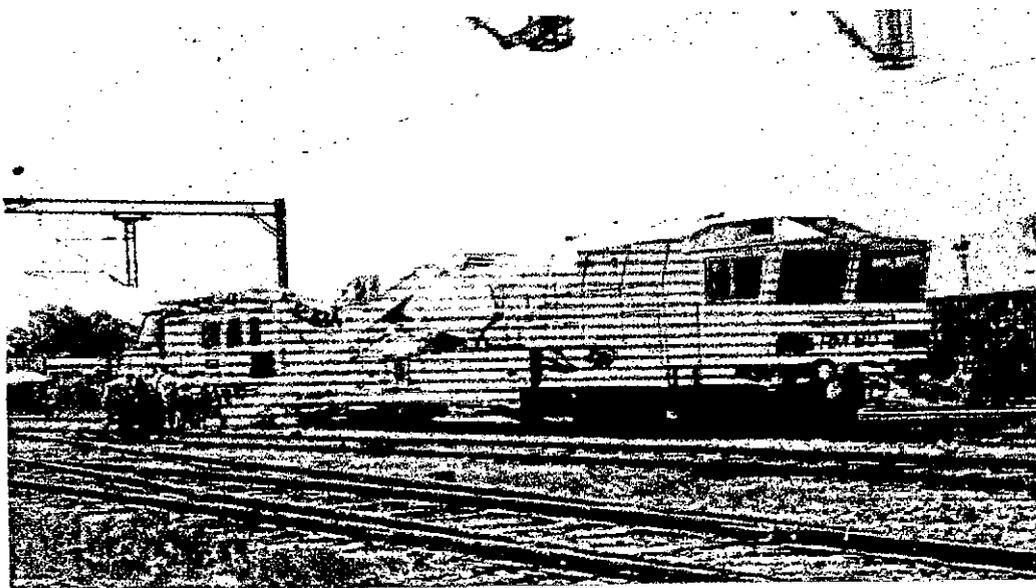




GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TROUBLE SHOOTING GUIDE
FOR
BALLAST CLEANING MACHINE



(RM-80)

REPORT NO. TM-42

(FINAL)

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RESEARCH DESIGNS AND STANDARDS ORGANISATION
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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 utilisation 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 Manuals for Continuous Tamping Machine (CSM 09-32), Points and Crossing Tamping Machine (UNIMAT) and Dynamic Track Stabilizer have already been prepared and issued. The Provisional Trouble Shooting Manual of Ballast Cleaning Machine (RM-80) was issued vide letter no. TM/HM/15 dated 08-5-2001. Suggestions, received in this reference from Central, Eastern and South Eastern Railways have been incorporated in the Final Trouble Shooting Manual of Ballast Cleaning Machine (RM-80) being issued for guidance of the machine staff.

It is hoped that the manual will be quite useful for field staff attending breakdown of machines.

Lucknow.
January, 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 GUIDE OF BALLAST CLEANING MACHINE

I. ENGINE : DEUTZ - BF-12L 513C 453HP @2300 rpm.

S. No.	Faults	Probable Causes	Remedial Actions
1.	Engine does Not start.	<ol style="list-style-type: none"> 1. Emergency stop switch is depressed. 2. No fuel in the tank. 3. Shutdown mechanism stuck. 4. Air in fuel system. 5. Governor is stuck. 6. Misconnection of starting switch. 7. Faulty valve clearance. 	<ol style="list-style-type: none"> 1. Emergency stop switch should be in release position. 2. Fill fuel in the tank. And bleed air from fuel system as explained below: <ol style="list-style-type: none"> i) Loosen the Bleed Plug on the fuel filter and operate the priming pump until the fuel is free from air bubbles. Tighten the bleed plug. ii) Then loosen Banjo Plug on injection pump and operate priming pump until fuel is free from air bubbles. Tighten the Banjo Plug. 3. Check shut down mechanism <ol style="list-style-type: none"> i) Release engine shutdown lever from stop position. ii) Check electrical shutdown circuit for proper functioning. 4. Bleed air from fuel system as explained in s. no. 1, item 2 above. 5. Replace complete fuel injector pump. 6. Check starting switch and if any misconnection is noticed, rectify it. 7. Adjust the valve clearance following these steps: <ol style="list-style-type: none"> i) Unscrew bolts and remove cylinder cover.

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S. No.	Faults	Probable Causes	Remedial Actions
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			<ul style="list-style-type: none"> ii). Crank the engine until the inlet valve is closed, then turn approximately half turn further. iii) The feeler gauge of 0.20mm and 0.30mm should pass between rocker lever and the cross head for the exhaust and intake valve with suction consequently. This will be done by loosen the lock-nut and readjust by means of setting screw. Renew gasket , sealing ring of cylinder head cover. iv) Tighten the lock-nut and readjust valve clearances with the prescribed feeler gauge mentioned in SL(iii)
8.	Not de-clutched.	8. De-clutch where possible	
9.	Wrong SAE grade of engine oil or poor quality of oil.	9. Replace by correct type of oil	
10.	Cable connection starter circuit loose / oxidized	10. Check the same.	
11.	Weak batteries.	11. Check electrolyte level in the batteries. Terminals should be clean and the charging system should be working. Over-aged batteries should be replaced.	
12.	Injectors not properly functioning.	12. Remove faulty injectors and get it overhauled/calibrated or alternatively replace it with new one.	
13.	Valves not seating properly.	<ul style="list-style-type: none"> 13.i) Check the valve springs and replace the broken spring if any. ii) Lap the valves. lii)Lap the valve seat, if required. 	

