



Andhra Pradesh State Road Transport Corporation
Office of the Managing Director, RTC House, Vijayawada - 520 013.

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Sub: MAINTENANCE - Introduction of Tata BS-IV compliant Buses in Corporation - Salient features and maintenance aspects communicated - Reg.

1.0 Corporation has recently introduced Tata LPO 1613 TCIC - BS IV Buses with EGR technology. The salient technical specifications, features & maintenance systems of these buses are furnished hereunder.

2.0 **Engine**

- Bus Model: LPO 1613-BS-IV
- Engine Model: 697 BS-IV TCIC Engine - 6 Cylinder, Turbocharged, Intercooled with Common Rail Direct Injection system and EGR technology
- Max. Power: 135 HP (100Kw) @2400 rpm
- Max. Torque: 430 Nm @1350-1800 rpm
- Idling RPM : 700 +50
- Cylinder Bore x Stroke: 97 x 128 mm
- Capacity: 5.675 lit
- Cylinder Liners: Dry type
- Compression Ratio: 17.5:1
- Firing order: 1-5-3-6-2-4
- Valve clearance: Intake - 0.20 mm, Exhaust - 0.30 mm

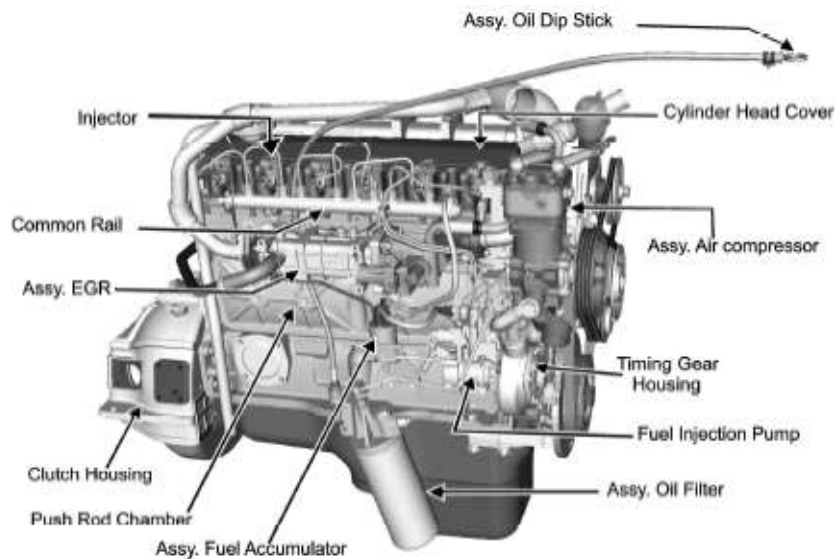


Fig.1 697-BS-IV CRDI ENGINE COMPONENTS

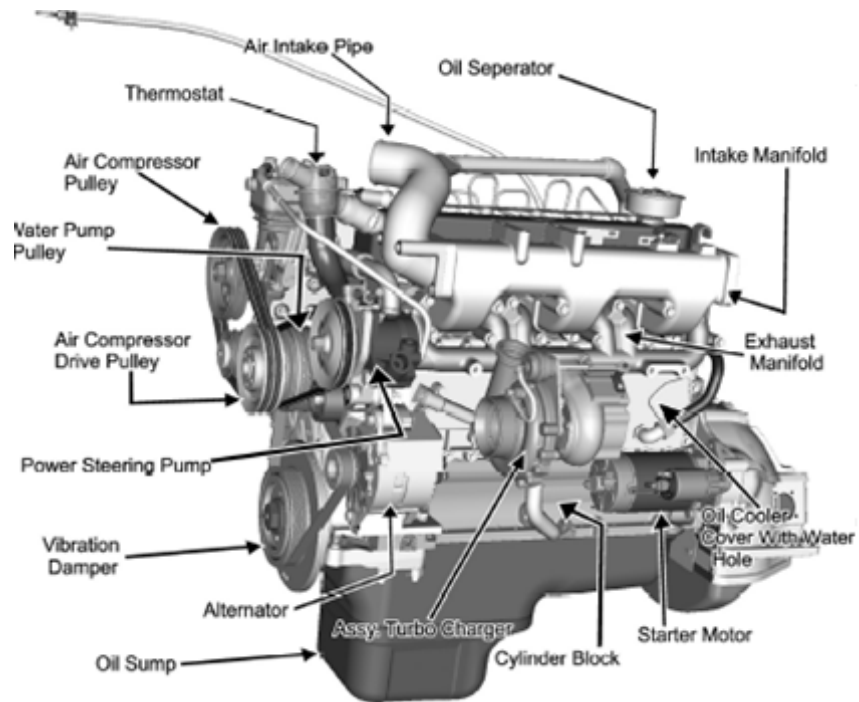


Fig.2 697-BS-IV CRDI ENGINE COMPONENTS

3.00 Fuel System

- Common Rail Direct Injection system of BOSCH
- High pressure Pump: Inline type with three plungers(CB-18) and Lubricated with engine Oil
- Governor: Electronic Control Unit for Fuel Injection Equipment (There are no control lever and mechanical linkages in FIE)
- Injector: Timing controlled by electrical signals to the injector solenoid.
- Rail pressure: 1400 bar max.
- Hand primer: Mounted on water separator
- Fuel Filters: Two stage Fuel filtration with Filter cum water separator and Spin on type Single fuel filter (Strata Pore type) are fitted at the low pressure side before HP Pump.
- Ejector: Low pressure diesel from return lines (High pressure pump, common rail and injectors) is collected in ejector bowl / accumulator mounted on engine below the common rail and sent to tank in a single line.
- Fuel tank capacity: 250 Lts
- EDC system: EDC 17
- If any traces of oil are found at ejector from return line of common rail, it indicates malfunctioning of either rail pressure sensor or metering unit on high pressure pump. Every time the PLV opens, it is counted in ECU and once the count reaches 150, engine will start malfunctioning and common rail has to be changed.

