ANDHRA PRADESH STATE ROAD TRANSPORT CORPORATION

Mechanical Engineering Department

Office of the VC& MD, Bus Bhavan, Hyderabad – 624

No : OP3/462(3)/Volvo/2009-MED

CIRCULAR NO. 15/2009 – MED Dt.06.07.2009

Sub: **VEHICLES** – Maintenance of VOLVO buses– Issuing of comprehensive guidelines and Instructions – Reg.

Ref:
1. Circular No. 11/2003 – MED Dt 08.04.2003.
2. This Office Lr. No. OP3/462(12)/05-MED Dt. 11.04.2005.
3. Circular No. 17/2005 – MED Dt. 24.12.2005.
4. This Office Lr. No. Even Dt. 02.11.2006 & 20.11.06 of CME (O).
5. Circular No. 13/2007 – MED Dt. 12.05.2007.
6. Circular No. 19/2008 – MED Dt. 05.09.2008.

1. INTRODUCTION:

Corporation has introduced Volvo B7R A/C buses in April 2003 as "Garuda" services, to meet the demand of high-end customers and inducted more number of Volvo buses in view of the good response and demand from the customers. At present 106 Volvo buses of Mark-1, Mark-2 and Mark-3 are in operation both on interstate & intrastate routes Spreading in 14 depots.

As the vehicles are having different features from the existing vehicles, adequate no.of drivers were trained by M/s VIPL at their Bengaluru training centre, so that only trained and qualified drivers are allowed to handle the vehicle. The technicians & Supervisors were also trained by M/s VIPL for carrying out the Preventive maintenance activities at Depot level itself.

Besides this, to impart on the job training to our technicians and also to make the depots self reliant in handling the vehicles without relying much on authorised service dealer, a Service Support agreement was also entered into with M/s VIPL for a period of six months. This Support was mainly confined to major centres like Hyd, VJA, VSP & TPT and other depots were attached to these sites. This arrangement has helped to a great extent to improve the confidence levels of technicians at depots.

In spite of taking all the precautions before inducting such high end vehicle into our fleet, the operational efficiency of these vehicle is far from satisfactory and complaints of unreliable operation are pouring in besides making these vehicles non available for operation for longer periods.

During the year 2008-09 about 2987 vehicle days were lost due to off road, thus resulting only in 92% fleet utilisation at corporate level. This is equivalent to keeping the vehicle off road for a period of one month on an average in a year. Scant attention is given at some of the depots to put these vehicles roadworthy, which is evident from the fleet utilisation ranging from 80% to 100%. Further the BD rate of these high end vehicles is also not upto the satisfactory level.

The analysis on expenditure incurred on these 106 vehicles shows that it is on high side and during the year 2008-09 it has gone up by almost 86 paise when compared to previous year.

All the above indicate, that the instructions issued by corporate office for maintenance of these vehicles is being neglected at various levels. It is noticed that, the vehicles are not given adequate time for attending to various basic attentions, resulting in increased risk of failure & heavy expenditure due to consequential damages.

Considering all the above, the following comprehensive instructions are once again issued for strict implementation.

2. MAINTENANCE OF THE VEHICLES:

WASHING & SWEEPING OF BUSES: since these vehicles are intended for elite customers, utmost care shall be taken to keep the vehicle in trim condition without giving scope for complaints. The following instructions may be followed for upkeep of Volvo vehicles:

i) The flooring of the vehicle shall be swept daily using hand brush (not broomstick) & cleaned with Vacuum cleaner once in a week. Before sweeping, the carpet provided in the gangway and on the steps shall be removed and dusted, so as to avoid any dust inside the vehicle.

ii) Chemical washing of seats and Interior with fabric lining shall be undertaken during every basic service (roughly monthly once). Instructions were already issued through letter no. OP2/462(upkeep)/08-09-MED dated 15.07.08 for identifying the agency for such works and meeting the necessary expenditure with delegation of powers.

iii) Vehicles shall not be washed with "Car washer" and exclusive men shall be provided with movable trolley for wiping the body & glasses with wet cloth/sponge. While cleaning, the liquid soaps alkaline in nature shall not be used since it affects the paint coating, which may fade in due course. The wind screen glass and side glasses shall be cleaned after wash with dry cloth to avoid strains on the glasses. Already instructions were issued through circular no. PD-15/2008, Dt. 25.02.2008 for providing extra men for washing & sweeping of Garuda buses, which may be followed while engaging the men through tender.

iv) The head rest covers also shall be cleaned on daily basis with wet cloth and when ever cracks on the cover are observed on the foam Rexine covers, they shall be replaced immediately. The cracked head rest cover gives feeling of irritation to the commuter.

v) The side curtains shall be replaced with spare curtains during every basic service.

PREVENTIVE MAINTENANCE SCHEDULES:

As in the case of other vehicles, the Volvo vehicles shall be undertaken for preventive maintenance on Daily (Schedule-I), weekly (Schedule-II), basic service at every 25000KMs for Mark-1&2 and 30000 KMs for Mark-3(Schedule-III) and Annual service at every 1,00,000 KMs for Mark-1&2 and 1,20,000 KMs for Mark-3(Schedule-IV).

The preventive maintenance due statement generated through VEMAS shall also reflect the programme of VOLVO vehicles, which include Schedule-II, Schedule-III, Schedule-IV, Filter changes, Oil changes, Coolant changes, Air filter changes etc., depending on the periodicity prescribed. The backlog on maintenance shall be reviewed at various levels and corrective action shall be taken.

