



Andhra Pradesh State Road Transport Corporation  
Office of the Managing Director, Bus Bhavan, Hyderabad - 500 0624.

No: OP3/462/2011-MED

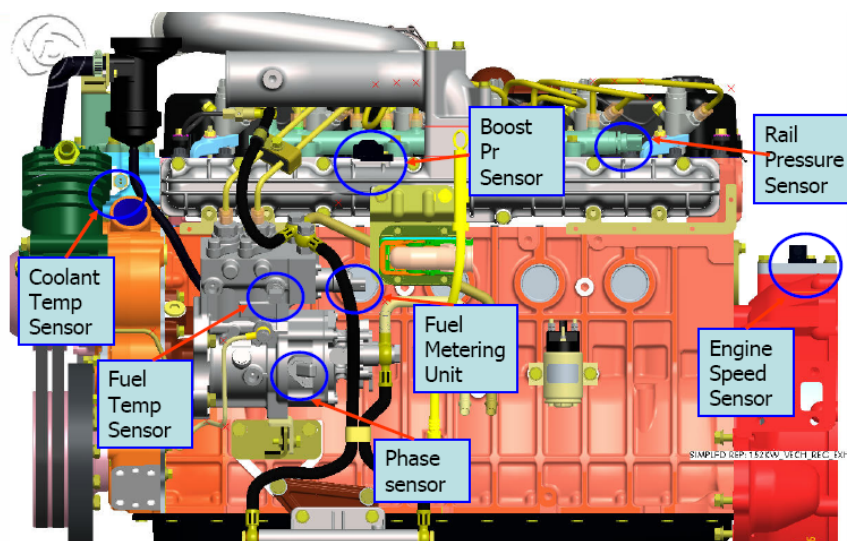
**CIRCULAR No. 33/2011-MED, Dt 30.08.2011.**

Sub : MAINTENANCE - Introduction of Ashok Leyland 12 meter 225 HP - BS3 - DDAC - ALPSV 4/157 A/c Buses branded as “*Indra*” - Salient features and maintenance aspects communicated - Reg.

- 1.00 Corporation has recently introduced Ashok Leyland 12 meter 225 HP - BS3 - DDAC - ALPSV 4/157 A/C Buses branded as “*Indra*” at selective depots as a new product in special type category.
- 2.00 The salient technical specifications, features & maintenance systems of these buses are furnished hereunder.

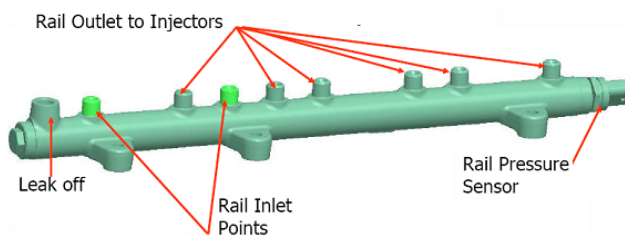
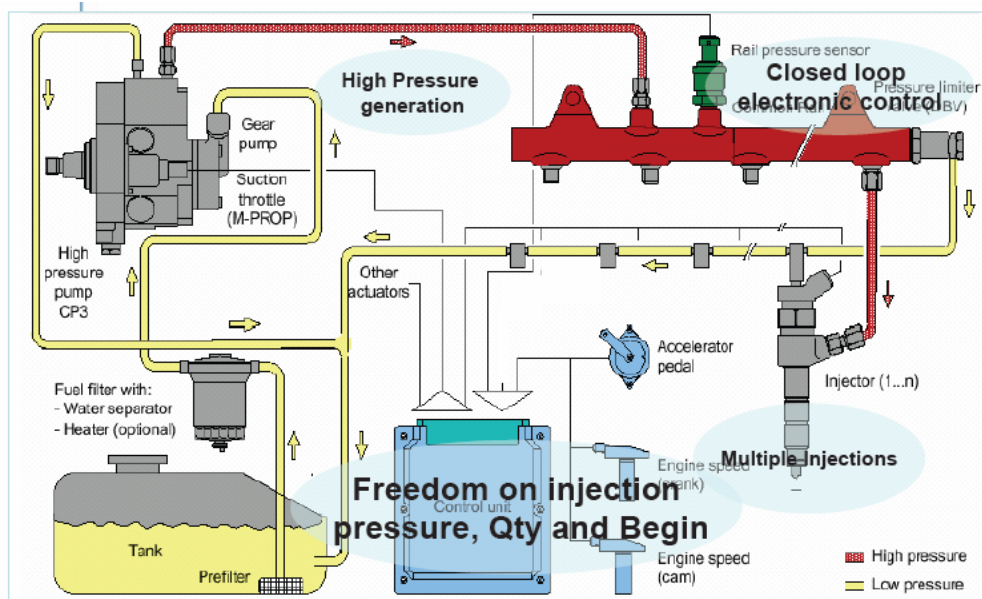
3.00 **Engine**

