

# ENGINEERING DATA



Smith &  
Loveless, Inc.®

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

Wet Well Mounted  
Submersible Pump Station  
Section Index  
June, 2012  
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## WET WELL MOUNTED SUBMERSIBLE PUMP STATION SECTION INDEX

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## GENERAL

The Smith & Loveless, Inc. Wet Well Mounted Submersible Pump Station was developed to fill the need for factory-built submersible pump packages, chiefly for use in conjunction with standard pre-cast concrete wet wells. The same pre-engineered, quality monitored concept applies to these stations, as to wet wells. The same pre-engineered, quality monitored concept applies to these stations, as to any of the Smith & Loveless, Inc. Factory-built and Factory-tested equipment modules. The design goals accomplished provide for a reduction in the initial and job site engineering time, a single-source warranty responsibility by Smith & Loveless, Inc. and the very highest quality performance – available in the submersible pump installation.

## PUMP

Tungsten carbide cartridge-mounted double mechanical shaft seals are provided in tandem with an oil medium for cooling and lubrication. Motors are air-filled for optimum dielectric properties. The cable entry junction is separated from the motor by a terminal board. No epoxies or other secondary sealing means are required or incorporated in the cable entry sealing system. The stainless steel shaft is oversized, with a minimum overhang length from the lower bearing to the impeller. The bearings nearest the impeller are designed for the combined thrust and radial load, with the upper bearing free to move linearly with the thermal expansion of the shaft. Class F insulation is provided with thermal overload protection embedded in each winding. A 1.15 service factor is provided with allowance for intermittent dry well operation. Motor housing, volute and impeller are ASTM A48, Class 30 cast iron. Non-clog impellers are fully enclosed, single or multi-vane.

## GUIDUCT®

Each pumping unit is provided with a **GUIDUCT®** discharge rail system, which completes the package concept. This compact arrangement serves as the discharge riser conduit, and when lowered on the **GUIDUCT®**, the pump is automatically and firmly connected to this system. Separate guide rails installed in the field have been eliminated.

## PUMP NOMENCLATURE

The pump nomenclature involves four (4) basic alphanumeric designs.

**First** is a number designating the nominal size of the pump discharge nozzle in inches.

**Second** is a letter coded to the diameter of the shaft through the seal.

**Third** is a number indicative of the physical size of the pump.

**Fourth** is a number that completes the impeller identification.

## SIZING AND SELECTION

A station friction loss table and station selection chart may be found in this section of your Smith & Loveless, Inc. catalog.

The station friction loss table is provided to assist you in accurately estimating the total dynamic head. Of course, velocity head loss is essentially a function of economics since it involves only the discharge side of the pump. One needs to keep in mind that station manifold velocities are very much different from economical force main velocities when relating capital cost to operating cost. However, it is not recommended that the velocities in this table be exceeded. Enter the station friction loss table with the design capacity in U.S. GPM from one pump only, since the results given consider the parallel nature of station piping.

Upon selection of the pump for your specific application, and consider the station piping size, turn to the station selection chart. Entering this chart with the pump model selected will yield much of the remaining station criteria and the appropriate drawing numbers to reference. The Smith & Loveless, Inc. standard specifications and drawings fully describe the basic station offerings. Popular options and alarms are available, if desired. Please do not hesitate to contact our local Smith & Loveless, Inc. Representative for assistance.

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## STATION FRICTION LOSS WET WELL MOUNTED SUBMERSIBLE PUMP STATION

4" PIPING			6" PIPING		
GPM	FEET	FT./SEC.	GPM	FEET	FT./SEC.
50	0.2	1.28	100	0.1	1.13
100	0.5	2.55	200	0.3	2.27
150	1.2	3.83	300	0.7	3.40
200	2.0	5.11	400	1.4	4.54
250	3.2	6.38	500	2.2	5.67
300	4.5	7.66	600	3.2	6.81
350	6.0	8.94	700	4.3	7.94
400	7.6	10.21	800	5.6	9.08
450	9.8	11.49	900	7.0	10.21
500	12.2	12.77	1000	8.4	11.35
			1100	10.0	12.48
			1200	11.6	13.65
			1300	13.4	14.75
			1400	15.2	15.89

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## SPECIFICATION SUBMERSIBLE WET WELL PUMP STATION WITH DUPLEX NON-CLOG SUBMERSIBLE PUMPS

### GENERAL

The contractor shall furnish and install one factory-built, automatic pumping station as manufactured by Smith & Loveless, Inc., Lenexa, Kansas. The station shall be complete with all needed equipment, factory-installed on a welded steel base with fiberglass cover.

