PHOOLTAS

PHOOLTAS TRANSRAIL LIMITED

RAIL BOUND MOBILE VEHICLE (8 -WHEELER)

MODEL : RBMV.02.B

G A U G E : 1676 mm

MAINTENANCE MANUAL

REFERENCE NO. MM/302B/3K23, REV.:-00

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1. INTRODUCTION

PHOOLTAS make Rail Bound Mobile Vehicle with MMU equipment (Model-RBMV.02.B) is a 8 Wheeler, twin power pack, self-propelled car. RBMV is idle vehicle for rail track civil maintenance work to run on B.G schedule of DFCC network. RBMV has been provided with hydraulic knuckle boom crane (Total 2 Nos) i e, one no. each end on RBMV. RBMV and its mounted cranes are suitable to load – unload rail maintenance material at required site from loading platform and attached BFRS which are usually used for shipping at track site construction and maintenance work. RBMV is equipped with multiple maintenance units (MMU) and various other necessary tools & spares which are used in emergency and routine maintenance-inspection of track. Therefore proper maintenance of RBMV is necessary to ensure the reliability and availability in emergency and for regular maintenance work of track. This Operation and Maintenance manual of 8 Wheeler RBMV has been prepared with the objective of making operating personnel aware to correct operation and maintenance techniques adopted in field.

This vehicle has been provided with two knuckle boom crane with load lifting capacity (1 ton at 15M reach), suitable storage rack, cubical, cupboards, pigeon box for MMU tools and spares track maintenance work. Vehicle has been equipped with A.C cabins for Crew and drivers which is an ideal vehicle for RBMV work.

I.O.H & P.O.H schedules are not included in warranty/DPL. I.O.H defined as 42 months working. P.O.H defined as 72 months working.

2. INDEX

3. MAINTENANCE SCHEDULE

Objective: To keep up of 8 wheelers all time availability in working conditions.

Back Ground: Rail Bound Maintenance Vehicle 8 Wheeler (RBMV.02.B) is twin power pack, self-propelled 4 axle vehicle to run on B.G schedule of DFCC network. RBMV has been provided with hydraulic knuckle boom crane (22tm) at either end of RBMV which is idle for handling rail construction material for attached BFR and RBMV itself which are used for regular loading – unloading of track construction and maintenance material to carry at maintenance site. This special maintenance instruction has been prepared to maintenance 8-wheelers so that its availability can be ensured all the time.

Following maintenance instructions to be followed for various components: -

3.1 DAILY CHECK – (by operator before work site proceeding)

S.No.	Visual check
1.	Check all safety locks are O.K
2.	Check shut off cock and drain cock of pneumatic line are in normal position.
3.	Check shut off cock of hydraulic reservoir are in open position for working.
4.	Check there is no leakage of fuel, hydraulics, transmission oil, ADGB oil and coolant.
5.	Availability of tools, manuals and emergency spares.
6.	Sufficient availability of fuels, hydraulic oil, transmission oil and ADGB gear oil.
7.	Availability of fire extinguisher.
8.	Availability of first aid box.
9.	Visual inspection of under frame e. g. wheels, springs, transmission, cardan shaft, axle drive gear box and nut-bolts etc.
10.	Visual inspection of on Floor & under floor mounted components i.e. Hyd. power pack, crane, elevating platform and control valve, drum stand, cradle unit auger aux. alternator 110 V battery.

3.2 DAILY FUNCTIONAL CHECK

S.No.	Functional check
1.	Proper condition of engine and battery, and switch box.
2.	Smooth starting of engine.
3.	Normal working sound and smoke of engine.
4.	Proper working of brakes (service SA-9, A-9, emergency, parking and V.C.D. applied.)
5.	Proper working of head light.
6.	Proper working of tail light.
7.	Proper working of flasher light.
8.	Proper working of horn.
9.	Proper working of wiper.
10.	Operation from both cabins and controls provided for other equipment.
11.	Proper function of safety switches and inter locks of operating equipment.

4. ENGINE MAINTANANCE SCHEDULE:

4.1 Daily check

A-Check

S.No	Maintenance steps
1.	Check previous day's engine log book, correct as required.
2.	Drain Water and sedimentation from fuel filter through drain cock. Before starting the engine.
3.	Check engine oil and top up if necessary
4.	Check fuel level in fuel tank top up if low level.
5.	Coolant level in radiator, fill radiator / makeup tank with premix coolant as per Manufactures recommendation
6.	Check fuel line joints for any leakage
7.	Start the engine and note oil pressure at low and high idle.(ref. Manufactures Manual)
8.	Engine display, check and record display reading of hour meter, speedometer and battery charging for proper working.
9.	Check Poly groove 'V' belts and 'B' belt coolant pump, charging alternator and AC compressors for proper tension.
10.	Check coolant line and fuel line leakage, rectify if any.

4.2 EVERY 300 HOURS OF ENGINE RUNNING

B-Check

S.No	Maintenance steps
1.	Repeat all maintenance steps of 'A' daily check and do additional 'B' check schedule of engine
2.	Check leakage of Engine and radiator assemblyI.e. lub. Oil , coolant ,turbo charger etc.
3.	Check other roof top components, pipe couplings are tighten properly.
4.	Vibration damper- check vibration damper attached drive shaft coupling bolts for Aux. alternator for proper fastener tighten if loose.
5.	Fuel filter, water separator filter, lub. oil and lub. oil filters- replace with new one.
6.	Coolant level check and top-up.

4.3 EVERY 1000 HOURS OF ENGINE RUNNING

C-Check

S.No	Maintenance steps
1.	Repeat all maintenance steps of Checks `B' and do additional 'C' check schedule of engine
2.	Mounting bolts of engine, check and ensure all mounting bolts and connecting pipes of engine are properly tightened.
3.	Engine coolant pump, check for if any leakage.
4.	Tighten of flexible connection of after cooler and radiator are proper. Do not tighten when engine is hot condition.
5.	Change air filter elements.
6.	Engine breather, clean engine breather.
7.	Air compressor, clean and check for proper functioning
8.	Check vibration damper attached drive coupling for Aux. alternator for proper fastener tighten if loose.
9.	Fuel filter, water separator filter, coolant filter lub. oil and lub. oil filters- replace with new one.