DAILY (Schedule-I) MAINTENANCE: Besides washing and sweeping, the Daily maintenance include checking of Oils, Coolant, Tyre inflation & replenishment if necessary, Belt tension, functioning of wiper, fuses, all lights, vision mirror, retarder dash board warning lamp and attending running repairs & log sheet complaints. The details of inspection to be carried during Schedule-I are given at **Annexure-A.**

WEEKLY (Schedule-II) MAINTENANCE: The weekly maintenance includes daily maintenance and activities like Battery maintenance, Lubrication, Inspection of silencer bedding, under chassis, Tightness check of Shack absorber mounting, Fuel Tank mounting bolts etc. Draining of water from water separator, tapping of cyclone filter, cleaning of radiator and Inter cooler and Air filter etc. The details of inspection to be carried during Schedule-II are given at **Annexure-B**.

BASIC SERVICE(Schedule-III): The basic service will be carried out at every 25000 KMs in case of Mark-1&2 vehicles and 30000 KMs for Mark-3 vehicles. The vehicle shall be stopped invariably for full day for attention of Basic Service. The date of carrying out Basic service should be intimated in advance to the concerned, for alternate arrangement of operation of service. The reservation of the service on the day of basic service attention may be stopped in order to avoid constraint to supply the vehicle for operation.

The basic service includes daily, weekly service and activities like Engine oil change, Engine oil filter change, HSD oil filter change and checking of the plays and adjustment of Fan Hub bearing, Clutch etc. The details of basic service check list during Schedule-III for Mechanic and other Artisan are given at **Annexure-C**.

ANNUAL SERVICE (Schedule-IV): Every 4th Basic service i.e., 1.00 lakh Kms for Mark-1&2 and 1.20 lakh Kms for Mark-3 is called as Annual service. The vehicle should be stopped invariably for attention of Annual Service for 1 or 2 days basing on the requirement. The Annual service includes daily, weekly, Basic service and activities like FIP timing, Injector pressure, Tappet clearance, Radiator & inter cooler servicing, Wheel alignment, Torque tightening etc. The details of basic service check list during Schedule-IV for Mechanic and other Artisan are given at **Annexure-D**.

Preferably, the vehicles shall be fixed to the mechanics for carrying out Schedule-I, II, III, IV. So that the preventive maintenance is carried effectively.

3. TOOLS AND T&P REQUIREMENT:

TOOLS: The list of Basic tools and Special tools required for maintenance was already communicated as Annexure-C and Annexure-B through Volvo Service Support Agreement. Instructions were also issued for procurement of the same and use invariable to carryout preventive maintenance. If any of the depots are not having the regular special tools and other tools action shall be taken immediately for procurement of the same. The list of the same special tools & other tools are once again enclosed at **Annexure -E** for convenience of the field people.

Further, it is observed that the special tools for removal and fitment of tubeless tyres are not available at some of the Volvo operating depots. Hence the Depot Managers are advised to procure the tool kit and Tiger grease required to assemble tubeless tyre from the authorised supplier whose address is given below:

M/s Sarveshwari Technologies Limited
355, Deepali, Pitampura,
New Delhi, 110 034.
Phone no. 011-27023750, Fax: 011- 27011629
Website: www.sarveshwari.com, www.garageequipment.com

4. STOCKING OF VOLVO SPARES:

The list of essential spares to be stocked at depots for Volvo Mark-1, Mark-2 and Mark-3 (9400) are given at **Annexure-F**. Unless the stocks are available at the depots, it is not possible to carry out preventive maintenance. Further extending the life of spare beyond its life, may result in consequential damage and increases expenditure in future.

All the Depot Managers are advised to keep sufficient stocks based on the number of Volvo buses. The Dy. CMEs shall workout the requirement of these spares and to be discussed during LFC (Limit Fixation Committee). All the COSs are advised to keep the required stock of Volvo spares as per the LFC decisions.

5. FLOAT AGGREGATES:

Though the life of the aggregates is considerably high when compared to other vehicles, there is a need to provide float aggregates & major spares to minimise the vehicle off road days. Previously sanctions were given for provision of float assembly in respect of FIP's, Injectors, Self Starter, Alternator, Radiator assembly etc. it is proposed to provide one set of minor float aggregates like FIP's, Injectors, Self Starter, Alternator, Radiator assembly, Turbocharger etc., for a fleet of upto 10 Volvo vehicles, two sets for a fleet of 10-20 Volvo vehicles and three sets for a fleet of above 20 vehicles.

However, in case of Engine & Gearbox, we can provide one float Engine & Gear box at Uppal workshop and another set at Vijayawada workshop, which can be utilised by the depots in emergency.

The above float aggregates for Mark-I & II can be developed from the vehicles that are going to be stabled for scrap after taking into consideration of present float and there is no need to purchase separately. Only for Mark-3 vehicles, there is a need to provide Injector sets as float, UPL and VJA procure from M/s Volvo. Separate sanction may be taken for the same.

The Works Managers are advised to gear up for overhauling of Engines at the workshop itself, duly making necessary arrangement for procurement of tools required and imparting training to the mechanics. Under no circumstance the loose spares from the float aggregate shall be given to the depots.

Further, the FIPs & Injectors can be directly get overhauled at BOSCH authorised service centre (M/s Secunderabad Engineering Corporation) instead of sending the same to M/s Sree Harsha.

6. MID TERM ATTENTION:

During the brainstorming session conducted at corporate office on Volvo vehicles, majority of officers and supervisors have opined that, there is a need to refurbish the vehicle at around 7.00 lakh KMs, so as to get an extended life from the same.

In this connection it is proposed to undertake a 'mid term attention' at around 7.00 lakh KMs, wherein the engine top overhaul and body refurbishing is undertaken after physically inspecting the engine for 'compression' test and body for its condition in respect of upholstery, panels, structure, painting etc.

The Dy. CME of the region shall organise this exercise and give recommendations for the works to be undertaken during midterm attention.

