

ENGINEERING DATA



Smith &
Loveless, Inc.®

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

Vacuum Primed
Rotating Assembly
Specification
June, 2012
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SPECIFICATION FOR VACUUM PRIMED ROTATING ASSEMBLY

GENERAL

The contractor shall furnish and install _____ vertical, close-coupled, motor-driven, non-clog rotating assembly as manufactured by Smith & Loveless, Inc., Lenexa, Kansas.

OPERATING CONDITIONS

Each rotating assembly shall be capable of delivering _____ GPM of raw unscreened sewage against a total dynamic head of _____ ft. 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 _____ feet minimum to _____ feet maximum.

ROTATING ASSEMBLY

The rotating assembly shall be suitable to fit into vertical, non-clog sewage pumps of heavy cast-iron construction, especially designed for the use of mechanical seals. In order to minimize seal wear caused by lineal 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 upper bearing shall have a minimum diameter of 1-7/8" for motor frame sizes 213 through 286; 2-1/8" for motor frame sizes 324 and 326; and 3" for frame 364 and larger. The dimension from the lowest bearing to the top of the impeller shall not exceed 6".

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

The pump-motor shaft shall be solid stainless steel through the pump to eliminate corrosion within the pump or mechanical seal. Removable shaft sleeves will not be acceptable if the shaft under the sleeve does not meet the specified minimum diameter.

[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 (4", 6", 8" PUMP OPTION)

The pump impeller shall be of the enclosed two-port type made of close-grained cast-iron and shall be balanced. The eye of the impeller as well as the ports shall be large enough to permit the passage of a sphere 3" in diameter in accordance with nationally recognized codes. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.

B. X-PELLER® SUPER CLOG-RESISTANT MONO-PORT IMPELLER (4" & 6" PUMP OPTION)

The pump impeller shall be of the enclosed mono-port type made of close-grained cast-iron and shall be in dynamic balance when pumping wastewater. Two port impellers are specifically disallowed. The dynamic balance shall be obtained without the use of balance weights or liquid filled chambers. The impeller shall be designed to allow for the trimming of the impeller to meet design condition changes without altering the balance. The eye of the impeller as well as the port shall be large enough to

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permit the passage of a sphere 3" in diameter in accordance with nationally recognized codes. To further prevent clogging, the impeller port shall have a minimum area of 10.6 in². The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device. The impeller shall not be screwed or pinned to the motor pump shaft and shall be readily removable without the use of special tools.

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

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

Priming from high-pressure connections tending to cause solids to enter and clog the priming system, will not be acceptable. The priming bowl shall be transparent to enable the operator to monitor the priming level.

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

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.

MOTORS

The pump motors shall be vertical, solid shaft, NEMA P-base, squirrel-cage induction type, suitable for ___ phase, ___ cycle, ___ volt electric current. They shall have Class F insulation, suitable for temperatures up to 105° C. Insulation temperature shall, however, be maintained below 80° C. The motors shall have normal starting torque and low-starting current, as specified by NEMA Design B characteristics.

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

The motor-pump shaft shall be centered, in relation to the motor base, within .005". The shaft run-out shall be limited to .003".

The motor shaft shall equal or exceed the diameter specified under rotating assemblies, at all points from immediately below the top bearing to the top of the impeller. To reduce overhung loads, the dimension from the centerline of the lower bearing to the top of the impeller hub shall not exceed 6". 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 grease relief fittings.

The motor shall be fitted with heavy lifting eyes, 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.

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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. In addition, moisture detectors shall be provided in each motor, as a backup. These alarm contacts shall be wired to a terminal strip in the panel for connection to the Owner's alarm system.

A spare volute gasket shall be provided.

The attached rotating assembly specification and checklist must be met in total. There are many reasons for incorporating a good rotating assembly 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 rotating assembly specifications will not be allowed.

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

WARRANTY

The manufacturer of the station shall warrant for one (1) year from date of start-up, not to exceed eighteen (18) months from date of shipment, that 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 rotating assemblies 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.

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

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

MANUFACTURER'S INSURANCE

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

MANUFACTURED EQUIPMENT

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.

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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 repair services.
- F. A list of five (5) installations in the states where similar equipment by the manufacturer is currently in similar service; include contact name, telephone number, mailing address of the municipality or installation, engineer, owner, and installation contractor; if five installations do not exist, the list shall include all that do exist, if any.
- G. Detailed information on site, architectural, structural, mechanical, plumbing, electrical, and control, and all other changes or modifications to the design and construction work necessary to adapt the equipment or systems to the arrangement shown and/or functions described on the drawings and in the technical specifications. This shall include plan view and section sketches illustrating any additional space requirements necessary to provide the minimum adequate clear space within and around the equipment for operation and maintenance, as shown on the drawings and specified.
- H. All differences between the specifications and the proposed substitute equipment shall be clearly stated in writing under a heading of "differences".
- I. Other specified submittal requirements listed in the detailed equipment and material specifications.
- J. A completed and signed copy of the "Vacuum Primed Rotating Assembly Certification Affidavit" which follows.

EVALUATION

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

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

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

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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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VACUUM PRIMED ROTATING ASSEMBLY CERTIFICATION AFFIDAVIT

A submittal will be required to be submitted to the owner by manufacturers proposing alternate, unnamed rotating assemblies with their bid. Included in the submittal shall be full-size drawings and detailed specifications on the proposed rotating assembly. Copies of the engineer's plans and specifications will not be acceptable. Included in the bid submittal shall be the following filled-out checklist. It shall be signed by an Officer of the company.

	YES	NO
Close-coupled pump design - no motor to pump shaft coupling		
Pump shaft diameter of _____ minimum through seal		
Full diameter impeller shrouds		
Stainless steel pump shaft		
Tapered shaft to impeller fit		
Maximum pump shaft overhang of 6"- lower bearing to impeller		
Bronze seal housing		
Minimum pump efficiency at design point of _____ GPM of _____ %		
_____ % pump efficiency at best efficiency point for proposed impeller		
Class F motor insulation with Class B max motor temperature rise and 1.15 service factor		
Motor shaft run-out 0.003" max		
Motor shaft centered to motor base with 0.005"		
Locked lower bearing and floating upper bearing		
One-piece motor adapter/backhead		
Motor HP of _____ at _____ RPM		
Priming from low pressure area behind the impeller		
Transparent priming bowl for operator monitoring		
Hollow priming adapter for positive seal lubrication		
Completely separate priming system for each pump		
Minimum 2-1/2" equivalent opening in priming passageways		
Product liability insurance, \$5 million per specification		

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

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

Signature of Company Officer

Corporate Seal
(Notarized)

Title

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PUMP 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 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 on a wet well		
Priming from low pressure area behind the impeller		
Transparent priming bowl for operator monitoring		
Hollow priming adapter for positive seal lubrication		
Completely separate priming system for each pump		
Minimum 2-1/2" equivalent opening in priming passageways		
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.

Corporate Seal
(Notarized)

Signature of Company Officer

Title