

Pulsation dampeners in mud pump suction and discharge lines serve to absorb the pressure-flow variations normally produced by the reciprocating motion of the pump pistons. If dampeners are not properly maintained and operated, the pressure-flow variations can produce damaging effects to piping and mud pump components.

A high-pressure relief valve must be installed in the discharge line as close to the mud pump as possible. Its purpose is primarily to protect the pump and discharge line against extreme pressures such as might occur when a bit becomes plugged or a mud pump starts against a closed discharge line valve. The relief valve should be used to limit the pressure in accordance with the pump manufacturer's rating for a given liner size. Usually, relief valves are set to exceed rated liner pressure by some given amount (i.e., no more than 10%). Ensure the high-pressure discharge relief valve is installed ahead of any valves so that accidentally starting a pump against a closed valve does not damage the mud pump. Any high-pressure relief valve must be installed before the discharge strainer in the discharge line. A plugged discharge strainer might keep the relief valve from actual discharge pressure levels at the outlet of the mud pump.

Centrifugal pumps

Centrifugal pumps should be installed below the fluid level to be pumped. A flooded suction helps to prevent cavitation. Installation of suction lines should avoid allowing air to enter the suction. Such air can also be introduced by a return line dumping close to the suction line to the centrifugal pump. Multiple centrifugal pumps should not share the same suction if they are to be run at the same time. A vortex breaker can help avoid air flowing into the suction. A concentric reducer should not be used in the suction line. An eccentric reducer with a flat side on top helps avoid air entering the centrifugal pump.

Pipe fittings should not be installed within a distance that is equal to or shorter than two pipe diameters from the suction inlet to the pump. The diameter of the suction piping should be small enough to allow a minimum of 4 ft/sec linear flow rate. Suction piping for water might be larger if the suction line is installed over a long distance. At slower speeds, solids can settle out and clog the suction piping.

Discharge piping can be sized for a minimum of ten ft/sec linear flow rate. Too small a discharge piping can limit the flow rate delivered. Too large a discharge piping can overload the motor.

A flexible coupling should be installed between electric motors and inline centrifugal pumps. The flexible coupling between the motor and centrifugal pump should not be used



Figure PM-5: Electric vertical centrifugal pump on mud tank. Pipe fittings for centrifugal pumps should not be installed less than two pipe diameters from the suction inlet to the pump. The diameter of the suction piping should be small enough to allow a linear flow rate of at least 4 ft/sec. Courtesy Precision Drilling.



Figure PM-6: In-line centrifugal pump. Centrifugal pumps should be installed below the level of the fluid to be pumped. Flooded suction helps to prevent cavitation. Installation of suction lines should avoid allowing air to enter the suction. Air can also be introduced by a return line dumping close to the suction line. Courtesy Precision Drilling.

to correct misalignment of the motor shaft and pump shaft. A flexible coupling should also be installed in the discharge piping of a centrifugal pump. These couplings can absorb vibrations that can damage the centrifugal pump. Discharge and suction piping should be supported by pipe support rather than the centrifugal pump.

Valves in the suction piping and discharge piping may be required to allow removal of the centrifugal pump for servicing and replacement.

Safety and handling

Mud pumps

Any time maintenance work is performed on a bladder-style pulsation dampener of a mud pump, the precharge on the dampener must be completely bled off. Component damage and personal injury could result if a dampener is disassembled while still pressurized.

Valve seats on mud pumps should be pulled with appropriate pullers rather than torch cutting. Torch cutting can damage discharge modules.

Mud pumps, despite their extreme size, are actually very precisely engineered pieces of equipment, manufactured to very close tolerances and fits. If good procedures are not followed and replacement parts are installed carelessly, you will most likely have shortened service life of these parts and

Table PM-1: Cross-reference to part numbers in Figures PM-8 & PM-9

1: Cylinder Head	17: Packing
2: Cylinder Head cover	18: Gland
3: Liner Packing Adjustment	19: Gland Nut
4: Cylinder Head Packing	20: Piston Rod
5: Liner Cage	21: Valve Cover
6: Liner	22: Valve Cover Plate
7: Tell-tale Hole	23: Valve Cover Packing
8: Liner Packing Cage	24: Valve Pot
9: Liner Packing	25: Valve Seat Deck
10: Lantern Ring	26: Valve Guide
11: Liner Pulling Threads	27: Valve Spring
12: Piston	28: Valve
13: Fluid Cylinder	29: Valve Seat
14: Rear Liner Cage	30: Liner Retention Arrangement
15: Stuffing Box	31: Liner Seal Plate
16: Junk Ring	32: Cylinder Head Adjustment

possible severe damage to the pump. It is important, therefore, that replacement parts be installed properly. Most manufacturers of pumps or pump parts publish recommended procedures for installing parts, and these instructions should be followed closely.

The moving parts of the fluid end of a mud pump should have a cover or guard installed to protect personnel from moving parts.

Never hammer on mud pump parts that are under pressure. Never tighten liner packing while the pump is under pressure. Always bleed off the pressure first. Shut down and disengage the power source before working on a mud pump.

Liners should never be struck directly with a hammer, since dents can damage the sleeve and/or plating material. Always use a piece of wood to absorb some shock from the hammer.

Mud pump components can be extremely heavy. Always ensure personnel stay a safe distance from parts being lifted.

