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SERVICE BULLETIN

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PAGE: 1 of 6

BULLETIN NO.: WSB0079
SECTION: 5-2 (PUMPS)
MODEL(S): ALL UNITS

SUBJECT: GEAR PUMP FAILURES

It has been our experience that after a gear pump failure, the mechanic will replace the pump and sometimes experience another failure or extremely short pump life. Usually these failures are not due to a faulty pump, but are caused by a variety of other factors. Some of the most common sources of gear pump failures are:

1. Abrasive wear caused by fine particles
2. Abrasive wear caused by metal particles
3. Incorrect installation
4. Aeration or cavitation
5. Lack of oil
6. Damage caused by metal objects
7. Excessive heat
8. Overpressure

ABRASIVE WEAR CAUSED BY FINE PARTICLES

Abrasive wear caused by fine particles is the most common cause of hydraulic failure. The main symptom for this type of failure is usually a gradual decrease in the power and speed of the hydraulic system. Fine particles such as dirt and other foreign matter circulating through the system cause wear on all components, especially on the pressure plates, housing bores and in the shaft bearing area.

Dirt can enter the system through worn seals, or if the system is serviced in dusty conditions, or with dirty equipment. Common indicators of fine particle damage include:

- A sandblasted-appearing band around the pressure plate bores. A small groove at an angle to the lube groove will also often be present with fine particle abrasive wear.
- Rounded edges and enlarged ends at the lube groove.
- A dull, sandblasted area at the root of each tooth at the face of the gear. The shaft will have a dull finish, as if it had been sanded with fine sandpaper.
- A gray, sandblasted appearance on the inlet side of the gear track.
- The seal lip cutting into the shaft. Fine abrasive particles will get under the seal lip and wear grooves in the shaft.

ABRASIVE WEAR CAUSED BY METAL PARTICLES

Metal contaminants usually result from component wear in the hydraulic system or insufficient flushing after a previous failure. Metal particle damage may be gradual or fairly sudden, depending on the quantity and size of particles.

Some common indications of metal particle damage:

- The pressure plate will have many circular scratches. If exposure is continued long enough, the entire surface will be very rough and heavily grooved.
- The bearing area of the shaft will have many small grooves. The severity of the damage will depend on the amount of contaminants in the system and the operating pressure. On double section pumps, one section may show greater damage than the other due to the difference in bearing loads.
- The housing will have small grooves in the gear track, a result of large particles being caught between tips of the gear teeth and body. This kind of damage is usually caused by metal particles from another failed component such a cylinder, or failure to clean the system properly after the previous failure.

INCORRECT INSTALLATION

Incorrect installation can impose external loads on the pump, which can cause various failures. Be sure the drive shaft does not bottom in mating part. Piping should be attached to the pump without force. Pumps should clear all machine components in all types of operation. Failure due to incorrect installation is often indicated by wear on the pressure plate at the rear of the drive gear only. This is caused by the drive shaft bottoming out in the machine drive coupling, which puts a heavy thrust load on the drive shaft.

AERATION OR CAVITATION

Aeration and cavitation are discussed together because they act very much alike in the system. In both instances, vapor or air bubbles in the oil cause pump damage. This type of failure is rare and careful investigation is required to pinpoint it.

Aeration occurs when air mixes with the oil. Air may enter the system through a small suction leak or by agitation of the surface of the oil in the tank. Surface agitation occurs when return oil is dumped back above the surface of the oil. This can occur due to a high-pressure leak inside the tank, or loose or failed lines inside the tank.

Cavitation is the formation and collapse of vapor bubbles in the oil. This is usually the result of the pump suction being restricted. Cavitation occurs more readily when the oil is hot.

Aeration and cavitation erode and pit the pressure plates and pump housing. As the air or vapor bubbles in the oil are compressed to pump discharge pressure they collapse. This collapse is called an implosion. The force of the implosion removes metal from the pressure plates and housing.

A pump cavitating or operating on aerated fluid is usually noisy. It makes a sound like pumping marbles. The system operates in a spongy or jerky motion.

Some common indicators of aeration or cavitation damage are:

- Clear erosion on the suction side in the gear track. Small marks sometimes appear in the gear track during pump break in, when small particles of metal pull out, leaving holes about 1/16” across. This should not be confused with erosion caused by aeration or cavitation.
- The pressure plate will have an eroded area near the end of the chamfer. Erosion on plates progresses at a much slower rate than in the body of the pump.
- There will be an eroded area on the pressure plate on the discharge side of the pump. This type of erosion usually appears in conjunction with erosion on the discharge side of the body. It results from the same causes.
- The housing will have an eroded area on the discharge side of the pump. Erosion in this section is very unusual and is usually caused by a leak in the suction line, oil being returned above oil level in the reservoir (which can cause severe foaming) , or a restricted suction line, among others.

LACK OF OIL

When failure due to lack of oil occurs, the deterioration is usually very rapid. This type of failure can occur from either of two conditions:

1. A low oil level in the reservoir, which allows the suction to be uncovered due to the sloshing of the oil.
2. A large air leak in the suction line.

This type of failure may occur with relatively little damage to the bearings. Bearings may also fail if the pump is allowed to run too long before removal. Some indications of failure due to lack of oil are:

- Heavy wear on the end of the pressure plate. Low oil level may allow the suction to be exposed for short periods of time. This can occur during machine operation (due to sloshing) even though suction may be well below oil level when the machine is not moving.
- Heavy wear on the ends of a gear. The wear is usually greater near the outside diameter.