4.4 EVERY 4000 HOURS OF ENGINE RUNNING.

D-Check

S.No.	Maintenance Steps
1.	Repeat all maintenance steps of A,B & C check
2.	Check exhaust and inlet manifold and nuts.
3.	Tighten all mounting bolts and nuts.
4.	Clean Turbocharger diffuser and impeller.
5.	Check turbocharger bearing sound and vibration for normal working.
6.	Check engine mounting pad for any crack or ageing, replace is required.
7.	Replace filter of lub. oil fuel oil and coolant.
8.	Replace engine lubrication oil, engine coolant.
9.	Drain the radiator coolant and fill-up with new coolant.
10.	Self-starter and alternator servicing

4.5 EVERY 10000 HOURS OF ENGINE RUNNING.

IOH check

S.No.	Maintenance Steps
1.	Repeat all maintenance steps of A,B,C & D check
2.	Fuel tank and suction strainer dismantle clean and re assembly
3.	Check engine blow by
4.	Check engine exhaust smoke (if any unburnt fuel, black/white smoke are rectify accordingly)
5.	Check engine temperature
6.	Self-starter and alternator servicing
7.	Check Turbocharger and rectify for any defect.

5. BRAKE AND PNEUMATIC LINE

5.1 Daily check

- Visually check for any damage of hose pipe, pneumatic pipe and components if any rectify them.
- Drain condensate water for CDC, and all air reservoir by manual cock provided at it bottom portion.
- Visually check of brake block, hanger, pin for any damage, if any rectify it.
- Check function of brake, horn and other pneumatic operated system for proper working.

5.2) Weekly check (Include all daily check schedule along with weekly check schedule)

- Check brake rigging arrangement for any defects / deficiencies and check brake cylinder mounting for proper condition.
- Examine brake beams / cross bar for any breakages / damages.
- Check and attend cross bar safety straps.
- Check and attend brake shoe head and key necessary.
- Check and adjust worn brake blocks clearance if required.
- Visually inspect brake hangers, brake leaver, pins and cotters /split pins for proper condition.

5.3) Monthly check (Include all Weekly check schedule along with Monthly schedule)

- Externally clean the brake system, after cooler pneumatic pipes and check for leakages. If required tighten the end fittings.
- Check the mounting fasteners of air reservoir, control panel / distributor valve relay valve magnet valve and other brake system equipment.
- Check and attend brake block adjuster.
- Examine and attend brake levers.
- Examine and attend brake hanger lever brackets.
- Lubricate pin and pivot joints of hanger and lever.
- Check governor cut in and cut out pressure for proper setting.
- Check safety valve for proper function.

5.4) Six Month check (Include all Monthly check schedule along with Six month schedule)

- Check brake block thickness, replace and adjust brake clearance as required.
- Check pressure switch and all pneumatic safety switches for proper functioning adjust if required.
- Check gauges and indicator for proper functioning.

5.5) Yearly check (Include all Six month check schedule along with Yearly schedule)

- Check rubber packing any leakage on panel brake, replace packing if required.
- Check all components on brake panel for proper functioning and no leakages from them.
- Check any damages of flexible hose / pipe for any external crack or damages, replace them.

5.6) I.O.H (42 months working)

- Overhaul the safety switch.
- Clean the chokes, exhaust plugs, mesh filters in the distributor valves on panel brake control valve and check proper functioning of all sub-assemblies.
- Overhaul the drivers brake valve (SA9, A9). Replace all the rubber items and clean filters.
- Check for proper functioning of relay valves and replace the damaged / worn out components / valve assembly
- Replace rubber / sealing washer of air brake hose end (B.P line) coupling.
- Check all the hose assemblies of brake system for damage or over ageing, replace if required.
- Replace all the rubber items and choke in the brake system equipment's like safety valves, Auto Drain Valves Drivers Brake valve, Relay valve Tread brake Block units, Isolating cocks, Dust collectors, Angle cocks, filters etc.
- Check the Distributor Valve sub-assemblies and entire assembly for proper functioning, replace rubber items, chokes and springs only if required.

- Replace all hose assemblies if not done so far.

5.7) P.O.H (72 months working)

- Repair and maintenance of brake system including overhauling of all components.
- Change of distributor valve.
- Change of all service brake cylinders.
- Change of all parking brake cylinders.
- Change of all rubber house.
- Change of all gauges.
- Change of all A9, SA9 & Emergency valve
- Change of all N1, D1 and pressure switch.

6. HYDRAULIC POWER PACK (for radiator fan, crane and A.C drive)

6.1) Daily check

- Check shut off cock of reservoir are open position.
- Check oil level in hyd. reservoir, if required top up.
- Check any leakage of hyd. hose / joints, rectify.
- Check smooth operation and pressure of working equipment are in proper range.
- Check any abnormal sound of pump, motor and control section, record for any service or maintenance required, attend.

6.2) Weekly check (Include all daily check schedule along with weekly check schedule)

- Externally through clean of hydraulic components if any oil leakage check and tighten the joints.
- Check any damages hose, pipe and clamp, rectify it.
- Check function of smooth operation and movement of all hyd. operated unit.

6.3) Monthly check (Include all Weekly check schedule along with Monthly schedule)

- Check filter clogging / chocking indicator are in normal working range.
- Check hydraulic pump, motor and control valve mounting face for any leakage rectify it.
- Check condition of pressure hose for any cut / damages, rectify or replace it.

6.4) Three Month check (Include all Monthly check schedule along with Six month schedule)

- Remove dust accumulation on hydraulic reservoir, valves unit, cylinder rod and hose joints.
- Check filter clogging indicator, replace filter element as required.
- Check any leakage from hydraulic power unit pipe joint, tighten them.
- Check mounting fasteners of hydraulic power pack, if any loose tighten them.

6.5) Six Month check (Include all Monthly check schedule along with Six month schedule)

- Remove drain plug and drain hydraulic reservoir.
- Remove suction strainer and clean before refitting in reservoir.
- Though clean of hydraulic bottom dirt of reservoir inside before putting new oil.
- Replace new filter elements for proper hydraulic equipment working.
- Check leakage from fitting and tighten, if still leakage observe then replace fitting.

