



SUBMERSIBLE ELECTRIC PROPELLER PUMP GUIDE SPECIFICATIONS

1.0 SCOPE

This specification covers supply and installation of submersible electric motor driven, end-suction Axial or Mixed Flow Pump, pump can and Discharge Piping designed specifically for municipal, commercial and industrial water handling applications. Pump(s) shall be manufactured by FPI of Pompano Beach, FL, or approved equal.

1.1 Qualifications - The pump manufacturer shall be a company actively engaged and specialized in the manufacture of the type of specified pump(s) in this section. Design of the pumps shall be under direct supervision of a Registered Professional Engineer in the State of manufacture and experienced in the design of pumps described in this section. Pump manufacturer must be ISO 9001 Certified for the manufacture of Axial Flow Pumps. The submersible motor manufacturer shall be ISO 9001 Certified for the manufacture of submersible electric motors.

1.2 Layout / Configuration – The can/ pump configuration shall consists of any of the following as recommended by the manufacturer:

1. Self-supporting vertical can with lift out pump
2. Suspended vertical can, with lift out pump
3. Suspended vertical can with built-in suction bell with a lift out pump
4. Standard vertical, angle or horizontal layout submersible electric pump
5. Special design configured for unique site conditions.

2.0 OPERATING CONDITIONS

Number of Pump(s)	_____
Design Capacity	_____ GPM (m ³ /sec)
Min. suction water elevation	_____ ft. (m)
Design suction water elevation	_____ ft (m)
Max. suction water elevation	_____ ft (m)
Min discharge water elevation	_____ ft (m)
Design discharge Water Elevation	_____ ft.(m)
Max discharge water elevation	_____ ft (m)
Min TDH	_____ ft. (m)
Design TDH	_____ ft. (m)
Maximum TDH	_____ ft. (m)

Guaranteed Efficiency at design point _____%

The pump(s) performance shall be non-overloading for the design HP (KW) of the furnished driver. Driver and related components shall have not less than a 1.15 S.F.

2.1 **Speed** – The speed of the pumps shall not exceed ___ revolutions per minute.

3.0 MATERIALS

Material types - Materials not specifically described shall conform to the latest approved industry standard(s) covering appropriate class or types of materials. In general, the material types used in the manufacture of the pumps shall conform to the following:

<u>COMPONENT</u>	<u>MATERIAL TYPE</u>	<u>SPECIFICATION</u>
Mounting Plate	Structural Steel	ASTM A-36
Column & Elbow	Corten	ASTM A-242
Steel Plate	Corten	ASTM A-242
Cold Rolled Steel bars		AISI/A-1018
Hot Rolled Steel Bars		ASTM A-36
Stainless Steel Plate	316 Type L	
Pipe	Schedule 80	A-53
Propeller Shafting	416 SS	ASTM 276
Intake bell	Corten	ASTM/A-242
Bearings	Angular contact	

4.0 PUMP CONSTRUCTION

The pump shall be electric submersible, consisting of an intake bell, impeller housing, bearing housing with mechanical seal, lower and upper bearing section and discharge diffuser components. The complete water pump assembly and discharge pipe shall be painted per Engineer's specifications.

4.1 **Pump / Diffuser Bowl** - The Intake Bell shall be made of ASTM A242 steel plate, with a minimum wall thickness of ___10 (mm) and shall be flanged for mating to the propeller housing. Intake Bell diameter shall be no less than 1-1/2 times the impeller diameter. It shall be supported entirely by the propeller housing. The propeller housing shall be made of ASTM A242 steel and shall be flanged for mating to the suction bell. It shall provide a close running tolerance to the propeller.

4.2 Propeller - The Propeller and hub shall be manufactured from ASTM A242 steel plate, with a minimum wall thickness of ____ (mm). The propeller shall be attached to the shaft by a locking nut and key. The propeller bore shall be tapered for ease of assembly and disassembly. The propeller blades shall be ground and polished for maximum hydraulic efficiency. The blades shall be chamfered on both sides for full penetration welding. The periphery of the blades shall be machined for a close running fit with the impeller bowl. The complete propeller shall be statically balanced after manufacturing.