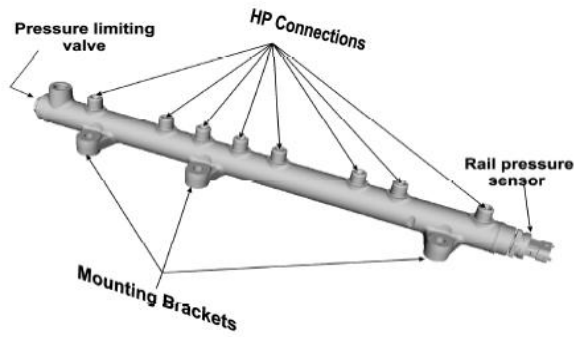


Fig. 3 Common Rail

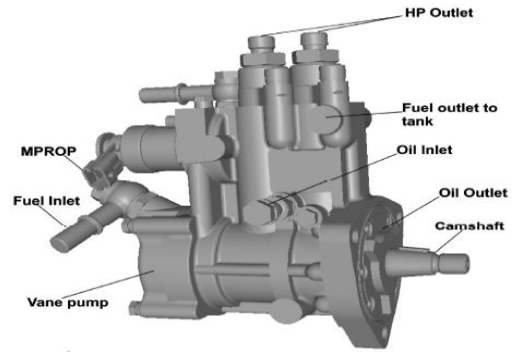


Fig. 4 High Pressure Pump CB-18

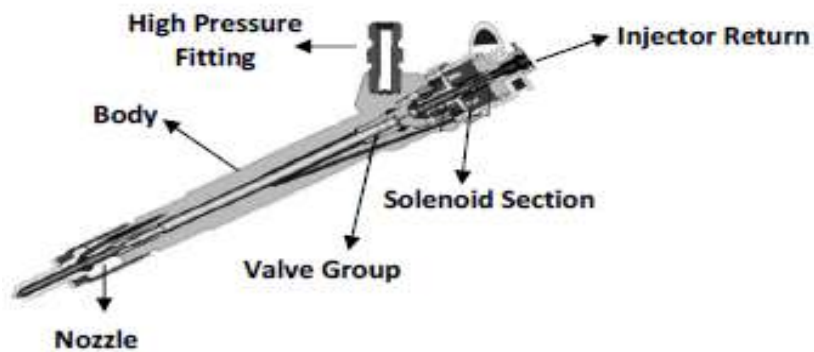


Fig. 5 Injector Construction

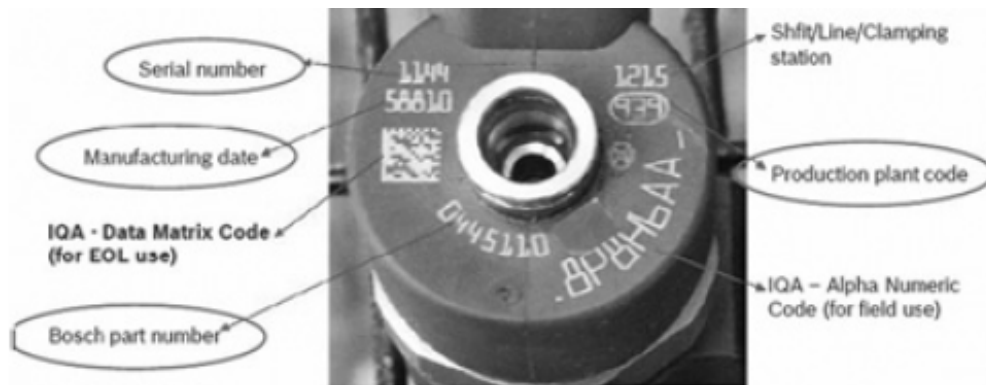


Fig. 6 IQA (Injection quantity adjustment) CODE FOR INJECTOR

The critical components of CRS system:

- a) High Pressure Pump(CB-18)
- b) Common Rail
- c) Solenoid type Fuel Injectors
- d) Sensors (Location)
 - Engine speed sensor (On Flywheel Housing)
 - Coolant temperature sensor (On Return Coolant Line)
 - Hot Air mass flow (HMF) sensor (In between Air Filter & Turbo Charger)
 - Boost Pressure Sensor (at Engine Inlet Manifold)

- Common Rail pressure sensor (At the end of Common Rail)
- Camshaft Position/Phase sensor (On Timing Gear Cover)
- Fuel temperature sensor (At Fuel Filter Head)
- Accelerator pedal sensor (at Accelerator Pedal Bracket)
- Vehicle speed sensor (At Gear Box Rear End)
- Water in Fuel sensor (at bottom of Fuel Water Separator)

e) Actuators

- EGR Valve(DC Motor)
- HP Pump Metering Unit (MeUn/ M-PROP)
- Solenoid Type Injectors (6 Nos)

f) Electronic Control Unit (EDC 17)

• The Electronic Diesel control includes ECU, Sensors, Actuators, electronically controlled high pressure pump CB-18 and solenoid type fuel injectors.

The Micro-controller inside the ECU continuously evaluates the signal from sensors. Electronic Control Unit controls vehicle operations like fuel injection, timing, governing, emission control, error identification, and self test and safety checks with the help of actuators in the engine/vehicle system based on closed loop feedback received from sensors.

ECU has two connectors, A connector & K connector. A connector has 60 pins and it connects all engine related sensors and actuators. K connector has 96 pins and it connects all body related sensors.

