OPERATION AND
SERVICE GUIDE
O-201
OCT. 1999

STEEL COALESCING SYSTEMS WITH ELECTRIC OPERATED PUMPS

Refer to Bulletin F-303.

MODELS	PRICE CODE NO.	PARTS LIST	
S50(1)X1F8KG ½S TS3-C.3-VV-PS	1277	P-7450 P-3951	P-3200
S100(2)X1F8KG ½S TS6-C.5-VV-PS	1278		P-3300
S150(3)X1F8KG 1S TS9-C1.0-VV-PS	1279		P-6300

SAFETY PRECAUTIONS BEFORE STARTING

1. Read operating instructions for system and instructions supplied with chemicals or solution thoroughly.
2. Do not perform service or replace cartridge unless electrical power supply is disconnected.
3. Refer to a chemical resistance data chart for compatibility of materials with solution.
4. Note temperature and pressure limitations of equipment.
5. Personnel operating equipment should always wear suitable protective clothing: face mask or goggles, apron and gloves.
6. Do not use piping as handles or steps.
7. Ensure that all fittings and connections are properly tightened.
8. All external piping must be supported and aligned independently of the chamber.
9. Close and open valves slowly (to avoid hydraulic shock) or shut pump off.
10. Do not operate filter with valves in throttle position.
11. Pump relief valve is factory set at 35 PSI. Do not readjust. Pressure excess may cause collapse of filter element.
12. When gauge shows 35 PSI, replace filter element.

DESCRIPTION

The coalescing system is comprised of a pump, a prefilter chamber and a coalescing chamber. The pump is a low-shear, positive-displacement, rotary, gear pump with self-priming capabilities. The pump is equipped with a pressure relief valve; factory set at 35 psi, to prevent excessive pressure in the system. The filter is a cartridge-type filter chamber designed to hold five 10", 20", or 30" filter cartridges depending on the model. The coalescing chamber is designed to hold one element, 4" to 6" diameter by 11" long. The chamber includes manual light and heavy phase valves and a sight glass. The system also includes an electric pressure switch (designed to deenergize the pump at 40 psi system pressure) and a suction strainer to protect the pump against large foreign particles.

A separation coalescer takes oil out of rinse water, cleaning solutions, waste effluents and pollution control systems, and separates water from oil in hydraulic systems and other applications of water/oil contamination. It handles dissimilar liquids with a specific gravity difference of 0.09 and greater, and leaves the effluent with less than 10 ppm of the discontinuous phase.

Coalescer separation is highly effective. It separates oil and water by coalescing and gravity separation. The oil/water mixture is pumped through the coalescing element which holds small droplets until they grow enough to float off. Oil rises to the top, water sinks to the bottom and accumulated oil or water is periodically bled off.

The coalescing element normally has an indefinite life. Replace it only when it becomes plugged with solid particles. Prefilter media of 5 to 10 microns is required to protect the element. Coalescing of fluid with excessive particulate loading is best accomplished when the solution is first clarified with a separate filtration system.

NOTE: Initial system gauge-pressure (with clean filters) is a function of solution viscosity, pump flow rate, filter retention (micron rating) and filter element style. When operating the filter on cold oil, the high initial pressure due to the high viscosity may open the pressure relief valve or cause an artificially high pressure that will signal a filter cartridge change before the cartridges are fully loaded with dirt. This practice is not harmful but can be avoided by operating the system when the solution is warm.

PRE-START-UP AND PREPARATION OF COALESCING ELEMENT

1. Review accompanying pump-motor information on pages 4 & 5 to assure proper start-up.
2. Install all hoses (disconnected for shipping) and tighten hose clamps.
3. Install cartridges in the filter chamber (it is shipped empty), see pages 2 & 3.
4. Wet coalescing element with primary phase of solutions being separated (water or oil) etc. This can be achieved by removing the element and immersing it in the pure primary solution or filling the chamber with same.
5. Check power source for correct voltage and phase and connect to motor starter/disconnect switch and motor. Match voltage to nameplate voltage on motor. Incorrect voltage can cause fire or seriously damage motor. Verify that the starter is wired for the correct operating voltage and with the correct overloads. It is recommended that a motor starter be installed for overload protection if one is not provided with the system. Wire in accordance with local codes and motor wiring schematics.
6. Pour one half pint of oil into suction hose and allow oil to drain into pump to lubricate gears before energizing motor.