7. SCRAPPING POLICY:

Corporation has taken a decision for replacement of Volvo vehicles at a mileage of 10.00 lakh KMs basing on the economics of operation. However, the scrapping of the vehicle is purely on the condition of the vehicle and ongoing expenditure to be incurred for continuation of operation of vehicle.

In this connection, instructions were issued vide letter no. R&D/Misc(60)/06 dated 13.03.08 for inspection of the vehicle after crossing 10.00 lakh KMs by the committee consisting of Dy.CME & Dy. CTM of the region for the recommendation on either for scrapping or for continuation of the vehicle operating on short distance routes duly incurring minimum expenditure. For the convenience of the committee, a proforma is designed and communicated vide letter no. *Volvo/ Scrapreport/08-MED, dt.05.09.2008* which can be utilized for inspection of the vehicle and giving recommendations.

While submitting the proposal, the committee shall also recommend the vehicle to be kept in auction in ' as is where is condition ' i.e., in running condition, or duly fitting the scrap aggregates, so as to facilitate in obtaining the approval of competent authority.

Further, for the convenience of the 'Upset value committee; the weights of individual aggregates & components of the vehicles were communicated vide letter no. Volvo/Upsetvalue/08-MED dated 03.10.08, which can be taken into consideration for arriving at the 'Upset Value' of the vehicles kept in auction.

8. PERFORMANCE REVIEW:

One of the reasons for large variation in the performance of the vehicles is due to lack of review and inspection at various levels. The instructions were already issued for submission of the operational data of these vehicles in three parts, vide letter no. OP3/462(13)/04-MED Dt. 25.09.07 and it can be utilised for compilation at Regional, Zonal & Corporate level and may be reviewed regularly.

The Regional Managers have to bestow their personal attention for reviewing the performance during the Depot Managers meeting and shall also organise for inspection of the vehicles at bus stations and depot at random for the upkeep and condition of the vehicles.

The Dy. CMEs shall cover the inspection of these vehicles during their depot visit and special note shall be given in the inspection report. They shall also ensure implementation of the Preventive maintenance checklist communicated for the improved health of the vehicle and reduced expenditure.

The Depot Managers are advised to ensure the implementation of the above instructions in the true spirit and enhance the image of these vehicles among the commuters.

VICE CHAIRMAN & MANAGING DIRECTOR

Encl : As above

To
All Depot Managers.

Copy to: Dir (Vig. & security), ED (E&IT), ED (O&MIS),ED (A&P), FA, CAO & OSD & Secretary to Corporation for information
Copy to: All ED (Zones) for information.
Copy to: CCOS, CME (O), CME(C&B), CM(R&T), CFM, CAO, CA for information
Copy to: CE(IT) with an advice to incorporate the above maintenance schedules in the VEMAS module.
Copy to: All Regional Managers for necessary action.
Copy to: All Dy.CMEs/WMs/COSs for necessary action
Copy to: All Dy.CAOs & AOs for information.
Copy to: Dy.CME(C&B), Dy,CME(IEU), Dy.CME(P) for information.
Copy to: Principal, TA/HPT, & all ZSTCs.
Copy to: Manual section, H.O.
Copy to: All Maintenance in-charges for necessary action.

SCHEDULE-I : Daily Work list

MECHANIC:

1. Check all Oil/Coolant levels - Top-up if required,
2. Check for Oil/Fuel/Coolant leakages arrest if required.
3. Check Accelerator Cable Ball Joints for play and Cable for alignment with Outer.
4. Check for EPG (Exhaust Pressure Governor) function i.e., for proper connection and function of Solenoid switch.
5. Check Engine rubber mountings for damage and replace if damaged
6. Check Air filter indicator, clean if required. The cleaning should be done by rolling the filter on plane surface. **Do not** use **pressurised air**, which may damage/ puncture the filter.
7. Tap cyclone filter to remove dust.
8. Check Hose pipe and clamping from Air filter to inlet, attend if required
9. Check noise in Fan hub bearing and Idler pulley, change if required.
10. Check all belts for wear and damages, replace if required.
11. Check belt tensioner for proper function
12. Check AC Return Air Filter – Clean if dust is collected
13. Check AC Drive belts for proper tension and wear & tear
14. Check AC Condenser coil for clogging & obstructions
15. Check the AC refrigerant fittings and the compressor for any oil and dirt, which indicates leakage, attend if required.
16. Check all nuts and bolts of Under chassis for proper tightness
17. Check air leakages from pressure line, Air drier regulator etc.
18. Check for Oil traces/Water from air tank.
19. Check Reaction rod , bolts of Differential unit for tightness.
20. Check Air bellow for proper function and arrest leakages if any.
21. Check condition of Air bellow levelling valve ball joint seating.
22. Check Gear lever ball joints for play, attend if required
23. Check Tyre inflation in all tyres including spare and correct if required. (for **Mark-1** i.e., 11.00 R 20 tyres: Front- 110 PSI / 7.70 Kg/Cm^2, Rear-105 PSI / 7.35 Kg/Cm^2 and for Mark-2 &3 i.e., 295/80 R 22.5 Tubeless tyres: Front- 115 PSI/ 8.10 Kg/ Cm^2, Rear-120PSI/ 8.45 Kg/ Cm^2)
24. Check for tyre NSD and uneven wear.
25. Check the AC hoses for wear and improper routing , correct if required.
26. Check for proper function of Speedometer, which has direct effect on retarder function.
27. Check for proper function of all gauges in dash board, attend if necessary.
28. Attend log sheet complaints/Driver reports.
29. Any other work as entrusted by superiors.

