Unit V

Failure and trouble shooting

Failure and trouble shooting - Hydraulics

Trouble/Fault	Probable causes	Remedial actions
I. PUMP		
1. Pump delivering insufficient or no oil	Wrong direction of shaft	Must be reversed immediately to prevent seizure and breakage of parts due to lack of oil
	Pomp shaft turning too slowly to prime itself	Check minimum speed recommendation and momentaril^{y} increase rpm, to Rectify
	Clogged strainer or suction pipe line	Clean strainer or suction pipe line. Remove foreign matter
	Strainer capacity insufficient	Replace with a strainer hose capacity is more than twice the maximum flow rate
	Air leak in suction line	Add oil and check oil level in reservoir. Check for leaks and repair
	Faulty rotating part in the pump body	Check by listening to the sound. Remove the cover and check the internal mechanism. Replace, if necessary
	Oil leak in pump casing due to seizure or wear of pump sliding parts	Check the sliding parts
	Low level of oil in the reservoir	Add the oil recommended as per the indicator line
	Oil viscosity too heavy to pick up prime or too light causing excessive slippage	Use oil as per recommendation

Trouble/Fault	Probable causes	Remedial actions
2.Pump developing unstable or Zero pressure	Pump not delivering oil for any of the above reasons	Apply the above remedies
	Relief valve setting not high enough	Correct valve setting by using pressure gauge
	Relief valve sticking open	Check relief valve. If necessary, dismantle and clan valve
	Clogged orifice of the relief valve	Overhaul and clean relief valve
	Mis-assembly, mis-connection or mis-operation of various valves in the circuit	Must be corrected
	Faulty performance of various valves or excessive oil leakages in the circuit through actuators and valves etc.	Test each component separately and repair
	Faulty pressure	Cheek and re lace if necessary
	Partially clogged suction line or suction strainer.	Clean and remove foreign matter

Trouble/Fault	Probable causes	Remedial actions
3. Pump making noise	Misalignment of pump and prime mover	Check and rectify
	Strainer capacity insufficient	Replace with a strainer whose capacity is more than twice the maximum flow rate
	Air leak at pump's suction pipe pints or from shaft packing of the pump	Pour oil on suspected joints while listening for change is sound. If sound stops, tighten the Mint
	Air remains in pump casing	Eliminate air through the air breather
	Small size of suction pipe	Replace so that the flow velocity on the suction side will be approximately 0.5 to 1 m/s
	Coupling misalignment	Re-align properly
	Pump bolts very loose	Tighten
	Resonance noises in the system	Reinforce by installing supports to eliminate resonance
	Air bubble or too much foam in suction oil.	Check to be certain that the return lines are below oil level and well separated from suction lines.
	Very high viscosity	Use recommended oil.
	Pump running too fast.	Check the recommended maximum speed.

Trouble/Fault	Probable causes	Remedial actions
4. Pump oil over-heated	Faulty oil cooler.	Repair
	Insufficient size of oil reservoir	Increase capacity or install an oil cooler
	Pump pressure too high	Readjust relief valve setting
	Excessive Pow velocity	Replace piping
	Seizure of pumps sliding parts	Dis-assemble and repair. Chick for foreign matter in oil and see if the pump casing is Idled with oil
5. Internal leakage around Pump	Shaft packing worn out	Replace
	Top cover packing damaged	Change the packing and apply clamping torque on the cover as per manufacturer's Recommendation
6. Excessive wear	Abrasive matter in the hydraulic oil being circulated through	Install an adequate filter or replace oil more often
	Viscosity of oil very low at working conditions	Check pump manufacturer‘s recomendations or consult your hydraulic engineer
	Sustained high pressure above the maximum pump rating	Check maximum setting of the relief valve
	Misaligned sinve or tight belt drive	Check and rectify
	Air recirculation causing chatter in the system	Remove air from the system

