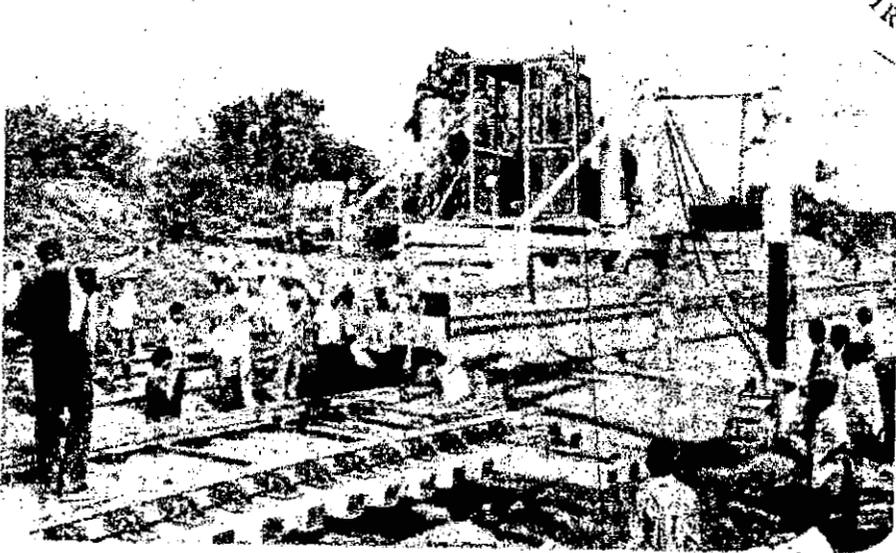


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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TROUBLE SHOOTING MANUAL
FOR
POINT AND CROSSING CHANGING MACHINE
(T-28)



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RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW-226011

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About 359 On-Track Machines are presently working on Indian Railways covering different works related to track maintenance and renewals. To improve utilization of these machines, it is important to reduce their downtime and repair them in the shortest possible time. In this context, need had been felt to develop Trouble Shooting Manuals for different On-track Machines. Railway Board, vide their letter no. 96/Track-III/TK/44 dated 01-4-1999, constituted a committee of Sr. Professor / Track Machines, IRICEN / Pune, Deputy Chief Engineer / CPOH, Northern Railway, Allahabad, Deputy Chief Engineer / Track Machines, Central Railway, Jhansi and Director/Track Machines, RDSO, for preparing such manuals for track machines. The Provisional Trouble Shooting Manuals for Continuous Tamping Machine (CSM 09-32), Points and Crossing Tamping Machine (UNIMAT), Dynamic Track Stabilizer (DGS) and Ballast Cleaning Machine (BCM)(final), have already been prepared and issued. This manual is also an effort in the same direction.

It is hoped that this manual will be quite useful for field staff attending breakdown of machines. However, there can always be scope for improvement for which suggestions may be sent to the undersigned.

Lucknow.
February, 2002

Dharm Singh
Executive Director/TM
RDSO/Lucknow-226011.

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EXPLANATORY NOTES

While preparing the text of these trouble shooting, the terms used and their meanings are explained below:

- CHECK - Ensure a specific condition does (or does not) exist.
- INSPECT - Look for damage and defects including breakage, distortion cracks, corrosion and wear, check for leaks, security and that all items are completed.
- REPLACE - Remove old parts and substitutes a new or overhauled or reconditioned part. Fit new or overhauled or reconditioned part in place of missing part.
- OVERHAUL - Dismantle, examine, recondition or renew parts as necessary against given specifications, reassemble, inspect and test.
- TEST - Carry out a procedure to determine performance against specific criteria.

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**TROUBLE SHOOTING MANUAL OF
POINT AND CROSSING CHANGING MACHINE (T-28)**

I. ENGINE : Model SUN/6105 I 125 KW Air cooled 170 HP @ 2400 rpm.

S. No.	Faults	Probable Causes	Remedial Actions
1.	Engine does not start.	1. Fuel pump faulty or obstructed. 2. Obstructed fuel pipes. 3. Obstructed fuel filters. 4. Faulty injection pump. 5. Air in fuel circuit. 6. Faulty valve clearance.	1. Get the fuel pump overhauled and calibrated through specified agency. 2. Fuel pipes should be cleaned if there is any choking by foreign material otherwise fuel pipe should be replaced with new ones if they became deformed. 3. Fuel filters should be replaced with new ones. 4. Injection pump should be overhauled. 5. Bleed air from fuel system with the help of bleeding point or directly through fuel filter housing. 6. Adjust valve clearances, follow these steps : i) Unscrew bolts and remove cylinder cover. ii) Crank the engine until the inlet valve is closed then turn approximately half turn further. iii) The feeler gauge of 0.69 mm & 0.36 mm should pass between the rocker lever and the cross head for the exhaust and intake valve with suction respectively. This will be done by loosen the lock nut and readjust by means of setting screws. Renew the gasket, sealing ring of cylinder head cover.

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S. No.	Faults	Probable Causes	Remedial Actions
			iv) Tighten the lock nut and recheck the valve clearances with the prescribed feeler gauge mentioned in sl.(iii).
		7. Faulty Injectors.	7. Get the injectors calibrated.
		8. Discharged batteries.	8. Get the batteries recharged.
		9. Wrong cable connection .	9. Check the connection and rearrange these if the cables are connected on wrong terminals.
		10. Faulty starting switch.	10 Check the supply on self starter while the starting switch is operated. If supply not found the problem may be in starting switch. Replace it if the supply cable is O.K.
		11. Faulty starting motor.	11. Motor should be overhauled or replace it if required.
		12. Obstructed cooling fins.	12. Cooling fins should be cleaned.
		13. Excessive spark advance.	13. Valve timing should be re-arrange by the representative of OEM.
		14. Blocked valve.	14 Blocked valve should be replaced by top overhauled the engine through service representative of OEM.
		15. Worn cylinders.	15. Engine should be top overhauled.
2.	Engine stops suddenly during run.	1. No fuel in tank.	1. Fill fuel in the tank above the safe level.
		2. Air in the fuel system.	2. Bleed air from fuel system same as 1(5).
		3. Valve clearances are not proper.	3. Adjust the valve clearances as explained in 1(6).
		4. Overheating of Engine.	4. Cooling system may be failed take necessary action to overcome the overheating problem as required.

