wet well being closer together. This reduces the slab requirement and minimized potential separation due to earth settling. Inherent in the design is the optimum angle for wet well penetration near the center in order to prevent vortexing. Neglecting buoyancy requirements, there is also less concrete required in the wet well due to the lower elevation of the **DUO-DUCT®** suctions. The overall excavation does not need to be as deep.

3. Static/Dynamic Pump Control

Pump control includes a pressure transducer in fluid communications with the **DUO-DUCT®** conduit extending to the wet well to sense the liquid level in the wet well. This more positive means of measuring the head in the wet well eliminates the need for bubbler compressors and installation of a bubbler line.

4. Smith & Loveless, Inc. Check Valves

Smith & Loveless, Inc. spring-loaded, clapper-type wafer check valves, with external lever arms and easily replaced resilient seats, provide far greater maintenance area in the station. These are the same high quality check valves that have been manufactured by Smith & Loveless, Inc. over the past thirty (30) years.

5. Optional Maintenance Lift

Due to the improved space utilization, a maintenance lift will be available for the 7' diameter station. Heretofore, this accessory was limited to a minimum 8' diameter station.

6. Optional Oversized Shell

Certain municipal and industrial customers have shown a preference for oversized station chambers. Consequently, we have included an 8' diameter option as part of the computer package. The customer should be made aware of the more spacious **DUO-DUCT®** station before specifying a larger shell. Of course, the usual alarm packages and other customary accessories are also available.

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SELECTION

The reliable Smith & Loveless, Inc. below ground centrifugal non-clog pump station is recommended for those flow rates equal to, or greater than, 100 GPM. For such capacities, when compared to submersible and self-priming pumps and pneumatic ejectors, you will almost always find Smith & Loveless, Inc. pumps are more efficient, require less connected horsepower, consume less electric power, and, therefore, offer the lowest cost per gallon of pumping capacity.

One should consider the applicability of the Smith & Loveless, Inc. Wet Well Mounted and Recessed Wet Well Mounted stations prior to selecting the below ground station. Wet well mounted-type stations offer lower installed cost and lower initial cost. The recessed version offers the same indoor maintenance benefits as the completely buried station.

Selection of the below ground station is basically predicated on the capacity, total dynamic head, power available, invert elevation of the influent sewer in the wet well and the elevation at grade. Once this information is available, refer to the Pump Performance Rating Curves in the Non-Clog Pump Section, to compare operating characteristics of the following Smith & Loveless, Inc. pump models presently designated for use in the **DUO-DUCT®** pump station.

4” Pumps	6” Pumps
4B2G	6B3D
4C2G	6C3D
4B2F	6D3D
4B3A	6B3E
4C3A	6C3E
4D3A	6D3E

Consult Factory for other pump sizes and **X-PELLER®** pumps.

Present and future capacity and efficiency considered, it is more economical to select the smallest pump at the highest speed to meet the design requirements.

The next step is the determination of the piping size. When the pumps and pipe sizes are known, then the most economical station size can be selected.

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

Recommended Maximum Velocities – These should be used when laying out the Smith & Loveless, Inc. lift station, and are considered good engineering practice.

Maximum Allowable Velocities – These velocities should not be exceeded without consulting the factory.

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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	1,400	8”	8.94 fps	1,400
10”	8.99 fps	2,200	10”	8.99 fps	2,200
12”	9.65 fps	3,400	12”	9.65 fps	3,400
14”	10.00 fps	4,800	14”	10.00 fps	4,800
16”	10.37 fps	6,500	16”	10.37 fps	6,500
18”	10.72 fps	8,500	18”	10.72 fps	8,500

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	1,400	8”	9.57 fps	1,500
10”	10.21 fps	2,500	10”	10.62 fps	2,600
12”	10.64 fps	3,750	12”	11.35 fps	4,000
14”	12.09 fps	5,800	14”	12.51 fps	6,000
16”	12.77 fps	8,000	16”	12.77 fps	8,000
18”	12.61 fps	10,000	18”	12.61 fps	10,000

Occasionally you may want to work with velocities in the range between Table I and table II in order to maintain station piping sizes consistent with published Smith & Loveless, Inc. station layouts. Please contact the factory if you wish for assistance.

