Propeller Pumps Since 1937

MIXED FLOW PUMP GUIDE SPECIFICATIONS

1.0 SCOPE

This specification covers supply and installation of Vertical Single End Suction Mixed Flow Pump and Discharge Piping designed specifically for municipal, commercial and industrial water handling applications. Pump(s) shall be manufactured by FPI Inc. of Pompano Beach, FL, or pre-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. ISO Certificate must be included with bid.

1.2 **Performance Test**- The pumps shall be given a certified performance test at the factory and approved before shipment. All performance testing shall be in accordance with Hydraulic Institute "Vertical Pump Tests" ANSI/HI 2.6-2000. Factory testing facility shall be in the continental United States. Proposed testing facility shall be submitted as a shop drawing.

2.0 OPERATING CONDITIONS

Number of Pump(s) _____
Design Capacity _____GPM (m^3/sec)
Min. suction water elevation _____ft. (GNVD) (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 H.P. 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.

2.2 **Reverse Rotation** – Pump shall withstand, with no damage, full rotational speed caused by subject pump to reverse flow. Head used to determine this reverse speed shall be calculated from the highest pipe discharge elevation and lowest pump intake water elevation. Both the pump and its connected electric motor shall be capable of full reverse speed when acting as a turbine by reverse water flow.

3.0 MATERIALS

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

COMPONENT	MATERIAL TYPE	SPECIFICATION
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 or
Pump shafting	Grade 1045	ASTM A-108
Intake bell	Cast Iron	
Bearings	Bronze	ASTM B 62

4.0 PUMP CONSTRUCTION

4.1 **Pump Bowl** –The suction bell and the suction bowl shall be made of close-grained cast iron and shall be designed for easy removal of the impeller and bearings. The suction bell shall have a flared inlet designed to reduce the inlet losses and sufficient number of vanes to support the lower guide bearing as well as to support the weight of the impeller and pump shaft when dismantling the pump.

4.2 **Impeller** - The Propeller and hub shall be manufactured from bronze or stainless steel , with a minimum wall thickness of ____ in (mm). The impeller shall be attached to the shaft by a locking nut and key.
The impeller shall be balanced statically and dynamically to reduce vibration and wear.

The impeller bore shall be tapered for ease of assembly and disassembly. The impeller blades shall be ground and polished for maximum hydraulic efficiency. The periphery of the blades shall be machined for a close running fit with the impeller bowl.

4.3 **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.

4.4 **Propeller Shaft** - The propeller shaft shall be of ASTM A-276, Type 416, stainless steel. Shafting shall be designed so that any necessary vertical adjustment of impeller can be made from the operation floor level, without interfering with shaft alignment. Also, provide for removal of propeller from below without disassembly of pump above propeller bowl.

4.5 **Pump Shaft** - The pump line shaft shall be steel, grade 1045, conforming to ASTM A-108 . It shall be sized to safely transmit the horsepower involved, and to prevent vibration. It shall be inlaid with stainless steel wherever seals and bearings come in contact with the water being pumped.

4.6 **Line Shaft Enclosure** - The shaft enclosing tube shall be made of ASTM A53, Schedule 80 seamless pipe of a size to accomodate the pump line shaft and its supporting bearings. The enclosure shall be oil filled and sealed with a double rubber lip seal to prevent oil from escaping or water and foreign materials from entering the tube during normal operation.

4.7 **Bearings** – Fluted bronze sleeve bearings shall be provided in the Line Shaft Enclosure tube. Bearings shall be in alignment inside the tube spaced less than 60" apart. Bearing shall be oiled from the top of the tube by means of a steel oil reservoir to insure bearing surfaces are constantly lubricated. (Optional water or grease lubricated bearings are available on request). Bearings shall be welded onto line shaft tube.
Optionally the bronze sleeve bearings shall be held in place positively on the shaft by locking cam collars. The bearing system shall allow quick bearing removal and replacement.
Pumps shall be supplied with thrust bearing located in the bearing housing at the top of the pump hood. Thrust Bearing shall be sufficient to support the entire weight of

the rotating element of the pump and all thrust and radial loads. The thrust bearing shall have a B10 life not less than 20,000 hours. The thrust bearing shall be packed

with grease and sealed at the top and the bottom. The bearing shall be easily removable in the field.

4.8 **Pump Mounting Plate** – The pump mounting plate shall be made of ASTM A36 Steel. It shall be of adequate thickness and strength to prevent excessive vibration and deflection. The mounting plate shall have mounting holes for anchoring the pump assembly.

4.9 **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.

4.10 **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.

4.11 **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.

4.12 **Hardware** – All Machine bolts, nuts and capscrews 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 coated with bitumastic enamel equal to Zophar Triple A coal tar enamel (minimum 6 mils), or as an option sandblasted to paint manufacturers specifications with two (2) coats (minimum 6 mils) of a high solids epoxy paint system similar to Ameron Amerlcok 400 and Amercoat 450 or approved equal. Alternate paint systems 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 owners representative shall have the option of witnessing the pump performance testing.