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

### OPERATING CONDITIONS

Each pump shall be capable of delivering \_\_\_ GPM of raw water or sewage against a total dynamic head of \_\_". 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 \_\_\_" diameter. The anticipated operating head range is from \_\_\_\_\_' minimum to \_\_\_\_\_' maximum.

### CONSTRUCTION

The valve and control chamber shall be constructed in one complete factory-built assembly. It shall be sized to rest on the top of the wet well as detailed in the drawings. The supporting floor plate shall be minimum 3/8" thick steel with reinforcing, as required, to prevent deflection and ensure an absolutely rigid support.

The valve and control chamber shall be enclosed by a hinged fiberglass cover. The cover shall have a suitable drip-lip around the edge and shall be provided with a hasp and staple connection to the floor plate to allow the pump chamber to be locked with a padlock.

The cover shall have a latch mechanism to keep the cover open under load. Adjustable ventilating louvers shall be provided on each end of the fiberglass cover which are capable of being closed during cold weather operation.

A steel pump access cover located exterior to the fiberglass pump chamber shall be provided, complete with padlocking provisions. The access cover shall be an integral part of the station and provide access to the wet well.

The pump volutes and discharge piping shall be mounted in relation to the wet well bottom as detailed in the drawings.

A stanchion with lifting arm shall be provided. The lifting arm shall have a hook over the center of the motor to support a hoist (provided by others) for removal of the pumps from the wet well.

### WELDING

All steel structural members shall be joined by electric arc welding with welds of adequate section for the joint involved.

### 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 coating shall be as formulated by Smith & Loveless for abrasion and corrosion resistance.

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

Finish coating shall be accomplished prior to shipment of the station from the factory, and shall comply fully with the intent of these specifications. A 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.

## NON-CLOG PUMPS

The pumps shall be submersible centrifugal non-clog type for wet pit installation. The pumps shall be capable of continuous submergence to a maximum depth of 66'.

When lowered on its **GUIDUCT**® discharge rail system, each pumping unit shall be automatically and firmly connected to a discharge fitting permanently mounted on the discharge pipe. Sealing of the discharge connection by means other than metal to metal contact of the pump discharge flange and the discharge fitting will not be acceptable. The guide rail system shall be furnished, complete, by the pump station manufacturer. Separate guide rails shall not be required. Each pump shall be equipped with a lifting chain of sufficient strength and length to permit easy removal for inspection or repair. There shall be no need for personnel to enter the wet well for any reason.

## PUMP CONSTRUCTION

The motor housing and volute shall be made of gray cast-iron, ASTM A48, Class 30, coated with **VERSAPOX**® epoxy resin. All bolts and nuts shall be stainless steel.

Impellers shall be \_\_\_\_\_ type of gray cast-iron, ASTM A48, Class 30, non-clogging design and shall be balanced and slip fit to the shaft.

The shaft shall be of stainless steel and shall have a minimum overhang length from lower bearing to impeller. Radial deflection and shaft distortion shall not exceed 0.002" at the lower shaft seal.

The pump shall rotate on two (2) permanently lubricated ball bearings. The lower bearings, for axial and radial forces, shall consist of two (2) angular contact ball bearings while the upper bearing, for radial forces, shall consist of a single-row-deep groove ball bearing.

The shaft sealing system shall consist of tandem mechanical seals built into a cartridge to facilitate replacement. The shaft sealing system shall run in an oil bath. The lower seal shall consist of one stationary and one positively driven rotating tungsten carbide ring while the upper seal between the motor and the oil housing, shall consist of one positively driven rotating carbon ring and one stationary tungsten carbide ring. Each interface shall be held in place by its own independent spring system.

The pump motor shall be housed in an air-filled watertight casing. The pump motors shall have Class F insulation and 1.15 service factor. Motor protection shall include one bimetal micro-switch in each winding wired to the motor starter for high temperature shutdown. Motors shall be \_\_\_\_\_HP, \_\_\_\_\_ RPM, \_\_\_\_\_ Volt, \_\_\_\_\_ Phase, \_\_\_\_\_ Hertz. Motors shall be non-overloading throughout the entire pump operating range specified under operating conditions.