- Bus Model: **ALPSV 4/157**
- Engine Model: 'H' Series HA57L165 Engine - 6 Cylinder BS3 Turbocharged Intercooled with Common Rail Diesel Injection system
- Max. Power: 225 PS (165Kw) @2500 rpm
- Max. Torque: 806 Nm @1400-1900 rpm
- Cylinder Bore x Stroke: 104 x 113 mm
- Capacity: 5.759 lit
- Cylinder Liners: Dry type
- Compression Ratio: 17.5:1
- Firing order: 1-4-2-6-3-5
- Valve clearance: Intake - 0.30 mm (0.012”), Exhaust - 0.45 mm (0.018”)



#### 4.00 Fuel System

- Common Rail Diesel Injection system  
Injection Pump: CPN 2.2 (Pump has integrated feed pump and phase sensor).
- Governor: Electronic Control Unit for Fuel Injection Equipment (There are no control lever and mechanical linkages in FIE)
- Injector: CRS Electronic type, Solenoid controlled injection quantity.
- Rail pressure: 1400-1600 bar
- Feed Pump: Vane type Feed pump inside the FIP
- Fuel filter / Water separator built with secondary hand primer
- EDC system: EDC 16 ( CAN- common area network for BS.4 ) enabled
- Fuel Filters: Fuel filter is fitted at the low pressure side before FIP and Chassis filter is fitted before feed pump.
- Fuel tank capacity: 350 lits



Following are the critical components of CRS system.

1. High Pressure Pump (CPN2.2)
2. Rail
3. Injector
4. Sensors
  - Engine speed sensor
  - Pump camshaft speed sensor
  - Fuel temperature sensor
  - Boost pressure sensor
  - Accelerator pedal sensor
  - Oil pressure sensor
  - Water temperature sensor
5. Electronic Control Unit (EDC 16)

5.00 **Air Intake System**

- Air cleaner: Dry type two stage Air filters with Service Indicator
- Turbocharger: Radial flow and Waste gate arrangement

6.00 **Lubrication system**: Full flow pressure circulation similar to the existing BS-III model vehicles

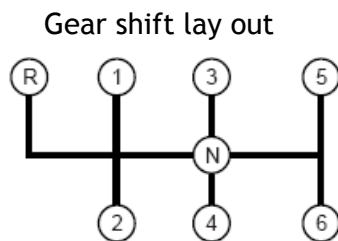
7.00 **Cooling system**: Same as that of existing vehicles. Fan is with integral ring for strength. The fan belt is of poly V grooves type, Unique from the existing.

8.00 **Clutch**

381 mm Dia Single Plate Dry Type - Hydraulically operated with air booster  
Standout - 114 +/- 2.5 mm  
Release Travel - 15 to 18 mm

9.00 **Transmission**

- Type: ZF-6S 850 Six speed Synchronesh Gear Box
- No. of speeds: 6 forward (including overdrive) and 1 reverse
- Gear Ratio: 1<sup>st</sup> - 6.72, 2<sup>nd</sup> - 3.68, 3<sup>rd</sup> - 2.15, 4<sup>th</sup> - 1.41, 5<sup>th</sup> - 1, 6<sup>th</sup> (OD) - 0.79, Reverse - 6.03
- Gear oil capacity: 6.5 litres



10.00 **Front Axle**

- Type: ALFA-99, Heavy duty forged I Beam, Reverse Elliot type

11.00 **Rear Axle**

- Type: R-149.6, Fully floating single reduction hypoid gear Heavy duty pressed beam banjo type
- Gear Ratio: 5.29
- Oil capacity: 14 ltrs

12.00 **Steering**

- ZF Power Steering
- Oil Capacity: 4 lit

13.00 **Suspension**

- Front: Rubber ended leaf spring / Air Suspension (Wheels India Ltd)
- Rear: Air suspension
- 14" dia Bellows

## 14.00 Brakes

### 1) Exhaust brake

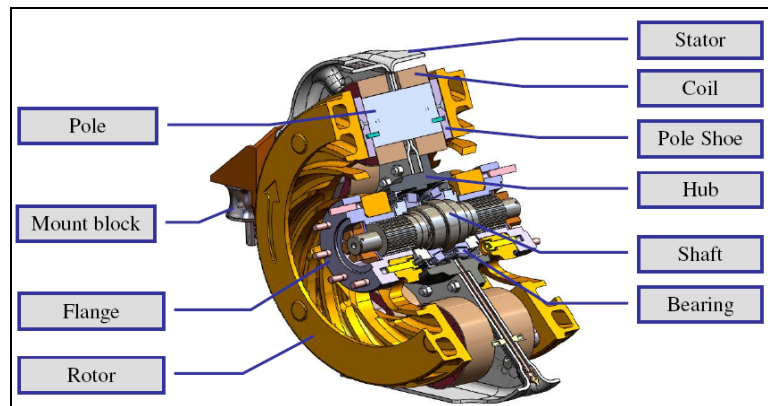
### 2) Retarder EMR (BIL R11 model)

Electromagnetic Retarder is an auxiliary braking system mounted on the transmission line in between Gear box and the Rear axle, capable of giving vehicle deceleration inclusive of rolling deceleration, when energized.