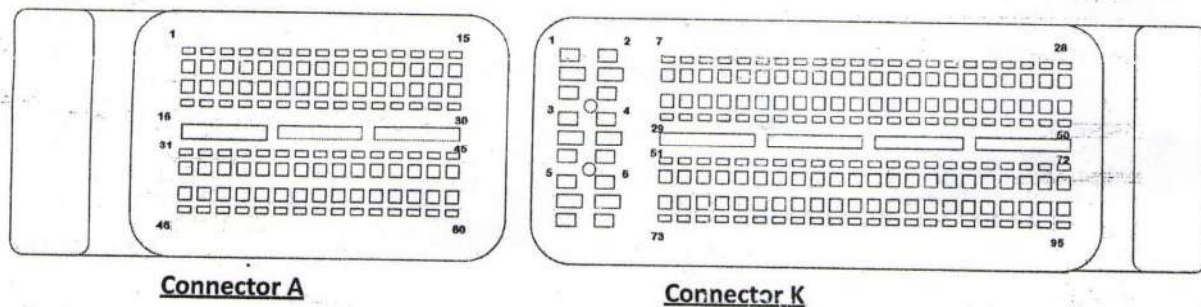
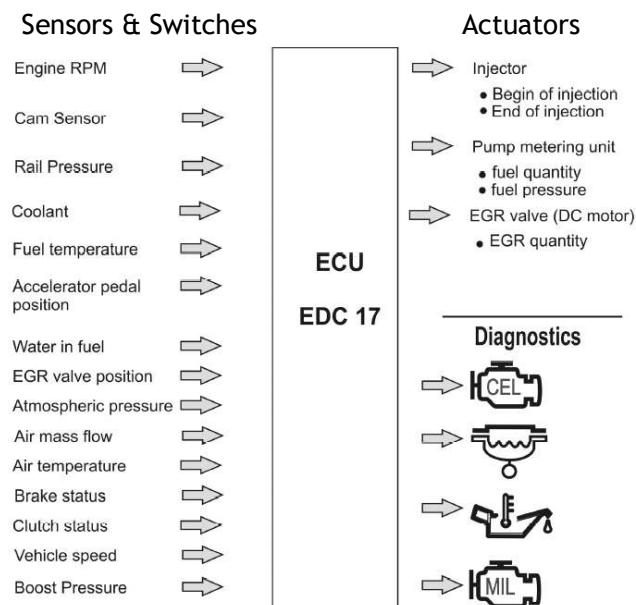
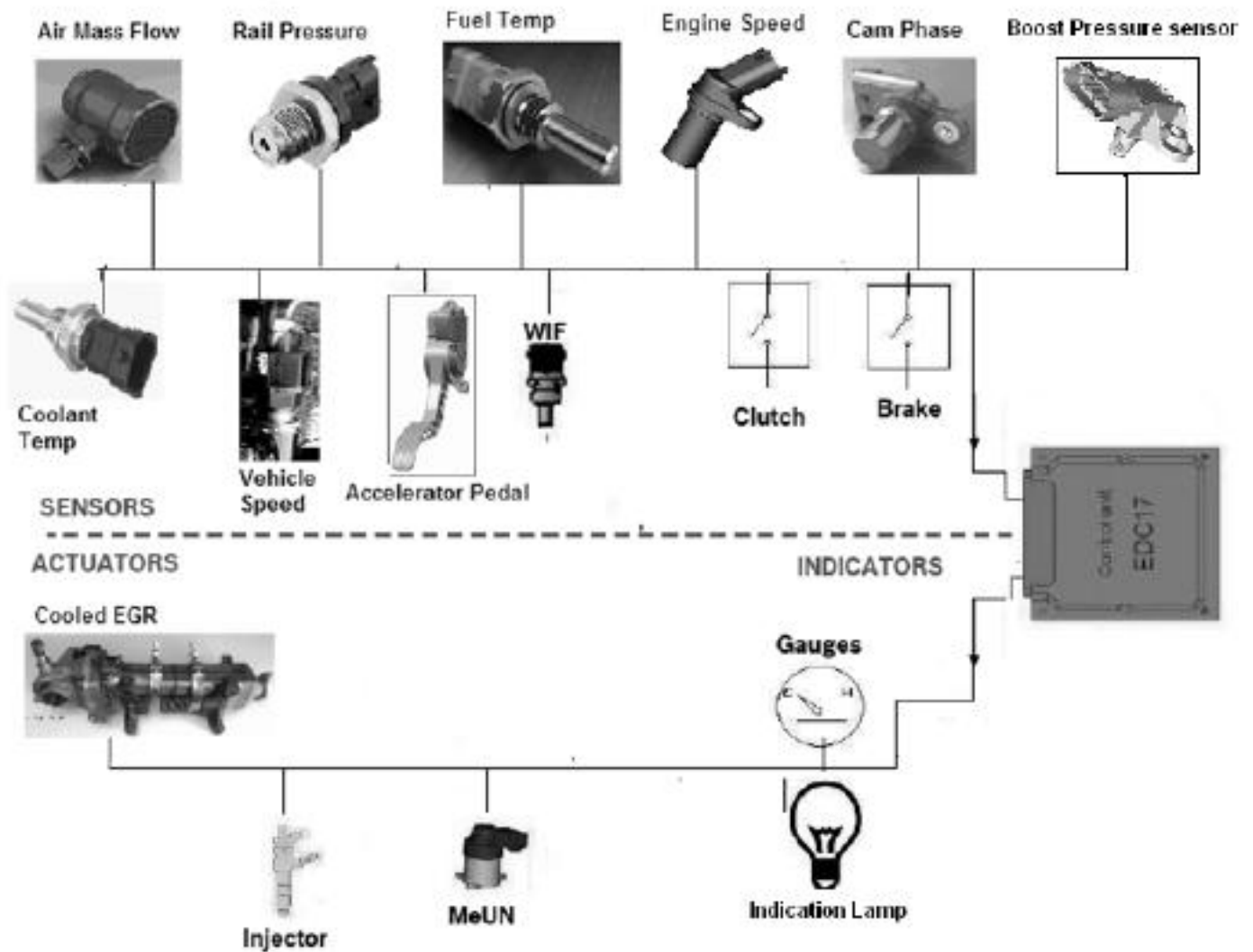


Fig. 7

Fig. 8 BLOCK DIAGRAM OF ECU:





*W/F - Water in Fuel; MeUn-Metering Unit in HP Pump; EGR-Exhaust Gas Recirculation

Fig. 9 SYSTEM LAYOUT OF ECU-SENSORS-ACTUATORS & INDICATORS

The sensor locations, their functions and symptom of failure are furnished in Annexure -1.