The cable entry junction box shall be separated from the motor by a terminal board and the cable entry water seal shall not require epoxies, silicones or other secondary sealing systems.

The pump motor cable shall be heavy-duty type suitable for submersible pump applications and sized in accordance with NEC specifications for pump motors.

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## CONTROLS

The control equipment shall be mounted in a NEMA Type 1 steel enclosure with a hinged access cover. The circuit breakers and control switches shall be operable without opening the access cover.

A grounding type convenience 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 short circuit 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 the 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, a minimum of three (3) mercury displacement switches shall be provided. A minimum of 30' of cord shall be provided with each switch to eliminate the hazards created by splicing. The cord shall have a corrosion resistant vinyl jacket and be multi-stranded in order to prevent fatigue.

An automatic alternator with manual switch shall be provided to change the sequence of operation of the pumps every eight (8) hours. The manual switch shall allow for either pump to be selected as base pump or for automatic alternation.

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

## MOISTURE SENSING ALARM

### (OPTIONAL ITEM – CHECK IF REQUIRED)

A moisture sensing probe shall be provided to activate a contact indicating moisture in the oil chamber between the two motor seals.

## ENVIRONMENTAL EQUIPMENT

A ventilating blower shall be provided, capable of delivering 250 CFM at 0.1" static water pressure in order to remove heat from the control chamber. The ventilating blower shall be turned on and off automatically by a pre-set thermostat. The ventilating blower shall be mounted on the fiberglass cover. A 500-watt electric heater controlled by a pre-set thermostat shall be furnished. The heater shall be rigidly mounted in the station to prevent removal.

## MAIN PIPING

The discharge line from each pump shall be fitted with a clapper-type check valve and gate valve. Size, location and quantity of check valves and gate valves shall be as shown on the drawings. The check valve shall be of the spring-loaded type with external lever arm and an easily replaced resilient seat. Check valves shall have stainless steel shaft with replaceable bronze shaft bushings and shall be sealed through the bearings with O-rings. Separate valve vaults will not be acceptable. The pump station manifold piping, valves and controls shall be integrally assembled within the fiberglass housing for ease of inspection, maintenance and backflushing of the opposite pump.

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Protrusions through the floor plate shall be gas-tight where necessary to effect sealing between the control chamber and the wet well. Where the discharge pipes pass through the station floor, they shall be welded continuously to prevent corrosive, noxious fumes from entering the control chamber. The lift station manufacturer shall extend the discharge connection below the floor plate at the factory, so that field connections can be made without disturbing the gas-tight seals.

The pump discharge pipes shall be square tubing utilized as pump guides. The square tubing discharge pipe shall have a flange on the bottom that can be bolted to the floor of the wet well with anchor bolts. Located at the bottom of each discharge pipe shall be a cast-iron adapter with a tapered face to receive the latching lugs located on the pump.

The manufacturer of the lift station shall provide a compression-type sleeve coupling for installation in the common discharge pipe.

## FACTORY TESTS

All components of the pump station shall be given an operational test of all equipment at the pump station manufacturers facility to check for excessive vibration, for leaks in the piping or seals, for correct operation of the control systems and all manifold auxiliary equipment. Pumps shall take suction from a deep wet well, simulating actual field service conditions. The control panel shall undergo both a dry logic test and a full operational test with all systems operating.

## SPARE PARTS

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

## INSTALLATION AND OPERATING INSTRUCTIONS

Installation of the Wet Well Mounted Submersible Pump Station shall be done in accordance with the written instructions provided by the manufacturer.

Operation and maintenance manuals shall be furnished which will include parts list of components and complete service procedures and troubleshooting guide.

## START-UP

The services of a factory-trained representative shall be provided for one day on-site by the equipment manufacturer to perform initial start-up of the pump station and to instruct the owner's 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 and guarantees of the suppliers of various components in lieu of a single source responsibility by the Manufacturer will not be accepted. The Manufacturer shall assume prime responsibility for the warranty of the station and all components.

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

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, or delays in delivery, replacement or otherwise.

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.



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## 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.



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- 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 \$\_\_\_\_\_.

