

Andhra Pradesh State Road Transport Corporation

Office of the VC & MD,
Hyderabad,

No.OP2/462(1)/2007-MED

Circular No : 4/2007-MED, Dt.05-02-2007.

Sub : **MAINTENANCE** – Introduction of Bharat Stage –II compliant vehicles by M/s
Tata Motors – Reg.

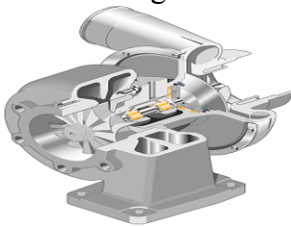
M/s Tata Motors Ltd have introduced Bharat Stage-II compliant vehicles, in order to comply with the new emission norms notified by the Ministry of Road Transport & Highways for implementation with effect from 1st Apr,2003. The BS-II compliant vehicles are supplied with 697 Turbocharged & Intercooled Engine with Distributor type FIP and the Engine is designated as **697 BS-II TC55**

The salient features of modifications & maintenance procedures are reiterated hereunder.

Aspiration	: Turbocharged with inter cooler
Max output	: 128 HP @ 2400 rpm
Max torque	: 410 Nm @ 1400 - 1700 rpm
Bore and Stroke	: 97 x 128 mm
Piston displacement	: 5.675 lit
Compression Ratio	: 17.5 : 1
Firing Order	: 1-5-3-6-2-4
Direction of rotation	: Clockwise viewed from the front
Compression pressure	: 20 Kg/sq.cm (min)
Fuel Injection Equipment	: Distributor type pump(Rotary),make BOSCH
Inj.Opening Pressure	: 250 – 260 bar
Valve Clearance	: Intake 0.20 mm, Exhaust 0.30 mm (Warm at 60 deg)
Engine Oil Cooler	: Multi Plate type

AIR INTAKE SYSTEM:

1. The 697 BS-II Engines are provided with Turbocharger and Intercooler (placed before the Radiator) for higher specific power outputs.
2. Inter cooler is provided for cooling the Charge Air after Turbocharger for better charge air density.



Turbocharger



Intercooler

FUEL SYSTEM :

1. VE type MICO FIP (Rotary type). This is self-lubricated with Diesel. Hence purity of Diesel plays important role in the functioning and life of the FIP.
2. To maintain the positive pressure in suction line of the FIP, Electrical Feed Pump of 12 Volts supply is provided between water separator and the dual fuel filter.
3. Both primary and secondary fuel filters are 1.1 liter star type paper filters. Both filter elements shall be replaced at every 18,000 kms.
4. Additional fuel strainer (Baby filter) is provided before the Water separator to prevent the dust entry into the fuel lines. Fuel strainer should be cleaned at every 9000 Kms
5. An improved spin on type fuel water separator with metallic body and water drain cock was provided for effective water separation. The change period of this spin on filter is at every 18000 Kms. **Water from the separator should be drained daily,** otherwise, the pump components may get damaged due to rust formation.
6. Injection line pressures are higher to achieve soot free combustion (To reduce particulates).
7. Multihole Injector nozzles with identification numbers etched on the nozzles.
8. Injector opening pressure is 250 to 260 kg/cm²
9. An Ejector valve is provided in the fuel return line to maintain a positive pressure in the fuel lines. This is a junction valve for overflow lines coming from Dual Fuel filters, Fuel injection pump and injection nozzles



Rotary Distributor Type FIP



Both Star type Paper diesel Filters



Fuel Strainer (Baby Filter)



Water separator with Hand primer



Ejector valve



Elec.Feed Pump



Feed Pump Fuse



Resistor

Note: Plunger Lift of Distributor pump for LP/LPO 1510 BS-II Bus is **1.3 mm**. Part number for the MICO Plunger Lift adaptor is **F 002 H 31 103**

- A 24 Volts shutoff solenoid is provided on the distributor pump to provide a remote shutoff of the engine with Ignition key. After getting supply only, this shutoff solenoid allows the diesel supply to the distributor.

- Electrical Feed Pump supply chain:

Ignition Key to Feed pump Fuse(10A) at fuse box	-	24 Volts
Feed pump Fuse to Resistor (DC to DC convertor)	-	24 Volts
Resistor to Electrical Feed Pump	-	12 Volts

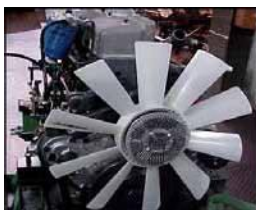
- Electrical Feed Pump gets supply and starts working as soon as the Ignition Key gets inserted into the Ignition switch. Hence for getting improved life of the Feed Pump, Ignition Key should be removed from the switch as soon as the Engine was stopped.
- Capacity of the Electrical Feed Pump is 2 to 2.5 Litres/minute.
- If the strainer in the Electrical Feed Pump is choked, it can be cleaned by providing the supply of reverse polarity and connecting the delivery side to pure diesel.