Compatible suction tube sizes are given in the Pump Station Selection Chart found in this section.

We offer a compatible selection of common discharge sizes to accommodate hookup to the force main. These may be found on the station outline drawing. Keep in mind that the station suction piping selected must yield suitable velocities to ensure proper suction conditions for the centrifugal pumps utilized in the station. This is particularly important when stations are designed to handle future increased capacity with low initial rates of flow. Do not hesitate to contact Smith & Loveless, Inc.

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for any needed assistance.

After determination of the final pump size, pump speed motor size and station piping, refer to the **DUO-DUCT®** Section Chart. Entering this table with the nominal Smith & Loveless, Inc. pump size and the suction and discharge valve size(s) yields the remaining basic station criteria. The station friction loss is also found in this table, and may be used to confirm the total head.

Final selection should be based on the applicable station outline drawing, which will provide the required pump prime level. Again, do not hesitate to contact Smith & Loveless, Inc., if we can be of service. We stand ready to assist you with full size reproducible drawings, special designs, or whatever attention is needed to solve your municipal or industrial water or wastewater transfer or treatment problems.

Ask us about our lease or lease-purchase plans for industry and government projects.

DUO-DUCT® TWO-PUMP STATION SELECTION CHART (REFER TO PUMP SELECTION CURVES)

(1) Nominal S&L Pump Size	(2) Suction Tube Size	(3) Suction Gate Valves	(3) Discharge Gate Valves	(4) Common Discharge Outlet	(5) Nominal Shell Diameter	(6) Nominal Inside Height	(7) Minimum Entrance Tube Diameter	(8) Maximum Motor Size			(9) Station Friction Loss
								1800 RPM	1200 RPM	900 RPM	
4B2F – 4C2F	4” x 6”	4”	4”	4” or 6”	7’	8’ –6”	36”	30	10	5	75’ of 4”
4B2F – 4C2F	6” x 6”	6”	4”	6”	7’	8’ –6”	36”	30	10	5	130’ of 6”
4B2F – 4C2F	8” x 8”	6”	6”	6” or 8”	7’	8’ –6”	36”	30	10	5	115’ of 6”
4B2G – 4C2G	4” x 6”	4”	4”	4” or 6”	7’	8’ –6”	36”	30	10	5	75’ of 4”
4B2G – 4C2G	6” x 6”	6”	4”	6”	7’	8’ –6”	36”	30	10	5	130’ of 6”
4B2G – 4C2G	8” x 8”	6”	6”	6” or 8”	7’	8’ –6”	36”	30	10	5	115’ of 6”
4B3A – 4D3A	4” x 6”	4”	4”	4” or 6”	7’	8’ –6”	36”	50	15	7-1/2	75’ of 4”
4B3A – 4D3A	6” x 6”	6”	4”	6”	7’	8’ –6”	36”	50	15	7-1/2	130’ of 6”
4B3A – 4D3A	8” x 8”	6”	6”	6” or 8”	7’	8’ –6”	36”	50	15	7-1/2	115’ of 6”
6B3D – 6D3D	8” x 8”	6”	6”	6” or 8”	7’	8’ –6”	36”	60	20	7-1/2	115’ of 6”
6B3E – 6D3E	8” x 8”	6”	6”	6” or 8”	7’	8’ –6”	36”	60	20	7-1/2	115’ of 6”

NOTES:

(1) For correct shaft designation, refer to Pump Motor Data found in the Non-Clog Pumps Section.
(2) Consult factory for other sizes. Reference Outline Drawing 28D1063 found in this section.
(3) For maximum and minimum piping velocities, consult Factory. Reference guide found in this section.
(4) Force main connection. Other sizes must be accommodated exterior to the station.
(5) Inside diameter may vary slightly. Eight foot diameter available on request.
(6) The clear height inside the station from floor to ceiling.
(7) Forty-four inch (44”) minimum diameter entrance tube required when maintenance lift provided.
(8) For motor sizes greater than shown, consult Factory.
(9) Equivalent length of straight pipe which will give the same friction loss, based on Williams & Hazen formula, C = 120.

CAUTION: *Station Friction Loss is determined by using the capacity in GPM from one pump only, and not from two pumps.*

(10) Reference Drawing 28D1063 for complete details of current station design.

