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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS



**Revised Draft
POH Schedule of Examination
of
1400 HP BG DEMU**

**Report no. MP - MISC. – 250 (Rev.- 01)
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Preface

1400HP BG DEMU, manufactured by **Integral Coach Factory, Chennai**, is a Multiple Unit Self- propelled Passenger Train powered by on-board diesel engines with AC-DC traction, and has been designed to run on non-electrified sections of Indian Railway tracks. One unit consists of **One Driving Power Car (DPC) & Three Trailer Cars (TC)** i.e. (1DPC + 3TC). It may be run in multiples of maximum 5 such units as per traffic demand. 1400HP DEMUs were introduced in Year '2000 over IR to meet the requirements of the fast-growing population of urban areas. It is provided with EP brake in combination of Air brake and Air suspension similar to EMUs.

The engines, fitted in 1400HP DEMUs, have been supplied by two different OEMs i.e. M/s **Cummins India Limited, Pune (Engine model KTA50L)** & **M/s Caterpillar, Hosur (Engine model CAT 3508B)**. Similarly, the electrics have been supplied by **BHEL & CGL**.

For a trouble free operation & effective maintenance, a '**POH Schedule of Examination of 1400HP DEMU Report no. MP-MISC.250 (Rev-00) Feb'2010**' was issued by RDSO vide letter no. SD.DEV.R.8 dated 02.03.2010.

Initially, 1400HP DEMUs were fitted with **Cummins KTA-50-L** engines only. Due to this reason, the existing POH Schedule of Examination of 1400HP DEMU contains POH Schedule of Cummins engine only. With the introduction of **Caterpillar Cat3508B** engines in 1400HP DEMUs, it has become necessary to include the POH Schedule of Caterpillar engine also.

M/s Gmmco, Chennai, who is the authorised dealer of Caterpillar engine, vide their letter no. Gmmco/EP/HQ/05/18-19 dated 16.01.2019, submitted the POH Schedule of 1400HP Caterpillar engine and requested RDSO to include the same. Accordingly, the existing POH Schedule of Examination of 1400HP DEMU has been revised by including the POH schedule of Caterpillar engines under the heading. **"PART – II (B): 1st Top End Overhauling after 54 months (For Caterpillar Engine Model Cat 2508B)"**

The **18-Monthly Schedule (D-Check)** applicable to **Cummins engine model KTA-50-L** has been shifted from this POH schedule to 'Schedule of Standard Examination of 1400HP BG DEMU Report no.MP-Misc.157 (Rev-03) August – 2019' since the same is also not applicable in case of Caterpillar 3508B diesel engine.

A new chapter, on POH of items pertaining to **Carriage Electricals**, has been included as **"PART – VI: POH Schedule for Carriage Electrical (18 months)"**.

POH SCHEDULE OF EXAMINATION OF 1400 HP BG DEMU

GENERAL DESCRIPTION

1. Introduction:

- 1.1 The Standard POH Schedule of Examination of **1400 HP BG Diesel Electric Multiple Unit (DEMU)** has been prepared by taking into account the existing maintenance practice followed in workshops, recommendation of OEMs and feedbacks received from Zonal Railways maintaining DEMUs.
- 1.2 Any change or addition in the POH schedule may be brought to the notice of the appropriate **Sr. DME/DME**, who alone is authorised to introduce any change in the Schedule of Standard Examination detailed herein. The **Sr.DME / DME**, in all such cases, will bring to the notice of the **Motive Power Directorate of RDSO**, for any modification to the schedules, giving full details.

2. References:

The following documents are also required to be referred for further information.

- i) **Cummins's** Operation and Maintenance Manual of Diesel engine, Bulletin No. 3243773-06 (September, 2004) or latest.
- ii) Shop manual no. 3810304 (12/87) for Diesel **engine** issued by Cummins India Ltd., Pune.
- iii) **Caterpillar** 's Operation & Maintenance Manual of Diesel **engine**, Bulletin No. SEBU7179-11 March-2014 or latest.
- iv) Propulsion Equipments for BG DEMUs: Traction Sales Division, **BHEL** Limited.
- v) Operating Instruction and Maintenance Manual for ELGI **Air Compressor** Assembly model: TRC – 2507.
- vi) Maintenance manual for **BG coaches** of ICF design (2002) issued by IRCAMTECH, Gwalior.
- vii) Maintenance Manual for AC/DC EMU & MEMU **Bogie and Undergear** Manual No. CMI- K001 (April, 2000) issued by RDSO, LKO.
- viii) Repair and maintain **air spring** as per Annexure 'B' of CMI-9802 (Rev. 1) of Maintenance Instructions on **Air Suspension** for EMU/DMU coaches issued by RDSO, LKO.
- ix) Complete overhauling of **Air dryer** in alternate POH starting from 2nd POH (36 month) including renewal of all rubber parts, precoalescer kit and final filter kit as per the maintenance instructions of the supplier.
- x) **Schaku Couplers & EP Brake** to be maintained as per the maintenance instructions of the supplier.