S. No.	Faults	Probable Causes	Remedial Actions
		5. Obstructed fuel lines. 6. Contaminated fuel filter. 7. Shut down circuit fails. 8. Faulty injection pump. 9. Excessive running. 10. Obstructed air filter. 11. Blocked valve.	5. Check the fuel line from tank to pump and from pump to injectors. Clean the pipe which are obstructed from foreign material otherwise replace the deformed ones. 6. Replace the choked filter. 7. Check through engine circuit & rectify the problem as required. 8. Get the injection pump calibrated. 9. Get the engine shut down for some period until the engine temperature comes to safe limit. 10. Clean the Air filter. If it is still not working replace it with new ones. 11. Valve to be replaced by service representative of OEM.
3.	Engine does not accelerate.	1. Obstructed fuel pipes. 2. Obstructed fuel filter. 3. Faulty injectors. 4. Excessive spark advance. 5. Faulty actuation mechanism.	1. Same as 1(2). 2. Replace the choked filter. 3. Get the injectors calibrated. 4. Reset the fuel injection timing through the service representative of OEM. 5. Check the mechanism. It may be loose or disconnected.
4.	Variable diesel engine revolution.	1. Obstructed fuel line. 2. Obstructed fuel filter. 3. Faulty injectors. 4. Faulty fuel pump. 5. Defective fuel actuation mechanism. 6. Level of oil in crankcase is too high.	1. Check the fuel line from tank to fuel pump and from pump to injector. Clean the choked pipes or replace if observed deformed. 2. Choked fuel filter should be replaced with new one. 3. Get the injectors calibrated. 4. Get the fuel pump overhauled and calibrated through specified agency. 5. Check the fuel actuation mechanism for any play at joints. Play should be removed. 6. Keep the level of oil within limits.

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S. No.	Faults	Probable Causes	Remedial Actions
5.	Excessive black smoke at idle.	7. Air in fuel circuit. 8. External/Internal leakage of fuel. 1. Cracked injector body. 2. Long idle period. 3. Gasket blow-by or leakage. 4. Broken or wrong piston rings. 5. Injectors needs calibrations. 6. Air in fuel system .	7. Bleed the air from fuel circuit same as 1(5). 8. Check leakage and prevent it. 1. Replace the broken one. 2. Do not run the engine at idle speed for long period. 3. Replace the defective gasket. 4. Use the piston rings of standard part no. from engine manufacturer. 5. Get the injectors calibrated through specified agency. 6. Bleed the air from circuit same as 1(5).
6.	Excessive white smoke at idle.	1. Poor quality of fuel. 2. Cracked injector body. 3. Coolant temperature low. 4. Long idle periods. 5. In correct valve and injection timing. 6. High level of lube oil in crank case. 7. Blowing fan failure.	1. Use proper grade of fuel. It will be better if fuel is tested chemically. 2. Replace the cracked one. 3. During winter season top up the radiator with boiled water to keep the water temperature normal. 4. Do not run the engine at idle speed for long periods. 5. Get the injector calibrated and called the engine service engineer for setting of valve and injection timing. 6. Keep the level of lube oil within limits. 7. Check the type of failure and replace the damage parts .
7.	Excessive smoke under load.	1. Obstructed air intake . 2. Poor quality of fuel. 3. Restricted fuel lines. 4. Fuel pump calibration in correct. 5. Injector needs calibration.	1. Clean the air filter or replace if required. 2. Use proper grade of fuel. It will be better if fuel is tested chemically . 3. Check the fuel lines and clean it as per requirement. 4. Get the fuel pump calibrated through specified agency. 5. Get the injector calibrated through the specified agency.

S. No.	Faults	Probable Causes	Remedial Actions
		6. Engine due for overhaul.	6. Get the engine overhaul through service engineer of engine manufacturer.
8.	Engine running too hot.	<ol style="list-style-type: none"> 1. Insufficient oil in crankcase. 2. Obstructed oil suction hose. 3. Excessive running of engine. 4. Blowing fan failure. 5. Low idling for long periods. 	<ol style="list-style-type: none"> 1. Keep the level of oil within limits. 2. Get the oil suction hose clean or replace it if required. 3. During run while the temperature is going to touch the safe limit, turn down the RPM to idle for some period. 4. Check the damage part related to blowing fan and replace as per requirement. 5. Do not run the engine at idle speed for long period.
9.	Loudy engine.	<ol style="list-style-type: none"> 1. Air in the fuel circuit. 2. Excessive spark advance. 3. Regulator spring inadequate or broken. 	<ol style="list-style-type: none"> 1. Bleed the air from fuel circuit same as 1(5). 2. Same as 1 (13). 3. Replace the spring if it is of below standard or broken.
10.	Output of the engine too low.	<ol style="list-style-type: none"> 1. Dirty fuel filter and fuel line. 2. Air in fuel system. 3. Faulty injector. 4. Faulty valve clearance. 5. Air filter choked. 6. Improper compression 7. Fuel pump calibration in correct. 	<ol style="list-style-type: none"> 1. Replace the filter and clean the fuel line. 2. Bleed the air from fuel line. 3. Get the injector calibrated and replace the broken one. 4. Adjust the valve clearance same as 1 (6). 5. Clean the air filter or replace it if required. 6. Engine required overhauling. 7. Get the fuel pump calibrated.
11.	Oil pressure low.	<ol style="list-style-type: none"> 1. Dirty oil filter. 2. Level of oil below lower limit in crank case. 3. Wrong grade of oil. 	<ol style="list-style-type: none"> 1. Replace the filter. 2. Keep the level of oil within limits. 3. Use the recommended grade of oil as per weather condition.

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S. No.	Faults	Probable Causes	Remedial Actions
		4. Clogged oil cooler. 5. Gasket blow-by or leakage. 6. Main bearing damaged. 7. Dilution of oil.	4. Clean the oil cooler. 5. Replace the damage gasket. 6. Get the engine top overhauled. 7. Replace the oil and Check dilution.
12.	Engine knocking.	1. Incorrect Injector setting or defective injector . 2. Mechanical damage to piston/piston rings /liners. 3. Connecting rod bearing damaged. 4. Injector pipe leaking. 5. Fuel pre-filter/fine filter contaminated. 6. Incorrect tappet clearance.	1. Remove the faulty injector and get it reset or alternatively replace it with new one. 2. Call in the service engineer for replacement the damage ones. 3. Replace connecting rod bearing. 4. Replace the damage one. 5. Check/clean/replace 6. Adjust tappet clearance as indicated in sl.1(6)
13.	Oil film present in crank case ventilation.	1. Incorrect compression. 2. Wrong grade of lube oil.	1. Engine needs repairs at workshop. OR Call the service engineer. 2. Use lube oil of proper brand and grade as recommended by the OEM.
14.	Fuel consumption too high.	1. Lube oil level too high. 2. Incorrect setting of Injector. 3. Incorrect valve and injection timing. 4. Clogged air filter. 5. Poor compression.	1. Keep the lube oil within limits. 3. Replace or overhaul faulty Injector. 3. Get the timing reset. 4. Clean air filter/replace. 5. Call the service engineer. Engine needs repairs in workshop.