6.6) Yearly check (Include all Six month check schedule along with Yearly schedule)

- Check pump and motor drive coupling for proper condition, replace if worn out or abnormal.
- Check and reset pressure for normal operating range as per manual.
- Check for damage hose pipes, joints leakage, replace as required.

6.7) I.O.H. / check (Include Yearly check schedule along with Three Year schedule)

- Externally clean all hydraulic components before removing from equipment.
- Check cylinder seal and cylinder condition, if required replace cylinder unit.
- Replace crack / damages and ageing pressure hoses if required.
- Replace suction strainer and filter element.
- Check electro hydraulic valve for any malfunctioning, replace them if earlier it has been not replace.
- Check pump and motors for proper working capacity pressure, shaft seal and drive shaft condition, if abnormal or wear out send them for reconditioning.
- Hyd. Tank cleaning & magnetic suction strainer cleaning
- New hyd. Oil change

6.8) P.O.H (72 months working)

- All hyd. Pump & motor. change or overhaul
- Change all hyd. House.
- Change all fillers & suction strainer

7. TRANSMISSION

7.1) Daily check

- Check oil level in oil sump, top up with proper grade (SAE 30, C4) if required.
- Check any leakage form transmission body joints, hose pipe and fittings rectify it.
- Check linkage / clevis of transmission shift control cylinder for loose, rectify it.
- 7.2) Weekly check (Include all daily check schedule along with weekly check schedule)
- Clean transmission externally by air.
- Clean air breather of transmission.
- Check transmission clutch/main pressure in pressure gauge for normal range (9.2 kg to10 kg/cm²).
- Check transmission control linkage are properly adjusted and tighten.
- Check transmission mounting fastener if loose, retighten it.

7.3) Monthly check (Include all Weekly check schedule along with Monthly schedule)

- Check transmission main / clutch oil pressure for normal range.
- Check transmission oil temperature for normal working range 82ºC to 93ºC Maximum oil temperature should not exceed from 120ºC .
- Check Electro pneumatic valve for transmission is working properly.
- Check clutch cut off cylinder is working properly.
- Check gears safety cylinder working properly.

7.4) Three Month check (Include all Monthly check schedule along with Three month schedule)

- Check breather and filter housing.
- Replace transmission filter element with proper seal ring after 500 hrs. working
- Sump oil-First replace after 500 working hrs. Thereafter replace the oil after every 1000 hrs.
- of working.
- Check and clean oil suction strainer.

7.5) Six Month check (Include all Three Monthly check schedule along with Six month schedule)

- Check main transmission oil pressure for proper range (140 PSR). (Ref. transmission manual)
- Check electro pneumatic valve and pneumatic air cylinder of transmission control for any leakage and proper functioning, rectify it.

7.6) Yearly check (Include all Six month check schedule along with Yearly schedule)

- Check house of gear shifting cylinder, replace if req.
- Check shifting cylinder, replace/rectify as req.
- Check all pneumatic valves, replace/rectify as req.

7.7) I.O.H

- Check transmission clutch pressure if low rectify clutch plates.

7.8) P.O.H

- Over hauling of transmission clutch plate, pressure plate and pump
- Change shifting cylinder
- Change pneumatic solenoid
- Change all hoses
- Change all safety switches

8. SUSPENSION /BOGIE

8.1) Daily check

- Visual check bogie frame and linkages for any damages.
- Visual check of helical coil spring, rubber packing for any damages.
- Visual check of linkages pin in and cotter pins are properly secured.

8.2) Weekly check (Include all daily check schedule along with weekly check schedule)

- Examine visually the condition of bogie side frame, transom, longitudinal, bolster etc. at all welded locations.
- Examine rubber stopper / stop of axle box crown for damage / missing / loose.
- Inspect axle box safety straps / loops for damage / breakage / missing.
- Inspect bolster safety straps / loops for damage / breakage / missing.
- Inspect brake hanger brackets for damages.
- Inspect safety brackets for brake hanger pins.
- Check visually hanger & brackets.
- Visually examine axle box springs for breakage/damage.
- Visually examine dashpot oil filling special screw for deficiency.
- Check oil leakages in dashpot through defective seals/vent screws.
- Visually examine axle box clearance.
- Visually examine bolster springs breakages / damages.
- Visually examine bolster lower spring beam.
- Visually examine BSS hangers, hanger blocks, and BSS pins.
- Visually examine equalizing stay rods and pins (small and big).
- Visually check rubbing plate.
- Visually examine equalizing stay brackets.
- Examine and attend safety loops of bolster.
- Check and attend safety loops of equalizing stay rod.
- Examine vertical shock absorbers for damages.
- Lubricate brake pivot and hanger pins weekly.
- Examine rubber stopper/stop screw of axle box crown for damage / missing / looseness.
- Inspect axle box safety straps/loops for damage/breakage/missing.

8.3) Monthly check (Include all Weekly check schedule along with Monthly schedule)

- Examine oil level in side bearer oil both and oil filling cap replace oil if needed.
- Add specified grade of oil in dashpot.
- Check center pivot clamp bolts for proper tightening.
- Check sock observer for any leakage.
- Lubricate side bearer ports and center pivot monthly.

8.4) Six Month check (Include all Monthly check schedule along with Six month schedule)

- Examine condition of side bearer wear piece and wear plate.
- Check and ensure proper axle guide assembly clearances with gauge.
- Clean through bogie frame and spring assembly
- Check bolster clearance for primary and secondary suspension for proper range.

8.5) Yearly check (Include all Six month check schedule along with Yearly schedule)

- Bogie frame should be checked thoroughly after cleaning for any possible cracks.
- Check for wheel flange gear in the rear cover box of roller bearing axle box.
- Check alignment of guide for proper range.

8.6) I.O.H (Include Yearly check schedule along with Three Year schedule)

- Clean thoroughly bogie and suspension assemblyRemove bogie and it attached brake hose components for replacing worn out bushes, packing and damages components.
- Check and replace worn out bushes and pins of bogie hanger.
- Check and replace guide bushes and wear plates.
- Check spring free height and pairing for assemblyIf required replace spring in the suspension unit.
- Check and adjust bogie bolster clearances in primary and secondary stage by adding required packing of after wheel profiling.

