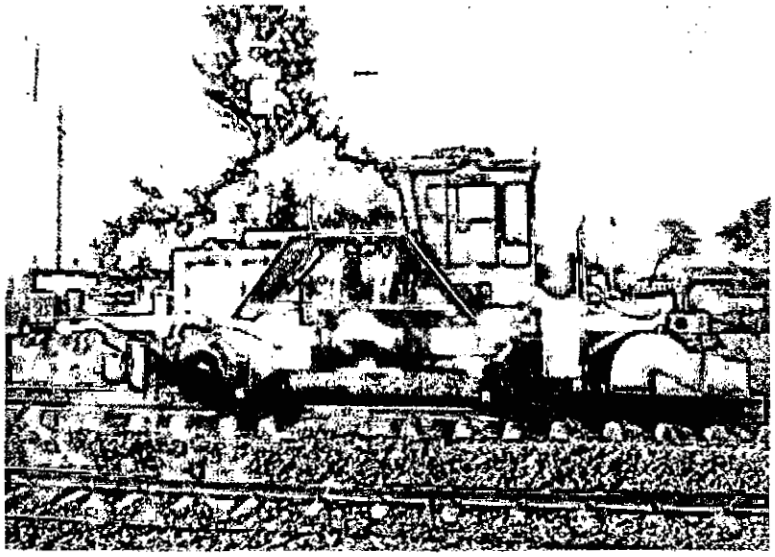
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

MAINTENANCE SCHEDULES FOR BALLAST REGULATING MACHINE



BRM - 66-4 and 56-3

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RESEARCH DESIGNS & STANDARDS ORGANISATION
LUCKNOW-226011.

PREFACE

Maintenance of On-Track Machine is challenging task before the Indian Railways. Presently, about 355 On-Track Machines are working over the railways. Maintenance of these machines is being done by zonal railways with the assistance of local trade available, CPOH / Allahabad and RDSO / Lucknow. With their experience over the years, the railway engineers have developed adequate expertise in the maintenance of these machines. However, in absence of approved maintenance instructions, different maintenance practices have come into vogue over the railways. It has, therefore, become imperative to have a uniform maintenance standard throughout the Indian Railways. Maintenance schedule for Continuous Action Tamping Machine (09-CSM), Points and Crossing Tamping Machine (UNIMAT), Ballast Cleaning Machine (RM-80), Dynamic Track Stabilizer (DGS-62N) and Shoulder Ballast Cleaning Machine (FRM-80) have been issued by RDSO. The preparation of present maintenance schedules for Ballast Regulator Machine (BRM) is an effort in the same direction.

While preparing these schedules recommendation of the Original Equipment Manufacturer (OEM) and experience of the zonal railways have been taken into account. Variations in operating conditions in different regions may make it necessary to introduce examination of certain items which have not been prescribed herein or to carry out maintenance at somewhat differing periodicity. The Railways in all such cases should bring this to the notice of the Track Machines & Monitoring Directorate of RDSO for any modifications to the schedule giving full details. Whenever, any scheduled examination, except trip (break down) examination is carried out, all the items of the lower schedules should also be attended to.

The maintenance schedules are provisional. While every care has been taken to make the maintenance schedules quite exhaustive, there is always scope for further improvement. Suggestions from the railways in this regard will be welcome and should be sent to the undersigned.

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Executive Director/TMM
RDSO/Lucknow-226011.

February, 2001

EXPLANATORY NOTES

While preparing text of these schedule, 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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SCHEDULE I

To be done daily

Inspect the complete machine for any abnormality, missing, damaged, loose parts, etc. Ensure the machine is in the same condition as left after the previous day's work. A proper visual check for lubrication is a must.

1. ENGINE

1.1 Before Starting

The engines should be inspected for following items:-

- Check levels of the lube oil and top up, if required with recommend Lube oil to bring oil to proper level on dipstick.
- Check fuel level and top up if required. It should be kept as close as possible to the full mark to prevent water condensation.
- Check and correct the belt tension of alternator V-belt. It should have 13-mm deflection at the center of the belt.
- Record the maximum engine temperature of the day. It should not be more than 204^0 F
- Clean engines and their premises.
- Check compressor for any pressure leakage.
- Check coolant level of radiator visually. Add as necessary Nal cool 2000 to be added in radiator water @ 500 ml/15 litre of water.
- Check water level, leak-proof-ness and terminal of batteries.
- Drain out water from air tank and water separator.
- Check engine crank case oil daily before starting.
- Check engine air cleaning service indicator. Change filter cartridge when indicator comes full red. Do not attempt to clean and reuse the old element. Reset the service indicator (bottom on end) after the new cartridge is provided.

1.2 ON **STARTING**

- Allow Engine to run at idle speed for three to five minutes and check the followings:-

- Check battery-charging system.
- Check any fuel leakage from the pump, injectors, fuel supply, return pipes, filters, etc.
- Check proper functioning of engine hour meter, fuel gauge, water temperature gauge and pneumatic pressure audible alarm, high temperature light, low oil light etc.

- Check for any unusual sound from engine and stop engine till it is repaired.
- Check engine oil pressure after warming up.

2. POWER TRANSMISSION

- Check oil level and top up both main gearboxes, if required. It can be checked either by means of dipstick having minimum and maximum mark provided or central bolt provided for checking in the middle or window glass fitted with min. and max. level of fluid.
- Check tightness of cordon shaft bolts.
- Check oil level of axle gearboxes and top up, if required.
- Check the contamination indicators (pilot lamps) for dry type air filter. When red light comes, filter element is nearing blocked condition and valve will soon allow unfiltered flow of oil to by pass. Change filter element immediately.
- Check axle gearbox oil level and top up, if required.
- Check proper axle clutch pressure and functioning of axle clutch pressure switches.