   DO NOT RUN PUMP DRY.
7. Place the ends of both hoses in the reservoir. Locate them at opposite ends or at different depths to obtain

maximum circulation across reservoir. For removing surface oils from reservoir, a skimmer installed on the suction hose is recommended. To prevent pump cavitation, keep the suction hose from touching the bottom or the sidewall of the tank.

8. Check that chamber drains are plugged.

START-UP

1. Check that V-band clamps on filter and coalescing chambers are secure.
2. Secure hoses to prevent them from falling out of tank.
3. Open the vent valve on filter chamber and the lightphase valve on top of coalescing chamber. Be sure to leave valves open. Failure to vent chamber when starting fluid flow will allow air to become com pressed in upper portion of vessel. Compressed air might rupture chamber, resulting in personal injury and damage to equipment.
4. Open inlet and outlet valves (if installed).
5. Energize pump and motor.
6. Close vent valve on filter chamber when solution level rises to the top of the chamber. Do not close vent valve until the chamber is completely purged of air.
7. Allow air to purge from coalescing chamber as described above. When air is completely purged, the light and heavy phase valves can be adjusted for the primary and secondary effluent flow rates.

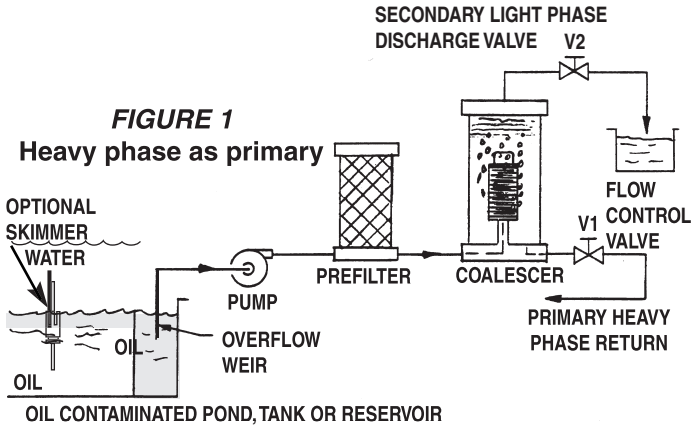

FIGURE 1
Heavy phase as primary

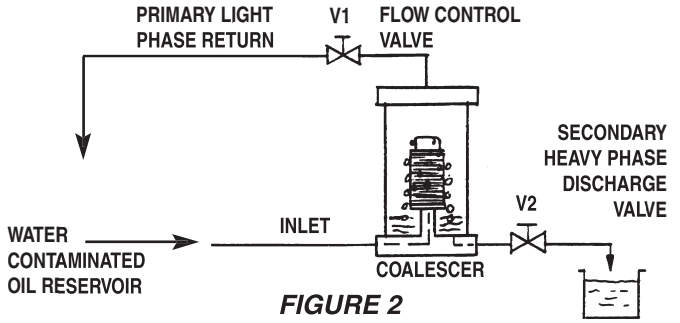

FIGURE 2
Light phase as primary

COALESCING CHAMBER AND ELEMENT

1. The coalescing chamber works on the principle of coalescing finely divided droplets into large droplets on the outside surface of the element. These large droplets form, and because of differences in specific gravity, float to the top of the chamber or fall to the bottom. NOTE: Solution flow through the coalescing element is from inside to outside.
2. The primary phase, whether heavy or light, is usually a constant flow and recirculated to the original reservoir. For solution transfer, the primary discharge may be directed to a second reservoir.
3. The secondary phase, whether heavy or light, may be "drawn off" manually or automatically. Recommended automatic methods are: timer or conductivity devices wired to solenoid valve. Automatic means of emptying the coalescing chamber of the secondary phase solution are available.
4. Be sure the coalescing element is wetted with the primary phase being separated prior to operation (i.e. if it is a rinse water-oil contaminated system, wet with clean water. If water contaminated oil, wet with clean oil).
5. The flow rate and degree of separation will vary with the system. If too much oil is accumulated in the chamber, oil will carry over with the water (or other liquid) discharged. If the flow rate is too high, oil will be entrained in the discharge flow instead of floating to the top of the chamber. Throttling the discharge valve will correct this condition.