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SPECIFICATION
7' AND 8' DIAMETER DUO-DUCT®
UNDERGROUND PUMP STATION

GENERAL

The contractor shall furnish and install one factory-built, automatic **DUO-DUCT®** 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 solid-state pump controller; 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 ___'. 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(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 drawings.

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.

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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 diameter of the ventilation duct shall be as shown on the drawings.

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 groundwater, 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®** 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 (2) 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 contract shall thoroughly review specifications and installation instructions for special anode lead connections prior to backfilling the station.*

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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 thru 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 specification 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. Volute or suction elbow clean-outs will not be an acceptable substitute.

The seal shall be of carbon and ceramic materials with the mating surfaces lapped to a flatness tolerance of one light band. The rotating ceramic shall be held in mating position with the stationary carbon by a stainless steel spring. The entire seal assembly shall be held in place by a bronze seal housing to prevent excessive heat buildup. Use of cast-iron or other ferrous material for the seal housing, which will rust and damage the seal, shortening its life, will not be acceptable.

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

The pump shall be fitted with a heavy cast-iron suction cover drilled and tapped to receive a 125 psi American Standard cast-iron flange.

[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.

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

The pump impeller shall be of the enclosed mono-port type made of close-grained cast-iron and shall be in dynamic balance when pumping wastewater. Two port impellers are specifically disallowed. The dynamic balance shall be obtained without the use of balance weights or liquid filled chambers. The impeller shall be designed to allow for the trimming of the impeller to meet design condition changes without altering the balance. The eye of the impeller as well as the port shall be large enough to permit the passage of a sphere 3" in diameter in accordance with nationally recognized codes. To further prevent clogging, the impeller port shall have a minimum area of 10.6 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. Insulation temperature shall, however, be limited to Class B. The motors shall have normal starting torque and low starting current, as specified by NEMA Design B characteristics. They shall be open drip-proof design with forced air circulation by integral fan. Openings for ventilation shall be uniformly spaced around the motor frame. Leads shall be terminated in 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, or 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 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.

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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 steel enclosure with hinged access cover. The circuit breakers and control switches shall be operable without opening the access cover.

A GFI type convenience outlet shall be provided on the side of the cabinet for operation of 120-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.

A pressure sensor shall be provided to control the operation of the pumps with variations of liquid level in the wet well. The pressure sensor shall have a minimum opening of 1-1/2" and be designed specifically for raw water and wastewater service in order to minimize maintenance. The pressure sensor shall not be located in the wet well. A 4-20 mA pressure transducer shall be provided in a NEMA 4 enclosure, located within the pump chamber in proximity to the wet well level sensor. The connecting piping shall be filled with an incompressible fluid and provided with isolation valves to facilitate maintenance.

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Displacement "float" switches, air bubbler systems, or other less positive means of measuring the level in the wet well will not be acceptable.

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 the parallel, should the level in the wet well continue to rise above the starting level for the low level pump.

The solid-state pump controller shall incorporate a Smith & Loveless, Inc. microprocessor capable of controlling the operation of the two main pumping units. There shall be no components located in the wet well. Grease, sludge or biological growth shall not affect the accuracy or reliability.

All wet well level adjustments, including a high wet well level alarm, shall be changeable by means of an operator key pad, accessible on the front of the control panel and independent of the actual wet well level.

Continuous readouts of the wet well liquid level as well as the state of the control and alarm outputs shall be displayed on an easy-to-read back-lighted digital panel.

Systems not incorporating continuous digital wet well readout or not capable of adjustment from the front of the control panel will not be acceptable.

The solid-state control system shall be provided with the following features:

1. Wet well liquid level indication in inches of water.
2. All set points programmable from the front of the control panel.
3. All set points maintained in non-volatile memory.
4. A lock function provided to lock the set points against unwanted tampering. With this function in the ON position, the set points may be viewed by not changed.
5. Liquid level transducer signal out of range indication.
6. Plug-in printed circuit board construction for easy repair.
7. Hand-Off-Auto pump selector switch.
8. Pump alternation.
9. Auto-fixed pump alternation sequence selector switch.
10. Lag pump time delay on start.
11. Wet well level simulating.