8.7) Packing below the spring in Bogie assembly after re-profiling the wheel.

- After wheel wear (in diameter) a packing, has to be provided below the lower spring seat to raise the body. After providing packing stopper assembly and axle safety strap assembly is adjusted accordingly.
- Once the diameter of the wheel reduced as (fully worn), it is discarded and is replaced by new ones. Earlier added / packing below the spring sheet should be removed to maintain buffer height

8.8) P.O.H

- Replace the all primary and secondary spring
- Replace all rubber pads
- Replace all brake chamber
- Replace all pin & bushes

9. AXLE DRIVE GEAR BOX (ADGB) ASSEMBLY

9.1) Daily check

- Check oil level of ADGB by oil level gauge or by dip-stick top up if required.
- Check any leakage from external pipe connection hose and joints, re-tight and rectify.

9.2) Weekly check (Include all daily check schedule along with weekly check schedule)

- Clean ADGB surface ADGB / Aux. gear box surface.
- Check the oil level in sump weekly, top up if required.
- Check any leakage on ADGB surface and auxiliary lubrication gear box attached with ADGB, tight fastener to rectify it.

9.3) Monthly check (Include all Weekly check schedule along with Monthly schedule)

- Clean oil filler and breather assembly
- Check input drive shaft fastener for proper tightening.
- Check any leakage from input bearing carrier seal or output seal, rectify it.

9.4) Three Month check (Include all Monthly check schedule along with Three month schedule)

- Through clean surface of ADGB and Aux. gear box.
- Change the sump oil after first 500 working hr. thereafter replace the oil after every six
- Months of working whichever is earlier.
- Remove oil from ADGB, Clean bottom internal face by removing drain plug and suction strainer.
- Clean suction strainer and oil filler breather assembly
- If reuse the oil then it should be clean properly or replace with new gear oil of proper grade in ADGB
- Check for any leakages from packing or pipe line of ADGB.

9.5) Six Month check (Include all Three Monthly check schedule along with Six month schedule)

- Through clean surface of ADGB and Aux. gear box.
- Check for any leakages from oil seal, packing or pipe line of ADGB, rectify it.

9.6) Yearly check (Include all Six month check schedule along with Yearly schedule)

- Check and ensure drive flange and coupling fastener condition for proper functioning.
- Replace ADGB oil and suction strainer with new.

9.7) I.O.H. or 2, 50,000 km. run

- This work should be carried out at authorized by OEM only. Remove final drive from 8 wheeler car, clean thoroughly ADGB and Auxiliary gear box surface and dismantle the assembly and sub assembly, inspect gear and bearing condition. The defective component, oil seal and packing should be replaced. Sagest to recommendation of OBM only.

9.8) P.O.H 300000 km run

- Dismantle ADGB and sub assembly, change Gear and bearing, oil seal, shaft etc. subject to recommendation of OEM only.

10. TORQUE ARM ASSEMBLY

Note: During maintenance of ADGB, torque arm assembly must be thoroughly for any crack etc.

10.1) Daily check

- Check the tightness and locking of fasteners.

10.2) Weekly check (Include all daily check schedule along with weekly check schedule)

- Lubrication of spherical joint to be done as and when required.

10.3) Six Month check (Include all Three Monthly check schedule along with Six month schedule)

- Spring disk to be checked physically. If found damage replace it.
- Pre- compression of spring disk to be maintained for the specified value by tightening the castle nut at one end of torque arm.
- Spherical joints and bushes are checked for wear.
- Check for proper tighten of lock nut and split pin.

10.4) yearly check (Include Six month check schedule along with Yearly schedule)

- Check rubber disc pad for any crack or ageing replace with new.

10.5) I.O.H

- Change all rubber and plates' disc.

10.6) P.O.H

- Change all rubber & plates' disc.
- Change all nuts & bolts and dowel pin.

11.POWER LINE DRIVE SHAFT CARDAN SHAFT

11.1) Daily check

- Check all fastener of anti-vibration mounting pads of alternator, engine and transmission are properly secured.
- Check all fastener of drive shaft flange are properly tightens and secured.

11.2) Monthly check (Include all daily check schedule along with weekly check schedule)

- Lubricate the cardan shaft cross joint and slip joint with grease gum.
- Check and tighten the flange bolts of cardan shafts.

11.3) I.O.H:

- Virtual inspection of shaft if req. to replace (subject to recommendation of OEM)

11.4) P.O.H:

- Cardan shaft replace with new one including all fasteners.

12. AXLE BOX ASSEMBLY

12.1) Daily check

- Check fastener lock nut and split pin for proper securing.
- Check any hitting of axle box crown and damage of pad if any.

12.2) Monthly check

- Clean axle box external surface for removing dust and any grease spilled out.
- Check housing stopper rubber are proper in position.
- Ensure for proper tighten of end cover.

12.3) Six Monthly check

- Clean axle box external surface for removing dust and any grease spilled out.
- Check & top-up the grease in axle box AP–3 grease 1.5 kg. In each axle box.
- Ensure for proper tighten of end cover.
- Check axle housing temperature after long run for good bearing health.

12.4) yearly check (Include Three month check schedule along with Yearly schedule)

- Replace new ‘O’ ring / packing.

12.5) I.O.H

- Over hollowing of ABM replace bearing (subject to recommendation of OEM)

12.6) P.O.H

- Replace the bearing of all axle (subject to examination of OEM)

13. WHEEL ASSEMBLY

13.1) Weekly check

- Check for any abnormal wear or drag on wheel face, flange for normal running.

13.2) I.O.H

- Check comedown limit and wheel profile machining (subject to recommendation of OEM)

13.3) P.O.H

- Check comedown limit & wheel profile of wheel subject to recommendation of OEM

13.4) Wheel Profile Maintenance

- At every wheel profile maintenance wheel gauge should be within tolerance should be +1/-1 mm.
- Wheel diameter new 952 mm, condemning limit 877 mm, last work shop machining size will be 885mm.

14. AXLE

14.1) Yearly Check

- Visual inspection of axle any observation noise coming during running or etc.