S. No.	Faults	Probable Causes	Remedial Actions
		14. Too much fuel in engine or flooded engine.	14.i) Clean fuel return pipe. ii) If return pipe is already clean, calibration of fuel pump may be defective and should be got calibrated.
		15. Starter defective or starter relay defective or pinion does not engage.	15. Check, rectify or replace.
2.	Engine stops suddenly during run.	1. No fuel. 2. Air in the fuel system. 3. Valve clearances are not proper. 4. Governor is stuck up. 5. Overheating of Engine 6. Fuel filter / fuel pre-filter contaminated. 7. Shut down circuit fails. 8. Lube oil pressure too low.	1. Fill fuel in the tank and follow steps same as 1(2). 2. Bleed air from fuel system as explained in steps same as 1(2). 3. Adjust valve clearances as explained in 1.7. 4. Governor needs repairs/overhauling in workshop. 5. Take remedial action same as 1(5). 6. Check / clean/replace as per need. 7. Check and repair the faulty circuit. 8. i) Check lube oil pump. ii) V-Belt for lube oil pump may be broken. Change with new one. iii) Wrong grade of lube oil. Use proper grade of oil.
3.	Engine misfiring.	1. Dirty fuel filter. 2. No / less fuel in tank. 3. Air in fuel system. 4. Faulty Injector/ Injection line leaky. 5. Faulty valve clearance. 6. Fuel injection timing improper.	1. Check fuel filters and if necessary replace the same . 2. Fill fuel in the tank and follow steps same as 1(2). 3. Bleed air from the system, same as 1(2). 4. Remove the faulty injector and get it overhauled / calibrated. Alternatively, replace the faulty injector with new one. 5. Adjust valve clearances 6. Correct the timings or call the service engineer.

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S. No.	Faults	Probable Causes	Remedial Actions
4.	Excessive black smoke at idle.	<ol style="list-style-type: none"> 1. Restricted fuel lines 2. Plugging of injector spray holes 3. Cracked injector body 4. Long idle period 5. Gasket blow-by or leakage 6. Broken or wrong piston rings 7. Injectors needs calibrations 	<ol style="list-style-type: none"> 1. Check the fuel lines. 2. Injectors needs cleaning 3. Replace the broken one. 4. Do not run the engine at idle speed for long period. 5. Replace the defective gasket 6. Use the piston rings of standard part no. from engine manufacturer 7. Get the engine calibrated through specified agency
5.	Excessive white smoke at idle	<ol style="list-style-type: none"> 1. Poor quality of fuel. 2. Cracked injector body 3. Coolant temperature low 4. Long idle periods 5. In correct valve and injection timing 	<ol style="list-style-type: none"> 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.	Excessive smoke under load	<ol style="list-style-type: none"> 1. Restricted air in take 2. Dirty turbo charger compressor 3. Poor quality of fuel 4. Restricted fuel lines 5. Fuel pump calibration in correct 6. Injector needs calibration 7. Engine due for overhaul 	<ol style="list-style-type: none"> 1. Clean the air filter or replace if required 2. Get it clean 3. Same as 5(1). 4. Check the fuel lines and clean it as per requirement 5. Get the fuel pump calibrated through specified agency 6. Get the injector calibrated through the specified agency. 7. Get the engine overhaul through service engineer of engine manufacturer.

S. No.	Faults	Probable Causes	Remedial Actions
7.	Engine running too hot.	<ol style="list-style-type: none"> 1. Coolant level too low. 2. Oil cooler/cooling fins soiled. 3. Air Blower defective. 4. Air Blower coupling broken. 5. Faulty valve clearances. 6. Atmospheric air temperature rise/hot air circulation. 7. Oil level too low or high. 8. Engine overloaded. 9. Lube oil pressure too low. 10. Faulty fuel pump. 11. Choking of corrugated fins of cylinder. 	<ol style="list-style-type: none"> 1. Check coolant level and top up with coolant upto the mark in the filler neck. 2. Clean oil cooler/cooling fins. 3. Check and replace. 4. Replace broken coupling/ bushes. 5. Adjust the valve clearance, same as 1 (7). 6. Check. 7. Keep the oil level within limits. 8. Check and reduce loads. 9. Engine has to be repaired at workshop. 10. Repair the pump or replace as required. 11. Clean the cylinder fins with water-jet during monthly schedule and clean the engine externally daily before and after the block with compressed air jet.
8.	Engine knocking	<ol style="list-style-type: none"> 1. Incorrect Injector setting or defective injector . 2. Mechanical damage to piston ring/liners. 3. Connecting rod bearing damaged 4. Injection line leaky 5. Fuel filter / fuel pre-filter contaminated. 5. Incorrect tappet Clearance. 6. Faulty fuel pump . 	<ol style="list-style-type: none"> 1. Remove the faulty injector and get it reset or alternatively replace it with new one. 2. Call in the service engineer. 3. Replace connecting rod bearing. 4. Check the leakage. 5. Check/clean/replace. 6. Adjust tappet clearance. 7. Repair /Replace the pump.

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S. No.	Faults	Probable Causes	Remedial Actions
7.	Output of the engine too low.	1. Dirty fuel filter and fuel line. 2. Air in fuel system. 3. Faulty Injector/Fuel pump. 4. Faulty valve clearances. 5. Air filter choked. 6. Leakage of compression. 7. Governor sticking.	1. Replace fuel filter and clean fuel line. Same as 3(1). 2. Bleed air from system as explained, same as 1(2). 3. Remove faulty injector/Fuel pump and get it overhauled or alternatively replace it with new ones. 4. Adjust valve clearances same as Sl. No. 1(7). 5. Clean/replace air filter element. 6. Engine needs repairs in workshop. 7. Governor needs repairs in workshop
8.	Oil pressure low.	1. Dirty lube oil filter. 2. Improper oil grade. 3. Oil control valve not working. 4. Oil level too low 5. Excessive inclination of engine 6. Dirty oil cooler. 7. Excessive wear in connecting rod/ main bearing. 8. Mixing of diesel or coolant in Engine oil.	1. Replace the lube oil filter element. 2. Use proper grade of engine oil. 3. Call the service engineer for repair of control valve. 4. Fill the oil up-to the required level. 5. Check 6. Call in the service engineer for cleaning of the oil cooler. 7. Engine needs to be overhauled in workshop. 8. Call the service engineer of OEM.
9.	Oil film present in crank case ventilation.	1. Incorrect compression. 2. Wrong grade of lube oil.	1. Engine needs repairs at workshop. OR Call in the service engineer. 2. Use lube oil of proper brand and grade as recommended by the OEM.