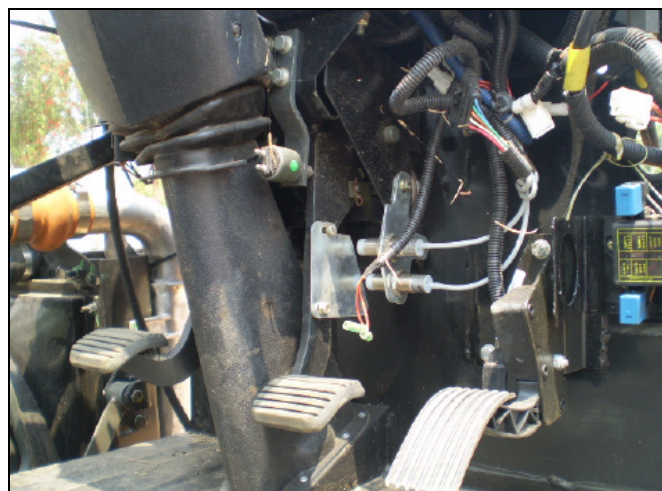
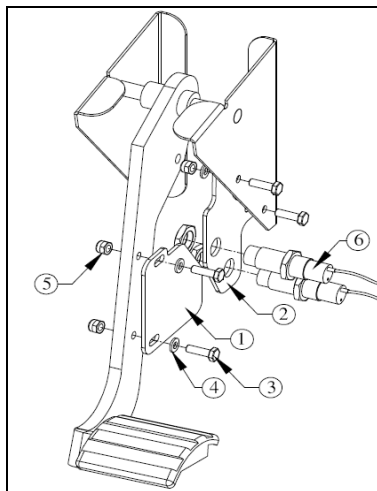
- EMR works on the principle of Eddy current
- Metallic Rotor rotating in a magnetic field - Produces Eddy Current
- When coils are energized, flux lines emanate from North Pole & pass through the rotor to the adjacent South Pole in straight line and these lines get distorted when the rotor rotates. They try to regain their shape. Hence Eddy current opposes rotation of the Rotor & braking is effected
- During braking - Kinetic energy is absorbed as heat & rotor becomes hot
- Vanes provided in the rotor to dissipate the heat generated during braking.



EMR INSTALLATION



EMR CONSTRUCTION



PROXIMITY SENSOR ARRANGEMENT AT BRAKE PEDAL

- EMR consists of a stator, 16 electromagnetic coils and 2 rotors arranged on either sides of the stator. A foot operated Proximity sensors located in the brake pedal energizes the coil through MosFET based ECU. In order to prevent the battery discharging, a trip ECU is provided which disables coil energization below a vehicle speed of 7.5 kmph and it is adjustable based on end user requirement.

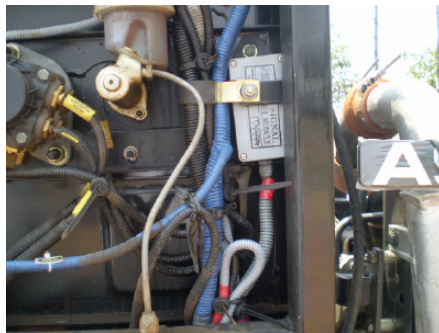
- Green LED integrated in the Piano type signal switch fitted on the Dashboard is to indicate EMR is ready for operation.
- Red LED integrated with a tell tale arrangement on the Dashboard is to indicate the working of EMR whenever brake pedal is pressed in the free play. If the indication glows continuously without pressing the brake pedal then the Main isolator switch provided for EMR must be put in Off position.

Specifications of EMR:

- Max Torque: 110 kg-m
- Overall Dimension : 496 x 470 x 300 mm
- Type of cooling: Air cooled
- Air Gap: 0.9 To 1.2mm
- Voltage configuration: 24V DC 120 Amps
- Cut-off speed: 7.5 kmph (adjustable)
- Steps of operation: 2 steps

**ECU SIGNAL CONTROL MODULE:**

The purpose of ECU control module is to sense the Engine RPM and give supply to Proximity sensor through Signal On/off switch provided in the Dashboard. Input to ECU is from Vehicle main wiring harness (3 pin male connector) through signal wiring harness (3 pin femaleconnector)



ECU module fitment location on vehicle



ECU singal module

**POWER WIRING HARNESS**

To connect Main assembly and ECU power control module



PARTS DETAILS	CONNECTION DETAILS
3 Pin connector - 1 no	To mate 3 pin connector with vehicle main wiring harness
4 pin connector	To connect ECU signal
3 Pin connector - 2 nos	To connect 2 proximity sensors
M6 Eyelet	To connect BLS
3 Pin connector	To connect ECU Power module
2 Pin connector	To connect Piano signal switch integrated with Green color LED
2 Pin conector	To connect dashboard indication - Red color LED
2 Pin connector	To connect ECU Power control & Main assembly