Status Indicating Lights:

1. Pump No. 1 Run.
2. Pump No. 2 Run.
3. Lead Pump Called.
4. Lag Pump Called.
5. High Level Alarm.
6. Controller Failure Alarm.

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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 into the combination base beam suction line through double check valves and a gate valve.

Separate sump pump discharge piping subject to damage during backfilling or settling will not be acceptable.

The sump shall be located in the station on the opposite side of the wet well, such that the slope of the station and integral suction lines provide that any air entrapment bleeds back toward the wet well for added pump protection.

MAIN PIPING

Pump suction lines shall be 1/4" minimum steel tube, designed as an integral part of the station reinforcing, terminating inside the wet well to ensure an airtight conduit to the pumps. Suction lines requiring separate connections between the station and the wet well will not be acceptable. Suction line size shall be as shown on the drawings.

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 wafer-type check valve for increased station maintenance room.

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Stations with suction lines above the base of the station reducing maintenance/service area will not be acceptable.

The common discharge header shall exit through the side of the station and terminate in a plain end Schedule 40 steel pipe. A special M.J. gasket shall be provided to adapt the plain-end steel discharge pipe to a cast iron M. J. bell. The diameter of all pipe and valves shall be as shown on the drawings.

Suction and discharge lines shall not incorporate grout sleeves as a means to penetrate the station shell.

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 120-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 and dehumidifier 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. 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: *The purchasing contractor shall inspect the interior of the station chamber prior to backfilling, for special installation instructions.*

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

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STARTUP

The Manufacturer shall provide the services of a factory-trained representative for a maximum period of one (1) day 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 warrant for one (1) year from date of startup, not to exceed eighteen (18) months from date of shipment, that the structure and all equipment he provides will be free from defects in material and workmanship.

Warranties of the suppliers of various components, in lieu of a single source responsibility by the Manufacturer, will not be accepted. The Manufacturer shall assume prime responsibility for the warranty of the station and all components.

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

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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.

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 $_____.

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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		
Solid state level controller		
Digital wet well level readout		
Keypad for wet well level adjustment		
Level transducer inside station		
No level control components (including floats or bubbler tube) in wet well		
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

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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		
Solid state level controller		
Digital wet well level readout		
Keypad for wet well level adjustment		
Level transducer inside station		
No level control components (including floats or bubbler tube) in wet well		
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