No.	Faults	Probable Causes	Remedial Actions
10.	Engine speed is irregular.	<ol style="list-style-type: none"> 1. Air in fuel system. 2. Governor struck-up. 3. Incorrect firing order. 4. Incorrect fuel pump calibration. 	<ol style="list-style-type: none"> 1. Bleed air from the system , same as sl.no.1 (2). 2. Call in the service engineer. Governor needs repairs. 3. Adjust firing order. (1,8,5,10,3,7,6,11,2,9,4,12). 4. Get the fuel pump calibrated through specified agency.
11.	Fuel consumption too high.	<ol style="list-style-type: none"> 1. Incorrect setting of Injector. 2. Incorrect valve and injection timing. 3. Clogged air filter. 4. Poor compression. 5. Lube oil level too high. 	<ol style="list-style-type: none"> 1. Replace or overhaul faulty injector. 2. Get the engine timing reset. 3. Clean air filter. 4. Call the service engineer. Engine needs repairs in workshop. 5. Keep the oil level within limits.
12.	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. Oil leaking from compressor. 5. Poor compression. 6. Broken or wrong piston rings / piston / liner. 	<ol style="list-style-type: none"> 1. Use proper grade and quality lube oil as recommended by OEM. 2. Check . 3. Keep the oil level within limits. 4. Overhaul the compressor. 5. Replace compression rings or valve, valve seat or lap. 6. Engine is due for overhauling.
13.	Mixing of diesel in oil.	<ol style="list-style-type: none"> 1. Defective injector. 2. Long idle periods. 3. Internal/external fuel leakage. 	<ol style="list-style-type: none"> 1. Replace the defective injector. 2. Do not run the engine at idle speed for long periods. 3. Prevent the leakage.

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

S. No.	Faults	Probable Causes	Remedial Actions
14.1	Lack of power boost pressure too low.	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 un-tight joints.
		1.1 Too high flow resistance in the exhaust gas system and / or leakage un-stream of turbine.	1.1 Check exhaust brake, pipes, gaskets and silencers, carry out repairs required.
		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.
		1.5 Turbocharger defective. Wheels rubbing on housing walls.	1.5 Examine turbocharger, repair or replace if necessary.

S. No.	Faults	Probable Causes	Remedial Actions
14.3	Black exhaust smoke.	Same as points 1.0, 1.3, 1.4, 1.5	See points 1.0, 1.3, 1.4, 1.5
14.4	Blue exhaust smoke.	<ol style="list-style-type: none"> <li data-bbox="532 469 841 543">1. Worn valve guides and piston rings. <li data-bbox="532 664 873 850">2. Compressor side and / or turbine-side sealing in the turbocharger defective. <li data-bbox="532 934 850 1045">3. Turbocharger oil drain-pipe clogged and / or deformed. 	<ol style="list-style-type: none"> <li data-bbox="906 469 1351 581">1. Measure blow-by volume at crankcase outlet. Overhaul engine if required. <li data-bbox="906 664 1399 739">2. Examine turbocharger, repair or replace it as required. <li data-bbox="906 934 1351 1008">3. Clean oil drain pipe, repair if necessary.
14.5	Oil leakage at turbocharger.	<ol style="list-style-type: none"> <li data-bbox="532 1129 873 1241">1. Oil-feed pipe and/or oil drain pipe loose and leaking <li data-bbox="532 1324 873 1473">2. Leakage at connection between compressor and bearing housings 	<ol style="list-style-type: none"> <li data-bbox="906 1129 1383 1203">1. Clean Turbocharger, check for leakage and rectify. <li data-bbox="906 1324 1393 1361">2. Repair or replace turbocharger.

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15.0 IMPORTANT : IN CASE OF ENGINE FAILURE DURING TRAFFIC BLOCK WORKING

S. No.	Faults	Probable Causes	Remedial Actions
15.1	Machine stopped during working in block section/ engine no. 1 failed.	1. Engine failed/cordon shaft connecting engine no. 1 and gear box failed/ Failure on main gear box no. 1 in block section.	<p>1. Since engine no. 1 failed, to reduce the time and avoid process of connection and disconnection of pipes, the system is modified for speedy winding up.</p> <p>In this system arrangement has been made to receive hydraulic pressure from external source, so that various assemblies can be lifted and locked in case of failure of both the engines.</p> <p>After locking up the various assemblies such as chain trough, lifting unit etc, the machine can be moved with only engine no. 2 working and axle no. 3 & 4 powered. The electrical circuit of axle 1 and 2 automatically gets disconnected. When engine no. 1 shut down and separates isolation of these switches is not necessary.</p>
15.2	Machine stopped during working in traffic block / engine no. 2 of the machine failed.	Engine no. 2 failed / cordon shaft connecting engine and gearbox failed/failure of main gearbox.	The winding of the machine can be done as usual because the hydraulic pump for these operations are run by the engine no. 1. After winding up, the machine can run with axle no. 1 and 2 powered. Electrical isolation of axle no. 3 & 4 takes place when engine no. 2 is shut down.

S. No.	Faults	Probable Causes	Remedial Actions
15.3	Both engine no. 1 and 2 failed in the block section.	It is not possible to start either of the engine during traffic block / working.	<ol style="list-style-type: none"> 1. Immediately ask for assisting power. 2. Separate backup system is not provided on this machine. 3. Normally these machines are followed by tamping machines. In this case a separate hydraulic pipe can be connected from the tamping machine to the BCM as explained in item 15.1 and winding up of the machine can be carried out. For this purpose hydraulic pipe SAE 100R2 size 5/8" of 30 meter long with end fittings should be kept on the machine. After winding up, the section can be cleared by coupling to the tamping machine or by assisting engine. 4. BCM other than SI. No. 285 to 291 are provided hand operated hydraulic system (back up system) to wind up the machine.