### Do's and Don'ts - EMR Main assembly

DO's	DON'Ts
Check for Electrical Wire Connection intact as per Electrical circuit diagram	Do not touch the Rotor immediately after vehicle stop/halt. It will be hot
Clamp the wiring Harness Suitably	Do not change the Rotor Direction
Maintain Pedal Free play as per spec	MB Earth Terminal Bolt should not get loosened
Maintain Brake pedal lateral play as per spec	Do not use Alternator less than 100 Amps
Green LED glows when ECU signal control o/p is ok. Press brake pedal and ensure proximity sensor functioning ok through indication provided in the sensor	Do not use Battery less than 200 AH
Red LED in dash board glows during MB working and Continuous Glow without any actuation during Malfunctioning	Do not route the electrical wire nearby any heat source like Silencer Muffler
Mag brake Isolator switch must be ON before start of the vehicle	Do not use Mag brake during any abnormal noise noticed in the vehicle
Do regular check up for Battery and alternator for proper working.	Do not remove or loosely connect the battery negative wires connecting to ECU and EMR brake
Ensure proper alignment of Yoke in propeller shaft connecting Gear box and differential	Do not remove Alternator RPM wire during service of vehicle not related to EMR brake

### Do's and Don'ts - MosFET ECU

DO's	DON'Ts
1) Fitment of Assembly must be intact	1) Do not drop the assembly on hard surface
2) Check for proper tightness of fasteners as mentioned in the drawing.	2) Do not take the assembly near any heat source
3) Battery terminals should be removed during welding	3) Do not load the assembly with heavy materials
4) Assembly must be removed during welding at closer to assembly	4) Loose connection of power connectors must be avoided
5) Ensure negative connection always connected to assembly	5) Not recommended for any electrical connections to be tapped from the assembly
6) Ensure proper routing of Power wiring harness as mentioned in wiring harness drawing	6) Do not open the box
7) Cable tie must be tagged on to the W/H as given in the drawing	7) Do not use the assembly for any other purpose

## TROUBLE SHOOTING IN EMR SYSTEM

EMR BRAKE NOT WORKING	Signal wiring harness not connected to Vehicle Main wiring harness	<ul style="list-style-type: none"> <li>• Ensure proper connection between Signal and Vehicle main wiring harness</li> <li>• Check for the sensor connectors intact with signal wiring harness</li> <li>• Raise the engine RPM (say nearly 1000 rpm) and press the brake pedal.</li> </ul>
	Proximity sensor not working	<ul style="list-style-type: none"> <li>• The LED in the sensor must glow, if not check the voltage at signal control switch with multimeter.</li> <li>• Ensure the distance between the pedal plate and sensor face is less than 8mm. If the sensor does not work replace the sensor and repeat the test</li> </ul>
	No output from ECU Signal control	<ul style="list-style-type: none"> <li>• Check the 4 pin input from signal wiring harness.</li> <li>• Raise the engine RPM (say nearly 1000 rpm).</li> <li>• Check the voltage at signal module o/p with multimeter</li> <li>• Check the 1Amp Fuse provided in the signal module</li> <li>• If there is no voltage, then tune the pot in signal module in clockwise direction till the green lamp provided in Piano s/w glows.</li> <li>• Press the brake pedal</li> <li>• Check for Proximity sensor functioning</li> <li>• Verify the working of EMR Brake using clamp meter.</li> </ul>
	MosFET ECU trip	<ul style="list-style-type: none"> <li>• Check the output from the ECU Power control connector.</li> <li>• Check the connection at EMR brake side</li> <li>• Check Power wiring harness, signal wiring harness and battery cables. If any problem is found, rectify the same.</li> <li>• Turn off the EMR brake isolator switch for few seconds and Turn on.</li> <li>• Even after multiple try if the problem persists, contact the nearest service point.</li> </ul>
	Isolator switch and Signal control switch in OFF position	<ul style="list-style-type: none"> <li>• Ensure that both the Piano signal switch &amp; EMR Brake battery isolator switch are turned ON</li> </ul>
	Improper Earthing	<ul style="list-style-type: none"> <li>• Ensure Negative connection between MB main assembly &amp; battery.</li> <li>• Ensure double earthing between MosFET and chassis and to the battery negative terminal</li> <li>• Clean the Eyelets and Earthing points and tighten the fasteners</li> </ul>
Wire cut in Signal and Power wiring harness	<ul style="list-style-type: none"> <li>• Inspect wiring harness connector connection</li> <li>• Check for any physical damage in the harness</li> </ul>	