DAMAGE CAUSED BY METAL OBJECTS

A pump failure due to large metal object damage is usually very sudden. It is possible, however, for the pump to completely destroy the metal object and pump it downstream. In either case, the results are easily observed and identified:

- Deep grooves cut into the housing, created by any large metal object, such as a nut or bolt, entering the suction side of the pump.
- Broken gear teeth, caused by a metal object being caught between the gear teeth.
- Severe peening of the pump inlet port. Usually, foreign objects will not be found because they are completely destroyed if the pump continues to run.

EXCESSIVE HEAT

Excessive heat will turn pressure plates and gears black and harden O-rings and seals. It usually results from a sticking valve or a relief valve set too low. If a sticking valve does not return to the neutral position, the pump flow will be dumped continuously. This will overheat the system rapidly. If a relief valve is set too low, part of the oil will be dumped across the relief valve each cycle. In this case the machine will be very slow.

Some indicators of failure due to excessive heat:

- The entire pressure plate will be coated with a black substance, although the surfaces will show very little damage otherwise. The plate cannot be reused.
- The shaft and gear will be black all over. The shaft will show some bright streaks but no real grooves. Parts are not reusable; the bearing surfaces have been damaged by such excessive temperatures.
- Seal strip will be extremely hard and brittle—almost as brittle as glass.

OVERPRESSURE

There are two main reasons for overpressure:

1. The relief valve failed to function. This produces one extreme surge, followed by immediate failure.
2. The relief valve setting was too high, resulting in repeated excessive pressure peaks.

The damage to the pump looks very much the same for both types, which can include a broken shaft and/or a cracked housing.

PRECAUTIONS WHEN INSTALLING A HYDRAULIC PUMP

Take the following precautions when installing a hydraulic pump:

1. Back off the adjustment on the relief valve.
2. Check suction line from hydraulic tank to pump, as heat and operation will cause hoses to collapse, which can lead to cavitation.
3. When replacing hose clamps, set the screw tighteners opposite one another. When clamps are both tightened on one side, the hose may wrinkle and cause an air leak, which in turn may cause cavitation.
4. Be sure the O-ring on the inlet or suction side the pump is in good condition and in place. If not, this will cause cavitation.
5. After replacing a pump, check the reservoir oil level. If the level is below the tank outlet, it will cause cavitation.
6. Units employing long, enclosed suction hoses are more susceptible to excessive heat damage and collapse. They should be inspected more closely, and at more frequent intervals.
7. With hydraulics, cleanliness is most important. Wipe tank caps, funnels and all areas around the filler neck clean before opening the tank, and immediately cover all disconnected lines, fittings and openings.
8. Make sure the filters are replaced regularly.
9. Clean the tank screens, and replace if necessary.
10. Clean the bottom of the hydraulic tank.

Additional troubleshooting tips and guides can be found in the table on the following page.

IDENTIFICATION	CAUSE	CORRECTIVE CHECKS
1. Sandblasted band around pressure plate bores 2. Angle groove on face of pressure plate 3. Lube groove enlarged and edges rounded 4. Dull area on shaft at root of tooth 5. Dull finish on shaft in bearing area 6. Sandblasted gear bore in housing	Abrasive wear caused by fine particles, usually dirt and other fine contaminants not visible to the naked eye	1. Was clean oil used? 2. Was filter element change period correct? 3. Were correct filter elements used? 4. Cylinder rod wiper seals in good condition? 5. Cylinder rods dented or scored? 6. Was system flushed properly after previous failure?
1. Scored pressure plates 2. Scored shafts 3. Scored gear bore	Abrasive wear caused by metal particles that are visible to the eye	1. Was system flushed properly after previous failure? 2. Contaminants generated elsewhere in hydraulic system? 3. Contaminants generated by wearing pump components?
1. Any external damage to the pump 2. Damage on rear of drive gear and rear pressure plate only	Incorrect installation	1. Did shaft bottom in mating part? 2. Any interference between pump and machine?
1. Eroded pump housing 2. Eroded pressure plates	Aeration or cavitation, caused by restricted oil flow to pump inlet and/or aerated oil	1. Tank oil level correct? 2. Oil viscosity as recommended? 3. Restriction in pump inlet line? 4. Air leak in pump inlet line? 5. Loose hose or tube connection near or above oil level in tank? 6. Excessive operation of relief valve?
1. Heavy wear on pressure plate 2. Heavy wear on end of gear	Lack of oil	1. Was oil level correct? 2. Any leaks in piping inside tank? 3. Any oil returning above oil level?
1. Housing scored heavily 2. Inlet peened and battered 3. Foreign object caught in gear teeth	Damage caused by metal object	1. Metal object left in system during initial assembly or previous repair? 2. Metal object generated by another failure in system?
1. Pressure plate black 2. O-rings and seals brittle 3. Gear and journals black	Excessive heat	1. Was a valve stuck? 2. Was relief valve too low? 3. Was oil viscosity correct? 4. Was oil level correct?
1. Broken shaft 2. Broken housing or flange	Overpressure	1. Relief valve setting correct? 2. Did relief valve function?