S. No.	Faults	Probable Causes	Remedial Actions
15.	Lube oil consumption too high.	<ol style="list-style-type: none"> 1. Incorrect lube oil brand. 2. Excessive inclination of engine. 3. Oil level too high. 4. External and internal Oil leaks. 5. Poor compression. 	<ol style="list-style-type: none"> 1. Use proper grade and quality lube oil as recommended by OEM. 2. Check the inclination . 3. Keep the lube oil level within limits. 4. Prevent the leakage. 5. Replace compression rings or valve. Valve seat have to be lap.
16.	Mixing of diesel in oil.	<ol style="list-style-type: none"> 1. External or internal fuel leaks. 2. Damaged injector O-rings. 3. Long idle periods. 	<ol style="list-style-type: none"> 1. Prevent the leakages. 2. Replace the defective ones. 3. Do not run the engine at idle speed for long periods.

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II. POSSIBLE DISTURBANCES IN TURBO-CHARGED DIESEL ENGINES WITHOUT BOOST PRESSURE CONTROL VALVES.

S. No.	Faults	Probable Causes	Remedial Actions
1.	Lack of power boost pressure.	1.0 Air filter system dirty. Suction and pressure pipes deformed and /or leaking.	1.0 Examine filter system, service or replace filter if required. Check and repair or replace pipes, tighten loose joints.
		1.1 Too high flow resistance in the exhaust gas system and/or leakage upstream of turbine.	1.1 Check exhaust brake, pipes, gaskets and silencers, carry out required repairs.
		1.2 Injection unit and/or fuel system defective.	1.2 Check setting values and function, correct if required.
		1.3 Compression too low.	1.3 Check valves, cylinders and pistons, service or replace defective parts if required.
		1.4 Charge air cooler dirty.	1.4 Clean unit and replace if necessary.
2.	Power and / or boost pressure too high.	1.5 Turbocharger defective. Wheels rubbing on housing walls.	1.5 Examine turbocharger, repair or replace if necessary.
		Injection unit defective.	Check setting values and correct if required.
3	Black exhaust smoke.	Same as points 1.0, 1.3, 1.4, 1.5	See points 1.0, 1.3, 1.4, 1.5
4	Blue exhaust smoke.	1. Worn valve guides and piston rings.	1. Measure blow-by volume at crankcase outlet. Overhaul engine if required.
		2. Compressor side and or turbine-side sealing in the turbocharger defective.	2. Examine turbocharger, repair or replace it as required.

S. No.	Faults	Probable Causes	Remedial Actions
5.	Oil leakage at turbocharger.	<ol style="list-style-type: none"> 3. Turbo - charger oil drain-pipe clogged and / or deformed. 1. Oil-feed pipe and / or oil drain pipe loose and leaking. 2. Leakage at connection between compressor and bearing housings. 	<ol style="list-style-type: none"> 3. Clean oil drain pipe, repair or replace if necessary. 1. Clean Turbocharger, check for leakage and rectify. 2. Repair or replace turbocharger.

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III. CRAWLER DRIVE .

S. No.	Fault	Probable Causes	Remedial Actions.
	Crawler drive Does not work In any direction.	<ol style="list-style-type: none"> 1. Faulty control mechanism. 2. Closed control orifice. 3. There is shortage of oil in the system. 4. Suction line or filter between the tank and loading pump is choked .High vacuum Pressure or low pressure in casing may create this problems. 5. Coupling for pump transmission is disconnected or motor is not engaged. 6. Safety valve for pressure into the load pump or wash valve blocked, opened or damaged. 7. Propeller shaft or key load pump may be broken. 8. Internal damage in motor or pump or both. 	<ol style="list-style-type: none"> 1. Check the whole control mechanism from the lever on the panel to the pump. Control cable should be regulated when control lever is in neutral position . 2. Remove the control valve and replace the broken parts. Or replace it with new one. 3. It will be identify if there is very low or zero load pressure. Top up the oil up-to maximum level. 4. Replace the filter and clean the suction line. 5. Check and repair power transmission line. 6. It will be checked as below: <ol style="list-style-type: none"> i) If load pressure is low in neutral position, the safety valve is damaged. ii) If pressure is low when control is operated the wash valve is damaged. <p>For both the conditions defective valve should be replaced.</p> 7. In this condition load pressure will become zero. The problem will be rectify by replacement of load pump. 8. In this condition load pressure will become zero. There will be heavy noise, brass pieces will occur in tank or around filter. To rectify the failure kept the machine at idle and clean whole the circuit and then replace the defective pump or motor.

S. No.	Fault	Probable Causes	Remedial Actions.
2.	Crawler drive is working only in one direction.	<ol style="list-style-type: none"> 1. Control system is damaged. 2. Check valve is damaged. 3. Safety valve damaged. 4. Pilot valve may be blocked or open. 	<ol style="list-style-type: none"> 1. Check the standard load pressure, vacuum pressure and standard pressure in the casing. If there is any problem in above said pressures, the whole control system from lever to the pump to be checked and blocking, if any, should be removed. 2. Check, whether the system pressure is leaking in one direction. If the hole of check valve is cracked, replace the same and if the ball of check valve is missing, then replace the pump and motor. 3. If there is a loss in high pressure with respect to standard value, then replace the damaged valve. 4. If there is a loss of high pressure than the standard value, then replace the pilot valve unit.
3.	Working is slow.	<ol style="list-style-type: none"> 1. Control orifice may be partially blocked. 2. Air in the system. 3. Internal damage in motor or pump. 	<ol style="list-style-type: none"> 1. Remove the control valve, clean the orifice and replace it, if required. During the procedure, make sure that it does not fall in to the orifice for pump control. 2. If there is irregular values on all gauges, it indicates air in the system. To rectify the failure make sure that plunged oil diffusers are available in each tank flow back line. 3. At the moment of start the load pressure drop suddenly even down to almost zero. Control unit will became noisy. This will indicates the internal damage in motor or pump. The replacement is only remedy.