14.2) P.O.H:

- Ultrasonic testing of axle shall be conducted out by authorized testing inspector by OEM only.

15. ELECTRICAL CHECK AND MAINTENANCE

15.1) Daily check

- Check operator panel switches and electrical gauges for proper functioning.
- Check light, fan and there switches for proper working.
- Check head light, tail light, marker light for proper working.
- Check remote control box and pendant for equipment and crane control are working properly.

15.2) Weekly check (Include all daily check schedule along with weekly check schedule)

- Check the battery terminal.
- Check and fill the electrotype level in battery.
- Check all junction box electrical connection are properly tighten.
- Check M.C.B switches for proper working.
- Check relay and contractor for proper working.
- Check electro pneumatic solenoid and electro hyd. solenoid proper working.
- Check battery charging alternator of engine 24 V and Aux. (110 V) for proper charging.
- Check engine display unit, tachometer and VCD for proper working.
- Check electrical safety switches, electro pneumatic pressure switches and electro pneumatic valve for transmission shift control and parking brake application for proper working.
- Check air drier electrical valve function for purging.

15.3) Monthly check (Include all Weekly check schedule along with Monthly schedule)

- Check manually operate control panel lever and switches for smooth operation.
- Check interlocks and safety switches for proper working.
- Check high and low voltage circuit in cable for good working.
- Check and clean dirt/rush on battery terminal, tight, clean apply petroleum jelly
- Check specific gravity of electrolyte.
- Check aux. alternator drive belt / coupling for proper condition.
- Check cable connection joints points for any loose or insulation damage.

15.4) Yearly check (Include all six month check schedule along with Yearly schedule)

- Check engine safety switches for proper working, if malfunctioning replace them.
- Check control panel switches for proper working, if malfunctioning replace them.
- Check battery voltage for proper working, check specific gravity top up if required.
- Apply petroleum jelly on battery terminal connection.

15.5) I.O.H

- Examination of all relay, contactor, switches, elements, safety switches, horns if malfunctioning to replace (subject to recommendation of OEM)

15.6) P.O.H

- Replace of all relay, connector, switches, elements, safety, and hones ((subject to recommendation of OEM)

16. RECOMMENDED OIL AND LUBRICANTS:

ENGINE (A.L N6)

Water coolant	-	240 Liters. (Twin radiator + coolant tank)
		EURO COOL LL MAX 50
Engine Lub. Oil Approx. quantity	-	30 liters. x 2 = 60 Liters
Oil Multi grade 20 W/40	-	Indian oil/Bharat Petroleum/Hindustan
		Petroleum / Equivalent.

TRANSMISSION (AVTEC)

Approx. quantity	-	80 liters. X 2 = 160 Liters.
Transmission oil	-	Type C4 - SAE 30

AXLE DRIVE GEAR BOX

Hydrodynamic drive

Approx. quantity	-	2 x 35 liters / box = 70 liters
Gear oil	-	EP – 90

AXLE BOX

Grease	-	8 x 1.5 kg / Bearing (AP-3 Castrol)
Bogie dash port and side bearer housing	-	EP – 90 oil 0.5 x 8 = 4 Liters.

HYD. OIL

Hyd. Oil	-	SAE 68, Qty.- As per equipment capacity.

17. MAINTENANCE OF BATTERY

17.1) Maintenance of battery can be divided into two schedules

I. Weekly Schedule
II. 6^{th} months Schedule

I. Weekly Schedule

- Check the level of electrolyte in all the cells and top up distilled water if necessary.
- Check the specific gravity and voltage of 4-pilot cells.
- Check the inter cell connection for looseness and crack in container. Rectify if necessary.
- Check the tap of cells and arrange for cleaning of dust etc by wet cloth.
- In case of sulphation of terminals remove the connections, clean, put back and apply petroleum jelly.

II. 6^{th} months Schedule

In addition to the weekly schedule following are also to be attended.

- Check specific gravity and voltage of all cells.
- Remove inter cell connections, take out the cells, clean thoroughly the cells, inter cell and end cell connections and fit back in the TW. Apply petroleum jelly.
- Check vent plugs. Provide ceramic vent plug if not provided. Tighten if necessary and replace if missing.
- Check the cells by cell tester. Replace defective cells.

17.2) Hydrometer Reading and Battery Condition

Hydrometer reading Correct at 27° C	Battery Condition
1.250 ± 0.005	Fully Charged
1.170 ± 0.005	75 % Charged
1.120 ± 0.005	50 % charged
1.100 or below	must be recharged

18. MAINTENANCE OF BRAKE VALVES

18.1) A-9 Automatic Brake Valve

The A-9 automatic brake valve is a compact self- lapping, pressure maintaining brake valve which is capable of graduating the application or release of OHE car air brakes. It has five positions, namely release, minimum reduction, full service, over reduction and emergency.

Maintenance Schedule

- Check for leak tightness at inlet, outlet and exhaust port on the pipe bracket.
- Check the operating handle movement; it should be free of undue resistance.
- The pressure setting must be checked and reset, if necessary.
- Check the five position movement of the handle and the pressure in each position.
- Check the emergency position repeatedly for complete and instant operation.

Yearly schedule

- The A-9 automatic brake valve should be dismantled from the OHE car cabin and overhauled as per procedure

I.O.H

- Replace all rubber components to overhauling.

P.O.H

- Replace A9 brake valve

18.2) SA-9 Independent Brake Valve

The SA-9 independent brake valve is a compact, self-lapping pressure maintaining straight air brake valve which performs the function of graduating the application or release of the OHE CAR air brakes.

Monthly Schedule

- Check the operating handle movement; it should be smooth and without any undue resistance.
- The pressure setting must be checked and reset, if necessary.
- Check the two position movement of the handle. Check for air pressure leakage in the valve. Half yearly schedule.
- The SA-9 independent brake valve should be dismantled from the OHE CAR and overhauled as per procedure.

I.O.H

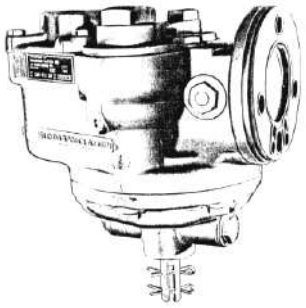
- Replace all rubber components to overhauling.