Trouble/Fault	Probable causes	Remedial actions
7. Breakage of parts inside pump housing	Excessive pressure above maximum pump rating	Adjust relief valve properly
	Seizure due to lack of oil	Check oil level in reservoir and cleanness of strainer and any other possible restrictions in suction lines
	Solid matter wedged in the pump	Install a filter in the system. Clean suction strainer more Often
	Excessive tightness of head screws	Follow manufacturer‘s recommendations
II. RELIEF VALVES		
I. Erratic pressure	Dirt in oil	Clean strainer and flush the system
	Worn poppet or seat	Lap the poppet or replace
	Piston staking in the Ind in body	Check and rectify

Trouble/Fault	Probable causes	Remedial actions
2. No or low pressure	Vent connection open	Check and rectify
	Balance hole plugged	Check and rectify
	Poppet not seating properly	Check, lap and repair
3. Excessive noise or chatter	High oil velocity	Check and rectify
	Faulty or worn poppet or seat	Check, lap or replace
	Excessive tank line pressure	Check and rectify
	Long vent line or pressure setting too slow to that of another valve in the Circuit	Check and rectify
	Valve setting too close to the system operating pressure	Set relief valve at least 10 bar higher than the required working pressure of the system
Ill. DIRECTIONAL CONTROL VALVES (DCVs)		
I. Faulty or incomplete shifting	Worn out control linkage, shift pin, etc .	Check and repair
	Insufficient pilot pressure	Check and rectify
	Burned out solenoid	Check and replace
	Worn spring centering mechanism	Check and replace
2. Cylinder creeping or drifting	Valve spool not centering properly	Check and rectify
	Valve spool not shifting completely	Check and replace
	Valve spool or body worn out	Check and rectify
	Leakage past the piston in the cylinder	Check and overhaul the cylinder

Trouble/Fault	Probable causes	Remedial actions
IV. SEQUENCING VALVES		
1. Premature movement of secondary operation	Valve set too low	Check and set it higher
	Excessive load on primary cylinders	Check and adjust accordingly
	High inertia load on primary cylinder	Check and make sequence valve remote controlled
2. No movement or slow secondary operation	Sequence valve setting too high	Check and adjust again
	Relief valve setting too close to that of sequence valve	Should have at least 10 bar differential
	Valve spool binding in body	Check and repair
V. UNLOADING VALVES		
I. Fails to completely unload pump	Valve setting too high	Set correctly
	Remote pressure setting too low	Adjust properly
	Valve spool binding in body	Overhaul valve

Trouble/Fault	Probable causes	Remedial actions
VI. COUNTERBALANCE VALVES		
1. Will not support load	Valve setting too low	Set properly
	Dirt under integral check valve	Flush the system
	Valve spool and body worn out	Replace worn out parts
	Leakage past the piston in the cylinder	Check and overhaul the cylinder
VII. FLOW CONTROL VALVES		
1. Variation in feed	Sticking hydrostat	Overhaul valve
	Cylinder or motor leakage	Overhaul cylinder or motor
	Change in oil viscosity	Check and replace oil
	Improper pressure drop across valve	Adjust correctly
	Inadequate lubrication of machine parts	Check and do the necessary rectifications

Trouble/Fault	Probable causes	Remedial actions
VIII. REMOTE FLOW CONTROL VALVES		
I. External leakage	Rack pressure in drain line or defective seals	Dram directly to reservoir or replace seals
2. Feed rate variation	Hydrostatic pressure compensator inoperative or sticking hʸdrostat	Clean valve and flush system. Polish hydrostat and metering SPOOL Replace defective seals
3. Maximum flow not obtainable	Contaminants in the throttling orifice. Metering spool binding or not shifting fully. Insufficient voltage in torque Motor	Clean valve Check torque motor coils and input current. Re-align properly
4. Check valve-inoperative	Dirt lodged between the mating faces or finished faces	Disassemble and flush thoroughly
IX. HYDRAULIC MOTORS		
I. Motor turning in wrong direction	Incorrect piping between control valve and fluid motor	Check circuits to determine correct piping
2. Absence of proper speed and torque	System overload, relief valve adjustment not set high Enough	Check required system pressure and reset relief valve
	Relief valve sticking open	Inspect and overhaul relief valve, set correctly
	Free recirculation of oil to Reservoir	Identify the exact point of fault and rectify
	Driven mechanism binding, because of mis-alignment	Remove fluid motor and check the torque required for drive Shaft
	Pump not delivering sufficient volume or pressure	Check pump delivery and pressure