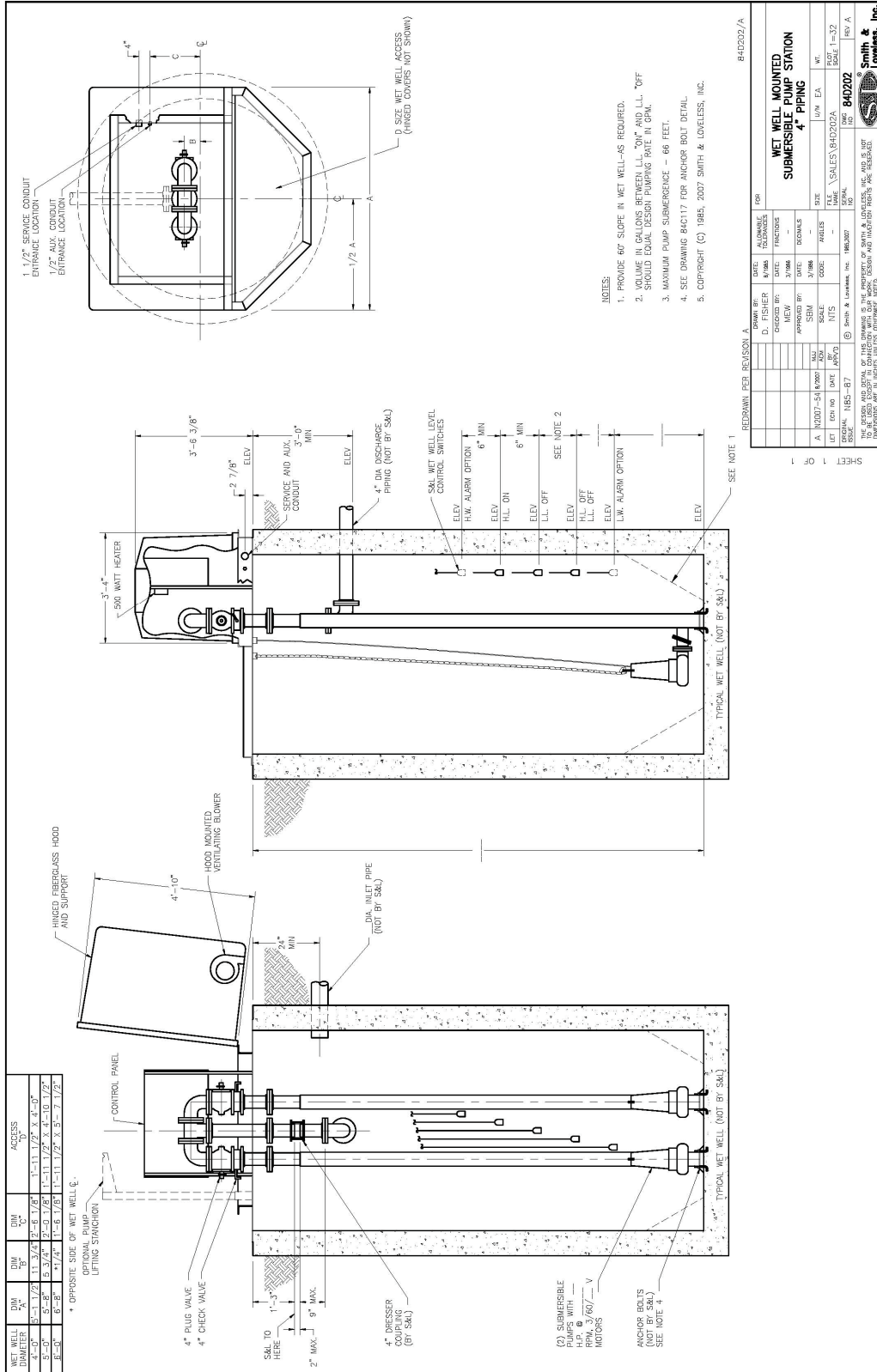
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4" Piping  
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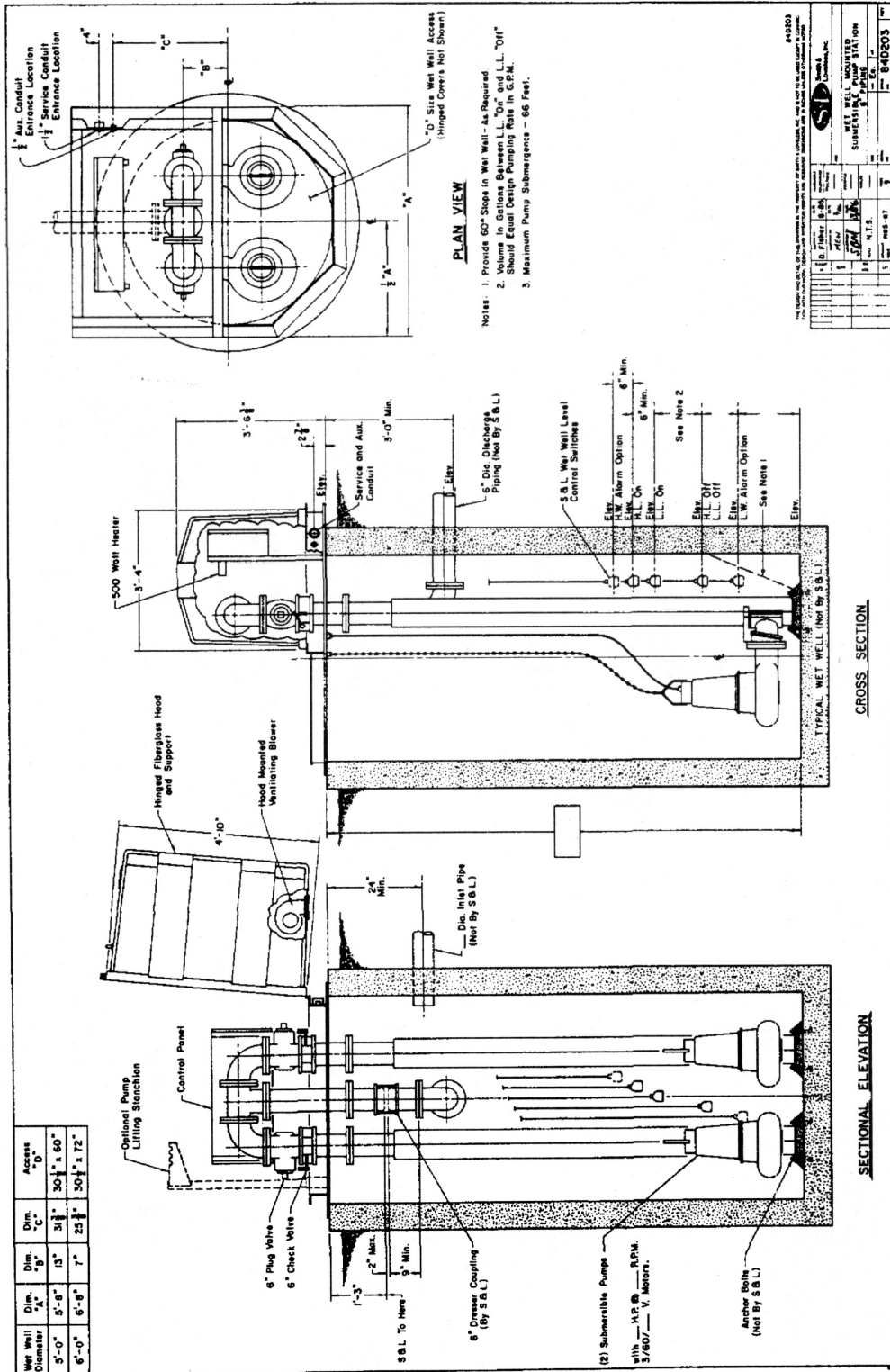