P.O.H

- Replace new SA9 brake valve

18.3) C3W Distributor Valve

The C3W distributor valve is a diaphragm operated, self-lapping valve that functions to supply and exhaust compressed air in proportion to the control air pressure in the signal port.



Maintenance Schedule

- Test the sensitivity of the relay valve functioning for the changes in control, by checking the delivery pressure for different control pressures.
- Ensure that there is no leakage in the valve.

Yearly Schedule

- The C3W distributor valve should be dismantled from the OHE CAR and clean dust from port filters.

I.O.H

- Replace all rubber components, if found damaged in addition to overhauling.

P.O.H

- Replace with new C3W valve.

18.4) D-1 Auto Drain Valve

The D-1 automatic drain valve automatically discharges condensate and moisture from a reservoir with each opening cycle of the compressor control device.

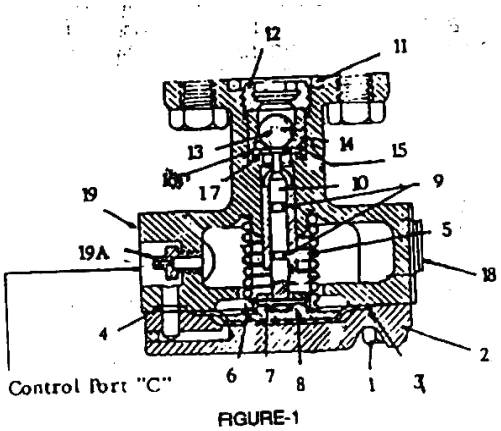


FIGURE-1

Maintenance Schedule

No separate maintenance schedule is required to check the performance of the valve. However, the valve can be actuated manually by pressing the manual over-ride feature provided on the magnet valve for compressor governing pressure switch.

Yearly Schedule

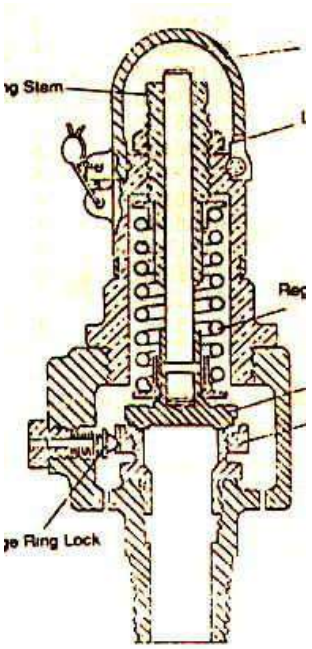
- The D-1 auto drain valve should be dismantled from the OHE CAR and overhauled as per procedure

I.O.H

- Replace all rubber components, in addition to overhauling.

P.O.H

- Replace with new D-1 Valve



18.5) J-1 Safety Valve

The J-1 safety valve, when properly installed in the main reservoir piping, functions to prevent the excessive buildup of main reservoir pressure by venting the excess pressure to atmosphere as soon as the pressure reaches the predetermined setting.

Maintenance Schedule

- Check the leakage in the safety valve.
- Check the set-up pressure and if necessary re- adjust the pressure setting.

Yearly Schedule

- The J-1 safety valve should be dismantled from the OHE CAR and overhauled as per procedure.

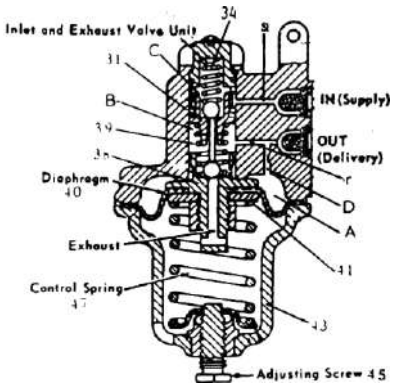
I.O.H

- Replace all rubber components, in addition to overhauling.

P.O.H

- Replace with new J-1 safety valve.

18.6) N-1 Reducing Valve



The N-1 reducing valve is a small capacity, self-lapping diaphragm operated type regulating valve and functions to reduce an air supply pressure, to that of a lower delivery pressure.

Maintenance Schedule

There is no specific maintenance procedure called to ensure the proper functioning of this valve, other ensuring whether the maximum brake cylinder pressure limited to whatever level set on the N-1 reducing valve.

Yearly Schedule

- The N-1 reducing valve should be dismantled from OHE CAR and overhauled as per procedure

I.O.H

- Replace all rubber components in addition overhauling.

P.O.H

- Replace new N-1 Reducing valve

18.7) Double Check Valve

It is a simple device with three port and very few components in the assembly. When two independent signal pressures are required to actuate the same control port of another device one a time, double check valve is used.

Monthly schedule

With the system fully charged, move the handle of SA-9 independent brake valve to minimum service position and allow the brake cylinder pressure to stabilize. Then make a full service application with the graduated hand control valve and observe that the brake cylinder pressure increase to whatever is allowed by the later. Release brakes at the graduated hand control valve fully. The brake cylinder pressure will drop down and again stabilize at the value corresponding to the pressure due to the minimum service position of the independent brake valve. Move the independent brake valve handle to release position and observe that the brake cylinder pressure reduces to zero completely.

Yearly schedule

- The double check valve should be dismantled from the OHE car and overhauled as per procedure

I.O.H

- Replace all rubber components, in addition to overhauling.

P.O.H

- Replace with new double check valve.

19. TROUBLE SHOOTING

19.1) TROUBLE SHOOTING OF ENGINE

Hard starting or failure to start

1. Out of fuel or air in fuel line.
2. Poor quality/grade of fuel.
3. Air leaks in suction lines.
4. Restricted fuel lines.
5. Broken fuel pump drive shaft.
6. Faulty EDC.
7. Cracked injector body or cup.
8. Water in fuel and/or waxing.
9. ECU calibration incorrect.
10. Long idle periods.
11. Gasket blow by or leakage.
12. Valve leakage / adjustment bad.
13. Broken or worn piston rings.
14. Engine due for overhaul.
15. Incorrect valve and injection timing.