SKIMMER

A floating weir skimmer is recommended for collecting surface oils from tanks without an overflow weir.

FILTER CARTRIDGES

The positive displacement gear pump delivers the same flow rate through clean or dirty cartridges. Indicated gauge pressure, not flow rate, will determine whether or not the filter cartridges should be replaced. When the gauge pressure reaches approximately 35 PSI, the filter tubes are loaded with dirt and should be discarded. The pump relief valve automatically cuts in at this pressure and a small portion of the total flow is recirculated internally in the pump to maintain this maximum pressure.

These filters are normally provided with 5 micron filter cartridges. However, refer to filter model number and original order when requesting replacement cartridges, parts or information.

SHUT DOWN AND COVER REMOVAL for the Filter Chamber and/or the Coalescing Chamber

⚠ **WARNING:** Do not attempt to open chamber while pump is energized or while unit contains pressure.

1. Turn the pump off and disconnect the power.
2. Close the inlet and outlet valves, if installed, (always close inlet or pressure side first) or pull the hoses out of the reservoir and drain liquid from the system.
3. Open the vent valve on the filter chamber and the lightphase valve on the coalescing chamber. Care should be taken to keep face and hands protected and clear of the vessels while venting.
4. ⚠ **CAUTION:** Do not, at any time, remove or loosen cover clamp before draining and venting thoroughly.

Failure to open drain and vent can result in pressurized liquid being trapped in vessel. Liquid could spray out when cover clamp is loosened, causing personal injury or damage to equipment.

5. Loosen and remove V-band clamp bolt and the V-clamp. The clamp joint with the round head bolt does not have to be loosened.
6. ***Inspect V-band clamp and bolt for wear. Also, inspect vessel for dents, corrosion, or other damage to equipment. Damaged components might cause malfunction during operation, causing personal injury and damage to equipment.***
7. **Remove cover from vessel by turning cover 5 degrees counterclockwise and lifting to remove.**

COALESCING ELEMENT REPLACEMENT

1. Chamber interior and all components should be examined for corrosion or other damage each time the element is replaced.
2. Loosen and remove top lock nut on coalescing element.
3. Lift out element.
4. Replace with new element and reassemble.
5. For replacement coalescing elements refer to Parts List or Bulletin M-210.

CARTRIDGE REPLACEMENT

1. Vessel interior and all components should be examined for corrosion or other damage each time cartridges are replaced.
2. Unscrew wing nut from center post.
3. Remove compression plate to expose cartridges.
4. Remove top seat plate assembly from each cartridge.
5. Remove filter cartridges and discard. If cartridges are stacked, remove top deck of cartridges first. Remaining tubes may be removed by lifting with "V". Retain spacers if cartridges are multi-stacked.
6. Inspect cartridge guides. In most cases it is not necessary to remove guides when routinely changing cartridges. Remove guides only if they appear damaged. Note: Guides are not used with extended core cartridges.
7. Inspect cartridge sump seat.
8. Place V-posts in bottom seat and slide filter cartridge over posts. When stacking 10" cartridges, a spacer ring is required between cartridges.
9. Insert spring seat plate assembly on top of all cartridge columns. If springs are not level, check for missing spacers or improperly seated cartridges.
10. Place compression plate over center post and tighten wing nut until compression plate contacts center post jam nut.

SUCTION STRAINER SCREEN is located in suction line to protect pump against damage from the larger foreign solids. Periodically remove the strainer element for cleaning and inspection. When strainer becomes plugged, it will impede flow of oil to the pump, resulting in unusually loud pump operation, reduction of flow and pressure.

1. **Loosen and remove nut in Y strainer for removal of screen.**
2. **Clean and replace screen.**

COVER REPLACEMENT FOR FILTER AND/OR COALESCING CHAMBER AND START-UP

1. **Clean and inspect gasket seating surfaces.**
2. **Clean and inspect gasket for damage. Replace if necessary. Relubricate gasket with petroleum jelly. Note: Tapered portion of gasket is to face outward.**
3. **Reposition cover to vessel body turning cover 5 degrees clockwise to engage safety feature.**
4. **Reposition V-band clamp to vessel.**
5. Inspect V-band clamps and bolts for wear. Also, inspect vessels for dents, corrosion, or other damage. Damaged components might cause malfunction during operation, causing personal injury and damage to equipment.
6. Reinstall bolts and tighten clamps to a point where joints are properly closed.
7. Do not exceed 10½ ft. lb. of torque. Overtightening can damage equipment. The use of a torque wrench is recommended.
8. Leave bent valves open.
9. Refer to steps under Pre-Start-Up and Start-Up.
10. ⚠ ***CAUTION:*** Do not attempt to adjust V-band clamp while filter vessel is pressurized.
11. If filter leaks, repeat shut down and start-up procedures with a new gasket and clean gasket seating surfaces. Do not overtighten V-clamp bolt.