Trouble/Fault	Probable causes	Remedial actions
3. External oil leakage from fluid motor	Casket leaking (may be due to drain not connected to the reservoir when required)	Replace gasket. If drain line is required, it must be connected directly to reservoir.
4. Times of operation longer than specified	Air in system	Bleed
	Internal leakage in actuating cylinder or directional valve	Repair and replace worn out parts
	Worn out pump	Repair
	Action is sluggish only on startup and becomes alright after warming up and vice-versa	It is due to wrong selection of hydraulic oil. Consult manufacturer's recommendations for correct hydraulic oil viscosity
	Low auxiliary control pressure	Control lines may be too small particularly it they are very long

Trouble/Fault	Probable causes	Remedial actions
X. HYDRAULIC CYLINDERS		
I. Piston packing failing too often	Defective or poor quality of packing	Check and consult a hydraulic engineer for the correct solution
	Packing retainer bent	Check and rectify
	Piston bearing worn out	Check and replace
	Cylinder wall surface excessively worn out or badly Scored	Check, smoothen and replace if necessary
	Getting damaged during assembling	Check and take care during assembling
	Packing might be facing very high pressures.	Adjust relief valve correctly
	Too much contaminants in the hydraulic oil	Flush system
	Design defects in mounting	Consult hydraulic engineer
	Defective rod wiper	Check and change rod wiper
2 Reduced speed	Oil bypassing the piston	Check and overhaul cylinder Replace defective parts
	Wrong setting of the control valve	Adjust properly
	Less delivery from pump	Check and rectify
	Directional valve not shifting fully	Check directional valve as discussed before
	Low setting or any defect in relief valve	Check and correctly set as mentioned before

Trouble/Fault	Probable causes	Remedial actions
1 Insufficient force available or no movement at all	Defective or very low set relief valve	Check and correctly set as mentioned before
	Oil bypassing the piston	Check and overhaul the cylinder
	Pump not delivering oil	Check and overhaul the cylinder
	Defective directional valve (specially solenoid operated or hydraulically operated)	Check and rechfy
Xl. ACCUMULATORS		
I Sudden drop of pressure when position of selector valve is changed	Internal or external leak in accumulator	Check and repair leak
2. No pressure available after pump is stopped	Leaking gas valve or leaking check valve in the line	Check and replace valve
3.Sluggish response	Gas pre-charge not sufficient	Pre-charge according to manufacturer's instructions and check for gas leak, if any.