3. Scope of POH Schedule:

This booklet covers POH schedules for different assemblies & components under different heads, mentioned below:

- Part – I** :Check sheet pre & post POH and work plan
- Part – II (A)** :POH schedule of Cummins Engine (KTA 50 L)
- Part – II (B)** :POH schedule of Caterpillar Engine (Cat 3508B)
- Part - III** :POH schedule of Electrical Transmission & Controls.
- Part - IV** :POH Schedule for Air Brake & Compressor
- Part - V** :POH Schedule For Coach Body, Under Frame, Bogie
- Part - VI** :POH Schedule for Carriage Electrical

4. Schedules of Periodical Overhauling (POH) of Major Items:

- i) CIL Engine (Model KTA50L) : After 54 months (E-Check)
- ii) Caterpillar engine (Model 3508B) : After 54 months (1st Top end overhauling) equivalent to E-check
- iii) Traction Alternators : 36 months.
- iv) Traction motors : 18 months.
- v) Compressor : 18 months.
- vi) Coach body & Under-gear : 18 months.
- vii) Carriage Electrical : 18 months

5. General Instructions:

- 5.1 The intensive utilisation of the 1400 hp DEMUs necessitates properly laid down maintenance schedules to be followed. A well organised inspection is essential to ensure reliability and freedom from failure in service.
- 5.2 There are certain fundamental requirements that are important to any successful maintenance programme. These are: -
 - i) Adequate provision of well-trained supervisors and skilled workmen.
 - ii) Adequate provision of proper maintenance facilities and tools.
 - iii) Adequate time for carrying out POH scheduled maintenance work properly before DEMU is released for passenger service.
 - iv) All measuring devices such as torque wrenches, electric meters, and lubricant dispensers etc. which require calibration should be checked quarterly or sooner, if required, for accuracy.
 - v) All tools and parts should be accounted for and removed from the 1400HP DEMU after any maintenance work has been performed.
 - vi) All work done including methods and tools used must be in accordance with the manufacturer's instructions, maintenance manual or any technical orders issued.
 - vii) In case of any ambiguity or details with regard to any maintenance item mentioned in the schedule, OEM's manual should be consulted.
 - viii) Different brands of greases should not be mixed. Excessive lubrication is as harmful as inadequate lubrication.

PART - I

1. DEMU Pre- POH status to be reported by user Railway

User Railway should provide the POH workshop / M/s Cummins /M/s Caterpillar a detailed history of performance of respective engine for the last 54 months (**E-check**) as applicable. This will enable the POH workshop / M/s Cummins/ M/s Caterpillar to give special emphasis / attention to the recurring problems that have occurred during operation. However, some of the parameters have been stated below for guidance that may be measured by user Railway after running the engine and values recorded before dispatch of the engine for POH. This information will be helpful in carrying out POH. Any other valuable information regarding repairs etc. carried out by user Railway may also be provided.

- i. Lube oil pressure (Working range: 1.5 to 3.5 kg/ cm²)
- ii. Max. cooling water temperature recorded
- iii. Engine oil consumption
- iv. Contamination in the engine oil
- v. Condition of Lube oil – sludge / excessive carbonising / fuel dilution
- vi. Vibrations at full load
- vii. Smoke level at full load
- viii. Blow by value
- ix. LCC & GAC actuator working
- x. Turbo end play / side clearance
- xi. Accessory drive end play
- xii. Engine Sound – any abnormalities
- xiii. Lube oil consumption in 300hrs.
- xiv. Hydraulic pump & motors condition
- xv. Last PT Pump & Injectors calibration date
- xvi. Safety devices of cooling water and lube oil – functioning / by-passed/defective, Over speed trip device functioning status
- xvii. Lube oil brand & grade being used
- xviii. Hydraulic oil brand & grade being used
- xix. Crank end play
- xx. Leakages of water, oil, diesel or air observed
- xxi. Last B check carried out on date
- xxii. Last C check carried out on date
- xxiii. Additional information, if any

2. Pre- POH check of DPC to be carried out by Workshop after receipt of DPC

2.1 General observations about condition of DPC:

2.2 List of deficiency items in DPC:

2.3 **Load box test & Electrical transmission control system:** Workshop should carry out load box test to ascertain the power output and electrical transmission related problems. Status of traction alternator, traction motor, auxiliary alternator, Rectifier Regulator (RR) Unit, reverser & power contactor, rectifier assembly, starter motor, blower motor & 24V alternator.

2.4 **Air intake & exhaust system:** Workshop should check for restrictions in air intake, exhaust back pressure, air leakage between air cleaner and engine, smoke level at idle.

2.5 **Fuel system:** Workshop should check for fuel leakage from actuator, priming pump or any other location and fuel dilution.

2.6 **Lubrication system:** Workshop should check for lube oil leakage and functioning of gauges.

2.7 **Cooling system:** Workshop should check the condition of cooling system i.e. radiator leakage, radiator fan blades, condition of radiator tubes, fins, headers, pipings, expansion tank including cap, PRV, LCWL switch, hydraulic hoses, belts, oil cooler and functioning of gauges and indicators/alarms.

2.8 **Brake system:** Workshop should carry out brake function test to check the functioning of different valves, gauges, compressor, pneumatically operated items and efficiency of brake rigging.

2.9 **Coach body, Undercarriage & bogie items:** Workshop should check functioning of parking brake, condition of buffers and Schaku couplers, status of cattle guard, rail guard, suspension system, headlights, cab lights, flasher light and tail lamp.

2.10 **Miscellaneous:** Workshop should check the status of working lights, ceiling fans, batteries etc.