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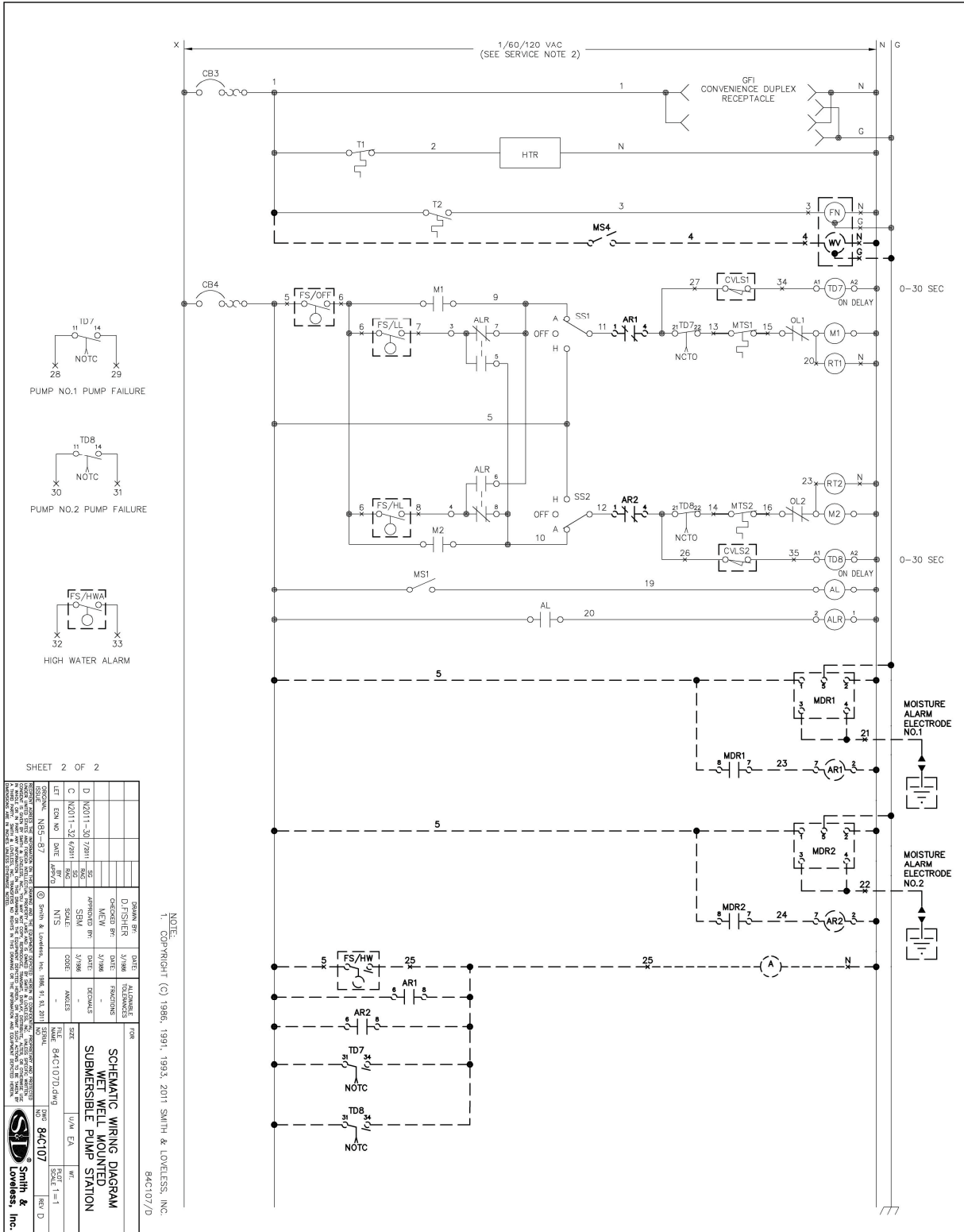
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## ELECTRICAL SERVICE REQUIREMENTS 2-PUMP WET WELL MOUNTED SUBMERSIBLE PUMP STATIONS