ELECTRICIAN:

1. Check all lights, replace if required, check fuses, replace if required.
2. Check Warning lamps function with buzzer, replace if required
3. Check Alternator charging, the out voltage should be 28 Volts.
4. Check Battery Electrolyte leak, keep the batteries clean and keep the batteries intact.
5. Check for retarder function and observe for Retarder fault code, attend if required.
6. Check for loose contacts in Electrical Connectors of AC system, correct if required.
7. Check for AC Condenser & Evaporator Fan Operation.
8. Check for Cooling Efficiency (22^o C).
9. Attend log sheet complaints/Driver reports.
10. Any other work as entrusted by superiors

COACH BUILDER:

1. Check for proper functioning of Passenger & Driver doors
2. Check for proper functioning of Rear view mirrors
3. Check for Driver seat adjustment
4. Check for proper functioning of Luggage compartment doors
5. Check for proper functioning of Passenger seats, inclination mechanism
6. Attend log sheet complaints/Driver reports.
7. Any other work as entrusted by superiors.

ANNEXURE-B

SCHEDULE-II : Weekly Work list

All items of Daily work list and the following items to be attended.

MECHANIC:

1. Lubricate all greasing points (**17** points for **Mark-1** i.e., 4-Slack Adjusters, 4- 'S' cam bushes, 2- PP shaft UJ cross & Yoke, 2- King Pin bottom, 4- King pin Top, 1-Steering Damper and **1** point (Steering Damper)for **Mark-2 &3**).
2. Check proper functioning of Coolant level sensor. Takeout the Coolant level sensor from the reservoir and check for buzzer sound & warning glow indication in dash board.
3. Check for Brake liner life and stroke (for Mark-I Adjust if required.).
4. Clean Radiator and Intercooler by external flushing. Use pre regulated jet for avoiding damage of fins. Caution: precaution must be taken to avoid damage of fins while performing cleaning of Radiator and Intercooler.
5. Check for Silencer mounting pads for damage, replace if required.
6. Clean Air Filter. To clean Air filter just roll on level surface. Do not use compressed air for cleaning, which may damage/ puncture the Air filter.
7. Check for proper tightness of Fuel tank mounting bolts, proper padding and Strap fitment.
8. Check for Shock absorber mounting for proper tightness and function of Shock absorbers.
9. Check for Clutch fluid level, function of Master cylinder (i.e., free movement) Check & attend if required
10. Check for Clutch Play, i.e., Basic setting for Mark-1 is 95-105 mm, for Mark-2 & 3 is 165 to 195. the Stroke length should be 27 to 30 mm for all three Models.
11. Check for Rear and Front Wheel Hub Bearing noise.
12. Check for Rear and Front Wheel Hub and Disc spline play for Mark-2 and 3
13. Check for AC Compressor Oil Level after 15 minutes of operation.
14. Check for tightness AC Compressor mounting bolts.
15. Check for damage of AC Compressor Rubber mounting, replace if required.
16. Check for AC Refrigerant Pressure / Level.
17. Drain Condensate Water from AC system.
18. Attend log sheet complaints/Driver reports.
19. Any other work as entrusted by superiors

ELECTRICIAN:

1. Check for Battery Electrolyte level & replenish as per requirement.
2. Check for Battery specific Gravity, and application of Jelly on terminals.
3. Check for proper functioning of AC Fuses in Relay Panel.
4. Check for proper function of AC Main Fuse 150 / 200 Amps
5. Attend log sheet complaints/Driver reports.
6. Any other work as entrusted by superiors

TYRE MECHANIC:

1. Check for tyre inflation and correct.
2. Check for tyre NSD and uneven wear.
3. Attend log sheet complaints/Driver reports.
4. Any other work as entrusted by superiors

ANNEXURE-C

SCHEDULE-III : Basic Service Work list

(At Every 25,000 Kms for Mark-1 & 2 and At Every 30,000 Kms for Mark-3 vehicles)

MECHANIC:

1. Chassis lubrication
2. Check coolant for contamination and coolant level.
3. Check drive belts for damage.
4. Check of Radiator fan, bearing play, fan shroud and fan ring with rubber seal.
5. Check of Radiator rubber mountings for wear & tear.
6. Check for Intercooler inspection for leakages.
7. Change engine oil & filter and check for any foreign particle in decanted oil.
8. Check Belt tensioner condition for noise and free movement.
9. Check for exhaust leakage and arrest if required.
10. Check for EPG (Exhaust Pressure Governor) function i.e., for proper connection and function of Solenoid switch.
11. Check for proper mounting of alternators.
12. Check engine rubber mountings for damage and replace if required.
13. Check Engine idling speed and adjust if required.
14. Check Intake manifold and hoses for leakage and for proper routing, attend if required.
15. Check Turbocharger rotor free rotation i.e., shaft play and for oil leakage, attend if required.
16. Check fuel pipes for proper routing and leakage, attend if required.
17. Check for proper fuel tank mounting, inter connecting hoses, venting and mounting, attend if required.
18. Replace water separator if due, otherwise check water separator for fuel system, drain condensation.
19. Check Fuel filter protection plate for proper mounting.
20. Clean Fuel tank Strainer.
21. Check function of Pneumatic fuel stop Cylinder.
22. Check Anti-roll bar Bushes for wear & tear.
23. Check V-stay rod Bushes for wear & tear.
24. Check wear & tear of Reaction rod bushes.
25. Check tightening torque of 650 Nm for 'U' bolts(Rear Axle) and 'I' bolts (Front Axle).
26. Check for gear shifting movement, attend if required.
27. Check gear shift linkage and clutch pedal for play, attend if required.
28. Check bearing clearance in pinion and rear axle input shaft. Leakage would be indication of damage of oil seal and shaft play.
29. Replace gear oil if due, check oil leakage from gearbox, tightness bolts.
30. Check propeller shaft, universal joints, sliding joints for play and attend if required.
31. Check Rear axle round bolts for tightness.
32. Clean Rear axle breather.
33. Check of seals for speedometer sensor and joint coupling.
34. Check oil level in rear axle.
35. Check slack in mechanical linkage for clutch.
36. Check oil level in Gearbox.
37. Clean gearbox breather.
38. Checking fluid level in the clutch fluid reservoir.
39. Check of AC compressor for proper function.
40. Check fluid levels in windscreen fluid reservoirs.
41. Check function of wipers, attend if required.
42. Check air drier (condensation), replace filter insert if due.
43. Check brake disks and brake callipers for Mar-2 & 3, attend if necessary.
44. Check function of Parking brake and Blocking valve.
45. Check Brake chamber mounting and proper function.
46. Check life of brake liner for Mark-1/Brake pads for Mark-2 & 3 and replace if required.
47. Check compressed air lines and hoses for proper routing and for air leakage, attend if required.
48. Check Retarder oil leakage and check coolant hose condition.
49. Check oil level in retarder
50. Check function of service brakes
51. Check Slack adjuster function. Adjust brake for Mark-1 vehicles.
52. Check air drier