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II. EXCAVATING UNIT

S. No.	Faults	Probable Causes	Remedial Actions.
1.	Chain stops running.	1. Any obstruction entangle with the chain. 2. Breakage in the pin of cutter chain. 3. Turret drum bearing not functioning properly. 4. Entanglement of wear plates with running chain. 5. Fastening pin of cutter bar might have broken and entangled with cutter chain.	1. Entanglement should be removed. 2. Replace cutter chain. 3. Chain and Turret drum should be checked. 4. It should be cleared. 5. Pin should be changed and broken piece if any should be replaced.
		6. Chain fall down from turret.	6. Re-route chain on turret and keep proper tension.
		7. Chain too loose.	7. Tighten chain.
		8. Chain drive pressure becomes more than 340 bar which is normally maximum preset pressure for chain drive.	8. Chain drive pressure should be kept around 250 bar so that due to any obstruction in the movement of chain should not increase the pressure beyond 340 bar. As soon as chain drive pressure increases beyond maximum limit, chain movement should be stopped.

S. No.	Faults	Probable Causes	Remedial Actions.
2.	Chain running but no proper excavation (650 m ³ /h)	<ol style="list-style-type: none"> 1. Excavating finger worn out. 2. Chain speed is not proper.(2--4m/sec). 3. Depth of cutting is less than required. 4. Motor for turret gear not working properly. 5. Hard bed or wet soil. 6. Fish plate joint not removed properly. 7. Ballast cleaning is being done with out track lifting. 	<ol style="list-style-type: none"> 1. Replace excavating finger. 2. Check chain speed. Normally it should be 2.7m/s i.e. auxiliary pump in off mode and main pump should be in fast mode. 3. Increase depth of cutting. 4. Motor should be checked for proper working speed. If speed is irregular then reset it with adjusting screw provided in the axial piston motor. 5 Machine should be deployed as per schedule. 6 All fish-plates should be removed before machine working. 7. Lifting of track should be done as per proposed rail level.

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III. Screening Unit

SL. No.	Faults	Probable Causes	Remedial Actions
1.	Screening unit is not working properly.	<ol style="list-style-type: none"> Function of screening unit is not proper. Sieve area of screen unit should be align to proper conveyor belt. Condition of ballast chute should be proper so that screened ballast should lie on distributing conveyor belt. Ballast screen should be of proper mesh size. Reconditioning of ballast screen shall be done time to time. RPM of Vibration shaft is improper. 	<ol style="list-style-type: none"> RPM of screen should be checked. It should be 750 at idle and 900 during screening mode. Check sieve are of screening surface. Weather any piece of ballast is disturbing the screen area. It should be checked for any damage/breakage. Check Ballast screen for proper size. Check the RPM of motor and adjust it if required for proper vibration. Finally replace the vibration shaft.
2.	Improper sized ballast coming out as waste.	<ol style="list-style-type: none"> Improper sequence or worn screens. Blocked Screening surface (30 m²). Screening unit is not in horizontal position. Excavation depth is set more than design. Improper Vibration of screening unit. Vibration motor is not working properly. Ballast drop on lower side of the guide. Hood closed. Wet soil 	<ol style="list-style-type: none"> Arrange screens in proper order i.e.80mm,50mm,30mm from top and repair the damaged screens. Check screening surface. Remove entangled ballast. It should be made horizontal. Adjust depth of cutting. Vibration of screen should be checked. Check vibration motor. Correct the adjustment of ballast drop guide to its required posit.on. Open the hood. Avoid using machine in case of wet soil.

IV. Conveyor Unit

S. No.	Faults	Probable Causes	Remedial Actions
1.	1. Condition of conveyor belt is not in order.	<ol style="list-style-type: none"> 1. Condition of conveyor should be proper. 2. Conveyor rollers shall function properly. 3. Alignment of conveyor shall be proper. 4. Waste conveyor shall function properly. 	<ol style="list-style-type: none"> 1. It should be checked to be in order. 2. Conveyor rollers should be observed for any defect and it should be lubricate properly. 3. Conveyor belt should be aligned properly. 4. Function of waste conveyor should be checked properly.
2.	Belt runs to one side through out entire length at specific idlers.	<ol style="list-style-type: none"> 1. Idler out of square with center line of conveyor. 2. One side screening material build-up 	<ol style="list-style-type: none"> 1. Realign the idler. 2. Remove accumulation of ballast.
3.	Belt slips and squeals	<ol style="list-style-type: none"> 1. Belt not tight enough. 2. Material build up. 3. Frozen idlers 4. Pulley lagging worn. 	<ol style="list-style-type: none"> 1. Adjust belt tension. 2. Remove accumulation. 3. Free idlers and lubricate. 4. Replace worn pulley lagging.
4.	Belt slips on starting.	<ol style="list-style-type: none"> 1. Belt not tight enough 2. Worn out Pulley lagging. 	<ol style="list-style-type: none"> 1. Adjust belt tension. 2. Replace worn pulley lagging.
5.	Belt too tight	<ol style="list-style-type: none"> 1. Adjust belt tension. 2. Material build-up. 	<ol style="list-style-type: none"> 1. Adjust belt tension. 2. Remove accumulation.
6.	Belt breaks behind fasteners.	<ol style="list-style-type: none"> 1. Belt improperly spliced or wrong fasteners used. 2. Belt not tight enough 3. Pulley lagging worn out. 	<ol style="list-style-type: none"> 1. Use correct fasteners. Retighten after running for a short while. If improperly spliced, remove belt splice and make new splice. 2. Adjust belt tension. 3. Replace worn out pulley lagging.