3. PNEUMATIC

- Drain air reservoirs after the day's work
- Drain out water from air tanks.
- Check air brake system pressure.
- Check rated pneumatic pressures.
- Drain out water from air tanks.
- Check (listen) for air leaks, after shutdown of engine. Tighten/repair or replace as necessary.

4. HYDRAULIC

- Check leakage in hoses, valves cylinders and joints. Repair/replace, if found leaking.
- Check hydraulic oil level in tank and top up (by recommended oil). (Minimum 3/4th of the tank should be filled up). Do not mix two brands of oils.
- Record the maximum hydraulic temperature of the day. It should not be more than 85^0 C. (Though the range of hydraulic oil temperature on a day will depend on the type of oil used).
- Check for any rubbing of hoses, loose clamping etc. and re-locate/re-adjust, if required.
- Check all hydraulic pressure for rated settings and adjust if necessary. It should be adjusted by means of controlling flow of hydraulic oil in certain system.

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- Check leakage at the joints.
- Ensure proper functioning of parking brakes and see that parking brakes are applied, whenever the machine is stabled.

5. ELECTRICAL:

- Check electrolyte level, leak-proof-ness and terminal of batteries.
- Check proper functioning of battery charging system.
- Check functioning of tow warning alarm system.
- Check functioning of derailing sensor.
- Check functioning of power pack emergency backup pump.

6. BROOM UNIT

- Check whether sweeping elements on broom are secured or not. Tighten bolts on loose elements to torque of 220-ft.lb (298 Nm.)
- Check broom reel to ensure that no foreign objects such as wire or shed strapping bands are wrapped around reel.
- Check chain for proper deflection (half inch or 13 mm at centre).
- Check whether broom is raised and locked after completion of the work.

7. GENERAL

- Clean complete machine.
- Check for any unusual sound from gearboxes, engine and hydraulic pumps.
- Check all the spares and tools for emergency.
- Check safety items.
- Update log books and schedule registers.
- Ensure proper stabling condition in the sidings. The following items should be checked before stabling the machine:-
  - No any wagons/rake should be placed on/above the machine.
  - It should be away from the fouling marks
  - There should be enough space to accommodate the machine as well as staff coach provided with machine and a running mobile workshop.
  - Drinking water facilities should be available near the sidings.
  - Electrical connections should be available nearby sidings.
- During operation of the machine, listen for any abnormal sound, which might indicate loose parts, damaged bearings or any other damage.
- Check free movement of wings, front plough and broom unit etc. before starting the first block.
- Perform daily lubrication as recommended.

8.0 IMPORTANT

Change all filter elements after initial ten hours of operation. Thereafter change each time six months oil change is done. Filtered with ten microns before adding to hydraulic system.

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SCHEDULE II

To be done after 50 kilometres of working or approx. 50 engine hours Whichever is earlier.

All items of Schedule-I will also be attended along-with this schedule.

1. ENGINE

- Clean cyclonic filter bowl.
- Inspect/clean air cleaner element (outer) with dry air. The dirt is to be blown out from inside to outside by air pressure approx.30 psi. The air jet should not be held too close to the filter. After cleaning inspect the filter under a light for tear or other damages.
- Check engine crank case oil. Drain engine crankcase while engine is hot.
- Replace oil filter element and fill crankcase with oil as per manual.
- Drain water/sediments etc. from drain plug of HSD oil tank. Slowly loosen the fuel tank from bottom drain cock and slowly drain approx. ½ litre of fuel to remove water and sediments. Close drain cock, start the engine and observe for general performance of lube oil pressure.
- Clean radiator fins by blowing air in opposite direction.
- Grease alternator
- Check fuel filter and replace if required.
- Check engine drive V-belt for proper tension and for damage or deterioration

2. POWER TRANSMISSION

- Grease axle gear box flange cover of driving bogie.
- Check two-speed transmission fluid. On new transmissions, drain and flush at the end of 50 hours.
- Check gear oil of transmission gearbox.
- Grease all cardon shafts with multipurpose grease.
- Check oil level in both axles, oil level plug is located on right side of axle hosing.

3. PNEUMATIC

- Check foundation bolts of brake cylinders.
- Check all pressure controls valves for rated setting.
- Check foundation and bracket bolts for compressor.
- Check unit-locking cylinder.

3. HYDRAULIC

- Check bolts and nuts of all hydraulic cylinders.
- Check condition of heater and pressurization unit filter. Replace dirty filter or wash in soapy water and allow to completely
- Check different system pressures for rated settings as specified and adjust, if necessary. It can be directly read on the gauge fitted on the machine at different locations for different purposes.

4. ELECTRICAL

- Clean battery plug connections and apply petroleum jelly.
- Clean alternator and check connections.
- Check electrolyte level in batteries and specific gravity [minimum specific gravity = 1.24].
- Check all working lights, push buttons, switches etc.
- Check functions of relays.
- Check hydraulic solenoid connection.
- Check emergency backup pump motor for proper functioning.
- Check function of all electrical gauges.

5. BROOM UNIT

- Grease wing ballast and box pivot pins with multipurpose grease by grease gun.
- Check condition of broom sweeper elements. Replace, if the size is less than 254 mm (Ten inch) in length.
- Check conditions of broom wheel bearing, bushes and grease it.
- Check broom drive chain housing. Add Gear Lubricant to obtain housing as necessary to bring oil level to check plug on lower side of housing. Remove drain plug and check for water in oil. If water is present, check cover seal and repair. Drain and refill with new oil.
- Grease wing lift frame, brake arm and wing pivot with graphite grease.
- Grease wing mounting using multipurpose grease by grease gun.
- Grease broom reel bearing using multipurpose by grease gun.