240-VOLT, 3-PHASE, 3-WIRE POWER WITH SEPARATE  
120-VOLT, SINGLE-PHASE SERVICE  
FOR AUXILIARIES

MOTOR H.P.	FUSIBLE ENTRANCE SWITCH SIZE (AMPS)	FUSE SIZE AMPERES	COPPER WIRE SIZE TYPE RHW	SERVICE ENTRANCE CONDUIT SIZE
1.6	60	20	6	1-1/4
3.2	60	25	6	1-1/4
5.0	60	30	6	1-1/4
6.5	60	50	6	1-1/4
8.5	100	70	4	1-1/4
11.0	100	100	3	1-1/2
15.0	200	125	1	1-1/2

480-VOLT, 3-PHASE, 3-WIRE POWER WITH SEPARATE  
120-VOLT, SINGLE-PHASE SERVICE  
FOR AUXILIARIES

MOTOR H.P.	FUSIBLE ENTRANCE SWITCH SIZE (AMPS)	FUSE SIZE AMPERES	COPPER WIRE SIZE TYPE RHW	SERVICE ENTRANCE CONDUIT SIZE
1.6	60	15	6	1-1/4
3.2	60	20	6	1-1/4
5.0	60	30	6	1-1/4
6.5	60	35	6	1-1/4
8.5	60	40	6	1-1/4
11.0	60	50	4	1-1/2
15.0	100	70	4	1-1/2