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S. No.	Faults	Probable Causes	Remedial Actions
		4. Material between belt and pulley.	4. Remove accumulation.
7.	Excessive wear including tips, gauges, ruptures and tears.	1. Material build-up. 2. Incorrect belt in working.	1. Remove accumulation of material 2. Install correct belt.
8.	Excessive wear of bottom cover.	1. Material build-up. 2. Frozen idlers 3. Pulley lagging worn.	1. Remove accumulation of material. 2. Free idlers and lubricate. 3. Replace worn pulley lagging.
9.	Excessive edge wear, broken edges.	1. One sided loading. 2. Belt strained on one side. 3. Belt bowed (belt damaged due to improper storage). 4. Material build-up.	1. Load in direction of belt travel, in center of belt. 2. Allow time for new belt to break in. If belt does not break in properly or is not new, remove strained section and splice in a new splice. 3. Avoid telescoping rolls or storing in damp locations. A new belt must be straightened out when broken in or it must be replaced. 4. Remove accumulation.
10.	Cover swells in spots, streaks becomes choked or brittle, and cracks.	1. Improper belt installed. 2. Damage by abrasion, heat or oil. 3. Entanglement of foreign material like tie bars, CST-9, signal rod etc.	1. Install correct belt. 2. For abrasive material working into cuts and between plies, make spot repairs with cold patch or with permanent repair patch. Don't over lubricate idlers. 3. These types of infringements should be removed in advance.
11.	Longitudinal grooving or cracking.	1. Frozen idlers. 2. Edge worn or broken 3. Improper belt installed	1. Get free the idlers and lubricate. 2. Repair belt edge. Remove badly worn or out of square section and splice in a new piece. 3. Install proper belt.

S. No.	Faults	Probable Causes	Remedial Actions
12.	Belt tear off.	<ol style="list-style-type: none"> 1. Puncturing of belt by ballast trapped in between roller and belt. 2. Belt tear off to its full length. 	<ol style="list-style-type: none"> 1. Check and cover up the openings which may allow ballast going in between roller and belt. 2. Check and remove the metal piece, ballast fixed near bottom opening or in ballast drop tray.
13.	Stopping of waste conveyor belt at swivel angle $> 45^{\circ}$.	1. Accumulation of fine muck in between roller and turn-table result in jamming of moving belt.	1. Clear the muck from the gap in between turn-table in roller. Provide stopper so as not to allow waste conveyor belt to swivel above 45° .
14	Jamming of distributing conveyor belt.	<ol style="list-style-type: none"> 1. Loose belt. 2. Entrapping of ballast in between belt and roller chute. 3. Worn out flap. 	<ol style="list-style-type: none"> 1. Keep regular watch on belts during daily schedule and get tighten it as per requirement. 2. Repair the damage chute. 3. Replace the worn out flap.

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V. Lifting Unit

S. No.	Faults	Probable Causes	Remedial Actions
1.	Lifting and lowering unit not lifting up by manual operation.	1. No system pressure. 2. No supply on solenoid.	1. Ensure system pressure. 2. Ensure supply on solenoid. Check the operation by manually operating the valve. If it is working there is defect in solenoid, it should be repaired/replaced. Otherwise valve should be changed.
2.	Lifting roller holding is not proper.	1. Clamping pressure is not sufficient. 2. Worn out rollers.	1. Check function of motor. 2. Change rollers.

VI. Swiveling System

S. No.	Faults	Probable Causes	Remedial Actions
1.	It is not working properly.	1. System is not rotating as required. 2. Negotiating in forward mode but not coming back to original place automatically, when switch is ON. 3. Traction mast sensor switch is not working.	1. System pressure & supply voltage should be checked. 2. i) Proper rotation of conveyor belt should be checked. ii) D.C. valve to be checked for proper functioning. 3. Traction mast sensor should be tested time to time.

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VII. Conveyor Belt

S. No.	Faults	Probable Causes	Remedial Actions
1.	Edges worn or frayed.	<ol style="list-style-type: none"> 1. Defective joint. 2. Mis-aligned running. 3. Off-center loading. 4. Defective self-aligning idler. 5. Inadequate edge clearance. 6. Belt too stiff for adequate toughing. 	<ol style="list-style-type: none"> 1. Rectify joint. 2. Check conveyor alignment and realign belt. 3. Re-position loading chute to feed load centrally. 4. Rectify or replace faulty idler. 5. Minimum recommended clearance between belt edge and structure is 75 mm. 6. Install a laterally more flexible belt. Repair or paint edges with conveyor belt solution to prevent moisture, grit, etc.
2.	Excessive uniform wear.	<ol style="list-style-type: none"> 1. Cover under specified or incorrect quality. 2. Worn or seized return idlers. 3. Spilled material under tail pulley setting up abrasion. 4. Return run of belt rubbing against spilled material along the conveyor 5. Load disturbance due to uneven conveyor level and incorrect idler spacing. 	<ol style="list-style-type: none"> 1. Specially thicker covers of correct grade depending on loading cycle and material carried. 2. Install cleaning devices or rubber disc idlers. Check periodically if all idlers rotate freely. Replace seized idlers with new ones. 3. Increase clearance between tail pulley and floor, fit decking to avoid spillage. 4. Prevent spillage along the run of the conveyor. Check return idler spacing and belt tension. Ensure all spilled material to be remove immediately. 5. Ensure correct conveyor level and recommended idler spacing.