53. Check steering link system for play and attend if required.
54. Check for tightness on power steering pump mounting, for oil leakages and contamination of oil, attend if necessary.
55. Check oil level for power steering
56. Check for King pin play and Front hub play, attend if required.
57. Check condition of air bellows, level sensors (mark-3) and level valves of air suspension, attend if required.
58. Check rear wheels hubs for noise and play, attend if required.
59. Check tightness of Front and Rear Hubs.
60. Check Rear & Front Wheel Hub Disc spline play and attend if required.
61. Check for un even wear of tyre and attend accordingly.
62. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
63. Any other work as entrusted by superiors

ELECTRICIAN:

1. Check for proper function of speedometer, instruments panel.
2. Check loose contacts in Electrical Connectors.
3. Check fault codes in the vehicle control units and attend if required.
4. Check batteries for– dust, leakage, acid density, liquid level, connections and battery box condition, attend if required.
5. Check for proper function of driver's controls and attend if required.
6. Check all Electrical connections and cables of alternators, starter motor for proper routing.
7. Check for proper functioning of retarder controls, PP (Proportionate) Valve connection routing and keep it dust free.
8. Check for proper functioning of warning symbols, control lamps and buzzer.
9. Function check of all lamps.
10. Start of engine and check of starter functioning.
11. Check alternator for voltage output of 28 Volts, attend if required.
12. Check AC Condenser & Evaporator Fan for proper Operation.
13. Check AC system Cooling Efficiency (22^{o} C)
14. Check all AC Fuses in Relay Panel for proper function.
15. Check AC Main Fuse 150 / 200 Amps for proper function.
16. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
17. Any other work as entrusted by superiors

COACH BUILDER:

1. Check proper function of rear-view mirrors and attend if required.
2. Check for proper functioning of Door opening and closing.
3. Check for Luggage compartment doors and locks for proper functioning.
4. Check for Sun roofs
5. Check for proper fitment of body side panels and waist rail.
6. Check for proper fitment of Windscreen glass and windows glasses, attend if required.
7. Check Driver's seat condition and seat adjustment, attend if required.
8. Check for availability of Hammer to break the emergency glass if necessary.
9. Check Floor , floor hatches for proper condition and rectify if required.
10. Check all Passenger seat condition and attend if required.
11. Check proper functioning of Roof hatches and attend if required.
12. Check all Seats for proper Inclination mechanism and attend if required..
13. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
14. Any other work as entrusted by superiors

TYRE MECHANIC:

1. Check for tyre inflation and correct.
2. Check for tyre NSD and uneven wear.
3. Attend tyre rotation and also disc rotation if required.
4. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
5. Any other work as entrusted by superiors

SCHEDULE-IV : Annual Service Work list

(At Every 1,00,000 Kms for Mark-1 & 2 and At Every 1,20,000 Kms for Mark-3 vehicles)

MECHANIC:

1. Chassis lubrication
2. Check coolant for contamination and coolant level.
3. Check drive belts for damage.
4. Check of Radiator fan, bearing play, fan shroud and fan ring with rubber seal.
5. Check of Radiator rubber mountings for wear & tear.
6. Check for Intercooler inspection for leakages.
7. Change engine oil & filter and check for any foreign particle in decanted oil.
8. Check Belt tensioner condition for noise and free movement.
9. Check for exhaust leakage and arrest if required.
10. Check for EPG (Exhaust Pressure Governor) function i.e., for proper connection and function of Solenoid switch.
11. Check for proper mounting of alternators.
12. Check engine rubber mountings for damage and replace if required.
13. Check Engine idling speed and adjust if required.
14. Check Intake manifold and hoses for leakage and for proper routing, attend if required.
15. Check Turbocharger rotor free rotation i.e., shaft play and for oil leakage, attend if required.
16. Check Tappet clearance and adjust accordingly.
17. Injector Pressure testing to be done.
18. Check fuel pipes for proper routing and leakage, attend if required.
19. Check for proper fuel tank mounting, inter connecting hoses, venting and mounting, attend if required.
20. Replace water separator if due, otherwise check water separator for fuel system, drain condensation.
21. Check Fuel filter protection plate for proper mounting.
22. Clean Fuel tank Strainer.
23. Check function of Pneumatic fuel stop Cylinder.
24. Check Anti-roll bar Bushes for wear & tear.
25. Check V-stay rod Bushes for wear & tear.
26. Check wear & tear of Reaction rod bushes.
27. Check tightening torque of 650 Nm for 'U' bolts(Rear Axle) and 'I' bolts (Front Axle).
28. Check for gear shifting movement, attend if required.
29. Check gear shift linkage and clutch pedal for play, attend if required.
30. Check bearing clearance in pinion and rear axle input shaft. Leakage would be indication of damage of oil seal and shaft play.
31. Replace gear oil if due, check oil leakage from gearbox, tightness bolts.
32. Check propeller shaft, universal joints, sliding joints for play and attend if required.
33. Check Rear axle round bolts for tightness.
34. Clean Rear axle breather.
35. Check of seals for speedometer sensor and joint coupling.
36. Check oil level in rear axle.
37. Check slack in mechanical linkage for clutch.
38. Check oil level in Gearbox.
39. Clean gearbox breather.
40. Replace Inertia mass Bearing for Mark-2 vehicles
41. Checking fluid level in the clutch fluid reservoir.
42. Check of AC compressor for proper function.
43. Check fluid levels in windscreen fluid reservoirs.
44. Check function of wipers, attend if required.
45. Check air drier (condensation), replace filter insert if due.
46. Check brake disks and brake callipers for Mar-2 & 3, attend if necessary.
47. Check function of Parking brake and Blocking valve.
48. Check Brake chamber mounting and proper function.
49. Check life of brake liner for Mark-1/Brake pads for Mark-2 & 3 and replace if required.
50. Check compressed air lines and hoses for proper routing and for air leakage, attend if required.
51. Check Retarder oil leakage and check coolant hose condition.