TROUBLESHOOTING

1. Ruptured filter element. Relief valve set too high. Maximum gauge pressure should be 35 PSI. Reduce relief valve spring compression by counterclockwise rotation of adjustment screw under acorn nut on pump. Refer to Figure **A and Parts List.**

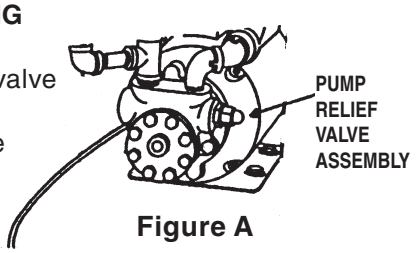

Figure A

2. High initial pressure on gauge, caused by dense filter element, or high flow rate high viscosity oil, or extremely dirty oil. Pressure can be reduced by using pleated style filter element or increasing temperature of oil.

3. Air in discharge hose or light color of oil in discharge hose, caused by plugged suction strainer screen. Refer to instructions on cleaning and replacement. Unusual loud noise, caused by pump cavitation which is the effect of a plugged strainer screen, or end of suction hose is against bottom or sidewall of reservoir.

TO SERVICE GEAR PUMPS TS3, TS6 and TS9

GENERAL DESCRIPTION

The SERFILCO series TS3, TS6 and TS9 are compact highly efficient, positive displacement, rotary internal gear type pumps with a mechanical seal.

PUMPING PRINCIPLE

These pumps employ the internal gear principle which is based upon the use of a rotor, idler gear and a crescent-shaped partition that is cast integrally with the cover. Thus, only two moving parts comprise this efficient pumping element. Power is applied to the rotor and transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the crescent partition . When the pump is started, there is an increase in volume as the teeth come out of mesh. This creates a partial vacuum, drawing the liquid into the pump through the suction port. The liquid fills the spaces between the teeth of the idler and rotor and is carried past the crescent partition to the pressure side of the pump. When the teeth mesh on the pressure side, the liquid is forced from the spaces and out through the discharge port.

SELECTION

The pumps are designed for working pressures up to 500 PSI and are required to develop 25" mercury vacuum at 0 PSI on factory test. While these pumps will develop as high as 27" of vacuum, it is sound engineering to avoid extreme vacuum whenever possible. Select pipe size to reduce line friction loss to a minimum. On transfer service, place pump as close to supply tank as conditions will permit, and eliminate the use of foot valves or check valves in the suction line whenever possible. Pumps are self priming and particularly suited to handle liquids of 35 SSU to 1000 SSU viscosity. It is important that the piping used in connecting the pump be clean and free of chips or scale.

SEAL

The seal is a device to prevent leakage between the stationary pump body and rotating drive shaft. A rotating lapped surface is attached to the shaft by an elastomer bellows. This rotating face is spring loaded to rub against a stationary lapped surface in the housing plug bushing. The clearance between these two surfaces is so minute that resistance to flow is great enough that fluid will not leak out and air will not be drawn in.

FOR TS3 & TS6 PUMPS

DISASSEMBLY OF SEAL

The seal assembly of the TS pumps may be changed without disassembly of the rest of the pump.

1. Place the pump in vise, shaft facing up, so that one jaw grips across the two ports. Do not tighten excessively as pump housing may be distorted.
2. Inspect shaft at keyway, flat or drive tang. Any burrs will interfere with removal of housing plug bearing assembly.
3. Remove housing plug with face type spanner wrench.
4. Remove the seal from shaft. The rubber boot will be bonded to the shaft, so it is necessary to push down on the seal to break this bond. Grasp the metal outer shell with any suitable device and pull the seal assembly upwards. The spring and washer should also be removed.
5. The TS3 pump assembly has a snap ring on the shaft to back up the seal assembly. Do not remove this snap ring unless you are completely disassembling the pump. TS6 pumps do not have a snap ring. A step on the shaft is used as the seal back up.
6. Remove stationary seal face from housing plug by pressing out from opposite side.
7. If damaged, remove the 'O'-ring from O.D. of housing plug.