S. No.	Faults	Probable Causes	Remedial Actions
3.	General Cover Problems:		
3a.	Surface cracks.	Exposure to sunlight or ozone for long periods.	Protect belt suitably, particularly in storage and when idle on the conveyor for long period.
3b.	Cover softening and bulging.	Oil contamination.	Avoid oil or grease contamination.
3c.	Cover hardening and cracking	Material carried too hot.	Quench material carried or use better heat resistant.
3d.	Bulging of cover at places and the same extending along belt length.	Fine material working into cuts or punctures in the rubber cover.	Immediate repair of cuts and punctures to prevent ingress of fine dust, etc.
4.	Belt Carcass.	Impact of large heavy material.	Use cushion idlers. Keep height of fall to a minimum and load in line with the belt at a speed equal to belt speed.
5.	Breaks in the carcass.	<ol style="list-style-type: none"> 1. Material entrapment between the belt and pulley. 2. Material build up on pulley. 3. Belt edges folding up due to mis-aligned running. 	<ol style="list-style-type: none"> 1. Use scrapers or ploughs at tail end section and proper decking at take-up pulley in case of gravity take-ups. 2. Use belt cleaning device and install scraper on pulley. 3. Use limit switches to stop excessive running out and investigate reasons for running out.

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S. No.	Faults	Probable Causes	Remedial Actions
6.	Traverse Breaks at edge.	Incorrect positioning of idler next to head pulley-too close or too high.	Re-locate or readjust idler or pulley position.
7.	Fastener pull out, or transverse carcass breaks.	Too much tension.	Reduce tension.
8.	General Operating Problems:		
1.	Belt wanders at random.	Too stiff, does not conform to contour of idlers.	Use belt with more transverse flexibility.
2.	Belt runs off center at certain times.	Wind pressures and effect on conveyor frame.	Use covers and wind deflector and self aligning idlers.
3.	Belt stretches excessively.	Excessive starting and operating tensions.	Increase speed keeping tonnage same or reduce tonnage keeping the speed same, thereby tensions will be reduced. Lag drive pulley or increase area of contact. Use minimum counter-weight in take-up. Replace with lower elongation or higher strength belt.

VIII. HYDRAULIC - PUMP

S. No.	Faults	Probable Causes	Remedial Action
1.	Pump not delivering oil.	<p>1. Pump driven in wrong direction vis-à-vis of shaft rotation (at the time of new pump fitment, this problem may occur).</p> <p>2. Oil level too low in the reservoir (if oil level is very low, aeration may take place and pump will not deliver oil).</p> <p>3. Intake filter/pipe choked.</p> <p>4. Air leaks in pump intake joints.</p> <p>5. Broken pump shaft or rotor.</p> <p>6. Pump speed too slow. (The delivery rate of discharge is prescribed at a certain rpm of engine. If engine speed become less than ideal speed, it may affect the proper suction of oil).</p>	<p>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.</p> <p>2. Check oil level in reservoir and it should be above minimum mark. If necessary, recoup the oil.</p> <p>3. Clean or replace filter for proper flow of oil.</p> <p>4. Pour hydraulic oil on intake joints and on observing abnormal sound, tighten the intake joint as required.</p> <p>5. Remove the broken shaft or rotor. Also align the prime mover shaft.</p> <p>6. Pump should run at prescribed speed. Engine rpm should be checked.</p>

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S. No.	Faults	Probable Causes	Remedial Action
		7. Dirty suction filter. 8. Faulty suction valve. 9. Air in system.	7. Replace the filter. 8. Repair or change the valve 9. Discharge air from the system.
2.	Pumps makes noise	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 mis aligned (Due to this bearing may get damaged, there will be a play at shaft, abnormal sound will be observed). 5. Reservoir not vented properly. 6. Suction Filter too small in size. 7. Air leaks 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 is air bound. 10. Cavitation. 11. Shaft seal leaks.	1. Fill the reservoir upto required level so that aeration is prevented. 2. Clean or replace the filter or line. 3. Reduce speed upto prescribed limit. 4. Realign the pump shaft & prime mover 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 the pump immediately. Bleed the pump by priming before restarting. 10. Vent the system and Seal it properly. 11. Replace jointing or seal.

S. No.	Faults	Probable Causes	Remedial Action
		12. Oil foams.	12. Vent the 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. Tighten bolts uniformly.
		17. Foreign bodies in suction line.	17. Remove foreign bodies, if needed flush the system.
		18. System dirty.	18. Flush the system.
		19. Sharp bends in suction line.	19. Eliminate or reduce number of bends in suction line.
		20. Oil temperature too high.	20. Check circuit for this cause. Oil cooler may be ineffective. Rectify the failure
		21. Boost pump failed.	21. Check boost pump.
		22. Resonance through tank.	22. Change the position of tank and install 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.
		2. Oil speed in system too high.	2. Install pipes of greater nominal size.
		3. Oil level too low.	3. Fill the oil upto safe level.
		4. Pump or motor rotor groove worn out.	4. Change 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.
		7. Inadequate cooling.	7. Increase cooling capacity.
		8. Cooling system is dirty.	8. Establish cause and repair the defect.
		9. Differential pressure too low.	9. Increase pressure setting of feed pressure.
		10. Pressure too high.	10. Reduce pressure setting.

S. No.	Faults	Probable Causes	Remedial Action
		<ul style="list-style-type: none"> 11. Wrong type of pressure valve. 12. Faulty operation in system. 13. Wrong seals. 14. Filter dirty or too small. 15. Pump running speed high. 16. Cavitation. 17. Oil foams. 18. Venting dirty. 19. System contaminated. 20. Sharp bends in suction line. 21. Boost pump failed. 	<ul style="list-style-type: none"> 11. Replace by appropriate type of valve. 12. Check circuit & modify the system. 13. Replace by suitable seals. 14. Clean filter or replace by larger type. 15. Reduce speed. 16. Bleed the system. 17. Vent system. 18. Clean vents. 19. Flush the system. 20. Eliminate bends or at least reduce them. 21. Establish cause and repair defect.
4.	Pump develops no pressure	<ul style="list-style-type: none"> 1. Wrong pressure setting. 2. Pressure valve sticks. 3. Leakage in system. 4. Pump shaft broken. 5. Belt drive slips. 6. System contaminated. 7. Wrong gaskets and seal. 	<ul style="list-style-type: none"> 1. Modify the pressure setting. 2. Repair defect. 3. Replace defective parts. 4. Replace shaft. 5. Adjust tension or replace belt. 6. Flush system completely . 7. Replace seals and gaskets.
5.	Speed loss on pump.	<ul style="list-style-type: none"> 1. Inlet pressure too low. 2. Outlet pressure too high. 3. Port plate does not make contact. 4. Oil temperature too high. 	<ul style="list-style-type: none"> 1. Increase pressure. 2. Check system pressure. 3. Disassemble motor and repair. 4. Check circuit.