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S. No.	Fault	Probable Causes	Remedial Actions.
4.	Crawler working is noisy.	1. Air may be in the system. 2. System pipe lines or any other part mounted loose causing vibration.	1. All the gauges will show the irregular values. Tank should be equipped with a suitable deflector and screen. Oil will always be within safe level. 2. Strengthen or stiffens the hangers of pipe lines and get tighten the loose nuts and bolts.
5.	Neutral idle position hard to set .	1. Adjustment valve is defective or wrongly adjusted. 2. Damaged control system. 3. Misplaced pulling tool.	1. Replace the adjustment valve, if required. 2. Disconnect control system on the control lever. If the system sets back in neutral position, replace or regulate the control system. 3. Pump is to be repaired by OEM.
6.	Crawler drive heats up during work i.e. the temperature of the engine casing exceeds 80 ^o C.	1. Dirty heat exchanger. 2. By - pass valve of heat exchanger is damaged. 3. Incorrect installation of drainage line of the casing. 4. Low oil level in the tank. 5. Suction filter or suction line partially obstructed.	1. Exchanger to be cleaned or replace the same. 2. By-pass valve to be repaired or replaced. 3. Check the location and install correctly. 4. Top up the tank with oil. 5. If so happens, the vacuum pressure gauges will show high pressure than the standard value, load pressure will be low and the pressure in the casing will also fall below the standard value. In this case suction line should be cleaned and suction filter should be replaced.

S. No.	Fault	Probable Causes	Remedial Actions.
		6. Excessive internal dispersion of oil.	<p>6. Following are the indications of the problems:</p> <ul style="list-style-type: none"> a. System high pressure is detected lower than the standard value. b. Load pressure will be lower than the standard value. c. System pressure may drop possibly. d. All other pressures will be normal. <p>If the situation so occurs then replace the high pressure valve of the same circuit.</p>
		7. Negative brake on the crawler motor operating improperly.	7. If the pressure modulating valve is obstructed or damaged, the problem will occur. This only can be rectify by cleaning the valve otherwise replacement is necessary.

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IV . HYDRAULIC MOTOR OF RAILWAY WHEEL .

S. No.	Fault	Probable Causes	Remedial Actions.
1.	Constant noise from motor at idle.	Bearing may be worn out.	Replace the bearings.
2.	Excessive vibrations from motor at idle.	Loose mounting.	Get tighten the bolts upto the required torque.
3	Excessive noise from motor during work.	Input power is too low.	Setting of back pressure valve may be disturbed. Check and set at correct pressure.
4.	Motor is not working.	<ol style="list-style-type: none"> 1 No oil supply to the motor. 2. No pressure in the circuit. 3. Slide valves may be blocked. 	<ol style="list-style-type: none"> 1. Feed pump may be failed. Check and replace if required. 2. Adjustment valve should be checked. 3. Clean the slide valve and replace if it is still not working. Control circuit should be cleaned.
5.	Motor is running lower than the standard speed.	<ol style="list-style-type: none"> 1. Brakes may remain pulled. 2. Pump is of insufficient capacity. 3. Too much leakage from motor branch circuit. 	<ol style="list-style-type: none"> 1. Brake setting circuit should be checked. 2. State of the pump and feed ratio should be checked. Replace the pump, if it is of less capacity. 3. Check the state of cylinder block and motor branch circuit.
6.	Motor is running irregularly.	<ol style="list-style-type: none"> 1. Working pressure is too low. 2. Pump is of lower capacity. 3. Too much leakage. 	<ol style="list-style-type: none"> 1. Setting of adjustment valve may be disturbed. Reset the valve by pressure regulator for adjustment valve. 2. Check the pump capacity. 3. Check the condition of cylinder block and motor branch circuit.
7.	External oil leakage.	<ol style="list-style-type: none"> 1. Faulty assembling. 2. Crank case pressure may be too high. 	<ol style="list-style-type: none"> 1. Check the tightness of assembling screw, bleeding screw and various joints. 2. Check the filter and drainage system.

V. PIPE WINDER.

S. No.	Fault	Probable Causes	Remedial Actions.
1.	Pipe winder does not wind or wind badly and split out.	Spring may be damaged or failed.	Check the pipe winder spring and replace the defective ones.
2.	Pipes worn-out excessively.	<ol style="list-style-type: none"> 1. Pipe winder and final joints are not aligned. 2. Unshaped flange of pipe winder. 	<ol style="list-style-type: none"> 1. Check alignment and correct as required. 2. Unshaped flange should be replace.

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VI. WORKING SYSTEM.

S. No.	Fault	Probable Causes	Remedial Actions.
1.	Load can not be lifted and / or machine does not slide up or lifts only by one side.	<ol style="list-style-type: none"> 1. No oil in the tank. 2. Pressure oil filter clogged. 3. Setting of pressure release valve is disturbed. 4. The electro valve of the height limiting device remains open. 5. Pressure line is obstructed. 6. Safety valve is faulty or damaged. 7. Spool of slide electro valve is not powered. 8. Spool of slide electro valve blown. 9. Body of slide electro valve may be damaged. 	<ol style="list-style-type: none"> 1. Check the level of oil and fill up to the safe level. 2. Replace the filter. 3. Check the valve setting and replace it, if required. 4. Clean the electro valve and if it is still not functioning, then replace it with new one. 5. Check the obstruction and clean the pipe, if required. 6. Replace the valve. 7. Contacts of electrical circuit may be dirty. Check and clean the contacts. 8. There may be electrical faults in the circuits. Check the circuit and replace the spool. 9. Electro valve should be replaced.
2.	Crawler cross slide and /or retraction can not be performed.	<ol style="list-style-type: none"> 1. No oil in the tank. 2. Pressure oil filter is clogged. 3. Pressure line is clogged. 4. Setting of pressure release valve on-control valve is disturbed. 	<ol style="list-style-type: none"> 1. Fill the tank within safe limits. 2. Replace the filter. 3. Check and clean pipe line. 4. Check the valve setting or replace it with new one.
3.	Crawler cross slide perform bumpy motion and it is noisy.	Flow regulator is faulty.	Adjust the pressure regulator for standard pressure and if it is still not functioning, then replace it.