Engine Miscellaneous

1. Poor quality fuel/grade of fuel.
2. Air leaks in suction lines.
3. Faulty EDC.
4. ECU calibration and power relay faulty.
5. Restricted fuel lines.
6. Plugged injector spray holes.
7. Cracked injector body or cup.
8. Damaged injector O-ring.
9. Water in fuel water/or waxing.
10. Injector flow incorrect
11. Long idle periods
12. Gasket blow -by or leakage
13. Valve leakage / adjustment bad
14. Broken or worn piston rings
15. Injectors valve and injection timing

Excessive black smoke at idle

1. Struck drain valve
2. Restricted fuel lines
3. Plugged injector spray holes
4. Wrong injector cups
5. Cracked injector body or cup
6. Faulty EDC control
7. Long idle periods
8. Gasket blow by or leakage
9. Broken or worn piston rings
10. Worn or scored liners or pistons
11. Broken/bent push rod or cam box

Low power or loss of power

1. Restricted air intake
2. High exhaust back pressure
3. Thin air in hot weather or high attitude
4. Air leaks between cleaner and engine
5. Malfunctioning of turbocharger
6. Poor quality fuel /grade of fuel
7. Air leaks in suction lines
8. Restricted fuel lines
9. Plugged injector spray holes
10. Faulty EDC control
11. Wrong injector cups
12. Cracked injector body or cup
13. Damaged injector O-ring
14. Fuel pump calibration incorrect
15. Injector flow incorrect
16. Faulty common rail pressure sensor
17. Dirty filters/screens/breather
18. Long idle periods
19. Engine overloaded
20. Gasket blow by or leakage
21. Valve leakage / adjustment bad
22. Broken or worn piston rings
23. Incorrect bearing clearance
24. Engine due for overhaul
25. Incorrect valve and injection timing
26. Worn or scored liners or pistons
27. Injectors need adjustment.

Low air output

1. Restricted air intake
2. Thin air in hot weather or high attitude
3. Air leaks between cleaner and engine
4. Dirty turbocharger compressor

Low oil pressure

1. External and internal oil leaks
2. Dirty oil filter
3. Clogged oil internal passages
4. Oil suction line restriction
5. Faulty oil pressure regulator
6. Faulty oil pressure sensor
7. Crankcase low or out of oil
8. Wrong grade oil for weather conditions

Coolant temperature too high

1. Crank case low or out of oil
2. Insufficient coolant
3. Improper grade of coolant
4. Engine overload
5. Faulty thermostats
6. worn water pump impellor

7. Damaged hose/loose belts
8. Damaged pipe coupling
9. Exterior leaks/air in system
10. Low cooling capacity due to chocked radiator
11. Engine exterior dirty

Oil temperature too high

1. Engine overload
2. Improper grade of oil used
3. Crank case low or out of oil
4. Oil level too high
5. Insufficient coolant/worn pump
6. Faulty thermostats
7. Damaged hose/loose belts
8. Clogged oil cooler or water passages
9. Exterior leaks/air in system
10. Low cooling capacity due to chocked radiator

Engine exterior dirty

19.2) TROUBLE SHOOTING OF TRANSMISSION : (Model: CRT 5633 MAKE: AVTEC)

S. No	CAUSE	REMEDY
A. LOW CONVERTER OUT PRESSURE		
1	Low oil level	Add oil to proper level
2	Oil line leakage	Check for leaks
3	Clogged magnetic oil strainer/oil filters	Clean magnetic oil strainer/replace oil filters
4	Defective oil pump	Rebuild oil pump assembly
5	Aerated oil	Air leaks in suction passages, bad grade of oil used.
B. HIGH OIL TEMPERATURE		
1	Low Or High Oil Level	Restore oil to proper level, bad grade/quality of oil.
2	Low Coolant Level	Add coolant. Check for leaks
3	Low Convertor out pressure	Refer "A"
4	TC cooler line kinked or clogged	Clean or replace cooler lines
5	Operating speed too high	Downshift to lower range
6	Torque convertor starter locked	Check converter components
7	Engine overloaded /overheating	Refer engine manual
C. HIGH STALL SPEED(engine rpm rises but vehicle movement is slow)		
1	Oil level low	Add oil to proper level
2	Low conv. Out pressure	Refer to "A"
3	High oil temperature	Refer to "B"
4	Clutch slipping	Overhaul transmission
D. LOW STALL SPEED(engine rpm not rising and vehicle speed is slow)		
1	Low engine output	Refer engine manual
2	Broken convertor parts	Overhaul transmission
3	Stator reversed	Overhaul transmission

S.No	CAUSE	REMEDY
V. LOSS OF TORQUE AT TRANSMISSION OUTPUT		
1	Stator reversed	Overhaul transmission
2	Low conv. Out pressure	Refer to "A"
3	Low engine power	Refer to "D"
4	Clutch slippage	Refer to "G"
5	Linkage not adjusted	Adjust pneumatic cyl. linkage
VI. NO POWER AT TRANSMISSION OUTPUT		
1	Linkage Not Adjusted	Adjust pneumatic cyl. linkage
2	Low Clutch Pressure	Refer to "G"
3	Mechanical Failure	Overhaul transmission
VII. LOW CLUTCH PRESSURE		
1	Low oil level/bad grade of oil	Add oil to proper level/ use proper grade of oil
2	Aerated oil	Refer to "A-5"
3	Oil leakage	Check for leakage
4	Main pressure regulator valvedefective	Overhaul valve assembly
5	Defective oil pump assy.	Rebuild oil pump assembly
6	Linkage not adjusted	Adjust pneumatic cyl. linkage
VIII. NO POWER TRANSMITTED IN ONE GEAR RANGE		
1	Range clutch failed	Overhaul transmission
IX. HIGH CONVERTOR OUT PRESSURE		
1	Restricted TC cooler & pipe line	Check TC cooler & pipe line for blockage
2	Lubrication regulator valve sticking	Inspect valve components correctfault
X. VEHICLE OPERATES IN LOW RANGE FORWARD OR REVERSEBUT STALLS IN OTHER RANGES		
1.	Failed low range clutch	Overhaul transmission
XI. VEHICLE OPERATED IN INTERMEDIATE RANGE FORWARD ORREVERSE BUT STALLS IN OTHER RANGES.		
1.	Failed int. range clutch	Overhaul transmission
XIL.VEHICLE OPERATES IN HIGH RANGE FORWARD OR REVERSEBUT STALLS IN OTHER RANGES		
1.	Failed high range clutch	Overhaul transmission
XIV. VEHICLE OPERATES IN FORWARD BUT STALLS IN REVERSE		
1.	Failed forward clutch	Overhaul transmission
XV. VEHICLE OPERATES IN REVERSE BUT STALLS IN FORWARD		
1	Failed reverse clutch	Overhaul transmission