EMR BRAKE NOT WORKING	Connector pin Loose/Connectors not connected	<ul style="list-style-type: none"> <li>• Check the continuity of wires.</li> <li>• Rectify faulty wires with proper insulation provided.</li> <li>• If any burnt occurred, replace the faulty w/h with a new one</li> </ul>
	No signal from thealternator	<ul style="list-style-type: none"> <li>• Start the vehicle and raise the engine RPM (say nearly 1000 rpm).</li> <li>• Measure the AC frequency at signal pin using multimeter.</li> <li>• The frequency will vary for the change in engine speed.</li> <li>• If not the alternator needs to be rectified.</li> </ul>
	Wrong tuning of Potentiometer	<ul style="list-style-type: none"> <li>• Raise the engine RPM (say nearly 1000 rpm).</li> <li>• Check the voltage at signal module o/p with multimeter.</li> <li>• If there is no voltage, then tune the pot in clockwise direction till the lamp in the signal isolator switch glows (or till there is an output from signal module).</li> <li>• Do not tune the Pot excessively in anticlockwise direction.</li> </ul>
EMR BRAKE CONTINUOSLY ON	Proximity sensor faulty. Sensor turns ON without the application of brake Pedal	<ul style="list-style-type: none"> <li>• Check whether there is any metal plate near the face of the sensor.</li> <li>• Check the pedal setting.</li> <li>• Replace the sensors and repeat the test.</li> </ul>
	MosFET - Short	<ul style="list-style-type: none"> <li>• Do not start the vehicle.</li> <li>• Ensure that MAGBRAKE battery isolator is turned ON. Measure the current through each wire (circuit) in the power wiring harness.</li> <li>• If the measured value is between 25 to 33 amps, then the MosFET would have failed. Replace the ECU or contact the nearest service point.</li> </ul>
EMR BRAKE PARTIALLY WORKING	One of the sensors not working	<ul style="list-style-type: none"> <li>• Start the vehicle and raise the engine RPM. Press the brake pedal. Check the pedal setting. Move a plate in the face of the sensor. Ensure that the sensors are working</li> <li>• If not, Replace the sensors and repeat the test.</li> <li>• MosFET - Open • Start the vehicle. Raise the Engine Rpm and press the brake pedal. Ensure that the pedal sensors are working</li> <li>• Check the current reading in all the four loops. If no current is read in one or more loops, the MosFET would have failed</li> <li>• Replace the ECU with a new one or contact the nearest service dealer.</li> </ul>



EMR BRAKE PARTIALLY WORKING	Improper grounding	<ul style="list-style-type: none"> <li>• Earthing is to be done properly on the chassis.</li> <li>• The tightness of the negative cable in the MB assembly is to be ensured.</li> <li>• The paint on the chassis is to be scrapped cleanly, where the Earthing wire is to be connected.</li> <li>• Earth terminal is to be fastened tightly.</li> </ul>
	One or more coil wire cut	<ul style="list-style-type: none"> <li>• Measure the loop current. If the current is in the range of 10 to 18 amps then one of the coil wire is cut.</li> <li>• The Retarder should be dismantled from the vehicle and coil is to be replaced.</li> </ul>
	Connector pin Loose/Connectors not connected	<ul style="list-style-type: none"> <li>• Ensure that the connectors are connected as indicated by the wiring diagram</li> </ul>

- The Maintenance schedules for EMR brake system are covered in item No.21

### 3) Service brake

- Type: S'cam dual Air brake system with Air with Dryer
- Air compressor: 230cc water cooled
- Slack adjuster: Automatic
- Front Brake Lining width : 7 inches
- Rear Brake Lining width : 8 inches
- Brake Drum Sizes: 15.5 inches (393 mm)

### 15.00 **Wheel & Tyre**

- Size: 10.00 R20 - 16PR
- Wheel rim: 7.5HD X 20
- Balanced wheels (Provided wheel balancing weights)

### 16.00 **Electrical system**

- Battery: 2 x 12v - 200 AH
- Alternator: 24v 100A
- Starter type: LUCAS-TVS make 9M14 pre-engaged with thermal cut off

### 17.00 **Performance**

- Max Speed: 94 kmph
- Grade ability: 27.39 %

### 18.00 **AIRCONDITIONING SYSTEM**

- Spheroes
- Eberspaecher Carrier

## 19.00 RECOMMENDED LUBRICANTS, COOLANT & CLUTCH FLUID

Aggregate	Specification	Gulf Oil Product Name	IOCL Product Name	Capacity
Engine Oil	API CI-4, SAE15W40	Gulf Super fleet LE Dura Max 15W-40	---	18 ltr
Gear Box oil	SAE 80W90 API GL5	Gulf Gear XP Dura Max 80W-90	Servo Gear ALT 80W-90 (LL)	6.5 Ltrs
Differential oil	SAE 85W140 API GL5	Gulf Gear DB Dura Max 85W-140	Servo Gear Axle ALT 85W-140	14 ltr
Power Steering oil	DEXTRON IID	Gulf Power Steering Dura Max	Servo Transdex II	4 ltr
Clutch Fluid	FMVSS DOT3	Gulf Clutch Fluid Max	Servo Power Brake ALT	1 ltr
Wheel Brg Grease	IS 12203	Gulf Crown Max RR 3	Servo Gem ALT	4 kg
Coolant		Eurocool LL max 50	Servo Kool ALT 50	22 ltr

## 20.00 MAINTENANCE SCHEDULES

The specific maintenance activities applicable for Indra buses (other than those stipulated in the regular Sch-I/II, III/IV and FC) are furnished hereunder.