LUBRICATING SYSTEM :

1. Recommended engine oil grade is API CF 4 SAE 15W40 and change period for both Engine Oil and Filter is every 18000 Km
2. Engine oil pressure switch was provided on the Engine oil filter base
3. Engine oil supply for lubrication to the turbocharger is provided from the outlet of the Cooler plate

COOLING SYSTEM :

1. Aluminum Radiator with Auxiliary tank is introduced in BS-II vehicles with coolant – water mix in 1:1 ratio.
2. VISCOUS FAN is introduced in place of ordinary fan to save the power being consumed during low temperature operation, and to improve the fuel economy. Viscous fan contains a fluid clutch, which will be activated as the sensor senses the temperature from air about 55 deg.
3. Additional Coolant temperature switch was provided on the coolant tube to provide the alert indication at the time of the engine overheating



Note: **Air bleeding should be done at the time of the Coolant replacement.**

The Viscous Fan Clutch has 3 sections,

- Engine powered driving section
- Viscous coupled Driven section (connected to fan)
- Separating disc
- The separating disc divides the internal chamber into supply & working chamber of fluids

The separating disc is connected to the center of a bimetallic coil, which acts as a temperature sensor. The coil senses the temperature of the air after it passes through the Radiator/Charge Air Cooler. The other end of the sensor coil is fixed. The coil will expand when the temperature increases causing the center shaft and the separating disc to rotate.

The clutch-driving disc receives the drive through the water pump pulley and transmits the power to the output through the internal friction of the highly viscous fluid. There is no mechanical connection between the input and the out put discs. (There is always a small amount of slippage between the output and the input drive)

When the clutch rotates, the fluid in the working chamber is continuously drained to the supply chamber and this is returned to the working chamber through a valve, which is regulated by the separating disc.

When the temperature is low, the separating disc closes the valve thereby not permitting the fluid to return to the working chamber. The working chamber empties and the clutch disengages.

The fan clutch needs to be handled carefully in the field. Any dust or mud over the bimetallic temperature sensing coil will affect the performance. The same needs to be cleaned using a brush. At any pint the fan clutch assembly must not be painted.

Checking procedure for Fan Clutch : The following is the procedure for checking the working of fan clutch in the vehicle,

1. Start the engine in neutral & run the engine for 3 minutes in idling
2. Run the engine at max rpm
3. Fan speed will be less than 1000 rpm
4. Observe water temperature
5. In case Radiator is blocked to increase the water temperature, a circular hole is to be made in the sheet aligning the axis of bi metal coil (temperature sensing element) so that the fan is able to sense the air temperature
6. Fan will engage around 80 – 90^O C water temperature. (Fan engagement can be confirmed by the change in the noise and also air flow in the engine tunnel

7. Fan will again disengage when the water temperature drops to around 80°C

In case the fan clutch is not engaging, the Radiator and CAC (Charge Air Cooler) are to be checked for choking of fins. If so blow clean with pressurized air (1 kg/cm²) and once again check the fan for engagement.

BRAKES:

Polyamide Nylon air pipes: In Brake system, Polyamide Nylon air pipes have been introduced in place of the Metal pipes. The Rust free nature of pipes will enhance the life and performance of the Brake system components and seal kits. The greater flexibility of the Polyamide pipes will provide improved routing and ease of replacement.

Relay valve: Relay valve is provided in the Rear air brake system, to provide the braking and the Quick releasing function which will improve the life of the brake liners and the fuel economy.

Dryer and Distribution Unit: This is the combination of the Air dryer, Purge tank, System protection valves and Unloader valve. All these units are united in a single unit with the intention of the reducing the no. of air pipes and the leakages causing by them.



Polyamide air pipes



Relay valve



DDU

EXHAUST BRAKE: -Exhaust brake has been provide for additional braking effort and to improve the life of the brake liners.



Air supply to exhaust brake will come from the brake control valve. Exhaust brake will be operative only if the Exhaust brake switch is kept ON.