PART – II (A)
(Cummins Engine Model KTA50L)
(E- Check / POH Schedule i.e. after 2 D- Check at 54 months)

POH or E- check of the engine is to be performed at 54 months. However, below mentioned engine parameters can also be used as basic guidelines for POH of the engine:

- i. Excessive oil consumption
- ii. Excessive drop of oil pressure
- iii. Excessive blow by
- iv. Engine oil contamination
- v. Unusual noise from engine
- vi. Excessive vibrations / smoke level
- vii. Any catastrophic failure

The engine overhauling i.e. E- Check includes complete dismantling of engine, examination of parts for reuse, repair and replacement including regrinding crankshaft, repair of cylinder block, replacement of combustion chamber and cylinder head components, reassembly with associated gaskets, seals and other repair along with dynamometer testing, preservation and painting.

1. Clean the engine, dismantle and inspect the engine components as mentioned below.
2. **Cylinder block**
 Use a scraper, a wire brush or 120 grit emery cloth to clean the dirt deposits from the cylinder block. Clean all the gasket surfaces, mounting surfaces, cylinder liner counter bore & packing ring bore, top of the block, main bearing saddle and all the cup plug bores. Check for physical damage. Replace, if found damaged beyond salvageable condition. If cylinder block is OK, de - carbonize & de-scale it. Replace all cam shaft bushes and all other hoses. Clean all lube oil and coolant passages inside the block. Clean the block with a suitable cleaning solution. Dry the block with compressed air. Measure counter bore diameters. If the counter bore is oversize, repair sleeve may be used.
3. **Cylinder head**
 - 3.1 **Tappet cover**
 Clean & check for crack & physical damage. Replace, if damaged. If found OK, clean the same and reuse.
 - 3.2 **Rocker Housing Assembly:**
 Clean & check for crack & physical damage. Replace, if damaged. Clean & check: Rocker lever, Bushes, Shaft, Cap etc. Replace worn out / damaged components. Clean lube oil passages.
 - 3.3 **Cylinder head**
 Clean by using solvent & check for crack & physical damage. Replace, if damaged, bent or broken. If found OK, de-carbonize & de-scale the cylinder heads. Replace all the intake valves, exhaust valves, valve spring guides, valve seat inserts, valve collets, valve springs & retainers etc. Proper testing of cylinder

head should be done and watch out leakage from injector sleeve / any other part of cylinder head

4. **Cylinder liners**
Replace all cylinder liners.
5. **Crank shaft**
Inspect the crank shaft for seizure, cracks, bend, hardness etc. Replace the crank shaft, if is beyond salvageable condition due to seizure of bearing, harness is low even after grinding, cracks, bend is beyond limit etc. If found OK, clean the crank shaft & lube oil passage inside the crank shafts. Check main journal size and crank pin size. Grind it to next undersize depending on harness and wearing on main journal and crank pin. Check & correct dynamic balancing.
- 5.1 **Main bearing caps**
Check for distortions, Replace caps, if found beyond repairs. Carry out line boring.
6. **Crankcase breather**
Replace the breather.
7. **Piston & Ring Sets**
Replace all pistons along with piston rings.
8. **Connecting rods**
Clean & inspect all connecting rods for bend, twist, burning marks etc. Replace, if necessary. If found OK, clean the same and reuse. Clean lube oil passages. Replace all the bushes.
9. **Connecting rod bearings**
Replace all connecting rod bearings with suitable size bearings depending on crank pin size.
10. **Main bearings**
Replace all main bearings with suitable size bearings depending on crank main journal size.
11. **Camshaft**
Inspect the cam shaft for bend, pitting marks and scratches. Replace, if bend is out of limit of pitting marks / heavy scratches are observed. If found OK, clean the same & re-use. Polish the cam lobes.
12. **Cam follower**
Inspect cam follower assemblies, check cam follower assembly. If found OK, re-condition the cam follower assemblies by replacing all rollers pins, socket & looks.
13. **Push rods**
Replace all push rods.
14. **Vibration damper**
Replace vibration dampers.

15. Cooling system

15.1 Engine

15.1.1 Water pump

Clean and de-scale the water pump housing, check housing for damage. Replace, if required. If found OK, re-condition water pump by replacing shaft, impeller, bearing seal & seat assembly etc. If water pump is beyond economical repair, replace it. Check the gear drive. Replace the same, if gear teeth are observed damaged.

15.1.2 Accessory Drive

Re-condition the accessory drive assembly by replacing bushing. Replace the shaft, if found damaged.

15.2 Radiator

Remove and dismantle radiator assembly and check for any leakage by pressurising the system at 2 kg/cm². If leakage is observed in the tubes, the same may be repaired / replaced. Clean the top, bottom header, piping and radiator core by hot water or steam jet. A Bosch tank can also be used. Clean the headers, radiator tubes with dry compressed air. Dry it with compressed air. Assemble the radiator and check for leakage by pressurising (hydraulic testing) at 2 kg/cm².

15.2.1 Radiator fan and hydraulic pump & motor

Check functioning of radiator fan pump & motor. Dismantle and overhaul the pump and motor. Check the hydraulic pump & motor on test bench. Replace, if found defective. Check condition of fan blades for bent & deformation. Perform dye penetration test on fan blades of radiator. If cracks are observed, replace radiator fan blades.