DISASSEMBLY OF PUMP

Seal assembly must be removed before disassembly of pump. Also remove snap ring on shaft on TS3. Mark cover and body of the pump for proper reassembly. Remove cap screws, cover, idler and rotor from housing.

INSPECTION

Check pump housing, rotor idler gear, idler pin and crescent for wear, chipped or broken teeth. Housing bore and rotor O.D. may be checked for wear by positioning rotor in the housing and check for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing, rotor or both. If both housing and rotor require replacing, it is economically advisable to replace the pump.

ASSEMBLY OF PUMP

The following must be carefully followed when pump is reassembled.

1. Clean all parts thoroughly using great care to eliminate all dirt.
2. Install rotor in pump body.
3. Apply gasket to cover. Use new gasket if old one is damaged.
4. Place idler gear on pin in cover assembly.
5. Place cover assembly with gear on pump. (Align matching marks for proper location.)
6. Install cover cap screws. Pull down gradually and alternate from a screw on one side to one on the opposite side.
7. Install snap ring on shaft.

ASSEMBLY OF SEAL

1. Clean all parts thoroughly using great care to eliminate all dirt.
2. Oil shaft with suitable lubricating oil.
3. Oil inside of new rotary seal assembly.
   a. Use plastic seal assembly tapered sleeve.
   b. Oil seal assembly sleeve.
   c. Place rotary seal assembly on sleeve. Tapered end of sleeve fits into spring end of assembly.

d. Place slotted end of sleeve on bench. Press down on carbon face of seal with your fingers and slide seal about mid-point on sleeve.
e. Place slotted end of tool over tang on pump shaft. Line up outside diameters of sleeve and shaft by eye.
f. Push seal down with your fingers so that it passes from the assembly sleeve to a position half way down the shaft.

4. Press stationary face into housing plug. Lapped surface must be up. Protect this lapped surface by covering it with a piece of paper when pressing down on face. Use your fingers for this operation.
5. Place new 'O'-ring on O.D. of housing plug, if required, and lubricate with oil.
6. Lubricate carbon face liberally with lube oil.
7. Reassemble housing plug into position over the pump shaft. Do not nick seal face by hitting pump shaft. Tighten the housing plug with spanner wrench. Rotating seal will automatically be positioned by this operation.
8. Check pump for free rotation by turning shaft with suitable wrench. There will be a definite resistance to turning because of the seal load. The pump must turn freely without binding.

FOR TS9 PUMP

INSTRUCTION FOR SEAL REPLACEMENT

1. Grip pump firmly across ports and opposite side of housing in vise with shaft end up.
2. Remove three cap screws and slide seal housing cap assembly off shaft.
3. Pry seal from housing cap, clean out seal cavity with cloth. Press new seal into housing cap with lip spring side facing mounting face.
4. Inspect shaft. If badly scored at seal area, rotor should be replaced. Carefully remove sharp edges from shaft and polish with crocus cloth. This will eliminate possible damage to the seal lip and assist in easy installation.
5. Install new gasket into bracket.
6. Apply a dab of petroleum jelly to the seal lip and in stall over shaft. CAUTION: Seal lip must retain its position on shaft. Work housing cap assembly up and down on shaft to make certain that seal lip slides freely. Rotate to align holes in cap flange with tapped holes in pump bracket. Insert and tighten cap screws.

DISASSEMBLY OF PUMP

Seal or packing must be removed from shaft end before disassembly of pump. Follow procedure as outlined under instructions for seal replacement.

1. Mark cover, housing and bracket for proper reassembly.
2. Remove cover cap screws, cover, housing, idler and rotor from bracket.
3. The individual parts should be inspected for damage. The keyway in the end of the rotor shaft must be in good condition and there must not be any deep scratches or grooves on the following surfaces:
   a. The I.D. surface of the housing
   b. The O.D. of the rotor
   c. The end face of the rotor
   d. The O.D. of the idler
   e. Both faces of the idler
   f. The inside surfaces of the cover including surfaces on the crescent

INSPECTION

Check cover, housing, bracket, rotor and idler for wear, chipped or broken teeth. Drop-off in capacity is generally caused by the abrasive action of foreign materials in the oil, resulting in end play of the rotor. In most cases this can be taken up by changing to a thinner cover gasket, so as to maintain end clearances. Refer to assembly of pump instructions.