LUBRICANTS, COOLANT & FILTERS CHANGE PERIODICITIES		
1	Change Engine Oil & Filter	First change at 16,000 km and thereafter every 40,000 km
2	Fuel Pre-filter (chassis) replacement	40,000 kms
3	Both Fuel filter elements (Engine mounted) replacement	40,000 kms
4	Replace Gear Box oil	1,20,000 kms
5	Replace Differential Gear oil	80,000 kms
6	Replace Power Steering Oil filter	80,000 kms
	Replace Power Steering Oil	1,60,000 kms
7	Replace Wheel Bearing Grease (RR3)	48,000 kms
8	Air Cleaner Primary replacement	Whenever the vacuum indicator shows redband
9	Air Cleaner safety replacement	At the time of every third replacement of primary filter element
10	Antifreeze Coolant replacement (applicable for Recommended coolant (pre-mixed) only)	200000 kms
11	Change clutch fluid	40,000 kms

## 21.00 PREVENTIVE MAINTENANCE SCHEDULES

Description of Activity	Sch-I	Sch-II	Sch-III	Sch-IV
	Daily	Weekly	20,000 kms	60,000 kms
<b>ENGINE</b>				
Check Engine oil level & arrest leakage if necessary	✓	✓	✓	✓
Check & adjust Valve clearance				✓
Check and tighten front and rear engine mounting / other peripheral bolts			✓	✓
Check Damper Pulley and attend if necessary			✓	✓
Drain water from Water separator	3-6 hours after a fresh fill of the diesel tank / Daily			
Clean Fuel tank inside & Tank strainer				✓
Check function of radiator cap		✓	✓	✓
Check Fan belts for damage/looseness	✓	✓	✓	✓
Check Exhaust pipes and mounting			✓	✓
Check Radiator coolant level	✓	✓	✓	✓
<b>ELECTRONIC DIESEL CONTROL</b>				
Check for engine full acceleration (Throttle response)	✓	✓	✓	✓
Check tightness of all mating connectors and ensure they are connected properly			✓	✓
Check and secure wiring harness away from temperature zones on the engine/vehicle			✓	✓
Check functioning of EDC and sensors with diagnostic tool				✓
Check tightness of engine speed sensors and clean the sensor tip for any dirt/dust deposits			✓	✓
Check functioning of warning EDC light	✓	✓	✓	✓
<b>TURBOCHARGER &amp; INTERCOOLER</b>				
Check Air duct connections, hoses and gaskets			✓	✓
Check charge air cooler for any blockage of fins and clean the cooler if necessary (2.5 kg/cm <sup>2</sup> )				✓
<b>CLUTCH</b>				
Check Clutch fluid level	✓	✓	✓	✓
Check function of clutch system		✓	✓	✓
Check Clutch pedal free play and pedal stroke		✓	✓	✓
Check Clutch booster exhaust cover			✓	✓
<b>TRANSMISSION</b>				
Check Gear box oil level	✓	✓	✓	✓
Check Looseness in gear control mechanism		✓	✓	✓
<b>PROPELLER SHAFT</b>				
Check Propeller shaft nuts tightness	✓	✓	✓	✓
Check Universal joint and splines for wear		✓	✓	✓
Universal joint and splines Greasing		✓	✓	✓

Description of Activity	Sch-I	Sch-II	Sch-III	Sch-IV
	Daily	Weekly	20,000 kms	60,000 kms
<b>SUSPENSION</b>				
Check Air Suspension U-bolt / nuts tightness		✓	✓	✓
Check Air Bellow for damage/leakage	✓	✓	✓	✓
Check Mountings for looseness and damage	✓	✓	✓	✓
Check Shock absorbers for leaks and damage	✓	✓	✓	✓
Check Shock absorbers for looseness in mounting	✓	✓	✓	✓
Check for Stabilizer bar for mounting looseness (Front and rear)			✓	✓
<b>REAR AXLE</b>				
Check Differential gear oil level	✓	✓	✓	✓
Check Axle case for damage and distortion				✓
Check Wheel Disc for damage OR balance weight missing			✓	✓
<b>FRONT AXLE</b>				
Check for Damage and distortion				✓
Lubricate King Pins		✓	✓	✓
Wheel Disc for damage OR balance weight missing			✓	✓
<b>STEERING</b>				
Check Power steering fluid level (When engine is in idle i.e. 500-600 rpm )	✓	✓	✓	✓
Check Power steering fluid tank strainer			✓	✓
Check Looseness in mounting			✓	✓
Check Bearings for excessive play			✓	✓
Check for Steering linkage for damage, looseness and excessive play		✓	✓	✓
Check Clearance between knuckle, King Pin and front axle			✓	✓
Check & adjust Wheel alignment			✓	✓
<b>SERVICE BRAKE</b>				
Check Brake Lining wear		✓	✓	✓
Check Brake drum for wear and damage			✓	✓
Check Function of dual brake valve			✓	✓
Check Air hoses and pipes for leakage, damage and loose connections	✓	✓	✓	✓
Check Cams and wheel brakes for excessive wear				✓
Check function of Brake actuator, slack adjuster and actuator rod stroke			✓	✓
Replace Air dryer desiccant	Once in a year			