15.3 Expansion tank

Check function of PRV (mounted on water tank) at 7 psi and LCWL switch. Replace, if malfunction is observed in both the cases. Check the condition of expansion tank cap. Replace, if found damaged or strainer is missing. Drain the expansion tank. Clean the tank thoroughly and re-fill it after complete assembly.

15.4 Ventilation fan and vent fan pump & motor

Check functioning of ventilation fan pump & motor. Dismantle and overhaul the pump and motor. Check the vent fan pump & motor on test bench. Replace, if found defective. Check condition of vent fan blades for bent & deformation. Perform dye penetration test on vent fan blades. If cracks are observed, replace vent fan blades. Replace V- belt for vent fan pump.

16. Fuel system

16.1 Fuel pump

Dismantle the fuel pump. Clean all the internal fuel passages. Inspect all fuel pump components for wear / damage. Replace as per requirement. Replace all gaskets, bushes & O rings. Check gear pump for wearing / damage / seizure and delivery flow. Replace, if excessive wearing / damage / seizure is observed or

fuel delivery flow is low. If found OK, reuse the gear pump after cleaning. Calibrate the fuel pump (PT pump) as per code.

16.2 Fuel oil priming pump

Check and replace, if required.

16.3 Injectors

Dismantle all the injectors, clean the injectors and inspect injector body for physical damage. Replace, if required. Check barrel and plunger assembly for wearing & clearance. Replace, if excessive clearance is observed. Also replace barrel plunger assembly, if excessive wear on plunger tip is observed. Since barrel & plunger are matched, they must be replaced together in pair. Check for STC components. Replace, if damaged. Replace all the injector's cups. Calibrate the injectors as per code. If any injector is observed beyond economical repair, replace the same.

16.4 Fuel oil filter

Change primary and secondary fuel oil filters.

16.5 Fuel tank & fuel gauge

Clean the fuel tank thoroughly including checking of baffle plates inside the fuel tank. Replace baffle plates, if necessary. Check the calibration markings. Fresh marking may be done, if required. Replace the fuel gauge, if found damaged.

17. Lube oil system

17.1 Lube oil pump

Clean the lube oil pump. Check housing for wearing / damage. Re-condition lube oil pump by replacing gears and all gaskets. Test lube oil pump on test bench for its outlet pressure.

17.2 Lube oil filter & lube oil by-pass filter

Change all the 4 lube oil filters and both the by-pass filters.

17.3 Centrifuge cleaner

Dis-assemble, clean the rotor, replace the gasket and assemble.

17.4 Lube oil cooler

Dismantle lube oil cooler assembly, check cooler housing for damage. Replace lube oil cooler, if required. If found OK, clean de-scale the housing. Replace the elements and gaskets. Check lube oil cooler for heat convection property on test bench i.e. inlet and outlet temperature.

17.5 Lube oil sump

Drain the lube oil sump. Clean it thoroughly and re-fill it after assembly.

18. Air intake & Exhaust system

18.1 Car body filter & Air intake element paper filter

Remove and replace all the car body filters. Replace both the air intake filter elements.

18.2 Cyclonic filter

Clean thoroughly all cyclonic filter tubes to remove dirt / dust particle. Clean it with a suitable solvent. Dry it with compressed air. Replace the damaged cyclonic tubes and re-fit the cyclonic filter.

18.3 Air intake manifold & Exhaust manifold

Clean the manifold. Inspect the physical damage. Replace, if damaged. Replace after-cooler elements. De-carbonize the exhaust manifold. Replace, if excessive wearing / warping observed.

18.4 Turbo supercharger

Dismantle the turbo supercharger. Clean it with solvent by plugging all the oil cavities. Clean and check after cooler, air jumper tubes for reuse. Check housing for excessive wear, damage or warping. Check the turbine and compressor wheels for fretting and broken vanes. Check for compressor impeller and turbine wheel radial clearances. Replace or re-condition the turbo supercharger by replacing wheel and shaft assembly accordingly. Replace turbocharger, if found beyond economical repair.

19. Hydraulic system

19.1 Hydraulic tank

Drain hydraulic oil from the hydraulic tank. Flush hydraulic oil tank and re-fill it with fresh hydraulic oil.

19.2 Hydraulic oil strainer, return line filter, hydraulic hoses & O- rings

Replace the hydraulic oil strainer & return line filter element. Replace all hoses and O-rings.

19.3 Thermatic valve & Shut-off valve

Check for its working condition at 92°C. It should close the flow at this temperature. Check the working of shut-off valve. Replace the valve, if not found OK.

19.4 Hydraulic pressure, temperature gauge & Sight glass

Check & calibrate all hydraulic pressure & temperature gauges as well as sight glass. Replace them, if found broken or damaged.

20. Gear Train

Check all gears for wearing damage. Replace, if found worn out excessively or damaged.

20.1 Gear case cover & housing

Clean gear case cover & housing. Replace, if found damaged.

22. Rubber components

Replace all rubber components and hose pipes.