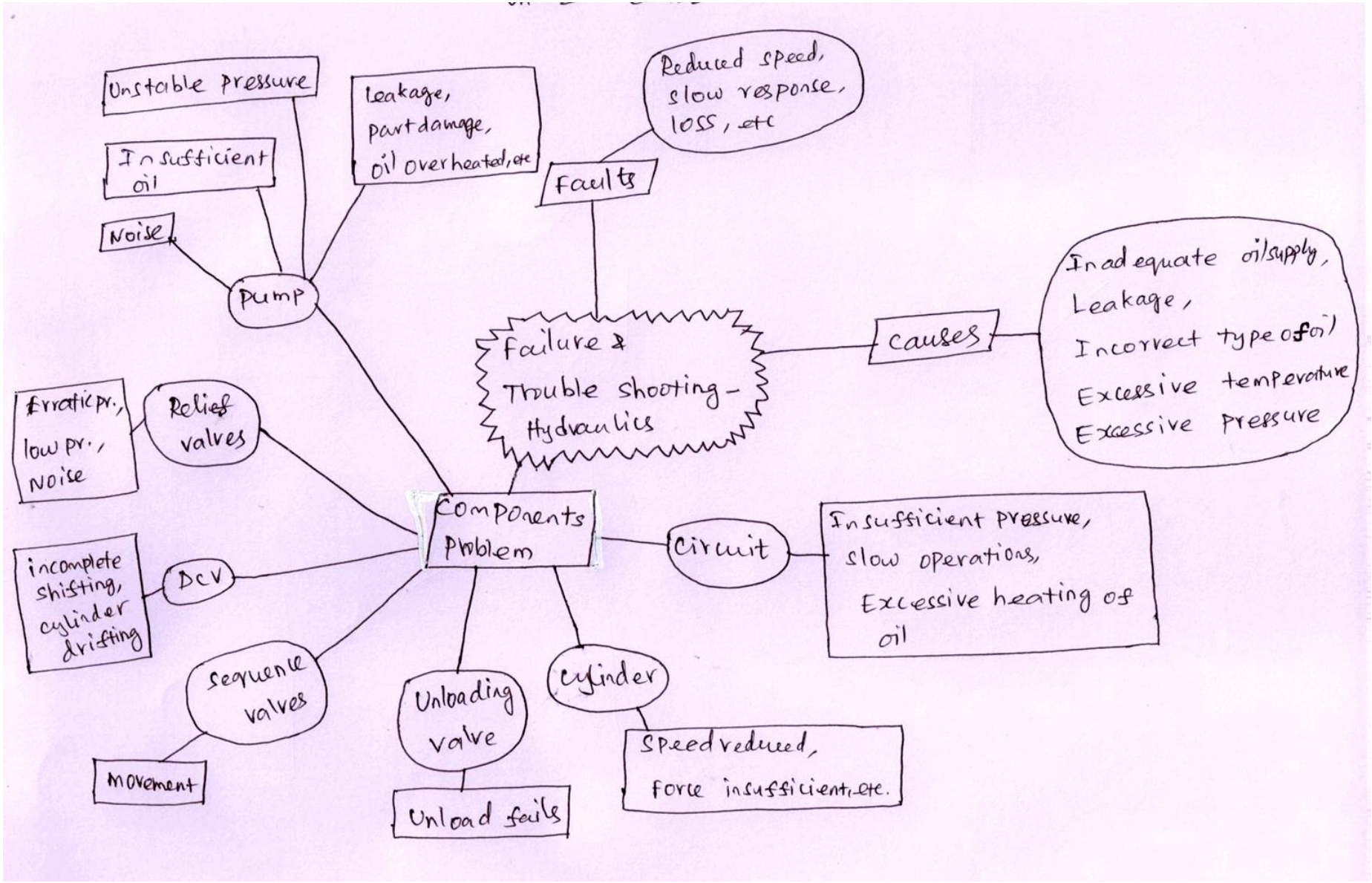
Trouble/Fault	Probable causes	Remedial actions
XII. GENERAL CIRCUIT PROBLEMS		
I. Insufficient pressure in system	Very low relief valve setting_	Reset
	Leakage of full pump delivery within circuit	Detect and rectify
	Pump slipping its entire volume	Check and repair
2. Slow operations	Leakage through cylinder or fluid mows	Check and repair
	Valve not closing or shifting properly	Check and repair
	Relief valve set at a much higher pressure than necessary. Excess oil dissipated through increased slippage in various parts or through relief valve or through throttle valve	Reset relief valve slightly above the maximum pressure required for the work stroke. Follow manufacturer's recommendations for maximum pressure setting.
	Internal oil leakage due to wear in pump or in other places	Replace or repair pump and rectify other faults after Detecting
	Viscosity of oil is very high	Follow manufacturer's recommendations for the correct viscosity grade to be used at various temperatures