Description of Activity	Sch-I	Sch-II	Sch-III	Sch-IV
	Daily	Weekly	20,000 kms	60,000 kms
<b>AUXILIARY BRAKE including EMR</b>				
Function of exhaust brake			✓	✓
Check Function of retarder (EMR- R11)			✓	✓
Check Air Gap (0.9 to 1.2 mm) in EMR			✓	✓
Brake pedal setting for Proximity sensors			✓	✓
Check and attend Earth terminal				✓
Check & attend flange mounting bolt nut				✓
Check & attend Chassis bracket				✓
Check & attend Mount block	Once in a year			
Check & attend Electrical connectors related to EMR brake	Once in a year			
<b>ELECTRICAL EQUIPMENT</b>				
Check Battery Specific gravity		✓	✓	✓
Check Function of starter motor			✓	✓
Starter motor brushes for wear				✓
Check Function of Alternator			✓	✓
Check Terminal of wiring harness for damage and looseness			✓	✓
<b>CHASSIS LUBRICATION</b>				
Lubricate all Grease points*		✓	✓	✓
<b>TYRES</b>				
Check Tyre inflation pressures		✓	✓	✓
Remove Trapped stones, replace Tyres at 2mm NSD	✓	✓	✓	✓
Tyre rotation and Wheel nuts			✓	✓
<b>AIR CONDITIONING</b>				
Clean A/C Filters	✓	✓	✓	✓
Check functioning of all A/C controls	✓	✓	✓	✓
Check for loose contacts in Electrical Connectors of AC system, correct if required			✓	✓
Check for AC Condenser & Evaporator Fan Operation	✓	✓	✓	✓
Check for Cooling Efficiency		✓	✓	✓
Check for AC Compressor Oil Level		✓	✓	✓
Check for tightness AC Compressor mounting bolts			✓	✓
Check for AC Refrigerant Pressure / Level			✓	✓
Drain Condensate Water from AC system	✓	✓	✓	✓
Check for proper functioning of AC Fuses in Relay Panel		✓	✓	✓
Check for proper function of AC Main Fuse		✓	✓	✓

**22.00 ESSENTIAL SPARES TO BE STOCKED AT DEPOTS**

The list of essential spare parts to be stocked at Depots for maintenance is shown at annexure

**23.00 ADDITIONAL TOOLS REQUIRED FOR MAINTENANCE**

S.NO	PART NAME	PART NO
1	Hub Check Nut Spanner	SMT 3757
2	Diagnostic Tester - BS III Tool Kit	FN201100

24.00 The Dy.CMEs are advised to educate the staff on operation and maintenance of INDRA buses at the depots duly providing necessary tools required for day to day maintenance. They are also advised to monitor the performance of INDRA buses and furnish the feedback to Head Office at regular intervals.

25.00 The Controllers of Stores are advised to supply required spare parts to the Depots duly fixing the limits in consultation with respective Dy.CMEs.

26.00 The Depot Managers and Maintenance incharges are advised to ensure proper maintenance to the vehicles and see that the vehicles are utilized to the full extent without any breakdown.

  
EXECUTIVE DIRECTOR (E&IT)

To  
All Depot Managers

Copy to: VC & MD for kind information.

Copy to: Dir (V&S), ED (O&MIS), ED (A), FA, CAO, ED (HRD&Med) for infn.

Copy to: ED (GHZ&HZ), ED (HYD), ED (KRM), ED (VJA), ED (VZM), ED(NLR), ED(KDP) for information.

Copy to: All RMs for information.

Copy to: CME (O), CCOS, CA, CFM, CME(C&B), CE (IT), CPM, CM (HRD) for information & n/action.

Copy to: DyCME (O), DyCME (P), DyCME(C&B), DyCME (IED), DyCAO (SP&A), CSTO, COS(C) I & II for information.

Copy to: DyCMEs, WM, COS & DyCAOs of GHZ for necessary action.

Copy to: All AOs & AMEs (T) for information & n/action.

Copy to: All Principals of ZSTCs, BTC, HPT & TA/HPT for information.

Copy to: Resident Audit Officer, Bus Bhavan, Hyd for information.

Copy to: In-charge, Manual Section for record.