52. Check oil level in retarder
53. Check function of service brakes
54. Check Slack adjuster function. Adjust brake for Mark-1 vehicles.
55. Check air drier
56. Check steering link system for play and attend if required.
57. Check for tightness on power steering pump mounting, for oil leakages and contamination of oil, attend if necessary.
58. Check oil level for power steering
59. Check for King pin play and Front hub play, attend if required.
60. Check condition of air bellows, level sensors (mark-3) and level valves of air suspension, attend if required.
61. Check rear wheels hubs for noise and play, attend if required.
62. Check tightness of Front and Rear Hubs.
63. Check Rear & Front Wheel Hub Disc spline play and attend if required.
64. Check for un even wear of tyre and attend accordingly.
65. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
66. Any other work as entrusted by superiors

ELECTRICIAN:

1. Check for proper function of speedometer, instruments panel.
2. Check loose contacts in Electrical Connectors.
3. Check fault codes in the vehicle control units and attend if required.
4. Check batteries for– dust, leakage, acid density, liquid level, connections and battery box condition, attend if required.
5. Check for proper function of driver's controls and attend if required.
6. Check all Electrical connections and cables of alternators, starter motor for proper routing.
7. Check for proper functioning of retarder controls, PP (Proportionate) Valve connection routing and keep it dust free.
8. Check for proper functioning of warning symbols, control lamps and buzzer.
9. Function check of all lamps.
10. Start of engine and check of starter functioning.
11. Check alternator for voltage output of 28 Volts, attend if required.
12. Check AC Condenser & Evaporator Fan for proper Operation.
13. Check AC system Cooling Efficiency (22^{o} C)
14. Check all AC Fuses in Relay Panel for proper function.
15. Check AC Main Fuse 150 / 200 Amps for proper function.
16. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
17. Any other work as entrusted by superiors

COACH BUILDER:

1. Check proper function of rear-view mirrors and attend if required.
2. Check for proper functioning of Door opening and closing.
3. Check for Luggage compartment doors and locks for proper functioning.
4. Check for Sun roofs
5. Check for proper fitment of body side panels and waist rail.
6. Check for proper fitment of Windscreen glass and windows glasses, attend if required.
7. Check Driver's seat condition and seat adjustment, attend if required.
8. Check for availability of Hammer to break the emergency glass if necessary.
9. Check Floor , floor hatches for proper condition and rectify if required.
10. Check all Passenger seat condition and attend if required.
11. Check proper functioning of Roof hatches and attend if required.
12. Check all Seats for proper Inclination mechanism and attend if required..
13. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
14. Any other work as entrusted by superiors

TYRE MECHANIC:

1. Check for tyre inflation and correct.
2. Check for tyre NSD and uneven wear.
3. Attend tyre rotation and also disc rotation if required.
4. Wheel Alignment to be done.
5. Wheel balancing to be done
6. Attend log sheet complaints/Driver reports and complaints repeated (Vehicle back history).
7. Any other work as entrusted by superiors.

ANNEXURE – E

TOOLS REQUIRED FOR VOLVO MAINTENANCE

SPECIAL TOOLS

S.No.	DESCRIPTION	PART NO.	Qty.
1	FILTER WRENCH 94MM	VO9996671	1
2	OIL FILTER WRENCH	VO9999179	1
3	EXTRACTOR	VO9998011	1
4	SETTING INDICATOR	VO9998645	1
5	MANDREL	VO9998012	1
6	TURNING TOOL	VO9998068	1
7	EXTRACTOR	VO9996738	1
8	STANDARD HANDLE	VO9991801	1
9	MANDREL	VO9992061	1
10	SLEEVE-DRIFT/ADAPTER	VO9996736	1
11	SOCKET WRENCH	VO9996773	1
12	SOCKET WRENCH	VO9996443	1
13	STANDARD HANDLE	VO9992000	1
14	MANDREL	VO9996175	1
15	SPINDLE	VO9992619	1
16	HYDRAULIC CYLINDER	VO9992671	1
17	CRANK	VO9992672	1
18	PRESSING TOOL	VO9992855	1
19	PULLER	VO9992676	1
20	PULLER	VO9996201	1
21	MANDREL	VO9996545	1
22	MANDREL	VO9996546	1
23	HOSE	VO9996049	1
24	PRESSING TOOL	VO9996861	1
25	PULLER	VO9996796	1
26	EXTRACTOR	VO9996657	1
27	EXTRACTOR	VO9998532	1
28	PULLER	VO9996419	1
29	MANDREL	VO9996420	1
30	RAM 10 TON (HYDRAUL CYL.)	VO9996600	1
31	HYDRAULIC PUMP	VO9809726	1
32	INSTALL SLEEVE	VO9996276	1
33	FILTER WRENCH 108MM	VO9996672	1
34	CENTERING MANDREL	VO9992640	1
35	EXPANDER	VO9998550	1
36	MANDREL	VO9992003	1
37	PULLER	VO9992576	1
38	MOUNTING RING	VO9996091	1
39	Socket wrench	VO 9996940	0
40	Mandrel	VO 9996640	0
41	Assembly Tool	VO 9998946	0
43	Assembly Tool	VO 9998573	0
44	Mandrel	VO 9996171	0
45	Mandrel	VO 9992677	0
46	Sleeve	VO 9998457	0