4.0 Air Intake System

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

5.0 Lubrication system:

- Full flow pressure circulation similar to the existing BS-II model vehicles.
- Usage of 1.5 lts capacity Combo-type Spin on type Engine Oil Filter i.e., By-pass filter integrated with main filter to suit EGR application.
- Some part of lubricating oil will circulate through High Pressure Pump for lubrication of its parts.
- Oil mist Separator cum Breather is also provided on Valve Door.

6.0 Cooling system:

- Same as that of BS-II buses with a total cooling system capacity of 21 Lts.
- Viscous Fan leaves are integral with a ring for increased strength called “Jet Ring Fan”.
- Engine fan belt is of poly V grooves type of size ‘8PK, 1260 mm length’.
- Thermostat opens at a temperature of 88^o+/-2^oC and fully opens at 94^o+/-2^oC. Ensure the working stroke of thermostat i.e 8.0+/-0.5mm at 94^o+/-2^oC
- Coolant is also supplied to (a) 230cc water cooled AC Head for cooling the air supplied for Brake system, (b) EGR for reducing the temperature of the re-circulated exhaust gases.

7.0 Clutch

- Pneumatically assisted (Booster) Hydraulic clutch operating system with 330 mm Dia Push type Pressure Plate with Single Plate Dry Type clutch disc - Organic/Ceramic lining

8.0 Transmission

- Type: GBS-40, Synchronesh on all forward gears and constant mesh on reverse gear
- No. of speeds: 5 forward and 1 reverse
- Gear Ratio: 1st - 7.51, 2nd - 3.39, 3rd - 2.30, 4th - 1.39, 5th - 1.00, Reverse - 6.93

9.0 Front Axle

- Type: 1312 type, Heavy duty forged I beam, Reverse Elliot type as given in BS-II/III models

10.0 Rear Axle

- Type: RA-108RR, Single reduction, heavy duty, hypoid gears, fully floating axle shafts
- Gear Ratio: 5.29:1 (37/7)

11.0 Steering

- ZF/Rane Power Steering
- Size/Length of P/St. Fan Belt - AVX13, 995 mm

12.0 Suspension

- Front & Rear- Rubber ended leaf spring (Weveller type)
- Front rubber element- 70 mm width
- Rear rubber element- 80 mm width

13.0 Brakes

- 1) Service brake with Modified Heavy Duty Foundation in Front and Rear(NGT- New generation technology)
 - **Type:** Dual circuit full Air ‘S’ cam brake system with Air Dryer
 - **Air compressor:** Single cylinder 230cc belt driven water Cooled (SC 230)
 - **Size/Length of Belt** : AVX13, 1060 mm - 2 Nos
 - **Slack adjuster** : Automatic
 - **Front Brake Lining width/Area** : 200 mm/2180 sq.cm
 - **Rear Brake Lining width/Area** : 220 mm /2470 sq.cm
 - **Brake Drum Sizes** : 410 mm
- 2) Foot operated Engine Exhaust brake
- 3) As the profile of wheel discs & brake drums is different from other TATA model buses, don’t interchange these disks and drums with other models. This may lead to brake drum failure
- 4) Brake drums are not interchangeable from front to rear or vice versa.

14.0 Exhaust System

- In order to meet the BS-IV emission norm following technology is used in this engine.
 - a) EGR (**Exhaust Gas Recirculation**)
 - b) DOC & POC (**Diesel Oxidation Catalyst & Particulate Oxidation Catalyst**)

a) Exhaust Gas Recirculation(EGR) System:

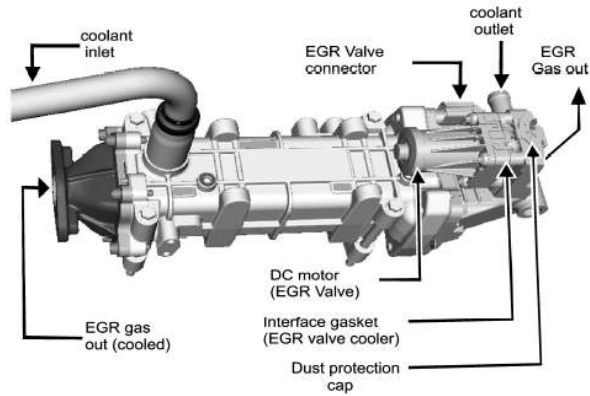


Fig. 10 EGR



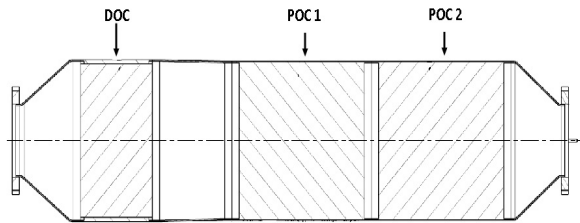
Fig. 11 EGR VALVE

- In diesel engines, NO_x formation takes place when the temperature in the combustion chamber exceeds 2000 K. In order to reduce NO_x emissions in the exhaust, peak combustion temperatures shall be kept under control.
- EGR reduces oxygen concentration in the combustion chamber by diluting the incoming ambient air with exhaust gases. During combustion, the lower oxygen content has the effect of reducing flame temperatures, which in turn reduces NO_x production.
- In order to further reduce the temperature of the exhaust gas that is being re-circulated, it is cooled in an EGR cooler which further suppresses the increase in combustion temperatures. The EGR cooler encompasses a bundle of heat exchanger core where-in the heat transfer between the hot EGR gas and the engine coolant takes place. EGR gas from the exhaust manifold passes across the EGR valve (incase if the EGR valve is opened) and gets cooled in the EGR cooler and rushes to the fresh air intake pipe.
- The EGR operating zone across the engine speed range and the corresponding quantity of the EGR are already pre-determined in the ECU. The EGR valve has a DC stepper motor and a gear train which converts the rotary motion of the DC motor shaft to the linear movement of the valve. The DC motor assembly also encompasses inside, a position sensor which gives the feedback of the EGR valve position to the ECU. To operate the EGR valve the ECU supplies current with a controlled duty-cycle to the DC motor terminals. Upon actuation, the position sensor in the DC motor assembly, gives feedback to the ECU and makes a close-loop operating cycle.
- The EGR valve stem area is protected by a dust protection cap as in EGR figure 8 above. This cap should remain intact with the EGR valve. Absence of this cap will allow the accumulation of dust in the EGR valve stem, which will make the valve malfunction.
- In event of any failure in EGR valve or the EGR cooler the entire assembly should be replaced because the surface finish of the interface area is very significant in sealing the coolant and gas passages. Separate fitment of either of the component in the field may not ensure proper sealing
- The entire EGR valve-cooler assembly will be hot after engine shutdown. Therefore precaution should be taken while accessing the areas nearby.

EGR valve is normally closed and opens only if the following three conditions are satisfied:

- Engine rpm is more than 1800 rpm
- Accelerator is in pressed condition
- Brake is not pressed.

b) **DOC & POC (Diesel Oxidation Catalyst & Particulate Oxidation Catalyst) System:**



Chemical Reaction in Diesel Oxidation Catalyst

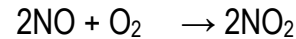
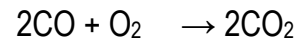
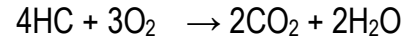


Fig. 12

- This technology uses unique Diesel Oxidation Catalyst which converts the unburnt hydrocarbon(HC) into carbon dioxide(CO₂) and water(H₂O), Carbon monoxide(CO) into Carbon dioxide(CO₂) and NO into NO₂
- Particulate Oxidation Catalyst/Particulate Filter (POC) is an open filter construction, consisting of corrugated stainless steel fine screens that form a cylindrical substrate. Exhaust gas has a free route to flow through the construction, but part of particulates is trapped inside the screen "eyes".
- POC collects soot and regenerates itself with help of NO₂ during strong accelerations and highway driving. POC unit is installed always behind an oxidation catalyst.
- To aid the formation of the NO₂ (for soot regeneration) the DOC has to operate efficiently. Use of fuel other than BS-IV will poison the catalyst in DOC and ultimately reduce the formation of NO₂. This will affect the regeneration of accumulated soot and will gradually increase the engine back pressure and may also lead to choking of POC.