4.3 Propeller Shaft / Bearing Housing – The propeller shaft shall be of ASTM A-276, Type 416, stainless steel. Provide for removal of propeller from below without disassembly of pump above propeller bowl. The propeller shaft shall be supported and held in place by means of angular contact thrust bearings designed for total down thrust and momentary up thrust and encased in a specially design bearing housing manufactured out of ASTM A-242. The shaft bearings shall be oil/grease lubricated. The bearings shall be designed for B10 life of _____. Appropriate lip seal/ mechanical seal (s) shall be provided to protect the bearings.

4.4 Submersible Electric Motor –

4.4.1 Motor materials and design:

The motor frame shall be rigged cast iron ASTM type A-48, class 30 or better with stainless steel hardware. The motor shall have a stator insulation that is specially treated class F and H non-hydroscopic with multiple dips and bakes with phase insulation included for inverter duty. The rotor shall be die cast aluminum, dynamically balanced and shall exceed NEMA limits per MGI 12.06. The motor shall be no less than high strength 416 stainless steel with bearings specially adapted for vertical assembly. Both upper and lower bearings shall be packed and sealed for life with special high temperature grease. The cable entry system shall be epoxy sealed, butt spliced connection for non-wicking cable entry design. The moisture detection system shall be two wire/ two probe monitoring system to constantly monitor oil chamber and stator housing for moisture. Seals shall be tandem shaft seal system working independent of each other. It shall be designed to withstand 200 psi at all seal locations. The motor shall have a 1.15 safety factor at 40 degrees C ambient for continuous duty rating submerged and 15 minutes in air at the temperature rating.

- The motor shall not be less than _____HP operating at a speed not greater than _____ RPM. The motor enclosure shall be TENV NEMA design B 3/60/voltage. It shall be certified UL approved and CSA listed for class I groups C and D for hazardous locations.
- The electric motor shall be designed for the torque imposed by the propeller and to meet the design speed criteria. The propeller shaft and the motor shaft shall be coupled using a jaw-type coupling.
- NEMA Squirrel cage induction motors are typically in the range of 514 to 1800 SRPM that allow up to 15 starts per hour and a SF of 1.15.

- Heavy duty oversized radial and thrust bearings are rated for minimum L10 life of 30,000 hours.
- Oversized shaft, high strength 416 stainless steel shaft
- Bearings pre-packed and sealed for life
- Tandem shaft seal system
- Cables available to withstand temperatures to 190 degrees F.
- Superior epoxy sealed cable entry and F stator insulation.
- Dynamically balanced die cast aluminum rotor
- Air filled stator housing
- Dual moisture probes
- Rugged Cast iron frame ASTM type A-48, class 30 or better, with stainless steel hardware.

4.4.2 **Submersible Electric Cable**- The cable shall be sized for the motor furnished and shall be UL, CSA, and MSHA approved and rated specifically for the submersible motor operation. _____feet of cable shall be supplied to connect to the electric distribution box as shown on the drawings.

4.4.3 **Pump Can** – The can shall be designed based on the site conditions and as proposed by the manufacturer to simplify the station design and lifting out of the submersible pump. The materials of construction shall conform to the pump specification.

4.5 **Pump Column and Discharge Elbow** - The pump column and discharge elbow shall be made of ASTM A242 steel plate, with a minimum wall thickness of ____in (mm). The elbow shall be of the long radius, with the centerline radius not less than 1 times the nominal pipe diameter.

4.6 **Lifting Lugs** – Major pump components shall be furnished with lifting lugs to facilitate handling, and designed and arranged to allow safe handling of pump components singly or collectively as required during shipping, installation, and maintenance.