## LIST OF ESSENTIAL SPARES TO BE STOCKED AT DEPOT FOR INDRA BUSES

S.No	Subassembly	Part Number	Description of Spare Part	Qty
1	FlywheelHousing	X7487500	Engine Speed Sensor For CRS	1
2	FlywheelHousing	X2705100/ X2705200	Crank Shaft Rear End PTFE Oil Seal	1
3	Alternator Assembly	X0301650/ X0301750	Belt 8PK1250	1
4	Cylinder Head Assembly	X1711400	Cylinder Head Gasket Multi-layered Steel	1
5	Water Cooled Air Compressor	X4901240	Copper Washer	8
6	Water Cooled Air Compressor	F2702850	"O" Ring	1
7	Water Cooled Air Compressor	X3105115	Banjo Bolt	4
8	Crank Shaft	F2702650	"O" Ring	1
9	Fuel Filter	P1302040	Main Filter Insert	2
10	Fuel Filter	B9243702	S/A of Pipe Inlet Main Fuel Filter	2
11	Fuel Filter	X3115715	M16X1.5 Banjo Bolt	2
12	Fuel Filter	F0j00515	Eye Bolt With Filter	1
13	Fuel Filter	B9243703	S/A of Pipe Outlet Main Fuel Filter	1
14	Flywheel	X7200122	Face Plate	1
15	Flywheel	F0245410	Deep Groove Ball Bearing	1
16	Flywheel	F7647114	Stopper, Bearing	1
17	Intake Manifold	X1707900	Gasket Inlet Manifold	1
18	Intake Manifold	X1708000	Gasket Air Intake Pipe	1
19	Intake Manifold	X7478300	Boost Pressure Sensor	1
20	Injector	X4900231	Injector Seal Ring	6
21	Oil Cooler	X1707700	Oil Cooler Gasket	1
22	Oil Cooler	X4000600	Filter Element Oil	2
23	Oil Cooler	F2749800	O Ring	2
24	Oil Cooler	F2749900	O Ring	2
25	Turbocharger	X1702500	Gasket TC to Exhaust Manifold	1
26	Turbocharger	F1760400	Gasket TC Outlet to Exh Pipe	1
27	Turbocharger	F3769515	Stud M10X1.5X1.25	4
28	Turbocharger	F7F00115	Nut	4
29	Turbocharger	X1965810	Oil Drain Pipe Flexible	1
30	Timing Gear Case	X2706700	Oil Seal Crank Frt	1
31	Timing Gear Case	F2749200	"O" Ring FIP Bearing Housing	1
32	Engine Thermostat	X7472800	Water Temperature Sensor	1
33	Engine Thermostat	F2734300	"O" Ring	1
34	Coolant Filter	X4000700	Water Filter	1
35	Water Pump	X1505022	Poly-V Pulley 1.2 Ratio	1
36	Radiator & Intercooler (Modine)	F8P01958	Hose	1
37	Radiator & Intercooler (Modine)	F8P02058	Hose	1
38	Radiator & Intercooler (Modine)	F1980150	Elbow Hose	1
39	Radiator & Intercooler (Modine)	F8601250	Hose	1
40	Radiator & Intercooler (Modine)	F8P07858	DAT Hose	1
41	Radiator & Intercooler (Modine)	P2652939	DAT Cap	1
42	Radiator & Intercooler (Modine)	F8P01858	CAC inlet Hose	1
43	Radiator & Intercooler (Modine)	F8P02358	CAC inlet Hose	1

44	Radiator & Intercooler (Modine)	F8P04958	CAC Outlet Hose	1
45	Radiator & Intercooler (Modine)	F8P02258	CAC Outlet Hose	1
46	Radiator & Intercooler (Modine)	X3900310	Jupitor T-bolt Clamp	1
47	Radiator & Intercooler (Modine)	F8290200	T-Bolt Clamp	2
48	Air Intake Piping (Mahle)	F4R01110	T-Bolt Clamp D 142	2
49	Air Intake Piping (Mahle)	F4R01010	T-Bolt Clamp D 132	1
50	Air Intake Piping (Mahle)	F4R00510	T-Bolt Clamp	1
51	Air Intake Piping (Mahle)	F7B01500	Primary Filter Element	1
52	Air Intake Piping (Mahle)	F7B01600	Safety Filter Element	1
53	Rear Hub	F1773400	Joint	10
54	Rear Hub	F2701400	Oil Seal	2
55	Rear Hub	F2730200	Oil Seal	2
56	Rear Brakes	P4316551	Brake Spring Kit	2
57	Rear Brakes	P4317351	8" HLP Brake Lining Kit	2
58	Rear Brakes	P2609751	Rivets Kit Brake Lining	2
59	Clutch Assembly	B1306304	Clutch Disc	2
60	Clutch Release Mechanism	F1939650	Flexible Hose Assembly	2
61	Clutch Booster	P1023151	Clutch Booster Kit	1
62	EDC circuit	F8844600	24V Main Relay	2
63	Buffer	F2632200	Bump Stop Rubber	2
64	Wheel Hub	F4915210	Tongue Washer for Outer Bearing	2
65	Wheel Hub	F4915310	Tongue Washer With Holes for Lock Nut	2
66	Wheel Hub	F2754200	Oil Seal Hub	2
67	Wheel Hub	F1721500	Joint For Hub Cap	10
68	Brakes	P4317151	Brake Lining Kit 7" HLP	2
69	Brakes	P4314451	Rivets Kit Brake Lining	2
70	King Pin	F0501042	King Pin Bush	2
71	King Pin	F2700259	Oil Seal For King Pin	2
72	King Pin	F0268310	Thrust Bearing	2
73	King Pin	F0991215	King Pin	2
74	King Pin	F0991115	Cotter Pin Bottom	2
75	King Pin	F0991015	Cotter Pin Top	2
76	Track Rod Assembly	P2620851	Tie Rod End Kit	2
77	Air Drier	P1023451	Major Repair Kit	1
78	Front Spring	F0130350	Rubber Element	8
79	Shock Absorber	F3950000	Front Shock Absorber	2
80	AC drive	F0300658	REC Banded Belt 2JSPBX 1700 Engine Damper Pulley to Idler	5
81	AC drive	F0T00758	REC Banded Belt 2JSPBX 1825 Idler Pulley to AC Compressor	5
82	AC drive	B8K00101	Idler Assembly	1
83	AC drive		Auto Tensioner	1
84	Clutch Pedal	F7873530	Master Cylinder Assembly	2
85	Center Bearing	P4501939	CB & Retainer	2
86	Center Bearing	P4502451	UJ Kit	2
87	Center Bearing	P4500426	Center Bearing Rubber	5
88	Center Bearing	P4500735	Nut	1
89	Silencer	F2638100	Pad Muffler Support	2