8.0 DRIVE EQUIPMENT

8.1 **Belt & Pulley Drives** – Belt Drives shall be designed using BX, B, C, CX, 5VX, 5V or 8V belt cross sections. Sheaves shall be locked securely to shafts by "QD" type bushings. Belts and pulleys shall be protected by a sheet metal guard. Guards shall be secured with sufficient structural steel brackets.

8.2 **Electric Motor Mount** – The motor mount shall be made to support the weight of the electric motor plus any loads imposed on it by the belt drive, plus a safety factor to account for shock loads. The motor mount shall be designed with a hinge type connection to maintain pump and motor parallel alignment and adjusting bolts to vary the belt drive center distance for proper belt tensioning, removal and installation.

8.3 **Electric Motors** – Motors shall be vertical hollow (or solid) shaft electric motor as manufactured by US Motor or GE or approved equal with minimum _____ HP and _____RPM/3Ph/60Hz/230-460V. The motor enclosure shall be Open Drip Proof (or optional weather protected type ____), of Nema design (B), 40° C ambient operation, and a 1.15 service factor.

8.4 **DIESEL ENGINE AND ACCESSORIES**:

8.4.1 The engines shall be a complete factory assembled radiator cooled unit, with the engine and all auxiliaries, mounted on a common base fabricated of steel sections. All internal connections shall be made, and the only connections required to be made at the site of installation shall be external connections, such as fuel, intake air, exhaust gases, and electrical connections.

The engine shall have a minimum continuous brake horsepower of _____ at 1,800 RPM with all accessories mounted and running. The engine shall be equal to _____, including PTO, base, muffler, _____ amp battery with rack and safety shut downs.

8.4.2 **Instrumentation**: The engine shall be equipped with instrument panel with the following :

Oil Pressure Swichgage,
Water temperature Swichgage
Emergency stop push button
Engine start push button

Ammeter
Tachometer with Hourmeter
Vernier Throttle cable
Externally accessible fuse holder .

8.4.3 **Air Induction System**: Engine shall be equipped with dry element-type 2-stage / Donaldson air cleaner.

8.4.4 **Fuel System**: Engine shall operate satisfactorily on fuel meeting the applicable requirements of ASTM D975 Grade 2-D. Engine to be equipped with a multiple plunger injection pump, primary and secondary full flow fuel filters, diaphragm fuel transfer pump, and a hand primer pump. Maximum fuel consumption of the engine shall be limited to _____ lbs. / BHP-HR.

8.4.5 **Lubrication System**: Engine shall be equipped with a full pressure lube system with high capacity gear-type pump, full flow oil filter with strainer and base-type oil pan.

8.4.6 **Silencer**: Engine shall be supplied with residential attenuation level (18 - 25 d.b.a. reductions) type silencer equal to a Nelson or approved equal. Inlet and outlet to be flanged with diameter matching the engine exhaust.

9.0 RIGHT ANGLE GEAR DRIVE

9.1 **Gears** All drives shall be furnished with spiral bevel gears as manufactured by Amarillo Gear Company or approved equal. Optimum tooth contact and maximum performance shall be insured by computer aided design analysis and strict adherence to the latest AGMA standards.

9.2 **Bearings**- Thrust bearing arrangements shall be standard, heavy, or Extra Heavy duty based on the application. Maximum reliability shall be assured by only using bearings from the leading bearing manufacturers and by only selecting bearings that exceed the AGMA recommended design life.

9.3 **Housing** – Housing shall be carefully designed and precision machined housing shall be provided to insure correct gear and bearing alignment while providing the stiffness, shock resistance and dampening characteristics required.

9.4 **Shafts** -Shafts shall be manufactured from heat-treated alloy steel properly sized to give maximum life and minimum deflection.

9.5 **Lubrication**- Cooled and filtered oil shall be delivered under pressure to all gears and bearings by a gear driven positive displacement oil pump. An oil to water shell and tube heat exchanger shall be provided so that oil is delivered at the proper

temperature arid viscosity.

9.6 **Efficiency** - The gear efficiency shall fall within the normal ranges of 96-98 % with the assurance of highest possible efficiency under full load conditions.

9.7 **Non-reverse clutch-** A non-reverse clutch shall be provided as desired by the installation requirement.

10.0 PIPING

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

10.2 **Siphon Breaker** – Siphon Breaker if required, shall be Harris ____" Siphon Breaker and Air Relief Valve by W.P. Wilson & Sons.

11.0 EXECUTION

11.1 **Testing** - The pumps shall be field certified performance tested as per ANSI/HI field 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.

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

11.3 **Warranty** – The pumps shall be warranted for one (1) year. Warranty shall include both the pump and the motor. 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.