19.3) TROUBLE SHOOTING OF THE ELECTRICAL SYSTEMS

Trouble Shooting of the Starter Motor

Failure of the engine to start may be attributed (treated) not only to the faulty starter motor but also to other system faults such as battery, switches, ECU's ,EDC controller wiring connections, ignition systems or fuel supply etc. Make sure that the trouble does not lie elsewhere before attempting to test the starter motor.

The following are some useful hints for dealing with trouble limited to starter motor, such as

Defect 1: When starter motor is operated its shaft fails to rotate or rotates slowlyand the starter motor does not crank the engine through pinion has engaged with ring gear.	
Cause	**Action - Remedy**
a) Discharge/defective battery.	Recharge battery/substitute a fully charged battery.
b) Defective/loose connections.	Tighten all connections.
c) Dirty, oily or badly burnt commutator	Remove the starter for further inspection.
d) Starter terminal or brush box havinga n earth fault.	- do -
e) Defective, solenoid switch.	- do -
f) Defective armature field coils.	- do -
Defect 2: Armature rotates but pinion fails to engage.	
Cause	**Action - Remedy**
a) Improper pinion engagement	Clean it.
b) Burr formation on pinion or ring gear	De burr it by filling
c) Defective auxiliary coil.	Change auxiliary coil.
d) Loose mounting.	Tighten mounting/units
e) Worn commutator end/drive end bush	Change the bush
f) Commutator bearing pin loose.	Check the tightness of bearing pinfixing screw.
Defect 3: Starter motor continuous running after release of ENGINE START switch.	
Cause	**Action - Remedy**
a) Sticky starting switch.	Open starter motor isolating knife switch immediately and repair/replace switch.
b) Short in wiring harness	Replace faulty wiring.
c) Dry-drive end bush	Trace cause and lubricate
d) Sticky solenoid switch contacts.	Remove the starter for solenoid inspection.
e) Bush in pinion seized on shaft.	Remove the starter for inspection.
f) Pinion/ring gear fouled or damage.	Clean thoroughly, de burring of pinion and ring gear by filling.

Defect 4: Pinion engage but starter motor does not crank the engine (whining noiseis heard)	
Cause	**Action - Remedy**
a) In sufficiently charged battery/corroded terminals.	Recharge the battery/clean terminal and smear petroleum jelly.
b) In sufficient pressure on carbonbrushes or worn out brushes.	Change the brush springs/brushes.
c) Shorted/earthling armature	Change armature
d) Slipping clutch assembly	Change clutch assembly.
e) Partially earthling field coil.	Change starter motor
f) Solenoid contact bad.	Re-set solenoid and replace spring.
Defect 5: Engine is not cranking	
Cause	**Action - Remedy**
a) Weakened battery	Check the voltage of the battery charge it ifrequired.
b) Emergency stop switch is ON	Ensure all emergency stop switches are in OFF position
c) Malfunctioning of ENGINE STARTswitch	Check and replace if necessary.
d) Faulty fuel solenoid	Check and replace if necessary.
e) Faulty magnetic switch	Check and replace if necessary.
f) Faulty starting motor solenoid	Check and replace if necessary.
g) Faulty starter motor	Check and replace if necessary.
h) Faulty engine starting relay	Check and replace if necessary.
Defect 6: Engine Does Not Stop	
Cause	**Action - Remedy**
a) Faulty ENGINE/START-STOP key	Check and replace if necessary.
b) Faulty emergency stop switch	Check and replace if necessary.
Defect 7: Even Though Lub Oil Pressure Is More, Engine Does NotSustain (Stops After Releasing The Start Push Button)	
Cause	**Action - Remedy**
a) Faulty low water level switch	Check and replace if necessary.
b) Faulty low water level relay	Check and replace if necessary
c) Faulty over speed switch	Check and replace if necessary.
d) Faulty lub oil pressure relay	Check and replace if necessary
e) Faulty low hydraulic oil level	Check and replace if necessary.
f) Faulty HLR relay	Check and replace if necessary
Defect 8: Engine Throttles In High Range But Car Does Not Move(Transmission Do Not Engage)	

Probable Cause	Remedy
a) Defective pneumatic solenoid valve & control linkages of cylinders	Check and replace.
b) Defective/sticky clutch cut off valve	Check and replace
Defect 9: Brake Applied Indication Does Not Extinguish EvenAfter All The Brakes Are Released.	
Probable Cause	**Remedy**
a) Defective service brake pressure switch	Check and replace
b) Defective parking brake pressure switch	Check and replace
c) Disturbed pressure settings in pressure switch	Check settings. and verify for Proper
Defect 10: Engine Throttle Does Not Take Place Even After The Throttle Handle Is Moved	
Probable Cause	**Remedy**
a) Defective relay	Check and replace
b) Defective timer relay	Check and replace
c) Defective solenoid	Check and replace
Defect 11: Car Does Not Move When Selected "Low" In The "Range Selector" Even After Direction Engaged Indication IsConfirmed	
Probable Cause	**Remedy**
a) Defective relay	Check and replace
b) Defective timer relay	Check and replace
c) Defective gear solenoid	Check and replace
d) Defective clutch cut off valve	Check and replace
Defect 12: Cabin Does Not Charge	
Probable Cause	**Remedy**
a) Defective cabin selector switch	Check and replace
b) Defective relay	Check and replace.
c) Defective drivers key switch	Check and replace
Defect 13: Head Light Does Not Glow	
Probable Cause	**Remedy**
a) Defective head light switch	Check and replace
b) Defective diode stack unit	Check and replace diode in that particularfault line.
c) Defective relay contact	Check and replace relay/and on block.