TOOLS & MEASURING INSTRUMENTS FOR TOOL ROOM - 1 Set Per Depot

S.No.	DESCRIPTION	SIZE	Qty.
1	Torque Wrench	3 - 14 Nm	1
2	Torque Wrench	14 - 68 Nm	1
3	Torque Wrench	70 - 340 Nm	1
4	Torque Wrench	450 - 1380 Nm	1
5	Vernier Caliper	15 Cm	1
6	Measuring Tape	5 m	1
7	Dial Gauge	(Mitutuyo)	1
8	Bore Dial Gauge (Mitutuyo)	50 to 150 mm	1
9	Micro meter (outside)	10 - 25 mm	1
10	Micro meter (outside)	25 - 50 mm	1
	Heavy Duty Hexagonal Sockets		
11	3/4" Square Drive	65 mm	1
12	3/4" Square Drive	60 mm	1
13	3/4" Square Drive	55 mm	1
14	3/4" Square Drive	50 mm	1
15	3/4" Square Drive	45 mm	1
16	3/4" Square Drive	36 mm	1
17	3/4" Square Drive	33 mm	1
18	3/4" Square Drive	32 mm	1
19	3/4" Square Drive	30 mm	1
20	3/4" Square Drive	27 mm	1
21	3/4" Square Drive	24 mm	1
22	3/4" Square Drive	21 mm	1
23	Circlip Plier Outer	10"	1
24	Circlip Plier Inner	10"	1
25	Pipe Wrench	600 mm	1
26	Steel Rule	600 mm	1
27	3/4" Drive T Rod	(Heavy Duty)	1
28	3/4" SQUARE DRIVE EXTENSION ROD	125 mm	1
29	3/4" SQUARE DRIVE EXTENSION ROD	250 mm	1
30	Gear box Trolley		1

TOOLS FOR MECHANIC

	SCREW DRIVERs:		
1	SQUARE ROD FLAT	6"	1
2	SQUARE ROD FLAT	12"	1
3	SQUARE ROD - STAR	TIP NO.2	1
4	SQUARE ROD - STAR	TIP NO.3	1
5	Screw Driv. HAMMERING	806 HM	1
6	ADJUSTABLE SPANNERS	-	1
7	1/2" SQUARE DRIVE T HANDLE	300 mm	1
8	1/2" SQUARE DRIVE EXTENSION ROD	75 mm	1
9	1/2" SQUARE DRIVE EXTENSION ROD	125 mm	1
10	1/2" SQUARE DRIVE EXTENSION ROD	250 mm	1

TOOLS FOR MECHANIC			
SL. NO.	DESCRIPTION	SIZE	Qty
11	1/2" SQUARE DRIVE REVERSABLE RATCHET HANDLE	250 mm	1
12	MONKEY PLIER	-	1
13	CUTTING PLIER	-	1
14	NOSE PLIER	125 mm	1
15	HAMMER	800gm	1
16	HAMMER	500gm	1
17	VICE GRIP PLIER	10"	1
18	CENTRE PUNCH	-	1
19	PIPE WRENCH	15"	1
20	ADJUSTABLE WRENCH	8"	1
21	CHISEL	100 mm	1
22	CHISEL	150 mm	1
23	FEELER GAUGE (26 Blades)	.03 TO 1.00 mm	1
24	1/2" SQUARE DRIVE HEX SOCKET SET - SHORT	8 mm	1
25		9 mm	1
26		10 mm	1
27		11 mm	1
28		12 mm	1
29		13 mm	1
30		14 mm	1
31		15 mm	1
32		16 mm	1
33		17 mm	1
34		18 mm	1
35		19 mm	1
36		21 mm	1
37		24 mm	1
38		27 mm	1
39		30 mm	1
40		32 mm	1
41	1/2" SQUARE DRIVE ALLEN HEAD SOCKET	4 mm	1
42		5 mm	1
43		6 mm	1
44		7 mm	1
45		8 mm	1
46		10 mm	1
47		12 mm	1
48		14 mm	1
49		17 mm	1
50	1/2" SQUARE DRIVE LONG (DEEP) HEX SOCKET	10 mm	1
51		12 mm	1
52		13 mm	1
53		14 mm	1
54		15 mm	1
55		16 mm	1
56		17 mm	1
57		18 mm	1
58		19 mm	1
59		21 mm	1
60		24 mm	1
61		27 mm	1
62		32 mm	1
63	1/2" SQUARE DRIVE HEAVY DUTY IMPCT SOCKET - BLACK	18 mm	1
64		19 mm	1
65		21 mm	1
66		24 mm	1

