General

Pumps will be a centrifugal vertical bearing / wet pit chopper design of heavy duty construction intended for services requiring a combined chopping and pumping action on fluids with entrained solids.

Acceptable manufacturers are: Hayward Gordon Ltd. CHOPX-VB Series or approved equal.

Performance

Pumps shall be sized to meet the following design criteria:

A. Fluid Properties:

Fluid _____	S.G _____
Viscosity _____	Temp _____
Solids % _____	Solids Type/Size _____/_____

B. Pump Characteristics:

Capacity _____	TDH _____
Suction Head _____	NPSHA _____
Minimum Disch. Size_____	Motor RPM _____
Max. Pump RPM_____	Motor HP _____

C. Pump Efficiency:
To minimize operational power costs, the minimum hydraulic efficiency of the pump at the design duty point shall be _____% and shall be no less than _____% at the Best Efficiency Point at the selected pump's RPM.

Pump Construction

A. Casing: The pump casing and inspection port cover shall be constructed of ASTM A48 Class 30 Cast Iron (*Optional: High Chrome Iron 450 BHN, 316SS, or CD4MCU*). Flanged discharge connections shall conform to the requirements of ANSI B16.1, Class 125. Casings with 4" or larger discharge diameter shall have an inspection port with removable cover to allow access to the casing passage. The casing backplate shall have a spiral cutting groove on the surface that is in close clearance to the rear flange of the impeller. The casing shall be a clamp type design.

B. Impeller: The pump impeller shall be an open type with sharpened vane edges incorporated into the rear of the impeller which provides cutting action against the backplate spiral groove, preventing fouling behind the impeller. Primary chopping/conditioning of materials shall be accomplished by the action of the sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings with a set clearance between the impeller and cutter bar of .010" to .015" on pumps with less than 14" diameter impellers or .020" to .030" on pumps with 14" diameter or larger impellers. Impeller shall be constructed of cast alloy steel case hardened to minimum Rockwell C60 (*Optional: High Chrome Iron 450 BHN minimum, 316SS, or CD4MCU*) and shall be dynamically balanced. The impeller shall be keyed to the shaft and the axial clearance at the front and rear of the impeller shall be externally adjustable.

C. Cutter Bar: The casing will be fitted with a replaceable suction plate with cutter bars constructed of cast alloy steel case hardened to minimum Rockwell C60 (*Optional: High Chrome Iron 450 BHN minimum, 316SS or CD4MCU*). The surface of the suction plate facing the impeller shall have multiple radial cutting slots to prevent binding of material between it and the impeller vanes.

D. Upper Cutter: The area behind the impeller shall be protected from fouling by the cutting and expulsion action of sharpened vane edges in the rear of the impeller sweeping across the spiral grooves in the casing backplate.

E. Deflector Nut: The impeller shall be secured to the shaft using a deflector nut made from 420 Stainless Steel hardened to 400 BHN. The nut shall be designed to protrude in front of the cutter bars and deflect stringy materials and prevent binding.

F. Pump Shaft: The shaft will be constructed of 4140 Carbon Steel *(Optional: 316SS)* and protected through the seal area by a renewable 316SS sleeve. The shaft shall be a minimum 1.75" diameter in order to minimize deflection during chopping. The shaft shall be designed such that the operating speed shall be 25% below the first critical speed. An O-ring between the sleeve and shaft will prevent pumped fluid from leaking along the shaft.

G. Pump Column: The shaft column shall be constructed of 4" schedule 40 carbon steel (Optional: 316SS) pipe welded to steel flanges, squared and spigotted with machined fits to assure accurate alignment of the pump shaft.

H. Bearings: The pump bearings shall all be oil bath lubricated by ISO Grade 46 turbine oil, with the exception of the top bearings, which shall be grease packed. The bearing lives are to be rated for a minimum of 100,000 Hrs B_{10} life, based on the calculated loads due to hydraulic thrust encountered at the duty point, as well as other mechanical loading due to shaft and impeller weight.

   Shaft thrust in both directions shall be taken up by double row angular contact ball bearings. The lower radial bearing shall be cylindrical roller type and located as close as possible to the mechanical seal so that overhang from the centerline of the lower radial bearing to the mechanical seal faces shall be a maximum of 1.2".

I. Mechanical Seal: Single mechanical seal shall be fully shrouded, set screw driven design with no springs exposed to the pumpage. Seal faces shall be silicon carbide to provide long life in the presence of grit and abrasive solids. The seal shall be mounted on a 316SS shaft sleeve.

J. Automatic Oil Level Monitor: An automatic oil level monitor shall be located above the mounting plate and be fitted with an internal switch to detect oil level and shut off the motor in the event of low oil level. A sensitive relay shall be included for mounting in the motor control panel.

K. Discharge Pipe: Discharge pipe shall be constructed of carbon steel *(Optional: 316SS)* schedule 40 pipe and shall be furnished with a 150# screwed on flange located above the baseplate.

L. Recirculator (Optional): A recirculator nozzle shall be provided for recirculation of the pit contents prior to discharge. The recirculator nozzle will be adjustable a minimum of 180 degrees horizontally and 70 degrees vertically. The recirculator system shall incorporate a valve assembly to direct discharge flow either to the nozzle or the discharge flange. The valve body will be ASTM A48 Class 30 Cast Iron with 316SS valve disk which incorporates a Graphalloy bushing to ensure smooth, low friction operation. The operating levers shall not require the use of a thrust collar below the mounting plate to maintain the assembly. The nozzle is to be self contained in the housing eliminating the need for field setting of collars.

M. Linear Actuator (Optional for recirculator): An electrically operated ball screw linear actuator shall be provided to position the valve for pumpout or mixer/recirculator operation. The actuator will operate on 1/60/110V AC power with 25% duty cycle and will be capable of producing 500 lbs. of actuation force. The actuator shall have a freewheeling feature to prevent overtravel at the end of the stroke and shall incorporate a weatherproof motor enclosure. Timer relays (by others) are required to control the actuator and to set the valve position.

N. Pump Baseplate: The pump baseplate shall be fabricated from mild steel *(Optional: Stainless Steel)*, designed to provide rigid support of the pump and motor. Each base shall be furnished with suitable lifting lugs and bolt holes to facilitate mounting at site. The baseplate shall be a minimum 1/2" thick.

O. Motor Pedestal: The motor pedestal shall be fabricated of carbon steel machined with spigotted fits to positively align the C-flange motor to the pump shaft with no adjustments.

P. Coupling: Units shall be provided with an elastomeric coupling sized to meet performance conditions with a minimum 1.5 service factor based on motor nameplate horsepower. Suitable OSHA guards are required.

Q. Motor: The motor shall be ____ HP, ____ RPM, ____ Volts, 3 phase, ____ Hertz, TEFC enclosure with 1.5 service factor and C-flange mounting. Motor shall be suitably sized to cover chopping requirements.

R. Nameplates: Permanent stainless steel nameplates shall be attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, speed and all pertinent data.