4.7 **Nuts and Bolts** – Bolts used in assembling pump and its supporting members shall be of Stainless Steel. Only hexagonal bolts and nuts shall be used. Washers shall be of Stainless Steel.

4.8 **Name Plate** - A stainless steel pump name- plate shall be furnished stating the manufacturers name and location, pump serial number, design RPM, rated gallons per minute capacity at the specified TDH. The name-plate shall be located in a readily visible location.

4.9 **Hardware** – All Machine bolts, nuts and cap screws shall be hex head type. Hardware and parts requiring special tool shall not be used.

- 5.0 **WELDING** – Pump and pipe welding shall be continuous and full penetration inside and out. All slag shall be removed and undercutting shall not exceed 15% of the material thickness.
- 6.0 **PAINTING** – Pump interiors and exteriors shall be painted with the manufacturers paint system, or as specified. As a minimum, the pump shall be sandblasted to paint manufacturers specifications, then painted with two (2) coats (minimum 6 mils) of a high solids epoxy paint system similar to Ameron Amerlock 400 and Amercoat 450 or approved equal. Alternate paint systems such Zophar Triple A coal tar enamel (minimum 6 mils) are acceptable provided that the pump manufacturer can demonstrate corrosion resistance equal to the high solids epoxy system.
- 7.0 **INSPECTION** – The pump manufacturer shall arrange for the inspection by the Engineer of the pump parts during manufacturing to assure compliance with these specifications. The owner's representative shall have the option of witnessing the pump performance testing.

8.0 PIPING

8.1 **Piping** - Piping shall be of ASTM A242 steel with a minimum ____in (mm) wall thickness. Approximate dimensions shall be field verified.

8.2 **Siphon Breaker** – Siphon Breaker if required, shall be Harris 7” Siphon Breaker and Air Relief Valve by W.P. Wilson & Sons.

9.0 EXECUTION

9.1 **Testing** - The pumps shall be field certified performance tested as per HI test standards prior to pump approval. The owners representative shall have the option of witnessing the pump performance testing. The manufacturer shall submit three bound copies of the field test report, prior to acceptance by owner.

9.2 **Inspection** – The pump manufacturer shall arrange for the inspection by the Engineer of the pump parts during manufacturing to assure compliance with these specifications.

9.3 **Warranty** – The pumps shall be warranted for one (1) year. Warranty shall include both the pump and the drive unit. Warranty shall go into effect from the date of acceptance by the owner. Defects or failures shall be promptly replaced with new parts by the manufacturer at no additional cost to the owner within the warranty period. Exceptions shall include instances where it could be conclusively proven that failure was a result of improper operation of the equipment, either prior or after the acceptance by the owner.

10.0 Optional Equipment

10.1 Automatic Insulation Tester and Monitor for 480Volt Motors and Cables -

Pump control panel shall be equipped with an automatic insulation tester and monitor to continuously test and display the motor winding and cable insulation condition. The test voltage shall be 500 VDC and current limited to 200 uA.

A control signal shall be provided by a N/C auxiliary contact to indicate when the motor is running and prevent the system from testing the motor until it stops running. The system will have 1 set each of Form C latching alarm and lockout contacts with a manual reset button.

System will have a 1% analog switchboard meter display with a color-coded dial calibrated in meg-ohms of resistance. The system shall have a "Cal, Test" pushbutton to allow for system check and meter calibration. Remote indicating means shall be a green "Test On" **L.E.D.** to show when the motor insulation is being tested and is acceptable and a red flashing "Alarm" LED, shall indicate when the motor insulation has tested below the alarm set point and the motor is unsafe to operate. A set of Form C pre-alarm contacts and yellow flashing "Pre-Alarm" LED remote indicator shall be provided to indicate when the insulation begins to breakdown into the yellow range of the meter display.

The automatic insulation tester and monitor shall be as manufactured by Meg-Alert, Inc