S. No.	Fault	Probable Causes	Remedial Actions.
4.	Railway wheel can not be lifted.	<ol style="list-style-type: none"> 1. Oil in the tank may be less than the lower level. 2. Pressure oil filter is choked. 3. Pressure line is clogged. 4. Setting of pressure release valve on-control valve is disturbed. 5. Safety valves are damaged. 	<ol style="list-style-type: none"> 1. Fill the tank within safe limits. 2. Replace the filter. 3. Clean the pipe line. 4. Reset the valve for standard pressure. 5. Replace the valve with new one.
5.	Uneven lifting / lowering of railway wheel.	<ol style="list-style-type: none"> 1. Valve for flow divider may be damaged or disturbed. 2. Flow divider is damaged. 3. Pressure filter may be clogged. 4. Drain pipe may obstructed. 	<ol style="list-style-type: none"> 1. Reset the valve, if disturbed or replace otherwise. 2. Flow divider should be replaced. 3. Replace the filter. 4. Clean or replace the drain pipe.
6.	Wheel drive is not working.	<ol style="list-style-type: none"> 1. Hydraulic valve for wheel drive motor may be defective. 	<ol style="list-style-type: none"> 1. Clean the hydraulic valve and replace it, if it is still not working.
7.	Vertical lifting cylinder is not working.	Electrical circuit may be faulty.	Check the electric circuit. Fuse no. F5 or Relay no. R 11 may be defective. Check and replace the faulty one.
8.	Frequent breakage of elbow for vertical lifting cylinder.	The elbow may be hitting the obstruction.	Get clear the obstruction.
9.	Hydraulic oil temperature gauge is showing wrong reading.	<ol style="list-style-type: none"> 1. Temperature sensor may be defective 2. Fuse no. F12 may be defective. 3. Relay no.R2 and R3 may be defective/. 	<ol style="list-style-type: none"> 1. Temperature sensor should be checked and replaced, if found faulty. 2. Fuse should be replaced. 3. Check both the relays simultaneously and replace as per requirement.

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S. No.	Fault	Probable Causes	Remedial Actions.
10.	Bridge coming down automatically while machine is in idle position.	<ol style="list-style-type: none"> 1. Internal leakage in lifting cylinder. 2. Stop valve Part no. 6020062 may be defective. 3. Leakage from fitting at piston end. 	<ol style="list-style-type: none"> 1. Lifting cylinder should be replaced with new one. 2. Stop valve should be replaced. 3. Prevent the leakage.
11.	There is no supply on starter.	<ol style="list-style-type: none"> 1. Fuse no. F1 may be defective. 2. Relay no. R, R1 or R2 may be defective. 3. Battery is not showing the required Voltage. 	<ol style="list-style-type: none"> 1. Fuse should be replaced. 2. Check the relay R, R1 and R2 simultaneously and replace as per requirement. 3. Check the voltage at battery terminals, if not found satisfactory, then get charged the battery.
12.	Cooler motor is not working.	<ol style="list-style-type: none"> 1. Fuse no. F5 may be defective. 2. Relay no. R3 may be defective. 	<ol style="list-style-type: none"> 1. Replace the fuse no. F5. 2. Relay no. R3 should be replaced.
13.	Working light (forward) is out of order.	<ol style="list-style-type: none"> 1. Bulb may be fused. 2. No supply on bulb holder i.e. wire disconnected. 3. Fuse F9 may be defective. 4. Relay R or R8 may be defective. 	<ol style="list-style-type: none"> 1. Bulb should be replaced, if found fused. 2. Check the circuit from panel to bulb holder and if any wire found disconnected, rejoin it or replace the whole cable. 3. Fuse F9 should be replaced, if found faulty. 4. Relay R and R8 should be checked symultaneously and replace as per requirement.
14.	Working light (backward) out of order.	<ol style="list-style-type: none"> 1. Bulb may be fused. 2. No supply on bulb holder . 3. Fuse F10 may be defective. 4. Relay R or R9 may be defective. 	<ol style="list-style-type: none"> 1. Bulb should be replaced, if found faulty. 2. Check the circuit from panel to bulb holder and rejoin the disconnected wire. Or replace complete cable. 3. Fuse, F10 should be replaced if found defective. 4. Relay R and R9 should be checked simultaneously and replace the defective only.

S. No.	Fault	Probable Causes	Remedial Actions.
15.	Alternator is not charging the batteries.	1. Fuse F2 may be defective. 2. Relay R2 may be defective. 3. Cable for battery charging is damaged.	1. Replace the fuse F2, if found defective. 2. Relay R2 should be replaced, if found defective. 3. Cable should be rejoin if found broken or replaceit.
16.	Hydraulic oil coolers are not functioning.	1. Fuse F5 may be defective. 2. Relay R or R4 may be defective.	1. Fuse F5 should be replaced if found faulty. 2. Relay R and R4 should be checked simultaneously and replace as per requirement.
17.	Operators light is not working.	1. Bulb may be fused. 2. No supply on bulb holder. 3. Fuse F1 may be defective. 4. Relay R2 may be defective.	1. Bulb should be replaced, if found fused. 2. Check the circuit from panel to holder. Rejoin the disconnected wire. 3. Fuse F1 should be replaced, if found defective. 4. Relay R2 should be replaced, if found defective.

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VII. HYDRAULIC - PUMP

S. No.	Faults	Probable Causes	Remedial Action
1.	Pump not delivering oil.	<ol style="list-style-type: none"> 1. Pump driven in wrong direction vis-à-vis of shaft rotation (at the time of new pump fitment, this problem may occur). 2. Oil level too low in the reservoir (if oil level is very low, aeration may take place and pump will not deliver oil). 3. Intake filter/pipe choked. 4. Air leaks in pump intake joints. 5. Broken pump shaft or rotor. 6. Pump speed too slow. (The delivery rate of discharge is prescribed at a certain rpm of engine. If engine speed become less than idle speed, it may affect the proper suction of oil). 	<ol style="list-style-type: none"> 1. To see the rotation of pump, stand facing the engine shaft end. If the pump rotates anti-clockwise, the rotation is left hand and vice-versa. Alternatively check the pump rotation by hand priming. Pour the hydraulic oil into inlet port and rotate the shaft. See whether the oil is delivering through outlet port or not. If not, change the rotation according to the engine shaft rotation. 2. Check oil level in reservoir and it should be above minimum mark. If necessary, recoup the oil. 3. Clean or replace filter for proper flow of oil. 4. Pour hydraulic oil on intake joints and on observing abnormal sound, tighten the intake joint as required. 5. Remove the broken shaft or rotor. Also align the prime mover shaft. 6. Pump should run at prescribed speed. Engine rpm should be checked.