CLUTCH:

- Single plate dry friction type, 330 mm dia clutch
- For effective and smooth working of the Hydraulic clutch,
 - Oiling of the felt on Release bearing should be done at every 9000 Km
 - Greasing of the release brg yoke shaft should be done at every 18000 Km

- Seal Kits in master cylinder and the slave cylinder should be changed at every 72000 Kms.
- Adjustment during repair of pressure plate: The distance between the outer face of the ring on the fingers and the flywheel contact surface should be 53 mm

GEAR BOX:

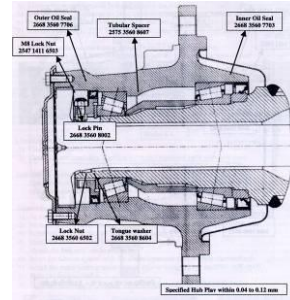
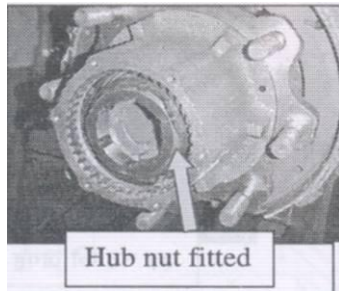
- GBS-40 Synchromesh gear box with 5 forward and 1 reverse speeds
- Gear ratios are Forward 7.51, 3.99, 2.50, 1.51, 1.00 and Reverse 6.93
- Gear box oil is Multigrade Oil SAE 80 W 90
- Oil change period is first time at 3000 Kms and after that at every 36000Kms for multi-grade oil.

FRONT AXLE:

- 1312 type heavy duty forged I beam, Reverse elliot type front axle.
- Standard Kingpin dia is 38.243 mm to 38.232 mm
- End play between stub axle and front axle beam is 0.025mm to 0.10mm
- Permissible axial Hub play is 0.02mm to 0.04mm
- King pin inclination is 9° 30'
- Toe-in is 0 to 3 mm
- Castor angle is $\frac{1}{2}^{\circ} \pm 30'$, Positive
- Camber angle is 1°, Positive
- Wheel Lock angle is 38°

REAR AXLE:

- Rear axle is modified with heavy duty RA108RR banjo type, Single reduction, Oerlikon type, hypoid gears, fully floating axle shafts and hub with single chuck nut.
- Crown wheel and Pinion ratio is 41/7
- Crown and Pinion permissible backlash is 0.20 to 0.26 mm
- Clearance between the thrust pad and crown wheel is 0.25 mm
- Permissible Rear axle hub play is 0.04 to 0.12 mm
- Rear axle oil is Multigrade oil SAE 85 W 140.
- Oil Change period is First time at 3000 Km and after that at every 36000 Km in the case of Multigrade oil.



SUSPENSION:

Type : Semi-elliptical leaf springs at front and rear
 Shock absorbers : Hydraulic double acting telescopic type at front and rear

Leaf spring parameters:

Part No	Description	Stack Height	Camber	No of Leaves	Thickness of Leaves	No Of Spacers	Thickness of spacers	Stiffness (kg/mm)
2625 3210 0101/ 207332100102	Assy Front Spring Co-Driver Side	176-Effective, 188 total	107.5	13	11	4	3 N0s-11, 1No -12thk	24.55
2750 3210 0103	Assy Front Spring Driver Side	188	107.5	13	11	4	3 N0s-11, 1No -12thk	24.55
2618 3240 0103/ 2073 3240 0102	Assy Rear spring	217	100	16	13 Nos-13thk, 3 Nos-16thk	Nil		K1=34.31 and K2=47.61

STEERING SYSTEM:

- Hydraulic power steering system of ZF, India make with steering wheel dia of 550 mm dia and steering gear ratio of 20.2 : 1.
- Transparent type plastic hydraulic tank with max.and min. marks was introduced in the place of the metal tank enabling the oil level check from outside.



OTHER MODIFICATIONS:

- Top land height 17.5 mm with 4 nos oil return holes on 3rd ring groove of the piston
- Fuel Injection Nozzle was modified

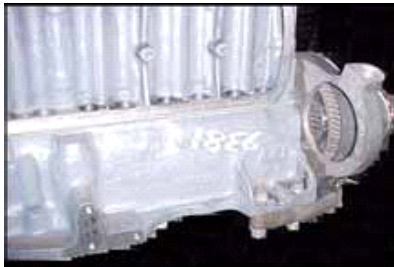


Old



New

- Vertical Dip stick mounted on the cylinder block at RHS of the engine
- Additional threaded Boss inbuilt on engine block for Rotary FIP rear support.