S. No.	Faults	Probable Causes	Remedial Action
6.	Pump does not work.	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.	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 proper delivery. 5. Replace bearing.
7.	Bearing failure.	1. Chips or other contaminants in bearing. 2. Coupling mis-alignments. 3. Inadequate lubrication. 4. Pump running too fast. 5. Excessive or shock loads. (Excessive loads due to operating pressure may damage the bearing).	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.

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IX. HYDRAULIC - RELIEF VALVE

S. No.	Faults	Probable Causes	Remedial Actions
1.	Erratic pressure.	1. Foreign material in the oil. 2. Wrong poppet or seat in upper stage. (oil from pilot stage will go to tank due to worn poppet 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 poppet or seat as required. 3. Clean piston after dismantling. Check free movement after re-assembling.
2.	Low pressure or no pressure.	1. Valve improperly adjusted. 2. Vent connection is open (at the time of starting the work, if vent remain open, then oil will go to the tank and no pressure will develop). 3. Balance hole in main piston choked. 4. Poppet in cover not seating. (So oil continuously goes to tank line and pressure drops). 5. Broken or weak spring in upper state (oil pushes the poppet easily and goes to tank. So pressure drops).	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 poppet condition. If required, replace it. 5. Replace the spring and again set the pressure with adjusting knob.

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

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X. HYDRAULIC - UNLOADER VALVE

S. No.	Faults	Probable Causes	Remedial Actions
1.	Low or no pressure.	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 1. Set proper pressure of valve (130 and 140 bar). 2. Check the accumulator pressure and prevent 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.

XI. Clutch Assembly

In these type of machines each powered axle has one clutch. And all the clutches have two speeds i.e. one for working mode and another for driving mode. Each clutch has one pinion shaft, two special compression ring, one bush and two clutch plate. These clutches had been provided with two filters. Trouble shootings are indicated below:

S. No.	Faults	Probable Causes	Remedial Actions.
1.	No out-put from clutch.	1. Clutch slips and there is no required pressure for operation. It should be 15-20 bar. It can be seen on panel box.	1. Open the cover and check compression ring, provided by the side of the clutch pinion. If it is worn out, change compression ring. <u>OR</u> 2. Check for any abnormal mark on the bush. If it is found change the bush.
2.	Erratic movement of the machine.	1. Pressure is not continuously applied on clutch plate. 2. Bearing failure.	1. First check as per item no.1. In addition to that check the pinion shaft. If all item in no.1 is OK, check skirt of the pinion. If skirt has worn out or formed recess between two ports, take out the pinion, provide material on the pinion by suitable (cold) welding and turn to proper sizes or provide over size compression rings. <u>OR</u> 2. Replace the pinion shaft with new one.
3.	Failure of clutch pressure of axle no-1 OR axle no-2 OR axle no-3 OR axle no-4.	Rings and bush of axle pinion shaft may be worn out.	Rings and bush of axle pinion shaft of axle (as the case may be) should be replaced with new one.

S. No.	Faults	Probable Causes	Remedial Actions.
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4.	Traction charge pressure is indicating but no traction pressure indication during block working.	There may be problem in electrical circuit .	Check weather drive indication lights L17,L18,L19 are glowing. If glowing,
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Check weather the traction pressure is available when the machine is in either forward or reverse direction. If traction pressure is available in forward direction but no pressure in reverse direction, relay d66 is defective. Similarly if traction pressure is available in reverse direction but no pressure in forward direction, relay d65 is defective.

If indication lights are not glowing Check limit switch b130 and b131 (for cutting chain drive protection area) for sticking.

Check pneumatic pressure. It should be 5.5 bar (min.). If it is OK, then pressure switch b42(for forward drive) and b43(for reverse drive) may be defective.

Check the relay d67.

Shut down engine no.1 and check weather drive indication is coming or not to verify the proper functioning of clutch pressure switch b128 and b129. If indication is coming and traction pressure is also available, shut down engine no.1 and clear the section by engine no.2

Shut down engine no.2 and check weather drive indication is coming or not to verify the proper functioning of clutch pressure switch b21 and b20. If indication

S. No.	Faults	Probable Causes	Remedial Actions.
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5.	Operating mode is changed from working to driving but any one of the axles has not changed from working mode to driving mode.	Locking of both the clutch pressure OR mechanical binding of both the clutches together is suspected.	<p>is coming and traction pressure is also available then shut down engine no.2 and clear the block section by engine no.1</p> <p>Working drive hydraulic valve is operated or pressure switch b41 is defective needs replacement.</p> <p>The above condition can occur on two accounts.</p> <ol style="list-style-type: none"> Both the clutches operating simultaneously due to internal leakage of clutch pressure in the pinion shaft. If skidding or vibration in axle is noticed, locking of both the clutch pressure is suspected. If time permits the pinion shaft rings and bush of that particular axle can be checked and rectified if required. Otherwise shut down the engine which is driving the traction pump for that axle and move the machine on driving mode by other engine. If the axle is rotating freely the machine can clear the section in driving mode with only one engine.
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S. No.	Faults	Probable Causes	Remedial Actions.
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2. In case the axle is not rotating freely in driving mode even after shutting down the engine related to it, mechanical binding of both the clutches together is suspected. In this case keep the machine in working mode.

Put 3way valve 62.05.3000.234 in fast position. Drive the machine in working mode. The maximum speed attained in this position is 5KM/H. If the valve remains in slow position, speed will be only 1.5KM/H.