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6. GENERAL

- Check effectiveness of shock absorber.
- Check wears on brake shoes. Adjust gap between brake shoe and wheels. It should be 3.18 mm when brake is in full OFF position. Minimum thickness of brake shoe at centre is 13mm. Brake shoe worn out to 3/8" thickness should be replaced.
- Clean accumulation of ballast and debris from the machine.

- Check all wear plates for proper tightness and replace if required.
- Grease hopper door hinges.
- Grease lift frame locks front and rear. Blow dust out of housing with pressurized air and spread light oil or kerosene.
- Check mechanical braking ratchet for effective working.
- Grease brake arms using multipurpose grease by grease gun.

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SCHEDULE III

To be done after 100 kilometers of working or 100 engine hours Whichever is earlier

1. ENGINE

- Clean engine externally.
- Clean fuel pre-filter. This can be checked visually.
- Check compressor mounting bolts.
- Change engine oil and lube oil filters.
- Clean air cleaner.
- Check engine foundation mounting bolts.
- Check all hoses and clamps and tighten/replace as per need.
- Check air unloader valve.
- Clean dry type air filter by blowing air in opposite direction or replace, if necessary.
- Check clutch fluid level in the container.
- Check anti vibration mounting pad of radiator, change if required. If the radiator-mounting pad is oval i.e. level of radiator is not proper. Change the mounting pad otherwise welding of cooling fins will be getting broken due to excess vibration and thereby will affect the cooling system.

2. POWER TRANSMISSION

- Lubricate clutch throw out collar with hand grease gun to avoid grease on clutch facing. If grease will come on clutch facing, it will disturb proper movement. Slipping of clutch will also occur
- Grease hand brake gear.
- Check universal joints for play and replace if required.
- Grease all cardon shafts.
- Clean filters of axle gear box clutch.
- Visually examine splines for any fracture, distortion or any abnormality.
- Check bushes and pressure separating rings of axle clutch pinion shaft.
- Check roller bearing. It can be checked only by seeing the rotation or unusual sound coming out of the bearing.
- Lubricate bogie pivot bearing and clutch lever shaft. On new transmissions, drain and flush at the end of 100 hours of operation. Refill to oil level check plug.
- Clean dirt, oil and grease from sliding surfaces of left and right wing slider box. Apply graphite based lubricating paint with a clean brush and allow drying.
- Grease universal joints and slip yokes with multipurpose grease with the help of middle type nozzle with an 18" flexible extension of grease gun.

3.0 PNEUMATIC

- Check compressor for any leakage.
- Check pipe lines for any leakage at joints.
- Check all brake linkage and adjust brake shoe clearance.

4.0 HYDRAULIC

- Check all hydraulic cylinders visually in case of leakage, repair or replace it.
- Check charge pump and its pressure. It can be seen on the gauge fitted for the system. If it is showing low pressure than specified, the pump should be checked for output.
- Check hydraulic pressure.
- Clean hydraulic tank magnetic trap.

5.0 ELECTRICAL

- Check function of all electrical relays.
- Check function of sensors. Sensor for temperature can be checked by starting the engine for a said period and allow the temperature to rise. As temperature rises, the sensor for which it is installed prevents further rising of temperature i.e. sensor is working or otherwise defective.
- Check all pressure switches. The pressure switch should operate at a particular pressure for which it is kept in the circuit or otherwise it is defective, may be changed.
- Check functioning of battery charger.

6.0 BROOM UNIT

- Grease broom chain and plough rollers with multipurpose grease by grease gun.
- Check condition of brooms.
- Check tightness of chains fitted with broom unit.
  (Min.13 mm approx. at centre).
- Check working of manual braking system.
- Check condition of broom sweeper element. It should be replaced when these worn out to 254 mm (Ten inches) long.

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7. GENERAL

- Check tightness and alignment of belts.
- Check working of the manual lever arrangement for disconnecting.
  engine to gear box working, placed below the working cabin.
- Check conveyer drive tension. Approx deflection quarter inch or six mm.
- Blow out dust.
- Check working of manual parking brake system.

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SCHEDULE IV

To be done after 200 kilometers of working or 200 engine hours Whichever is earlier

1. ENGINE

- Change engine oil.
- Check compressor for satisfactory operation. Satisfactory operation of compressor can be checked on starting. When compressor is generating its rated pressure in specified time. It is said to be in satisfactory working order.
- Check proper concentration of additives in radiator water. The concentration of additives can be checked by using basic litmus paper (Ph. Value 7.5 – 8.5). If colour of litmus paper changes to violet. If not add proper additives to the radiator or otherwise OK.
- Change lube oil filters.
- Clean dry type air filter by blowing air in opposite direction.
- Grease clutch drive shaft bearings.
- Check clutch fluid level in container.
- Check tension pulley of compressor and water pump.
- Check tightness of engine mounting bolts.
- Check corrosion register if coolant is not proper.
- Check fan hub drive pulley and water pump.
- Check piping and connections.
- Check crank case breather.
- Check governor linkage.
- Record oil pressure after two hours of working on full load.
- Record water temperature and rated rpm of engine.

2. POWER TRANSMISSION

- Check clutch pressure and adjust it if necessary.
- Check bushes of axle gear box.
- Check condition of piston ring grooves, change piston rings if required.
- Lubricate the bogie pivot bearing.
- Check function of shock absorber.
- Lubricate hand brake linkage.
- Grease rollers, universal joints and propeller shaft coupler.

3. HYDRAULIC

- Clean breather filter of hydraulic oil tank.
- Clean hydraulic cylinder for leakage and damage.
- Change oil pump of drive gearbox.

- Clean hydraulic tank magnetic trap.