Hydraulic (fast-change) systems can simplify and expedite removal and installation of piston rods, liner retainers, valve covers and discharge strainer covers. Hydraulic and pneumatic wrenches can also be used to loosen and tighten bolted connections. These systems can be faster and safer than swinging a sledgehammer.

High-pressure mud pumps must never be operated at speeds, pressures or hp exceeding the limitations speci-



Figure PM-7: Fluid end triplex pump in winterized building. The moving parts of the fluid end should have a cover or guard installed to protect personnel from moving parts. Courtesy Precision Drilling.

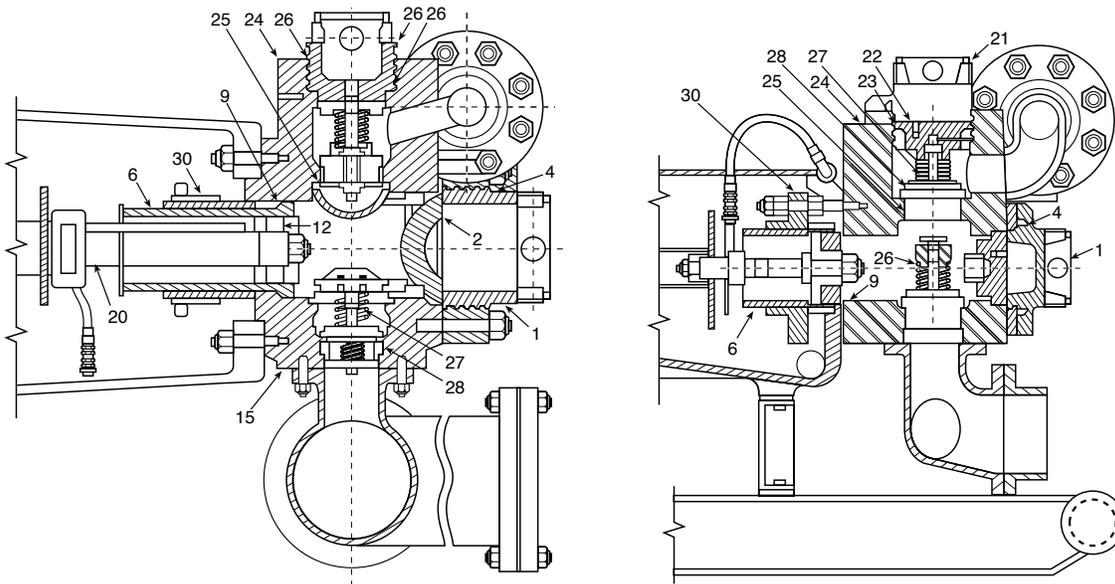


Figure PM-8: Two types of single-acting mud pumps with over and under valves, front loading. Part numbers are listed in **Table PM-1**.

fied by the manufacturer on the rating plate (i.e., data plate). Do not paint over the rating plate—it contains critically important information.

Use caution when tightening or loosening hammer lug connections and valve covers. Always wear proper personal protective equipment (safety shoes, safety goggles, impact resistant gloves, etc.).

Bladder-style discharge dampeners and suction dampeners should only be pre-charged with nitrogen. Never pre-charge these systems with air.

Ensure that any manual pump rotating devices have been removed before starting the mud pump.

Centrifugal pumps

The moving parts of a centrifugal pump should be covered or guards installed to protect personnel from moving parts. Do not attempt to remove guards or covers when a pump is running.

Inadequate lubrication or excessive lubrication can damage bearings.

Ensure centrifugal pumps have been locked out (isolated from energy sources) and tagged out (marked "Danger/Do Not Operate") before any maintenance or repairs are performed. Adjustments should not be made when a centrifugal pump is running.

Competent personnel and/or qualified electricians should be the only ones working on electrical systems.

A pump that is hot should never be worked on until it has cooled off.

Centrifugal pumps should have all guards and hardware installed when starting up. Water in a centrifugal pump running against a closed discharge valve can boil quickly.

Ensure any suction valves are open and a discharge valve is at least partially open before starting a centrifugal pump. Do not operate a centrifugal pump with the suction valve or discharge valve closed.

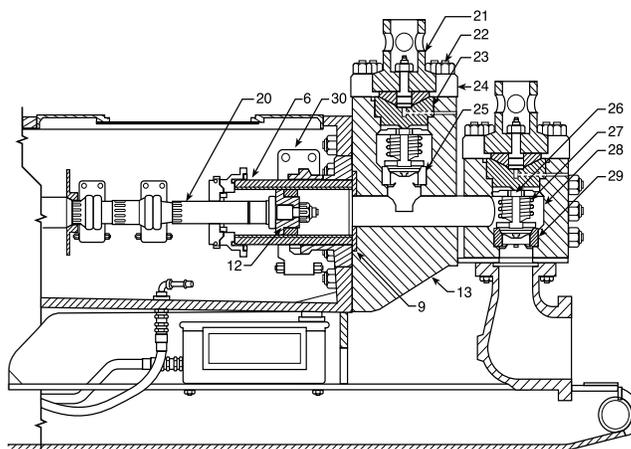


Figure PM-9: A typical single-acting mud pumps with "I" head back loading. Part numbers are listed in **Table PM-1**.