PART – II (B)
(Caterpillar Engine Model Cat 3508B)
After 54 months (1st Top end Over hauling)
equivalent to E-Check of Cummins Engine

The following activities is to be carried out after 18000 Hrs. engine service / 54 months, whichever is earlier as per OEM's orientation

SN	Details of work to be carried out	Remarks
A.	Replace the following components	
1.	Connecting Rod Bearing	Replace
2.	Electronic Unit Injectors	Replace
3.	Piston Rings	Replace
4.	Cylinder Liners	Replace
5.	Spacer Plate	Replace
6.	Crank Shaft seals & All Gaskets	Replace
7.	Main Bearing	Replace
B.	Inspect, recondition / replace the following components	
1.	Cylinder Head	Repair with new Valves, inserts & Guide
2.	Water pump	Repair with Rebuild Kit
3.	Turbocharger	Inspect / Replace Cartridge
4.	Engine wiring Harness	Inspect & replace if required
5.	Connecting rod	Inspect
6.	Fuel Transfer Pump	Inspect
7.	Oil Pump	Inspect
8.	Piston	Inspect
9.	Piston Pins	Inspect
10.	Camshaft Follower	Inspect
11.	Camshaft	Inspect
12.	Camshaft Bearing	Inspect
13.	Crankshaft Vibration Damper	Inspect
14.	Engine control Module	Inspect
15.	Gear Train Bushing s & Bearings	Inspect
16.	Radiators	Clean, inspect & replace, if required
17.	After cooler core	Clean, inspect & replace, if required

PART – III
POH Schedule for Electrical Transmission & Controls
(18 month / 36 month as applicable)

Carry out all lower schedules, i.e., Monthly, Quarterly and Half-yearly items

1. General

- i) Blow out electrical wiring panel and remove dust and dirt with dry air
- ii) Check all switches and push buttons for proper working
- iii) Check all circuit breakers for 'ON' and 'OFF' operations
- iv) Clean throttle tips and check for proper operation.
- v) Check all gauges for proper working & readings to be noted down on idle as well as on 8th notch.
- vi) Blow out switch gear box and rectifier box and clean all contactor tips.
- vii) Check rectifier blower motor and its carbon brushes
- viii) Disconnect traction motor connections and remove inspection covers. Change all carbon brushes.
 - Measure IR value
 - Clean the commutator.
 - Complete traction motor connections and secure all cables with proper crimping
- ix) Examine LCC connections and check speed and load control as well as constant output and constant speed at each notch
- x) Check all electrical equipments for high temperature, unusual sound & odour, including alternator, aux. alternator, 24V alternator traction motor and starter motor.

2. Remove components mentioned below from DPC. Overhaul, test on test bench and fit back on the DPC.

- i) Traction motors
- ii) Relays
- iii) Contactors
- iv) LCC
- v) Auxiliary alternator & RR unit
- vi) Starter Motor
- vii) Blower Motor
- viii) 24V alternator

3. MAIN ALTERNATOR (Model TA7003 of BHEL /Model C1012 TA of CGL)

- i) Clean main alternator with dry air for removal of dust and dirt.
- ii) Torque foundation bolts.
- iii) Measure IR.
- iv) Check belts for proper tension and healthy operation

Note: Alternator should be over hauled during alternate POH (i.e. completion of 36 months).

3.1 Check and measure following parameters:

- i). Insulation Resistance (IR) of alternator stator (std. value 5 M Ohm)
- ii). Insulation Resistance (IR) of alternator rotor (std. value 5 M Ohm)
- iii). Insulation Resistance (IR) of exciter stator (std. value 5 M Ohm)
- iv). Insulation Resistance (IR) of exciter rotor (std. value 5 M Ohm)
- v). Resistance of alternator stator TA
- vi). Resistance of alternator field TA

- vii). Resistance of exciter stator TA
 - viii). Resistance of exciter armature TA
- 3.2
- i) Ball bearing 6326 C/3
 - ii) Diode wheel assembly
 - iii) Check for the requirement of any special
- 4. AUXILIARY ALTERNATOR (18.5kW, 110V DC of KEL make)**

- i). Measure Insulation Resistance (IR) before dismantling.
- ii). Replace belt pulley.
- iii). Remove rotor from stator.
- iv). Remove both side bearing.
- v). Clean rotor & stator.
- vi). Coat Stator with insulation varnish.
- vii). Bake stator for at least 4 Hours.
- viii). Measure IR of field before assembly.
- ix). Fit both side bearings with end assemblies.
- x). Assemble rotor with stator.
- xi). Paint outer surface after final testing.

5. TRACTION MOTOR (Model TM4303 of BHEL /Model C1005 TM of CGL)

Measure & record the following:

Sl. No.	Description	Mode of testing	Permissible value	Observed value
5.1	A, AA cables IR	Megger 1000 V	1 M Ohm, min.	
5.2	Y, YY cables IR	Megger 1000 V	1 M Ohm, min.	
5.3	Armature IR	Megger 1000 V	1 M Ohm, min.	
5.4	Brush holder IR	Megger 1000 V	2 M Ohm, min.	
5.5	Commutator ovality	Dial Gauge	0.03 mm max.	
5.6	Commutator diameter	Outer Calipers	305 to 325.3 mm	
5.7	Arm. Winding Resist.	Ohm meter	0.0186 Ohm	
5.8	A, AA cables on condition basis. HV	HV Test Kit	1450 Volt, 15 Seconds	
5.9	Y, YY cables on condition basis. HV	HV Test Kit	1600 Volt, 15 Seconds	
5.10	Main pole resistance	Ohm meter	0.009 Ohm	
5.11	Inter pole resistance	Ohm meter	0.010 Ohm	
5.12	Bearing clearance PE before assembly	Feeler Gauge	0.145 to 0.190 mm	
5.13	Bearing clearance CE before assembly	Feeler Gauge	0.105 to 0.130 mm	
5.14	Gap between brush holder to comm.	Feeler Gauge	1.6 to 3.2 mm	
5.15	Gap for Arc Horn	Internal Gauge	11 to 12 mm	
5.16	Tension of Brush Holder Spring i) Top ii) Bottom iii) Suspension Brg. iv) Nose Sus. Brg.	Spring Balance	2.7 to 3.65 kg/cm ²	