4. ELECTRICAL

- Check battery electrolyte level topper if required to proper level.
- Check function of heater and blower.
- Check cooling system effectiveness.

5. PNEUMATIC

- Check brake pressure.
- Clean filter element of pneumatic system.
- Check pneumatic valves for proper functioning and clean if required.
- Check all pressure gauge for their working.

6. BROOM UNIT

- Check proper fittings of rubber elements, repair if required.
- Check condition of bearing for sweeping element.
- Check broom bearing (161099) for excessive play.
- Check broom drive chain for wear.

7. GENERAL

- Check broken/ crack brake shoes. If it is burnt, it should be replaced (minimum thickness in worn-out condition is 3/8" approx.).

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SCHEDULE V

To be done after every 500 kilometers of working or approx. 500 engine hours Whichever is earlier.

All items of Schedule IV will also be attended along with this schedule

1. ENGINE

- Check carbon brush of self-starter and alternator.
- Check air cleaner element, inner and outer.
- Grease accelerating mechanism.
- Check high-pressure fuel pipes, clamps and hoses.
- Change anti vibration mountings pads of the engine.
- Clean diesel tanks.
- Replace air cleaner screening elements.
- Check engine air cleaner screw indicator.
- Change filter cartridges when indicator shows full red. Do not clean or reuse old element. Reset the service indicator after the new cartridges are placed.
- Check safety circuit of engine electrically by sorting the switches:
  a) High temperature switch.
  b) Low lube oil switch.

2. POWER TRANSMISSION

- Grease axle bearings of the bogies (screw the flat grease nipple below).
- Change oil in the axle gear boxes. Replace clutch filter.
- Grease sliding surfaces, guide column surface and bolts of torque supports.
- Check rubber element of axle gearbox, torque plate for damage. Replace, if required.
- Check torque plate rubber element and replace it if necessary.
- Check two-speed transmission fluid. Drain, flush, clean magnetic drain plug and refill with recommended oil.

3. HYDRAULIC

- Drain and flush entire hydraulic oil from the system. Clean suction strainers, refill hydraulic tank by passing drum oil through Ten microns porta-filter system.
- Check hydraulic valve after flushing tank.
- Check functioning of solenoid block of axle clutch.
- Change return line filter element.
- Check condition of hydraulic and pneumatic hoses. Replace if required.

- Check effectiveness of the brake both manually and hydraulically.
- Change pump drive oil at 500 hours or whenever the oil level shows that or affects of high temperature, evidence of discolourisation or strong order.
- Clean breather and magnetic drain plug.

4. ELECTRICAL

- Check functioning of pressure switch of axle clutch, and adjust pressure, if required.
- Check all working lights, repair, if required.
- Check sensor for engine stopping.
- Check carbon brushes for self-starter and alternator. Carbon brushes of self-starter should be changed when continuous sparking starts coming at the location of it.

5. PNEUMATIC

- Check air leakage on stopping the engine and repair as required.
- Check air compressors.
- Check pneumatic cylinders for their proper working.

6. BROOM UNIT

- Check revolution of the sweeping unit. It should be 244 rpm.
- Check skirting and stone deflectors. It should be replaced when its length reduces to 254 mm (Ten inches).
- Shutdown broom unit valve and allow the engine to run until broom comes to stop.
- Grease bearing of the sweeping element, replace if required.

7. GENERAL

- Check effectiveness of the brake both manually and hydraulically. The effective of the brake can be checked by applying the brake and checking the stopping distance of the machine as per OEM.
- Check brake shoe lining. It should not be less than 3/8" at any stage.
- Check functioning of pressure switch of axle clutch and adjust pressure if required.
- Check tightness of engine mounting bolts.

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SCHEDULE VI

To be done after 1000 kilometers of working or 1000 engine hours Whichever is earlier

1. ENGINE

- Check compression pressure.
- Overhaul self-starter.
- Check and clean air reservoir.
- Check wheel tyre defects.
- Change dry type air filter element.
- Check the air compressor. Overhaul if necessary.
- Replace V-belts.
- Renew fuel filter cartridge (Two pieces per engine).
- Check tightness of piping.
- Check alternator and starter.
- Clean turbocharger and check for end and radial play.
- Test cylinder head warning system.
- Test engine temperature indicator.
- Change batteries, if required.
- Check exhaust manifold, pipes and silencer for tightness.
- Check functioning of monitoring devices.

2. POWER TRANSMISSION

- Grease axle bearing.
- Grease clutch lever shaft and clutch through out collar.
- Change gear oil of front and rear axle housing

3. HYDRAULIC

- Change oil of main gearbox.
- Clean suction filter element. Inspect for tear, puncture etc. Replace damaged filters.
- Change hydraulic oil (after flushing the tank).
- Remove sediments in the return line filter housing.
- Grease sliding surfaces.
- Change air cleaner filter above the hydraulic tank.
- Change following filter elements:-

  a) Return line filter element.
  b) Case-drain filter.
  c) Pilot control pressure filter.

d) Suction filter.

4. ELECTRICAL

- Replace defective lights.
- Change sensors if required.

5. PNEUMATIC

- Replace defective seals of pneumatic cylinder, pipe joints and hoses, if leaking is found.
- Replace defective pneumatic valves, if it is leaking.
- Drain air through unloading valve.

6. BROOM UNIT

- Change element of broom unit, if required.
- Check tightness of broom element with a torque of 220-Ft. lb (298 Nm.)

7. GENERAL

- Brush all wing sliders.
- Clean slider surface.
- Check condition of idler sprocket (for proper functioning of broom) for its correct revolution.