OLD



NEW

- Larger silencer muffler with glass wool design to reduce noise level
- Front projected Engine oil sump



- Fitment of front engine mounting crossmember shifted towards rear from the spring mounting bracket to accommodate inter cooler

PART NUMBERS OF IMPORTANT CONSUMABLES :

SPARES STOCK FOR TATA LP/LPO 1510TCIC BS II BUS AT DEPOTS

SI No	Description	Part No-LP BSII	Part No-LPO BSII	Remarks
1	V Belt Cogged(Water Pump)	252520156312	252520156312	1355mm
2	V Belt Cogged(Power Steer)	260020156302	260020156302	980mm
3	Assy Pressure Plate(330Dia)	276325400120	276325400120	Coil type- Lipe
4	Kit-Pressure plate	272425400109	272425400109	
5	Clutch Disc(330Dia)	272425200137	272425200137	Ceramic Button type
6	Kit-Clutch disc Facing	272425200111	272425200111	Ceramic Button
7	Assy Release Bearing	275425400118	275425400118	
8	Repair kit-Clutch master cyl (Minor)	261829100110	261829100110	25.4 dia , Only seals
9	Repair kit-Clutch master cyl (Major)	261829100109	261829100109	25.4 dia, with plunger
10	Repair kit-Clutch slave cyl	257329100161	257329100161	
11	Oil Seal Front Hub	257633407801	257633407801	
12	Outer Oil Seal Rear Hub	266835607706	266835607706	
13	Inner Oil Seal Rear Hub	266835607703	266835607703	
14	Center Bearing	257441303104	257441303104	Greasable type
15	Center Bearing Rubber Housing	257641306301	257641306301	
16	Assy Cross Kit	885441211612	885441211612	
17	Kit brake lining FRT STD	257342130124	257342130124	
18	Kit brake lining Rear STD	257342330124	257342330124	
19	Kit brake lining FRT R/S1	257342130125	257342130125	
20	Kit brake lining Rear R/S1	257342330125	257342330125	
21	R/Kit Dual Brake Valve	2641437000115	2641437000115	
22	Desiccant Cartridge – DDU	M311700	M311700	CD-TVS Part No.
23	Seal Kit – DDU	3/86	3/86	CD-TVS Part No.

MAINTENANCE SPARES FOR TATA LP/LPO 1510TCIC BS II BUS

SI No	Description	Part No-LP BSII	Part No-LPO BSII	Remarks
1	Engine oil filter	252518130124	252518130124	Same as CMVR
2	Primary fuel filter	9451037406	9451037406	Paper element
3	Secondary fuel filter	9451037406	9451037406	Paper element
4	Dry type air filter primary	278609139910	278609139910	Same as CMVR
5	Dry type air filter Secondary	278609139911	278609139911	Same as CMVR
6	Hydraulic oil filter cartridge	257344400128	257344400128	ZF
7	Fuel Water separator	252509120206	252509120206	MICO
8	Fuel Strainer	278609999951	278609999951	Pre filter for Feed Pump

PREVENTIVE MAINTENANCE SCHEDULE FOR BS-II ENGINES :

The following maintenance schedules are recommended for BS-II engines.

- Drain and replace the Engine oil at every 18,000 kms.
- Drain and replace the **multi-grade oil** in Gear Box & Rear axle at every 36,000 kms
- Change the Fuel Filters (both are 1.1 ltr star type paper filters) along with spin-on filter with water separator at every 18,000 kms.
- Drain the water from Water separator daily.
- Clean and refit the fuel strainer (Baby filter) at every 9,000 kms.
- Apply Oil to the felt on Release bearing at every 9000 Km
- Apply Grease to the release bearing yoke shaft at every 18000 Km
- Change the Seal Kits in master cylinder and the slave cylinder at every 72000 Kms

The Depot Managers and Maintenance incharges are advised to make note of the above features of Bharat Stage-II vehicles and educate all the Maintenance staff about the changes incorporated in the vehicle for proper maintenance. The DMs & Maintenance I/Cs are advised to paint as “Bharat Stage-II” on the vehicles at conspicuous place for identification.

The Dy.CMEs are advised to ensure proper maintenance of BS-II vehicles as indicated above during their inspection of Depots.

EXECUTIVE DIRECTOR (ENGG)

To
All Depot Managers.

Copy to: Director (Vig. & security), ED (MIS), ED (A), ED (O), FA, CAO & ED (HRD) for information

Copy to: All ED(Zones) for favour of information and necessary action.

Copy to: CCOS & CME(C&B) for necessary action.

Copy to: All Regional Managers for necessary action.

Copy to: All DVMs/WMs/COSs for necessary action

Copy to: All Dy.CMEs. They are advised to inspect the Buses for proper upkeep during the inspection of Depots, and ensure rectification of defects noticed immediately.

Copy to: Principal, Transport Academy/HPT and all ZSTCs for necessary action.

Copy to : Manual section, H.O.