5.17	Pinion advance	Dial Gauge	2.9 to 3.1 mm	
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6. REVERSER & POWER CONTACTORS

6.1 Contactors

- i) All contactors are to be stripped completely. Clean and overhaul.
- ii) Replace fixed & moving contact tips.
- iii) Check & repair magnet valve. Replace operating coil, if necessary.
- iv) Replace air hoses preferably by PU Hoses & one touch fitting.

6.2 Reversers

- i) Replace contact tips, if necessary.
- ii) Check & replace operating coil, if necessary.

6.3 Other contactors

Check and repair the following:

- i) EP contactor.
- ii) Circuit Breaker. Replace, if required.
- iii) Motor Reverser.
- iv) Master Controller.
- v) GP Relays.
- vi) Latch Contactor to repair-FAN. Check operating coils & replace, if reqd.
- vii) Latch Contactor to repair-LIGHT. Check operating coils & replace, if reqd.
- viii) Excitation Contactor: Check operating coils & replace, if reqd.
- ix) Ground Relay: Check operating coils & replace, if reqd.
- x) Motor Overload Relay.
- xi) AV, BV, CV, DV & other relays.

6.4 Replace FRP cover for motor switch group.

7. MISCELLANEOUS ELECTRICAL ITEMS

- i. Overhaul blower motor.
- ii. Overhaul main rectifier.
- iii. Overhaul auxiliary alternator.
- iv. Overhaul self starter.
- v. Check and repair 24V alternator.
- vi. Check and repair emergency bell.
- vii. Check and repair signal bell.
- viii. Check and repair LCC.
- ix. Check & repair ECP. Calibrate / replace PCB of engine control panel, if required.
- x. Change V-belts of main alternator.
- xi. Change V- belts of 24V alternator.
- xii. Change HWT- 1 switch.
- xiii. Change HWT- 2 switch
- xiv. Change lube oil pressure switch.
- xv. Change hydraulic oil flow fault switch.
- xvi. Change magnetic pick-up (MPU).

- xvii. Change magnetic switch.
- xviii. Change RPM meter in driver's cab.
- xix. Change volt meter of 0 to 50 volt range.
- xx. Change volt meter of 0 to 150 volt range.
- xxi. Check & attend isolating switch 24 volt.
- xxii. Check & attend main switch 110 volt.
- xxiii. Check Motor Cut-out Switch (MCOS) & replace, if necessary.
- xxiv. Change Emergency Rotary Switch.
- xxv. Overhaul / replace following items
 - a) Load Ammeter selection switch
 - b) Reverse current diode
 - c) High Rupturing Capacity (HRC) fuses and their bases
 - d) Rectifier and regulator panel(110 V DC)
 - e) Replacement of air duct of traction motors
Replacement of cable cleats of traction motors ensure its securing with proper safety chain.
 - f) Replacement / intensive cleaning of air intake filters for traction motors and blower motor (fitted in cabin of DPCs).
 - g) Master controller
 - h) Driver control switch
 - i) Engine control switch
 - j) Air solenoid valve for compressor
 - k) Air solenoid valve for parking brake
 - l) Air pressure switch for compressor
 - m) Air pressure switch for parking brake
- xxvi. **For EP brake DPC only**
 - a) E. P brake controller (fitted in driver cabin)
 - b) E. P brake unit (fitted in under frame)
 - c) E .P hold valve (fitted in under frame)
 - d) E.P application valve (fitted in under frame)

8. LIGHT & FAN

- Check and repair
- i. RC fans.
 - ii. Tube lights.
 - iii. Toggle switches.
 - iv. Fuse & distribution box.
 - v. Tail light.
 - vi. Flasher light.
 - vii. Blinking light.
 - viii. Head code light.
 - ix. PAC system.
 - x. End wall MU (A, B, C, D &E) coupler.
 - xi. MCBs to check & replace.
 - xii. MU couplers meggering.
 - xiii. TB panel.
 - xiv. DC-DC converter.
 - xv. Flasher unit. Overhaul, if required.
 - xvi. Cab fans.
 - xvii. Cab tube light.

- xviii. Engine room fans.
- xix. Engine room tube light.
- xx. All control coupler must be checked in end wall so that no any sharp edge of partition shutter may damage its insulation.
- xxi. New cable markers should be provided on the wiring those are running with erased cable marker.

9. Batteries (24 V & 110 V)

- i) Remove the batteries. Measure specific gravity & cell voltage of each cell and recharge accordingly. Test ampere - hour capacity of the battery.
- ii) Clean and paint battery boxes with acid resistant paint.
- iii) Broken battery boxes should be replaced.
- iv) Battery cables should be changed, if required.
- v) Ensure adequate ventilation in battery boxes while mounting.

10. Safety devices

Check working of safety devices: Test all devices and calibrate.