S. No.	Faults	Probable Causes	Remedial Action
2.	Pumps makes noise.	7. Dirty suction filter. 8. Faulty suction valve. 9. Air in system. 1. Low oil level in the reservoir causing aeration. 2. Restricted or partly clogged suction line, suction filter. 3. Pump running too fast. 4. Coupling misalignment (Due to this, bearing may get damaged, there will be a play at shaft, abnormal sound observed). 5. Reservoir not vented properly. 6. Suction Filter too small in size. 7. Air leak at pump intake pipe joints and air drawn through inlet line. 8. Oil viscosity too high. (In cold climate, oil viscosity becomes high so no free flow will take place and cavitation will occur). 9. Pump air bound. 10. Cavitation. 11. Shaft seal leaks.	7. Replace the filter. 8. Repair or change the valve. 9. Discharge air from the system. 1. Fill the reservoir upto required level so that aeration is prevented. 2. Clean or replace filter or line. 3. Reduce speed upto prescribed limit. 4. Realign the pump shaft & prime over shaft. 5. Air breather screening element should be cleaned. 6. Replace by proper size of filter. 7. Take action as explained in s.no.1, item no. 4. 8. Start the engine for few minutes to warm-up the hydraulic oil used in machine for proper flow. Use only proper grade of oil. 9. Stop pump immediately. Bleed the pump by priming before restarting. 10. Vent system and Seal. 11. Replace jointing or seal.

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S. No.	Faults	Probable Causes	Remedial Action
		12. Oil foams.	12. Vent system.
		13. Casing leaks.	13. First tighten bolts, then check for cracks and sealing.
		14. Vane spring broken.	14. Change spring.
		15. Pump or motor part defective.	15. Replace defective parts.
		16. Pump or motor stressed.	16. Check mounting alignment & get tighten the bolts uniformly.
		17. Foreign bodies in suction line.	17. Remove foreign bodies. If needed, flush the system.
		18. System is dirty.	18. Flush the system.
		19. Sharp bends in suction line.	19. Eliminate or reduce number of bends in pipe.
		20. Oil temperature too high.	20. Check circuit for this cause.
		21. Boost pump failed.	21. Check boost pump.
		22. Resonance through tank.	22. Change the position of tanker. Installed sound damping means.
		23. Porous suction hose.	23. Change suction hose.
		24. Vibration in system.	24. Check unusual occurrence in the system.
3	Pump or Motor overheats.	1. Wrong oil grade	1. Fill oil as recommended by OEM.
		2. Oil speed in system too high.	2. Install pipes of greater nominal size.
		3. Oil level too low.	3. Fill with oil.
		4. Pump or motor rotor groove worn out.	4. Exchange pump or motor parts.
		5. Radial or axial loading too high.	5. Limit to acceptable amount, check alignment.
		6. Initial speed rises.	6. Check max. pressure, if needed increase pump size and install pipes of larger nominal bore etc.
		7. Inadequate cooling.	7. Increase cooling capacity.
		8. Cooling system is dirty.	8. Establish cause and repair defect.
		9. Differential pressure is too low.	9. Increase pressure setting of feed pumps.
		10. Pressure too high.	10. Reduce pressure setting.
		11. Wrong type pressure valve.	11. Replace by appropriate type of valve.
		12. Faulty operation in system.	12. Check circuit & modify the system.

S. No.	Faults	Probable Causes	Remedial Action
		13. Wrong seals.	13. Replace by suitable seals.
		14. Filter dirty or too small in size.	14. Clean filter or replace by larger type.
		15. Pump running speed high.	15. Reduce the speed.
		16. Cavitation.	16. Bleed the system.
		17. Oil foams.	17. Vent system.
		18. Venting dirty.	18. Clean vents.
		19. System contaminated.	19. Flush the system or if needed pickle and flush out.
		20. Sharp bends in suction line.	20. Eliminate bends or at least reduce them.
		21. Boost pump failed.	21. Establish cause and repair defect.
4.	Pump develops no pressure.	1. Wrong pressure setting. 2. Pressure valve sticks. 3. Leakage in system. 4. Pump shaft broken. 5. Drive machine defective. 6. Belt drive slips. 7. System contaminated. 8. Wrong gaskets and seal.	1. Modify pressure setting and increase pressure. 2. Repair defect. 3. Replace defective parts. 4. Replace shaft. 5. Repair machine drive. 6. Adjust tension or replace belt. 7. Flush system completely. 8. Replace gaskets and seals.
5.	Speed loss on motor.	1. Inlet pressure too low. 2. Outlet pressure too high. 3. Port plate does not make contact. 4. Motor part defective. 5. Oil temperature too high.	1. Increase pressure. 2. Check system pressure. 3. Disassemble motor and repair. 4. Repair defective part. 5. Check the circuit.

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S. No.	Faults	Probable Causes	Remedial Action
6.	Motor does not work.	<ol style="list-style-type: none"> 1. Torque too low. 2. Oil spill at motor. 3. 'O' Ring on port plate defective. 4. Inadequate pump delivery. 5. Too much play in the shaft. 	<ol style="list-style-type: none"> 1. Increase pressure setting. 2. Check ball valve. Check if port plate is in contact. 3. Replace 'O' Ring. Check if stroke is defective. 4. Repair pump or change for larger delivery. 5. Replace bearing.
7.	Bearing failure.	<ol style="list-style-type: none"> 1. Chips or other contaminants in bearing. 2. Coupling misalignments. 3. Inadequate lubrication. 4. Pump running too fast. 5. Excessive or shock loads. (Excessive loads due to operating pressure may damage the bearing). 	<ol style="list-style-type: none"> 1. Replace bearings and check intrusion of contaminants. 2. Align prime mover shaft vis-a-vis pump. 3. Lubricate the system properly. 4. Adjust speed of prime mover. 5. Reduce operating pressure.

VIII. HYDRAULIC - RELIEF VALVE

S. No.	Faults	Probable Causes	Remedial Actions
1.	Erratic pressure.	1. Foreign matter in the oil. 2. Wrong puppet or seat in upper stage. (oil from pilot stage will go to tank due to worn puppet or seat and pressure will drop). 3. Piston sticking in main body.	1. Drain the oil, clean the tank and refill with clean oil. 2. Replace puppet or seat as required. 3. Clean piston after dismantling. Check free movement after reassembling.
2.	Low pressure or no pressure.	1. Valve improperly adjusted. 2. Vent connection open (at the time of starting the work, if vent remain open, then oil will return back to the tank and no pressure will develop). 3. Balance hole in main piston choked. 4. Puppet in cover not seating. (So, oil continuously will return to the tank line and pressure drops). 5. Broken or weak spring in upper state (oil pushes the puppet easily and goes to tank. So pressure drops). 6. Dirt, chip etc keeps valve partially open.	1. Adjust valve by adjusting knob to proper pressure setting. 2. Plug the vent connection. 3. Remove piston and clean the orifice. Clean the tank and replace hydraulic oil. 4. Check the puppet condition. If required, replace it. 5. Replace the spring and again set the pressure with adjusting knob. 6. Clean the complete valve.