Trouble/Fault	Probable causes	Remedial actions
3.Excessive heating of oil in system	Pump assembled too tightly after overhaul. This reduces clearance and increases rubbing friction.	Follow manufacturer's instructions while trying to reassemble
	Leaking check valves and relief valves in the pump	Repair
	Improper functioning of oil cooler or supply of cooling water cut-off	Check and repair
	Automatic unloading control inoperative	Check and repair
	Restricted lines	If lines are crimped, replace. If partially plugged for any reason remove obstruction
	Large pump deliveries not unloaded properly	Study circuits and rectifʸ the fault
	Insufficient radiation	Use artificial cooling
	Reservoir too small to provide adequate cooling	Replace with larger reservoir or install cooler
	Undersized valves or pipings	Check and repair

Trouble/Fault	Probable causes	Remedial actions
6. Delay or lack of reverse flow	Regulator is not designed for reverse flow	Check manufacturer's specifications
	Inlet pressure exhausts too slowly	Check exhaust path for ade-quate capacity; check path for restricting flow control valves
	Downstream pressure is above the set-points, regulator is exhausting through vent path rather than reverse flow	Alter system conditions to keep downstream pressure at or below set-point before reverse flow starts

Questions

1. List the basic requirements on which the life of the fluid power systems depend.
2. What are the common faults in hydraulic systems?
3. What are the troubleshooting term refer?
4. What is the cause if the pump supplying in sufficient oil?
5. What is cause and remedial action of pump noise?
6. What is the cause of reverse flow of oil?
7. What is the cause for reduction in cylinder speed ?


Unstable pressure
Insufficient oil
Noise
Pump
Leakage, part damage, oil overheated, etc
Reduced speed, slow response, loss, etc
Faults
Failure & Trouble shooting - Hydraulics
causes
Inadequate oil supply, Leakage, Incorrect type of oil, Excessive temperature, Excessive pressure
Erratic pr., low pr., Noise
Relief valves
Components Problem
Circuit
Insufficient pressure, slow operations, Excessive heating of oil
incomplete shifting, cylinder drifting
DCV
sequence valves
movement
Unloading valve
Unload fails
cylinder
Speed reduced, force insufficient, etc.

Summary

- Common Faults
  - Reduced speed of travel of machine tool elements
  - Slow response to control
  - Excessive loss of system pressure
  - Excessive leakage in the system
  - Rise in the oil temperature
  - Non uniform or jerky movements of tables, carriages, etc.

Assessment

1. If the Pump delivering insufficient or no oil, then _____

A.Top cover packing damaged B. Shaft packing worn out

C. Clogged strainer or suction pipe line D. Misaligned sinve or tight belt drive

2. If Pump oil over-heated then_____

A. Seizure of pumps sliding parts B. Top cover packing damaged

C. Dirt in oil D. Worn poppet or seat

3. If there is an _____ then Dirt in oil presents in relief valves.

A. No pressure B. low pressure C. Erratic pressure D. Excessive noise or chatter

4. Cylinder or motor leakage results in

A. Variation in feed B. External leakage C. Feed rate variation D. Maximum flow not obtainable

5. Piston bearing worn out in cylinder results in

A. Reduced speed B. Piston packing failing too often C. Insufficient force

D. no movement

Answer

1. If the Pump delivering insufficient or no oil, then _____

A.Top cover packing damaged B. Shaft packing worn out

C. Clogged strainer or suction pipe line D. Misaligned sinve or tight belt drive

2. If Pump oil over-heated then_____

A. Seizure of pumps sliding parts B. Top cover packing damaged

C. Dirt in oil D. Worn poppet or seat

3. If there is an _____ then Dirt in oil presents in relief valves.

A. No pressure B. low pressure C. **Erratic pressure** D. Excessive noise or chatter

4. Cylinder or motor leakage results in

A. Variation in feed B. External leakage C. Feed rate variation D. Maximum flow not obtainable

5. Piston bearing worn out in cylinder results in

A. Reduced speed B. **Piston packing failing too often** C. Insufficient force

D. no movement

Higher Order Question

- What are the general problems, causes and remedies in vane pumps?