Note : 1.If the two filters provided before the clutch assembly is being changed at proper interval of 150 – 250 hrs. Lube oil is replaced in gear box (capacity 40-45 liters) at a interval of 500 hrs, normally NO any clutch failure should occur.

2. Check bearings and change if required.

XII. 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 is of 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. 4. Out let pressure too high. 5. Port plate does not make contacts. 	<ol style="list-style-type: none"> 1. Increase pressure by resetting relief valve. 2. Change defective parts. 3. Check cooling circuit. Hydraulic oil cooler may be defective. 4. Check the system pressure. 5. Dismantle the motor and repair as per requirement.
4.	Motor does not work	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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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XIII. 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 in 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 item no.1 to 6.

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 of wire strands.	Use swivel fittings or joints to be sure that there is no twisting force on a hydraulic hose.
5.	Fitting blew 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 hose 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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XIV. BEARING

The following cause 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 matters 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 a fracture occurs, because the possible causes of failure can be limited in according to the time of fracture occurrence. For reference, time of fracture occurrence and related causes are categorized and listed Table-1.

Table 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 matters, 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	Scuffing]	
Seizure	Rust CorrosionSeizure, Discoloration, Smearing	Improper lubrication

Table-3

Faults	Probable Causes	Remedial Actions
Increase in temperature	1. Excessively tight bearing internal clearance	1. Replace with a new bearing (Correct bearing internal clearance and interference)
	2. Creep of bearing ring.	2. Replace with a new bearing (Correct interference)
	3. Excessively heavy load	3. Remounting (Correct load by adjusting housing)
	4. Improper centering in mounting	4. Remounting (Correct centering or widen mounting clearance)
	5. Defect in bearing	5. Replace with a new bearing (Take proper countermeasures after inspecting the causes)
	6. Improper volume of lubricant	6. Correct lubricant volume
	7. improper lubricant	7. Change to proper lubricant if required.
	8. Improper lubrication method	8. Correct lubrication method by remounting or replacement with new parts
	9. Excessive interference at oil sealing.	9. Correct interference by installing new seal or changing seal.
	10. Shortage of lubricant	10. Supply lubricant in sufficient quantity.
	11. Improper oil seal	11. Correct oil seal type or sealing method
	12. Abnormal contact with labyrinth seal or other parts	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		*				
Fretting						
Cracks						
Chips			*			
Brinelling		*	*	*		
Nicks		*	*	*	*	*
Scratches			*	*	*	
Scuffing			*	*		*
Rust	*		*	*	*	*
Corrosion			*	*	*	*

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Important Items For BCM

1. Longer blocks should be stressed for effective working.
2. Track should be surveyed thoroughly for broken sleepers & rail pieces etc., which may obstruct the working.
3. Signal cables and rods passing under the track must be attended by S&T official at site.
4. Track fastenings should be tightened before cleaning work and replace missing fastenings to avoid hanging of sleepers during cleaning operation.
5. Muck wagon to be arranged on through ballasted bridges and cuttings, where disposal is not possible on sides.
6. Ballast train should be available immediately after cleaning the ballast, to relax speed restriction in shortest period.
7. Preferably, Tie Tamping Machine and Dynamic Track Stabilizer should follow BCM working.
8. Level Crossings should be opened in advance of deploying BCM for continuous working.
9. Frequent shifting of BCM from one location to another should be avoided to achieve good work and adequate progress.
10. Normally, BCM should be deployed on concrete sleepers.
11. Availability of ballast cushion upto 250 - 270 mm should be ensured.
12. Ensure that there must not be any obstruction in a width of 4100 mm i.e. 2050 mm on either side of the centre of track, to avoid infringement to the cutter chain.
13. Adequate stock of cutter chain wear plates and other fast wearing parts should be procured in advance.
14. A set of gas cutting machine should be readily available with the machine.

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Precautions To Be Observed During Movement Of The Machine

- All parts which are not connected to the machine must be secured against tilting and shifting.
- Waste conveyor belt should be secured in central position against tilting.
- Upper part of waste conveyor should be secured in lower position.
- Both chain troughs are to be completely lifted, retracted and secured with chain.
- Chain tensioning cylinder should not be extended by more than 25 cm.
- Excavation chain must be secured against sliding down the chain troughs.
- The end of cutter chain must be received with brackets.
- The lifting beam for cutter bar and the hook must be secured in upper position.
- Retract ballast distributing conveyor and secure by safety chains.
- The cutter bar, which is being left in the track should be properly covered in order to avoid any entanglement with any traffic.

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General Safety Notes

- ◆ The machine has to be operated to 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 equipment 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 unauthorised persons to operate the machine.
- It is prohibited to use exposed light or fire on or near the machine.
- Do not tow the machine if the final drive is engaged.

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IRICEN

1.S/Shri C. P. Tayal Sr. Professor/IRICEN/Pune

RAILWAYS

1.	S/Shri Ashutosh	Dy. CE/CPOH Workshop, N.Rly, ALD.
2.	Manoj Arora,	Dy. CE/TM, Central Rly, Jhansi.
3.	R.K. Srivastava	Dy. CE/TM/SE Rly Kolkata
4.	O.V.S. Murty	Dy. CE/TM, Central Rly, Mumbai CST
5.	Ramesh Candra	Dy. CE/TM, Eastern Rly,/PD/Mughalsarai
6.	S.M. Mitra,	Vice Principal, IRTMTC/N.Rly, Allahabad
7.	V.K.Mishra	AEN/TMC/ER/Mughalsarai
8.	Hari Lal Sharma,	Foreman, Eastern Rly, Mughalsarai.

RDSO

1.	S/Shri Arun Kumar Shrivastava,	Director/Track Machines.
2.	Neerendra Prasad,	ARE/TM.
3.	S.K. Singh	ARE/TM.
4.	Mohd. Naeem Siddiqui	STA/TM.
5.	A.N. Srivastava	SRA/TM
6.	Kailash Chandra	JRA/TM
7.	Sant Lal	PA /DTM-II

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