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S. No.	Faults	Probable Causes	Remedial Actions
3.	Excessive noise or chatter.	1. High oil velocity through valve. 2. Distorted control spring. 3. Worn puppet or seat in cover. 4. Vent line too long. 5. Valve pressure setting too close to that of another valve in circuit.	1. Check valve flow rating. Replace with larger valve, if necessary. 2. Replace spring. 3. Replace puppet or seat. 4. Replace restrictions e.g. needle valve or orifice. Plug in vent line next to the relief valve. 5. Set relief valve pressure at-least 150 PSI higher than other valves in circuit.
4.	Valve do not function.	1. Spool sticks. 2. Water condensation in system. 3. Oil temperature too high. 4. Oil speed too high. 5. Internal leakage. 6. Tank line under high pressure. 7. Control line dirty.	1. Clean stuck spool. 2. Check condensed water. 3. Check circuits. 4. Check speed of the pump. 5. Prevent the leakage. 6. Check pressure in tank line. 7. Clean lines properly.
5.	Valve over-heating.	1. System pressure too high. 2. Dirt in the system. 3. Spool sticks. 4. Spool defective.	1. Adjust spring pressure. 2. Clean the system. 3. Check and clean spool. 4. Check and replace spool.

IX. HYDRAULIC - UNLOADER VALVE

S. No.	Faults	Probable Causes	Remedial Actions
1.	Low or no pressure.	1. Orifice of main piston choked. 2. Vent connection open to tank. 3. Safety valve at zero setting. 4. Broken or weak spring. 5. Worn ball or seat in upper stage.	1. Clean the orifice. 2. Plug the vent connection. 3. Set the safety valve at proper pressure. 4. Replace the spring. 5. Replace the ball or seat.
2.	Fails to completely unload pump.	1. Valve pressure setting too high. 2. Remote pressure too low. 3. Valve spool binding in body. 4. Incorrect assembly. 5. Nil or low nitrogen pressure in the accumulator. 6. Punctured bladder.	1. Set proper pressure of valve (132 to 140 bar). 2. Check the accumulator pressure or any leakage in the system. 3. Clean the spool and oil in the tank. 4. Assemble as per proper drawing. 5. Check pressure and recharge the accumulator (80 to 85 bar). 6. Change the bladder.

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X. HYDRAULIC - MOTOR

S. No.	Faults	Probable Causes	Remedial Actions
1.	Motor makes loud noise.	<ol style="list-style-type: none"> 1. Due to cavitation (pressurized fluid is not approaching properly due to obstruction). 2. Vane spring broken. 3. Shaft seal leaks. 4. Casing leaks. 5. Oil temperature too high. 6. Motor parts defective. 	<ol style="list-style-type: none"> 1. Check flow line for obstruction and remove it. 2. Change the spring. 3. Replace the seal. 4. First tighten bolts, then check for cracks and sealing. 5. Check cooling circuits. 6. Replace defective parts. Tighten bolts uniformly.
2.	Motor overheats.	<ol style="list-style-type: none"> 1. Motor under-capacity. 2. Rotor worn out. 3. Inadequate cooling. 4. Pressure too high. 5. Wrong seal. 	<ol style="list-style-type: none"> 1. Install motor of proper capacity. 2. Replace the rotor. 3. Check the cooling circuit. 4. Reduce pressure setting at relief valve. 5. Replace by proper size seal.
3.	Speed loss on motor	<ol style="list-style-type: none"> 1. Inlet pressure too low. 2. Motor parts defective. 3. Oil temperature too high (Hydraulic oil cooler is not functioning). 	<ol style="list-style-type: none"> 1. Increase pressure by resetting relief valve. 2. Change defective parts. 3. Check cooling circuit.

S. No.	Faults	Probable Causes	Remedial Actions
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4.	Motor does not work.	1. Torque too low. 2. O-ring on port plate damaged. 3. Inadequate pump delivery. 4. Too much play in the shaft. 5. Under-capacity motor is provided.	1. Increase pressure by resetting relief valve. 2. Replace the O-ring. 3. Repair pump or change for larger size. 4. Replace the bearing. 5. Install motor of proper capacity.
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XI. HOSE ASSEMBLY

S. No.	Faults	Probable Causes	Remedial Actions
1.	The hose has burst and examination, of the wire reinforcement after stripping back the cover, reveals random broken wires in the entire length of the hose.	This would indicate a high frequency pressure impulse condition. SAE impulse test requirements for a double wire braid reinforcement are 2,00,000 cycles of 133% of recommended working pressure. The SAE impulse tests requirement for a four spiral wrapped reinforcement (100R-9) are 3,00,000 cycles at 133% maximum operating and at +200°F (93° C).	If the extrapolated impulses in a system amount to over a million in a relatively short time a spiral reinforced hose would be the better choice.
2.	The hose has burst, but there is no indication of multiple broken wires throughout the entire length of the hose. The hose may have burst in more than one place.	This would indicate that the pressure has exceeded the minimum burst strength of the hose.	Either a stronger hose is needed or the hydraulic circuit has a mal-function which is causing unusually high pressure conditions.
3.	Hose has burst. An examination indicates the wire braid is rusted and the cover has been cut, abraded or deteriorated badly.	The primary function of the cover is to protect the reinforcement. Elements that may destroy or remove the hose covers are: <ol style="list-style-type: none"> 1. Abrasion. 2. Cutting 3. Battery Acid. 4. Chemical Cleaning Solutions. 5. Heat. 6. Extreme Cold. 	Once the cover protection is gone, the wire reinforcement is susceptible to attack from moisture or other corrosive matter. hence take care of 1 to 6 items.