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SCHEDULE VII (IOH)

To be done after 2000 kilometers of work done or 3 years or 2000 engine hours Whichever is earlier

1. ENGINE

- De-carbonize the engine heads.
- Overhaul the fuel injection pump.
- Overhaul the air compressor.
- Overhaul self-starter.
- Clean diesel tank.
- Replace the crank case breather.
- Change air inlet hoses.
- Rewire the engine wiring with temperature proof wires.
- Replace dry type air cleaner paper cartridges.
- Overhaul blower assembly.
- Overhaul radiator.
- Check compression pressure.
- Check bent piping.
- Overhaul radiator or clean radiator externally.
- Check safety switches.

2. POWER TRANSMISSION

- Check all gearboxes and repair, if required.
- Check shock absorber and replace / repair as necessary.
- Grease the bogie pivots.
- Replace the shaft of gearboxes for which splines have twisted or worn out.
- Check the bogie pivot for wear and attend as necessary.
- Check the wheel tyre profile.
- Adjust the timing of gearbox.

3. HYDRAULIC

- Replace old hoses alongwith clamps.
- Check hydraulic pumps, valves, motors in the test bench for rated output and replace, if required.
- Replace all filters.
- Clean the hydraulic oil tank. Paint the surface of tank with approved quality of paint and fill new oil.

4. ELECTRICAL

- Thoroughly clean all panel boxes.
- Replace the batteries.
- Replace defective switches and potentiometers.
- Replace defective indicative instruments.
- Replace all non-working lighting arrangements.
- Overhaul self-starter and replace, if required.
- Overhaul alternator and replace, if required.

5. PNEUMATIC

- Check all brake blocks, change, if required.
- Replace defective pneumatic cylinders.
- Replace damaged hoses.
- Replace pneumatic valves, if required.
- Overhaul air compressor.

6. BROOM UNIT

- Overhaul broom reel bearing and bushes.
- Overhaul broom chain.
- Change all the sweeping elements less than 254 mm (Ten inch).
- Change all fittings for rubber elements if found defective.

7. GENERAL

- Check function of all assemblies after IOH.
- Replace pneumatic cylinder seals.
- Change worn out rubber pads provided at broom.
- Repair missing and defective hand tools.
- Test machine for one week near the IOH workshop before it is put for actual working in section on regular basis.

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SCHEDULE VIII (POH)

To be done after 6000 kilometers of work done or approx. 6 years or 6000 engine hours , whichever is earlier

1. ENGINE

Overhaul or replace the engine on condition basis, if compression and lube oil pressure are well within the safe limits, then carry out the following repair work.

If there is low compression, there will be starting problem, smoke will be more and consumption of fuel will increase considerably too.

- De-carbonise the engine.
- Overhaul the air compressor.
- Overhaul the self-starter.
- Overhaul the alternator.
- Change anti-vibration mounting pads of the engine.
- Clean diesel tank.
- Change all the high-pressure fuel pipes, pipe clamp, flexible fuel hoses and rubber hoses.
- Check crankshaft and camshaft end play. There should not be any lateral play and the profile of the cam may be checked with original profile of the cam supplied by OEM only.
- Overhaul turbo charger.
- Change shut down valve.
- Change engine safety system.
- Overhaul air cleaner elements.
- Change all engine filters alongwith lube oil.
- Check chassis side members, cross frames, buffer beams and welded joints etc. If damaged, it should be repaired.
- Check bogie side frame, bolster, springs, shock absorbers, wheels torque supports, rubber springs, shackles, brakes, and rod linkage. If any damage is noticed, it should be changed.
- Overhaul blower assembly.

2. POWER TRANSMISSION

- Strengthen the machine frame where cracks have developed by means of suitable welding only.
- Check the wheels for any tyre defects, re-profile or change if required. Wheel can be checked with the help of original profile of the wheel. At site it can be checked only by metallic strip (Aluminium) for sharp/thin flange easily.
- Check the axle bearing and grease them. Change, if required.

- Change mounting pad of all gearboxes.
- Overhaul the gearboxes.
- Replace the propeller shaft or these may be overhauled.
- Replace the shaft coupling and holding nuts & bolts.
- Overhaul the driving and idle bogies. Replace the defective parts.
- Dismantle the clutch assembly. Inspect all parts for wear/damage etc. and replace defective parts.

3. HYDRAULIC

- Replace all the hydraulic hoses alongwith clamps.
- Check all hydraulic pumps and motors in the test bench for rated output. Replace, if required.
- Check all hydraulic cylinders. Change, if required.
- Clean hydraulic tank, inside surface is to be painted with approved type of paints.
- Check the action of float switch in the hydraulic oil tank.
- Fill new oil after replacing return line and suction filters.
- Check all the pressure control valves and change, if required.
- Check all the stop cocks and flow control valves and change, if required.
- Flush complete hydraulic system.

4. PNEUMATIC

- Replace air unloader, if required. It should unload at proper set pressure. And if it is not unloaded at a particular pressure means it is defective.
- Test air tank.
- Check all pneumatic valves and change, if required. There should not be leakage at the valve. We can check this after stopping the engine at system pressure only.
- Check all the pneumatic cylinders,
- Check brake cylinder bore for corrosion. If corroded, the inner bore Should be chrome plated and ground to standard size.
- Overhaul the air compressor.
- Change all the brake shoes.

5. ELECTRICAL

- Check calibration of all the indicative instruments.
- Arrange insulation test of main cables and replace the defective ones.
- Overhaul the panel boxes. All the items provided on the main panel box should be checked for proper functioning.
- Change all the defective switches and lights.
- Check temperature switch
- Change sensors, if required.

6. BROOM UNIT

- Change worn out sweeping element.
- Change bearing of the broom unit.
- Replace blade graders.
- Replace chains fitted for broom unit in order to correct revolution of the unit.