(C) **MAINTENANCE OF DOC & POC:**

- It is recommended to run bus at high speeds (60-70 kmph) for minimum of 15 kms as it will help to clean the exhaust system and catalytic converter.

Or

First warm engine in idling for 3 minutes, then raise to 2400 rpm or above for 2-3 minutes in standing condition of vehicle atleast weekly once.

Or

Cleaning with compressed air:

The catalytic converter should be removed and cleaned with compressed air with pressure of 5 to 7 bar at the inlet. While cleaning with compressed air, tap the catalytic converter surface gently with the rubber / plastic mallet to increase the soot removal. Then fit the catalytic converter on the vehicle

15.0 Wheel & Tyre

- Size: 10.00 R20 - 16PR
- Wheel rim: 7.50" X 20"

16.0 Electrical system

- Battery: 2 x 12v - 150 AH
- Alternator: 24v 55/60A, LUCAS-TVS make SA45 type (Multi Groove Pulley)
- Starter type: LUCAS-TVS make 9M14 Axial Starter Motor

17.0 RECOMMENDED LUBRICANTS, COOLANT & CLUTCH FLUID:

Aggregate	Specification	Capacity
Engine Oil	SAE15W40 API CI-4 (Plus),	16.5 ltr (Including Filter)
Gear Box oil	SAE 80W90 Long Drain SS 6577	5.2 Ltrs
Differential Oil	SAE 80W140 Long Drain	8.6 ltr
Power Steering oil	DEXRON II D	3.0 Ltr
Wheel Brg Grease	IS 12203 / RR3	1.8 kg
Chassis Grease	Lithium MP	200 gms per week
Coolant	Non Amino Base 50% water + 50% Ethane Glycol	20 ltr
Clutch Fluid	SAE J1703 F OT3/DOT4	1.1 ltr

LUBRICANTS, COOLANT & FILTERS CHANGE PERIODICITIES		
1	Change Engine Oil & Filter	At every 60,000 km (For Dist) and At every 30,000 kms (For City)
2	Fuel filter cum Water separator replacement	20,000 kms
3	Fuel filter element (Engine mounted, Spin on) replacement	20,000 kms
4	Replace Gear Box oil	1,20,000 kms
5	Replace Differential Gear oil	1,20,000 kms
6	Replace Power Steering Oil	1,20,000 kms
7	Replace Power Steering Oil filter	1,20,000 kms
8	Change clutch fluid	1,20,000 kms
9	Replace Wheel Bearing Grease (RR3)	60,000 kms
10	Air Cleaner Primary replacement	Whenever the vacuum indicator shows red band
11	Air Cleaner safety replacement	At the time of every third replacement of primary filter element
12	Antifreeze Coolant replacement (applicable for Recommended coolant (pre-mixed)	3,20,000 kms or Two Years which ever is earlier

18.0 MAINTENANCE SCHEDULES

The specific maintenance activities applicable for BS-IV buses are furnished at Annexure 2.

19.0 ESSENTIAL SPARES TO BE STOCKED AT DEPOTS

The list of essential spare parts to be stocked at Depots for maintenance is shown at Annexure-3

20.0 TOOLS REQUIRED FOR ENGINE MANAGEMENT SYSTEM (EMS) DIAGNOSIS

(A) The Electronics in this BS-IV vehicle made it necessary to introduce the CAN diagnostics. To support the CAN diagnostic the new Samtech VCI has been introduced. The VCI is capable of diagnosing both K-Line and CAN diagnostics on vehicle.