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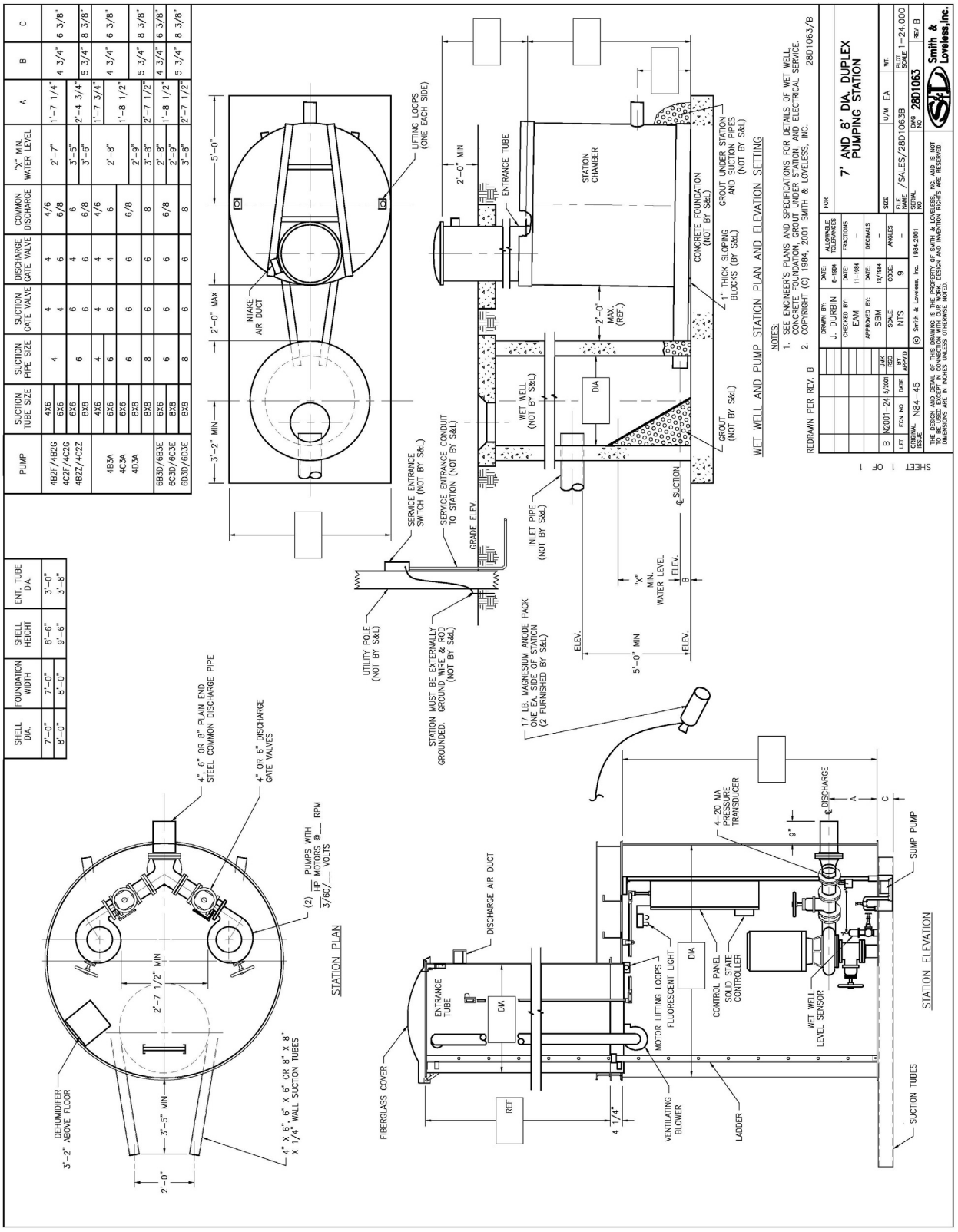
ENGINEERING DATA

Smith & Loveless, Inc.®

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

DUO-DUCT®
Underground Pump Station
Outline Drawing 28D1063
June, 2012



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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

A weatherproof fused disconnected 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 burial 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 the 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 DUO-DUCT® TWO-PUMP STATIONS

Main Pump Motor Size Rated HP (Each)	Total Station Full Load Amps		
	208-Volt	230-Volt	460-Volt
1	24	21	11
1-1/2	28	24	12
2	32	28	14
3	39	34	17
5	53	47	24
7-1/2	70	62	31
10	85	75	38
15	119	107	54
20	149	134	67
25	174	165	83
30	213	192	96
40	---	---	123
50	---	---	153

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 when the station is ready to be set in position.

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SETTING PUMP STATION

Depending upon the contractual terms, your Smith & Loveless 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'	12,000 lbs.
8'	14,000 lbs.

Lower the pump station to the slab and set according to the plans. The station is furnished with one-inch (1") elevating blocks. They are shipped taped to a tie-down near the discharge pipe. Remove the blocks and place them under the base beams on the wet well side of the station. The elevating blocks are to ensure that any water accumulation in 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 terminate in rectangular structural tubing with sufficient length to extend through the wet well wall, leaving 24" between the pump station and the wet well. Slip these pipes through the holes in the wet well wall and close the openings in the wet well with cement mortar containing "Embeco". Be sure to remove the closure installed on the suction lines to protect the station during shipment.

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 plan 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 the side of the unit, but may be on the top. **Be sure to remove the closure installed on the discharge line in 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 flathead 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.

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 sleeve 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 edge of the station. In saturated soil, it may be desirable to place reinforcing rods projecting up from the base slab alongside the base beams which form the pump station base. Bend the rods over the base beams before pouring the concrete anchorage.

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 suction lines are at least supported by concrete. This will eliminate any damage to any of these lines by earth settlement.

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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 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 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 placed 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 pump station for anodes requiring wire connections to be made to test boxes within or near the pump chamber.*

BACKFILLING

CAUTION: *Do not backfill the station without entering the pump chamber 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. 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 procedure 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.

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4. Notify the Smith & Loveless, Inc. representative when the station is ready for start-up.

   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.

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