5. GENERAL

Paint complete machine with approved paint.
Test machine for one week near POH Workshop, before it is put for actual working in the section on regular basis.

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FUNCTIONS OF MAJOR ASSEMBLIES OF BALLAST REGULATING MACHINE

1.0 The important assemblies and dimensions of models 66-4 and 56-3 are shown in Sketches 1 & 2 respectively. Power is supplied for driving the machine and its various attachments by a Cummins diesel engine. To propel the machine, a closed circuit high pressure hydrostatic transmission powers the final drive. Both the rear and the front axles can be driven simultaneously for improved tractive effort. The machine is equipped with clasp air brakes on all the four wheels.

2.0 The horn, brakes, plow locks and broom locks are operated pneumatically. The system is governed to regulate the pressure in air tank between 110-120 psi.

3.0 The electrical system is of 24 volts. The system has a 30 Ampere alternator and two 205 Ampere-hour batteries wired in series. Protection is provided by circuit breakers.

4.0 The **one pass transfer plow (ballast plow)** has two blades, which are pivoted on a common shaft in the centre of the plow frame. The plow can be positioned from the operator's cab to plow out, plow in or to transfer ballast to either side of the track with the machine travelling either forward or backward.

5.0 The **ballast wings** attached to the sides of the machine are hydraulically operated and controlled from the cab. The machine can be equipped with standard fixed width ballast wings or optional variable width ballast wings for better profile shaping.

6.0 The **broom** is mounted at the rear of the ballast regulator. It is used for track dressing operations to remove ballast from top of sleepers, to fill empty cribs and to place excess ballast on the shoulders for final regulating and dressing.

7.0 SALIENT FEATURES

Description	Model 66-4	Model 56-3
• Length over buffers	10389 mm.	12344 mm
• Wheel base (C/C between wheels)	4725 mm.	5791 mm
• Wheel dia	838.2 mm	832.0 mm
• Maximum width of the machine (in travelling mode)	3166 mm.	3122 mm

• Maximum height above rail top	3617 mm.	3810 mm
• Maximum axle load	10.66 t.	12.97 t
• Engine	Cummins NTA-743P 232 HP @ 1800-2100 rpm.	Cummins NTA-743C 250HP @ 1800-2100 rpm

- **Maximum speed (as per RDSO Stipulation):**

Own power	50 km/h.	60 km/h
Train formation	40 km/h	40 km/h

• Engine oil pressure	At idle speed At rated speed	0.34 - 1.38 kg/ cm^2 2.9 - 5.1 kg/ cm^2

- Water temperature : 100 - 250^0 F (40 - 120^{0}C)
- Speedometer/Odometer : 0 - 85 Mph (0 - 130 kmph)
- Tachometer : 0 - 3000 rpm
- Hydraulic propelling pressure : 5500 psi (379 bar)
- Motor threshold pressure : 4500 psi (310 bar)
- Cab control end secondary valve of broom : 2500 psi (172 bar)
- Broom circuit pressure : 2000 psi (138 bar)
- Emergency pump pressure (max.) : 2000 psi (138 bar)
- Volt meter : 18 - 32 V
- Fuel gauge (indicate amount of fuel in tank) : 0, 1/4, 1/2, 3/4, full
- <u>Fuel tank capacity</u>
  - a) Hydraulic tank : 511 litre
  - b) Engine crankcase : 42 litres
  - c) Engine cooling system: 19 litres
  - d) HSD capacity : 617 litres

- Weight of the machine : 21315 kg
- Air compressor capacity : 378.8 litres/minute
- Driving / working (variable) pressure : 345 bars
- System pressure : 172 bars
- Broom motor drive pressure : 138 bars
- Conveyer motor pressure : 138 bars
- Driving pump charge pressure : 27.5bars
- Emergency pump pressure : 138 bars
- Air brake system pressure : 4.14 - 7.5 bar
- Air pressure in pneumatic tank : 110 - 120 psi

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GENERAL SAFETY NOTES

- The machine has to be operated to existing Indian Railways rules and regulations.
- The safety of you and other people is a most important consideration in the operation and maintenance of the machine.
- Remember that 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 railway 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.
- Whenever going out of the rear cab working on or near the tamping bank area, operate the emergency push button and ensure latching position.
- Do not tow the machine if the final drive is engaged.

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TABLE OF EQUIVALENT OILS AND GREASE

Sl. No.	Oil/Grease	Make	Equivalent Makes	Remarks
1.	Hydraulic oil	ISOVG HLP-46	BP - HLP-46 IOC-SS-46 HPCL-ENCLO-46	Shell Tellus-46
2.	Chain housing	EP-90	IOC Servo Gear HP-90	
3.	Two speed trans-mission fluid	EP-80W90 EP85W140	IOC Servo Gear Super 80W90	Below 100^0F above 100^0F
4.	Gear Lubrication oil	SAE-80W90 SAE-85W140	IOC Servo Gear Super 80W90	Below 100^0F above 100^0F
5.	Pump drive oil	EP-80W90 EP85W140	IOC Servo Gear Super 80W90	Below 100^0F above 100^0F
6.	Graphite based lubricant (MP)	NLGI Grade-2	Servo Grease Graphite 4080 or Balmerol Grease No.2	
7.	Light oil	Kerosene Spindle oil	Servo Spin 12 PROTOMAC SP(EL)	
8.	Axle gear box	EP-80W90 EP85W140	IOC Servo Gear Super 80W90	Below 100^0F above 100^0F
9.	Engine lubrication oil	SAE-15W40 CF4	IOC Servo Premium 15W40 CF4	Shell Remula TX
10.	Fuel	HSD Oil	IS-1460-1974 Grade HSD Specifications.	