RADIAL PISTON PUMPS — Expanded Table

TROUBLE	CAUSE	REMEDY
EXCESSIVE PUMP NOISE	1. Air leak in suction line. Air leak around shaft seal	1. Pour hydraulic oil on joints and around shaft seal while watching pressure gauge and listening to sound of pump. Steadying of pressure gauge indicates leakage. Replace seal or tighten joints in suction line.
	2. Low oil level in reservoir	2. Fill reservoir so that surface of oil is well above end of suction line during all of machine cycle.
	3. Air bubbles in intake line	3. Provide reservoir with baffles. All return lines must be below oil surface and away from intake line.
	4. Restricted filter	4. Clean filter. Calculate required size and add 100% for partial blocking by dirt.
	5. Restricted flow through suction line	5. Check suction piping and fittings to make sure full size is used throughout. Make sure suction line is not plugged with rags or other foreign material.
	6. Reservoir not vented	6. Vent reservoir through air filter.
	7. Coupling misalignment	7. Motor and coupling must be aligned to within 0.005" total indicator reading.
	8. Wrong type oil	8. Use good, clean hydraulic oil having a viscosity of 60-300 SUS at running temperature.
	9. Piston hanging up	9. Loosen piston cap while pump is running, allowing oil to free piston. Tighten again after piston is moving freely.
	10. Running in wrong direction	10. If self-primer is used, rotation must be correct as indicated by arrow.

SYSTEM EXCESSIVELY HOT	1. Pump not unloaded during idle periods of machine operating cycle	1. Install unloading device in high pressure line. Unload pump whenever possible.
	2. Insufficient cooling facilities	2. Install heat exchanger of proper size to control temperature of the oil.
	3. Pressure set too high	3. Use only pressure required to provide satisfactory operation of machine.
	4. Excessive system leakage through cylinders or valves	4. Check progressively through the system for excessive leakage.
	5. High ambient or radiant temperatures	5. Relocate power unit, or baffle against radiant heat.
LEAKAGE AT OIL SEAL	1. Abrasive on pump shaft	1. Protect shaft from abrasive dust and foreign material.
	2. Packing damaged in installation	2. Replace oil seal.
	3. Excessive inlet pressure	3. High pressure seal modification must be used.
	4. Improper fluid	4. Special seals are needed for synthetic fluids.
	5. Oil too hot	5. Seal breaks up at high temperatures. Reduce temperature.

TROUBLE	CAUSE	REMEDY
BEARING FAILURE	1. Coupling misalignment	1. Re-align pump and motor.
	2. Chips or other foreign material in bearing	2. Make sure clean oil is used. Essential to efficient operation and long life of bearings.
	3. Incorrect fluid	3. See oil recommendations.
	4. Electric motor end play	4. Do not allow motor shaft to butt up against pump shaft. Allow clearance in coupling.
	5. Pump running too fast	5. 1,800 rpm is maximum allowable speed.
PUMP NOT DELIVERING OIL	1. Air leak in suction line	1. Check and tighten all connections in inlet piping.
	2. Pump not free of air	2. Back out cylinder sleeves until oil flows freely and pump is free of air.
	3. Hollow piston sticking in cylinder sleeve	3. Check gauge for erratic flutter and listen for noise in pump.
	4. Insufficient supply of oil in pump	4. Check volume of oil that will free flow through inlet line at pump.
	5. Sheared key at coupling	5. Check and replace if required.
PUMP NOT DELIVERING PRESSURE	1. Pump not delivering oil	1. See section on "Pump Not Delivering Oil."
	2. Relief valve set too low	2. Relief valve regulates the maximum pressure the pump will put out.
	3. Relief valve not functioning properly	3. Seat may be worn or springs may be broken
	4. Oil bypassing	4. Test circuit progressively. Watch for open-center valves or other valves open to reservoir.
	5. Excessive system leakage through cylinders and valves	5. Check progressively through system for excessive leakage.