- i) LCWL
- ii) LOPS
- iii) HWT
- iv) OSD
- v) LHOL
- v) H-OFF
- vi) Load meter
- vii) Voltmeter

11. LOAD BOX PARAMETERS (ELECTRICAL)

Carry out load box test and record horse power at every notch.

NOTE:

- i. SKF/FAG (imported) make bearings for alternator procured directly from manufactures as specified in the RDSO specification shall be used. Use of other makes of bearing is not permitted.
- ii. Shock pulse meter shall be procured by Railways and workshops to monitor condition of the bearing regularly. During maintenance service and after replacement of defective bearings, induction heater / oil bath shall be used for heating the bearing to the required recommended temperature.
- iii. The pulley condition such as wear on V groove, pulley key way, shaft way, groove angle etc, shall be monitored during POH. Proper gauges shall be used for checking "V" groove of the pulley.

PART – IV

POH Schedule for Air Brake & Compressor (18 month)

All Lower Schedule

1. Overhaul & test following valves on test bench. Replace, if necessary.
 - i) A-9 Valve
 - ii) SA-9 Valve
 - iii) C2 Relay Valve
 - iv) AD Valve
 - v) Safety Valve
 - vi) Distributor valve
 - vii) Feed valve
 - viii) N-1 reducing valve
 - ix) Guard's emergency valve.
 - x) Pressure limit valve.

2. Check and overhaul following pneumatic equipments. Replace, if necessary.
 - i) Hand brake provision
 - ii) Inter cooler.
 - iii) All dirt collectors element.
 - iv) Slack adjuster.
 - v) Horns.
 - vi) Wiper motor.
 - vii) Wiper arm & blade.
 - viii) Feed pipe.
 - ix) Brake pipe.
 - x) Parking brake.
 - xi) Air dryer

3. **COMPRESSOR**

Dis-assemble the compressor. Overhaul following components. Test it on test bench after assembly.

 - i) Crank shaft
 - ii) Piston LP & HP
 - iii) Liner LP & HP
 - iv) Bearings
 - v) Intercooler
 - vi) Safety valve

- 3.1 Replace V-belt.

NOTE:

The pulley condition such as wear on V groove, pulley key way, shaft way, groove angle etc, shall be monitored during POH. Proper gauges shall be used for checking "V" groove of the pulley.

PART – V

POH Schedule for Coach Body, Under Frame, Bogie & Brake Rigging (18 months)

All Lower Schedule

1. Sequence to be followed during POH of Coach:

The following sequence of work should be generally followed during POH of coach:

SN	Details of work to be carried out
i)	Verification of deficiencies.
ii)	Pre-inspection and Lifting of coach body
iii)	Stripping
iv)	Body repair.
v)	Repair of internal panels
vi)	Fitment of shutters
vii)	Fitment of doors
viii)	Fitment of seats
ix)	Repair, maintenance & fitment of CBC and Side Buffers
x)	Painting and finishing
xi)	Repair and maintenance of bogie
xii)	Repair and maintenance of brake system
xiii)	Repair and maintenance of rolling gear
xiv)	Lowering of coach body on bogies.
xv)	Brake Testing
xvi)	Testing of branch wiring
xvii)	Testing of electrical equipment
xviii)	Final Inspection & Dispatch

2. BOGIE

Check the condition of wheels & axles of DPC. Measure wheel diameter for all the wheels. Record difference in wheel diameters on the same axle and on different bogies. Check the wheel gauge dimensions (Std. Value 1600+2/-1mm.)

2.1 Record Bogie Clearance for each Traction motor as per format:

Traction Motor No.	Radial Clearance		End Clearance	
	Commutator End	Pinion End	Commutator End	Pinion End

Check from respective OEM's Manual.

2.2 Record following parameters of the bogie components & buffer height:

SI No.	ITEM	Observed value	
		Engine Side	Passenger Side
1	Axle box height		
2	Bolster to Bogie Frame		
3	Bogie frame to body bolster		
4	Buffer height		

2.3 Bogie components

Check the condition of following items. Overhaul & replace, if necessary.

- i. Bolster spring (outer & inner)
- ii. Bolster rubbing plate
- iii. Equalizing stay
- iv. Dashpot guide
- v. Guide bushes
- vi. Brake cylinder. Test it on test bench.
- vii. Brake cylinder hoses (Must be replaced).
- viii. Parking brake system. Test it.
- ix. Steel pipes fitted to bogie brake system
- x. Nose pad sheet
- xi. Centre pivot housing
- xii. Side bearer pocket
- xiii. Shock absorber. Test it on test bench.
- xiv. Bogie bolster assembly

3. Buffer & coupler:

Check, overhaul following items & replace, if necessary

- i. Schaku coupler.
- ii. Screw coupling.
- iii. Buffer assembly with bolts & split pins
- iv. Gear case & Felt.
- v. Gear case bolts on condition basis.
- vi. Traction Motor bracket bolts.
- vii. Traction Motor wick pads.
- viii. Wick pad assembly.
- ix. Nose pad (Rubber).
- x. Nose pad (Steel).
- xi. Nose pin (Two types).
- xii. Gear case sealing
- xiii. Traction Motor bracket sealing
- xiv. Safety strap for crown bolts.
- xv. Wearing plate for buffer height
- xvi. Wearing piece.
- xvii. Centre pivot & pivot bolt.
- xviii. Tightness of centre pivot bolt

4. MISCELLANEOUS

Check and repair following.