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SAFETY PRECAUTIONS FOR MACHINE OPERATIONS

1. No body should be allowed to work under the machine frame while it is raised on the turn-table.

2. The machine in-charge should take block on adjacent track while working in double line section at start and close of day's work because it has got infringement in moving dimension during these period.

3. Always apply parking brakes whenever operator is leaving the cab.

4. Be sure all protruding parts are suitably locked in working mechanism before travelling.

5. Never tow the machine without disengaging the input and output shaft (both) from the gearbox. Steps required before towing the machine are as under:

   i) Shift the gear lever to neutral position (provided below/side of the panel box which will disconnect the input shaft from the gear box)
   ii) Pull disconnect control knob "OUT" and rotate 90° CCW to lock position which will disconnect the gear box output shaft.
   iii) Release the parking brake and remove mechanical wedge if any placed at wheel level on the rail,

   Now towing off machine may be done but before it is allowed to tow, pull the machine for some distance. If the tow warning alarm on the back of the engine, SOUNDS, it means the disconnection of shaft has not been proper.

   CAUTION

   - Battery should be always in ON position before towing machine for long distance. Battery should be in working condition and/ or master switch is turned ON. Otherwise **Toe Warning Alarm** will not function.

   - In any case when engine fails, these disconnection should be done by means of **EMERGENCY PUMP.**

   WARNING

   If disconnection of both the shafts is not proper, it will damage all the pumps and motors of the entire system.

6. As engine temperature reaches 204 ° F, and a sound comes, the engine should be stopped immediately, otherwise the machine will come to standstill at a temperature of 210 ° F.

7. Before closing run engine at idle speed for approximate five minutes. Failure to do so can result in damage to turbo charger bearings and oil seals.
8. The track may contain high or long ties or objects in he shoulder area which the templates could hit. The operator must be aware of this possibility and take necessary action.
9. Stand clear of the wings when deploying or storing. Never work or perform maintenance on, under, or near wings unless they are stored in locks, supported with a suitable supporting device such as a jack stand, or at rest on the ground.
10. Always close template (TEMPLATE-IN control) before storing wings. Failure to do so and follow the above procedure can result in damage to the cab and other components. DO NOT force wing against stops. Once wings is in contact with stop, release control handle then jog its slightly in the opposite direction to relieve the pressure on the stop.

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LIST OF SPARES

S. No.	Description	Part no.	Quantity
1.	Fuel filter	3166555	2
2.	Lube Oil Filter	3166554	1
3.	Lube Oil Bypass filter	3873576	1
4.	Air cleaner filter element outer	4055280	1
5.	Air cleaner filter element inner	4055279	1
6.	Screen filter for PT fuel pump	200743	1
7.	Screen filter for PT fuel pump	149767	1
8.	Injector pipe in let		1
9.	Injector pipe outlet		1
10.	Injector in-line filter		6
11.	Injector copper washer		12
12.	Injector fuel feed connection pipe		6
13.	Cable for propeller shaft		1
14.	Cable for engine accelerator		1
15.	Charge flow filter (Hydraulic)	714374	1
16.	Return filter 10 Micron (Hyd.)	733692	2
17.	Broom element	230016	10
18.	Diaphragm for brake cylinder		1
19.	Brake shoe	732166	4
20.	Hydraulic pressure pipe	1509/4	10 Meter
21.	Hydraulic pressure pipe with end connections	1509/16 1100 mm	1
22.	Hydraulic pressure pipe with end connections	1509/20 1900 mm	2
23.	Hydraulic pressure pipe with end connections	2755/20 2000 mm	1
24.	Hydraulic pressure pipe with end connections	1509/10 2000 mm	1
25.	Broom driving chain 1" with chain lock	210011	1 No.
26.	Broom drive shaft bush and bearing	211222, 211620, 161099	1 each
27.	V-belt for engine	B-43, 41, 37	1 set
28.	Hydraulic return filter element	176521	1
29.	Seal set for hydraulic cylinders		1 set
30.	Self starter		1

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LIST OF TOOLS AND PLANTS

S. No.	Description	Part no.	Quantity
1.	Jack 20 t with traversing base		1
2.	Jack 5 t with foot lifting arrangement		1
3.	Terfer 2 t capacity		1
4.	Socket ¾ inch square drive	106763	1
5.	Chain wrench 5/8"-4,1/2"	106766	1
6.	Open end wrench 1 -11/16"	773878	1
7.	Handle T-bar	031097	1
8.	Adopter T-bar	031010	1
9.	Socket ¾" square drive	040891	1
10.	12 PT 2, ¼ , ¾ " drive	106298	1
11.	Pipe wrench 18"	106760	1
12.	Socket 3,1/2 size, 6 PT	108321	1
13.	Grease gun having needle type nozzle with 18" flexible connection	300010	1
14	Hammer ball peen 160 Z	300054	1
15.	Pliers Allo joint combination 6"	300152	1
16.	Screw driver 4"	300256	1
17.	Screw driver 6"	300258	1
18.	Wrench ADJ 6"	300406	1
19.	Socket set 17 PCs ½" drive	300502	1
20.	Wrench ADJ 12"	300406	1
21.	Wrench 2-3/8 open end	301050	2
22.	Wrench set 9 PCs open end	301060	1
23.	Wrench set Hex Key	301061	1
24.	Wrench combination 1,1/2"	106057	1
25.	Diesel driven Porta-filter (10 μ) having 7.5 HP engine.		1
26.	Emergency back up system.		1
27.	Torque wrench		1
28.	Wire Brush		1
29.	Aerosol can		1
30.	Pneumatic air gun for pressurized air (with pressure gauge)		1
31.	Lamp arrangement for inspection		1
32.	Hot blower		1
33.	Calipers of sizes		1
34.	Pressure gauge (Digital)		1
35.	Litmus paper		1
36.	Wheel tyre defect gauge		1