S. No.	Faults	Probable Causes	Remedial Actions
4.	Hose appears to be flattened out in one or two areas and appears to be kinked. It has burst in this area and also appears to be twisted.	Torquing of a hydraulic control hose will tear loose the reinforcement layers and allow the hose to burst through the enlarged gaps between the braided plaits of wire strands.	Use swivel fittings or joints to be sure that there is no twisting force on a hydraulic hose.
5.	Fitting blow off of the end of the hose.	It may be that the wrong fitting has been put on the hose. In the case of a crimped fitting the wrong machine setting may have been used resulting in over or under-crimping. The fitting may have been applied improperly to the hose.	Check manufacturer's instructions. The hose should be installed with enough slack to compensate for the possible 4% shortening that may occur when the hose is pressurized. Recheck the manufacturer's specification and part nos.
6.	Hose is leaking at the fitting because of a crack in the metal tube adjacent to the braze on a split flange head.	Because the crack is adjacent to the braze and not in the braze this is a stress failure brought on by a hose that is trying to shorten under pressure and has insufficient slack in it to do so.	The hose assembly or change the routing to relieve the forces on the fitting.
7.	The hose fitting has been pulled out of the hose. The hose has been considerably stretched out in length.	1. This may not be high pressure application hose. 2. Insufficient support of the hose. It is very necessary to support very long lengths of hose, especially if they are vertical.	1. Use the hole as per the pressure of fluid line. 2. All the hoses should be supported by clamping the same at proper distance giving sufficient slacks between two clamps to make up for the possible 4% shorting that could take place when the hose is pressurized.

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XII. BEARING

The following causes which are responsible for the failure should be considered while maintaining a bearing.

- Improper use of bearings.
- Faulty installation or improper processing.
- Improper lubricant, Lubrication methods or sealing device.
- Improper rpm and operating temperature.
- Contamination by foreign materials during installation.
- Abnormally heavy load.

When bearing failure is found, even if it is insignificant, it is important to investigate the phenomenon to determine the causes. At this time, not only bearing but also the shaft housing, and lubricant used with the bearings should be comprehensively investigated, together with the bearings. To judge the causes of failure, sufficient knowledge and experience in bearings and lubricant and a good understanding of the characteristic of the equipment are necessary. In addition, consideration of the installation and operation process of the bearings is required.

1. **Bearing Fracture:-**

1.1 **Time of Fracture occurrence and Causes**

For failure analysis, it is important to accurately determine the time of fracture accurately, because the possible causes of failure can be limited in according to the time of fracture occurrence. With referenceto time of fracture occurrence and related causes are categorized and listed in Table-1-1.

Table 1-1 Time of Breakage Occurrence and Causes

Time of fracture Causes Occurrence	In appropriate use of bearings	Faulty design of shaft housing or other installation aspects or improper processing	Improper lubricant, lubrication method or sealing device	Defects in bearings	Mis-mounting of bearings	Defect in sealing device contamination of water, dust or other foreign materials, shortage of lubricant
1. Fracture occurring immediately after bearings were mounted or within a short time after mounting	*	*	*	*	*	
2. Fracture occurring immediately after overhaul			*		*	
3. Fracture occurring after lubricant was supplied			*			
4. Fracture occurring immediately after repair or removal of shaft housing or other parts		*	*		*	
5. Fracture occurring during normal operation			*		*	*

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2. Bearing Failure

Defects in the appearance of bearing are referred to as bearing failure. Table-2 describes bearing failures first assigning general term to each type of failure, then adding more detailed classification.

Table-2

Failures	Failure details	Main Cause(reference)
Rolling Fatigue	Flake Pitting]	Unavoidable
Wear	Wear, fretting] -----	
Fracture	Cracks, chips,]	Improper handling
Flaw	Brineling nicks scratches] _	
Rust	scutting]	Improper lubrication
Seizure	Rust Corrosion	
	Seizure, Discoloration, Smearing	

Table-3

Faults	Probable Causes	Remedial Actions
Increase in temperature.	<ol style="list-style-type: none"> 1. Excessively tight bearing internal clearance. 2. Creep of bearing ring. 3. Excessively heavy load. 4. Improper centering in mounting. 5. Defect in bearing. 6. Improper volume of lubricant. 7. improper lubricant. 8. Improper lubrication method. 9. Excessive interference at oil seal. 10. Shortage of lubricant. 11. Improper oil seal. 12. Abnormal contact with labyrinth seal or other parts. 	<ol style="list-style-type: none"> 1. Replace with a new bearing (Correct bearing internal clearance and interference). 2. Replace with a new bearing (Correct interference). 3. Remount (Correct load by adjusting housing). 4. Remount (Correct centering or widen mounting clearance). 5. Replace with a new bearing (Take proper countermeasures after inspecting the causes). 6. Use correct lubricant volume. 7. Change to proper lubricant 8. Use correct lubricant method. 9. Correct interference by installing new seal or changing seal. 10. Supply lubricant in sufficient quantity. 11. Use correct oil seal and sealing method. 12. Remounting or modify parts.

TYPES OF FAILURE AND PARTS ON WHICH THEY OCCUR

Table 4

Bearing ring, Rolling element			Bearing ring		Cage	
Bearing failure	Raceway surface Rolling surface	Roller guide surface Cage guide surface Roller end face	Others	Fitting surface	Pocket surface Guide surface	Rivet
Flaking pitting			*	*	*	
Wear		*				
Chips			*			
Brinelling		*	*	*		
Nicks		*	*	*	*	*
Scratches			*	*	*	
Scuffing			*	*		*
Rust	*		*	*	*	*
Corrosion			*	*	*	*

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Important Items For T-28

1. Longer blocks should be stressed for effective working.
2. Track should be surveyed thoroughly for broken sleepers & rail pieces which may obstruct the working before block.
3. Signal cables and rods passing under the track must be attended by S&T official at site.
4. Frequent shifting of machine from one location to another should be avoided to achieve good work and adequate progress.

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General Safety Notes

- ◆ The machine has to be operated as per existing Indian Railways rules and regulations.
- The safety of yourself and other people is a most important consideration in the operation and maintenance of the machine.
- Remember, the machine is a working unit, carrying delicate instruments. Therefore the machine should not be driven at excessive speed over bad track or turnouts.
- Always keep your eyes open for other men working close to the machine.
- Do not forget to look out for signals, switches and track obstructions.
- Remember to make sure that all protection equipments and safety devices are in place on the machine and in working order especially when it is being driven from site to site.
- Always, keep the machine clean. Excessive oil or grease on the machine can cause you to slip and fall and is also a potential fire hazard.
- Always lock the machine before you leave. Make sure that the machine is protected in accordance with railways regulations.
- Whenever you have the opportunity while waiting to get out on a job, do some of the smaller maintenance jobs such as tightening loose nuts and bolts and cleaning the machine.
- Do not permit unauthorized persons to operate the machine.
- It is prohibited to use exposed light or fire on or near the machine.

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