TOOLS FOR MECHANIC			
SL. NO.	DESCRIPTION	SIZE	Qty
67	DOUBLE ENDED SPANNER SET	6--7 mm	1
68		8--9 mm	1
69		10--11 mm	1
70		12--13 mm	1
71		14--15 mm	1
72		16--17 mm	1
73		18--19 mm	1
74		20--22 mm	1
75		21--23 mm	1
76		24--27 mm	1
77		30--32 mm	1
78		32--36 mm	1
79	RING SPANNERS SET	6--7 mm	1
80		8--9 mm	1
81		10--11 mm	1
82		12--13 mm	1
83		14--15 mm	1
84		16--17 mm	1
85		18--19 mm	1
86		20--22 mm	1
87		21--23 mm	1
88		24--27 mm	1
89		25--28 mm	1
90		30--32 mm	
91	COMBINATION SPANNER	6 mm	1
92		7 mm	1
93		8 mm	1
94		9 mm	1
95		10 mm	1
96		11 mm	1
97		12 mm	1
98		13 mm	1
99		14 mm	1
100		15 mm	1
101		16 mm	1
102		17 mm	1
103		18 mm	1
104		19 mm	1
105		20 mm	1
106		21 mm	1
107		22 mm	1
108		23 mm	1
109		24 mm	1
110		25 mm	1
111		26 mm	1
112		27 mm	1
113		28 mm	1
114		29 mm	1
115		30 mm	1
116		31 mm	1
117		32 mm	1
118	STEEL RULE	300 mm	1
119	OIL CAN	250 ml	1
120	CHOIR BRUSH	-	1
121	WIRE BRUSH	-	1
122	TEST LAMP	-	1

ANNEXURE – F

EESENTIAL SPARES FOR VOLVO VEHICLES

S.No	Group	Code	Description	Mark-I	Mark-II	Mark-III	Remarks
1	SERVICE AND MAINTENANCE	OL	Engine oil	1161278	1161278	67-18001	
2		OL	Engine oil	21039495	21039495	21039495	For Retarder
3		OL	Differential oil	1161279	1161279	1161279	
4		OL	Gear oil	1161280	1161280	1161280	
5		OL	Steering oil	1161941	1161941	1161941	
6		VO	Coolant	1089238	1089238	1089238	
7		VO	Brake fluid	85112076	85112076	85112076	
8		VO	Oil filter	466634	466634	20998807	Oil Filter Kit for Mark-3
9		VO	Bypass filter	477556	477556		
10		VO	Filter	349619	349619	349619	Steering Filter
11		VO	Air filter	1544449	1544449	8149064	Air Filter
12		VO	Air filter	1660903	1660903		
13		VO	Fuel filter kit	8193841	8193841	20998805	Fuel Filter
14		VO	Fuel filter	8159975	8159975	20853583	Water Separator
15		VO	Filter cartridge	20773824	20773824	20773824	Air Drier Cartridge (Part No. Changed from 20546795)
1	ENGINE BELT DRIVE	VO	V-belt	9958479	9958479	20581953	Fan Belt
2		VO	Top alternator belt	9958477			
3		VO	Bottom alternator belt	978273			
4		VO	V-ribbed belt		20564267	20860507	Alternator Belt
5		VO	Idler roller			20759364	
6		VO	Idler roller			20795659	
7		VO	Belt tensioner	3093090	3183643	3183643	
8		VO	Idler belt	9958478	9958478		
1	ENGINE AND ACCESSORIES	VO	Rubber cushion	20776308	20776308	20499474	Engine Bedding - Rear
2		VO	Rubber cushion			20502976	Engine Bedding - Front
3		VO	Radiator hose	9517020	9517020		RADIATOR HOSE
4		VO	Elbow	20416038	20416038		RADIATOR ELBOW
5		VO	Coolant pipe	20522073	20522073		
1	ELECTRICAL	VO	Voltage regulator	21058175	20523391	20918011	
2		VO	Relay		3173824	20795890	For Starter Motor
1	TRANSMISSION AND CLUTCH	VO	Clutch	20569139	20569139	20569139	Pressure Plate with release Brg
2		VO	Clutch disc	20366370	20366370	20366370	
3		VO	Clutch servo	1673067	8171722	8171722	Common For Mark 2
4		VO	Master cylinder	1669488	1669488	1628218	
5		VO	Ball joint	85108331	85108331	1190131	Gear Cable Ball Joint
6		VO	Ball joint			1190132	Gear Cable Ball Joint
7		VO	Bearing	85108766	85110086	85110086	For Inertia Mass (Gearbox)
8		VO	Seal		85110083	85110083	
9		VO	Lock ring	85108767	85108767	85108767	

S.No	Group	Code	Description	Mark-I	Mark-II	Mark-III	Remarks
1	COMPRESSED AIR & BRAKES	VO	Sensor			20928544	Wheel Speed Sensor
2		VO	Brake pad kit	3097168-F 3097169-R	20918891	21024702	
1	WHEELS & STEERING	VO	Kingpin kit	3090267	85108338	20751021	
1	SUSPENSION	VO	Anti-roll bar	70321664	9959538	9959538	Front
2		VO	Rubber bushing	9959304	9516524	9516524	For Front Anti-roll Bar
3		VO	Link		9521922	9521922	Front Anti-roll Bar Link
4		VO	Anti-roll bar	8157253	70371200	10371200	Rear
5		VO	Stay		20994420	20994420	Rear Anti-roll Bar Link
6		VO	Rubber bushing	9519245	70371206	70371206	For Rear Anti-roll Bar
7		VO	Shock absorber	3177327	20485166	20485166	Front
8		VO	Shock absorber	3177328	70371256	70371256	Rear
9		VO	Air bellow	1137888	1137888	1137888	Front
10		VO	Bellows	1134445	20540789	20540789	Rear- Rear
11		VO	Bellows	1134445	20540792	20540792	Rear -Front
12		VO	Bushing		70371217	70371217	For Reaction Rod