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37.	Compression measuring instrument		1

S. No.	Description	Part no.	Quantity
38.	Bench grinder		1
39.	Multimeter		1
40.	Tachometer		1
41.	Vibration meter		1
42.	Bearing puller		1
43.	Flow meter		1
44.	Vacuum gauge		1
45.	Steel scale		1
46.	Taper gauge upto 1"		1
47.	Feeler gauge		1
48.	Cell Tester and battery charger		1
49.	Thread gauge		1

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LIST OF SAFETY TOOLS

S. No.	Description	Quantity
1.	Detonators	1 box
2.	H.S. Flags (Red & Green)	3 sets
3.	H.S. Lamp	2 nos.
4.	Chain & Pad lock	1 set
5.	Terfor (7 t capacity)	1 no.
6.	50 t Jack with traverser	2 nos.
7.	Crow bars	4 nos.
8.	Beaters	4 nos.
9.	Wooden blocks of sizes	4 nos.
10.	Gauge-cum-level	1 no.
11.	Rail Thermometer	1 no.
12.	First Aid Box	1 no.

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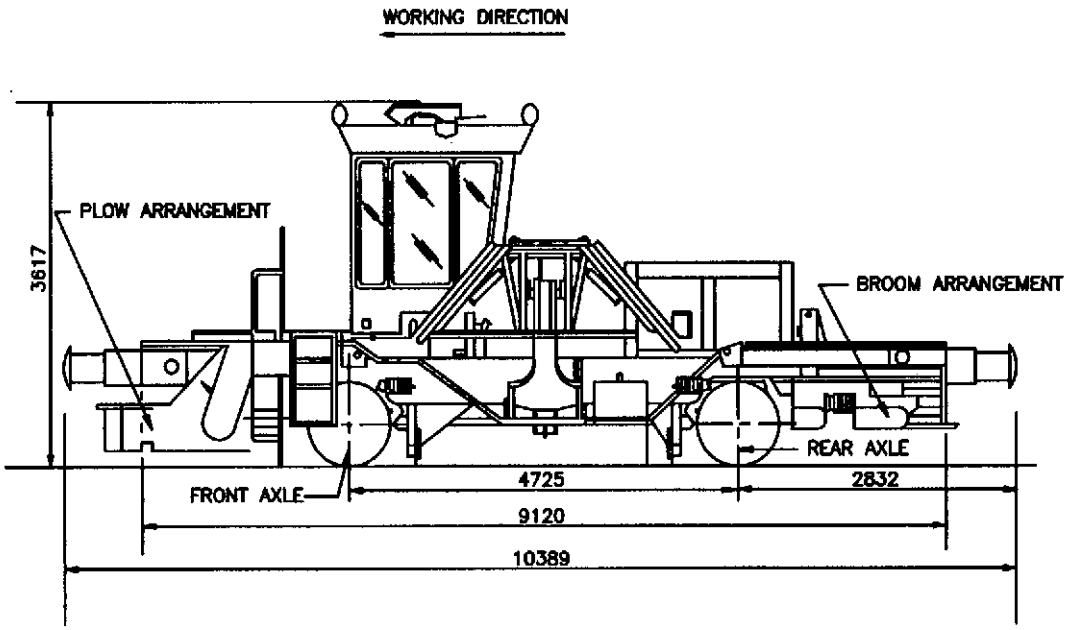
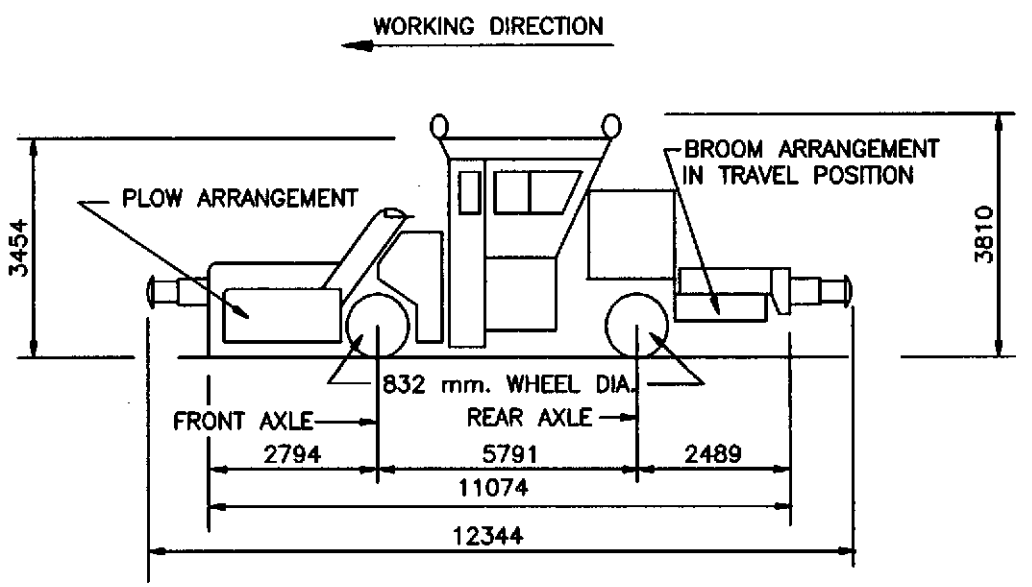


BALLAST REGULATOR(MODEL 66-4)
(SKETCH-1)



BALLAST REGULATOR (MODEL 56-3)
(SKETCH-2)

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RDSO

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7.		Sant Lal,	Personal Asstt. to Director/TM-II.

Finally - Remember the Golden Rule

KEEP THE SYSTEM CLEAN