- i. Emergency windows.
- ii. ACP handles.
- iii. Driver's seat.
- iv. Foot steps.
- v. Doors.

- vi. Glass shutters.
- vii. Louvers shutters.
- viii. Floor.
- ix. Side walls.
- x. Look out glass.
- xi. Cattle guard
- xii. Rail guard
- xiii. UIC vestibule & vestibule plates.
- xiv. Door seal plate.
- xv. Passenger seat & back rest.

5. PAINTING & FINISHING

Paint and finish the DPC before dispatch.

6. Final Inspection & Dispatch

Carry out final inspection related to brake system, electrical system and dispatch.

NOTE: POH of the coaches is to be done as per the details given in the following: -

- i) Maintenance manual for BG coaches of ICF design (2002) issued by IRCAMTECH, Gwalior.
- ii) Maintenance Manual of bogie, brake, brake gear and coupler for 1400HP DEMU stock fitted with air suspension (BG-1676mm) no. CMI-K401 (Oct-2004) issued by RDSO, Lucknow.
- iii) Repair and maintain air spring as per Annexure 'B' of CMI-9802 (Rev. 1) of Maintenance Instructions on Air Suspension for EMU/DMU coaches issued by RDSO, LKO.
- iv) Complete overhauling of Air dryer in alternate POH starting from 2nd POH including renewal of all rubber parts, pre-coalescer kit and final filter kit as per the maintenance instructions of the supplier.
- v) POH of Schaku Couplers: Carry out as given in Chapter "Semi Permanent Coupler".
- vi) POH of EP Brake: To be maintained as per the maintenance instructions of respective makes.

PART – VI

POH Schedule for Carriage Electrical (18 months)

All lower schedule

S. No.	Items to be checked
1.0	Wiring
1.1	The wiring shall be completely inspected for damage by opening side panels, end wall near couplers and also near fitting after stripping. The rewiring shall be done on condition basis are planed on basis of life of 6 years for cables. Cables used for requiring shall be E-Beam cables, as specified by RDSO. The cables taken up for requiring shall be done through conduits in super structure. Bushes / grommets use shall be of hard PVC as specified by RDSO.
1.2	Coach insulation Insulation resistance of coach measured with 500 V megger IR value should be minim 2 mega ohms but it should not be less than 1 mega ohm.
1.3	Cable termination joint: <ol style="list-style-type: none"> All cable joints shall be checked for its looseness or heating signs. Loose joints and cables having damaged insulation shall be replaced / repaired. All cable ends shall be properly socketed with crimping type sockets. Surface of crimping sockets of bus bar shall be cleaned to remove the oxide film from the jointing surface before remaking the joint and shall be coated with corrosion resistant conducting grease of approved make to prevent reformation of oxide film. Fire retardant PVC grommets as per RDSO specification shall be provided at all cable entry points in metallic members. All inspection covers shall be opened to check the distribution boards and condition of wiring.
1.4	General Precautions <ol style="list-style-type: none"> Do not peel insulation for testing. If wires are found with peeled insulation replace them with fresh wires. If peeling is of short length, apply proper PVC adhesive tape. Remove earth fault by isolation method instead of hit and trials and short circuiting of opposite polarity of earth. Use proper rating of MCBs/fuses both in branch circuits, rotary panels and regulator boxes for field and main fuse. Use HRC fuse use only Use connectors for lights and fans. Ensure extra length of cable near termination's for future maintenance and replacement if found inadequate at the earliest opportunity. Check for earth fault on every maintenance and rectify those detected. Do not tamper with regulator potentiometer setting unless tested in a proper alternator drive having variable speeds.
2.0	Switches, Light fittings, etc. Light fittings: The light fittings, reflectors, clear acrylic sheet cover, glass globe holders, etc., shall be checked and cleaned. Any defective part shall be replaced. Anti-theft arrangement for fluorescent light fittings shall be checked as per ICF Drg. No. ICF/SK-7-6-079
3.0	Fans: <ol style="list-style-type: none"> Dismantle the lower guard, upper guard, blade and fan motor. Check the guard assembly repair/replace if necessary. Check the blade angle with a measuring gauge. Correct the same, if

S. No.	Items to be checked
	<p>necessary.</p> <p>d) Check the insulation resistance of the fan motor. The IR value should not be less than 2 Mega ohms as specified in IS 6680-1992</p> <p>e) Check the fan leads and change it if necessary</p> <p>f) Check the armature winding and field coil. repair/replace, if necessary.</p> <p>g) Check the commutator for grooving, putting marks, ovality, blackness etc. Polish the commutator if required.</p> <p>h) Check the carbon brush and brush spring. Replace by correct grade of carbon brush as recommended by RDSO. The fan spring should meet the requirements given in IS 6680. Replace the same if necessary.</p> <p>i) Apply air drying insulating varnish if IR value of the armature and field coils is low, give impregnation treatment in an air circulated oven.</p> <p>j) Clean the ball bearing, check for noise, replace if necessary or grease it with recommended grade grease.</p> <p>Testing:</p> <p>k) Check the load current at rated voltage. The wattage of the fan should not exceed the value specified in IS:6680.</p> <p>l) Check the air delivery of one or two fans from a batch to ascertain the correctness of the blade angle. The value of the air delivery shall not be less than that specified in IS:6680.</p>



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