The rotor should be positioned in housing or bracket, and checked for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing, bracket, rotor or all three parts.

REASSEMBLY OF PUMP

The following points must be carefully followed when pump is reassembled:

1. Clean all parts thoroughly using great care to eliminate all dirt.

2. Install rotor in bracket or housing (depending on model of pump).

3. Position selected gaskets over mounting registers of bracket and cover.

NOTE: Gaskets of various thickness are supplied with each pump so that proper internal end clearances are maintained. This clearance depends on the size of the pump and the viscosity of the lubricant being handled. Select gasket thickness to obtain minimum end clearances as follows:

		GASKET	
		COLOR	THICKNESS
#2 size pump	.001 to .002 clearance	Green	.003"
		Tan	.004"
		Blue	.005"

4. Install housing over rotor head positioned on bracket register.

5. Apply idler to cover and position in housing register. Align matching marks for proper location. Check position of vent holes in bracket or housing.

6. Install cover cap screws.

NOTE: Pull down gradually and evenly when tightening cap screws. The shaft should be revolved slowly as the cap screws are gradually tightened. Not one fastened down to the limit and another, and so on, but each screw in its turn tightened a little at a time until all finally become secure and the shaft turns freely without any detectable end play or binding.

7. Install packing or seal (follow procedure as outlined under instructions for seal replacement).

TROUBLESHOOTING HINTS
WHAT TO LOOK FOR WHEN:

NO OIL IS DELIVERED

a. Suction lift too high for vapor pressures of liquid pumped. While these pumps will develop as high as 27 inches of vacuum, it is good engineering practice to reduce the vacuum to a minimum.
b. Bad leaks in suction line or port passages can be detected by submerging pressure line from discharge side of pump into a pail of oil, where the air will be seen in the form of bubbles.
c. Pump shaft not rotating. Coupling defective - tongue and groove or gear not engaged.

CAPACITY IS TOO LOW

a. Suction lift too high
b. Air leaks in suction line.
c. Suction line too small.

Can be detected by installing a vacuum gage directly at the pump suction. The maximum vacuum at the pump suction should never exceed 15 inches of mercury. It is necessary to keep below 15 inches, not because of the inability of the pump to handle a higher vacuum, but primarily because of the vaporization that is liable to take place at a higher vacuum. Vaporization caused by higher vacuums will generally result in capacity drop-off.

d. Pump speed too slow.
e. Strainer too small or obstructed.
f. Suction pipe or port not immersed deep enough in the liquid.
g. Piping improperly installed, permitting air pocket to form in pump.
h. Increased clearances or wear in the pump will sometimes cause the pump to deliver an insufficient supply of liquid.

PUMP WORKS SPASMODICALLY

a. Leaky suction lines.
b. Suction lift too high.
c. Air or vapor in liquid.
d. Coupling slipping on pump shaft.

PUMP WASTES POWER

a. Pressures too high.
b. Liquid more viscous than desired.
c. Suction or discharge lines obstructed.
d. Mechanical defects

End thrust on pump shaft. (These pumps are not designed to take end thrust toward the pump cover and extreme care must be taken to prevent thrust in this direction.) Driving shaft and pump shaft misaligned. The pump may be binding due to insufficient end clearance. Pump shaft bent. Misalignment within pump due to strains built up by bad piping or installation of pump into equipment.

PUMP IS NOISY

a. Machine or part of it is acting as a sounding board.
b. Misalignment or bad design of coupling.
c. Coupling set up too close to pump.
d. Vibration of pump.
   Bent shaft
   Worn pump
   Inferior workmanship
e. Air leaks into suction side of pump
f. Suction lift so high that vapor forms within liquid.

PUMP LEAKS

a. Cover bolts need tightening, or cover gasket is defective.
b. See seal under service instructions.

HANDLE WITH CARE

If it becomes necessary to remove pump from your equipment to return to the manufacturer, plugs should be inserted in the ports to prevent foreign material from getting into the moving parts These pumps are precision-built and should be given every reasonable care.