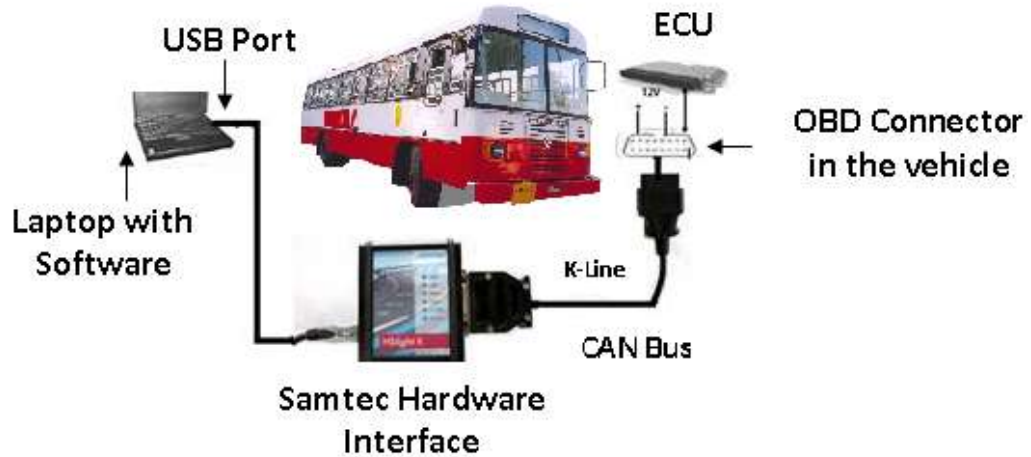


Fig. 13

S.NO	PART NAME	PART NO
1	Diagnostic software for LCV/M&HCV BSIV vehicles	210323609978
2	Samtec HSLight	210323259933
3	OBD cable for Samtec	210323269955

(B) BLUETOOTH DEVICE



Fig. 14

This device is used to diagnose the EMS defects through Android App in smart phone.

(C) INJECTOR BACK LEAK TEST KIT:



Fig. 15

The back fuel volume from the injector is a good indicator of the deterioration or contamination of the injector. This kit is used to measure the back fuel quantity of the injectors for diesel engines with "Common Rail" injection system. The Common Rail injection system consists of modules and components which are manufactured with high precision. Failure may occur even if small amount of dirt falls into the injection system. We must be very careful not to contaminate the Common Rail system during the test and repair. It consists of 6 pieces of Plastic 50 ml measuring bottles with graduated scales, plastic hose 1 m- 6 pieces, metallic frame, 6 Metal connector for the injectors.

Test procedure:

- The engine must be heated to working temperature and turned off.
- The metal connectors are inserted in the transparent silicone hoses and are connected to the back fuel lines over the injectors.
- The metal connectors are clipped to injectors with original spring clips.
- Start the engine and let it run in idle speed for about 1 minute. After that increase to full RPM and retain it the same for 30 seconds. Turn off the engine.
- After completing the test, measure the fuel quantity in each measuring bottle and analyze the test results. For the proper injection, Ratio of maximum and minimum quantity of back leak fuel should not cross 3:1. If exceeds, identify the injectors whose back leak delivery is abnormally low/high as compared to other injectors and change.

21.0 As the Engine management system consists of number of electronic components, to protect them from damage against voltage surge, the following care is very vital. Hence the Do's & Don'ts to be observed during routine maintenance of bus are furnished here under:

(a). Do's & Don'ts in fuel system:

- If the engine does not start, check the respective fuses related to Common Rail components.
- Flushing of CR components and injectors should be avoided.
- Don't clean HP pipes with compressed air, oil or water.
- Do not plug / unplug electrical connection to FIP, injectors & common rail if ignition is ON.
- Do not connect injector directly to any external power source (battery) for checking purpose. This will lead to total damage of electrical parts of injector
- To remove fuel return line press circlip and then gently pull off the back leak pipe connector by hand.
- To avoid foreign material entry inside the injector, provide protective caps immediately after removal. Once the injector is removed, new copper sealing washer has to be used
- Carefully unscrew HP pipe cap nut from HP connector. Use 2nd spanner to lock HP connector. HP pipe lines should not be bent and force should not be applied.
- Whenever common rail is removed from engine the high pressure pipes have to be replaced with new ones
- When injectors are repaired/changed, injector codes must be loaded in the ECU correctly as per the cylinder order.
- Don't try to dismount / repair rail pressure sensor & pressure limiting valve
- Always remove the injectors before dismantling the cylinder head. This will avoid damage to injector nozzle tips which protrude out of cylinder head. In case of HP pump removal, handle the pump with proper care to avoid any damage to inlet pipe, leak off pipe and connectors.
- HP pipes are one time use only. Avoid unnecessary removal and don't reuse.
- Never bleed on high pressure side of fuel system which may cause severe damage to the person working on it.
- Even in case to remove high pressure lines, it should be done only after minimum 20 minutes of engine shut off.

(b). General Precautions:

- Battery to be disconnected in case of any welding on the vehicle.
- ECU connectors also to be disconnected before doing welding.
- Fix rubber cap to ECU to prevent dust/moisture entry inside ECU. Don't spray water on ECU.
- EMS wiring harness to be routed as specified using clamps/ clips & brackets.
- Wiring harness of the vehicle should not be tampered by tapping extra electrical connections. Separate provision is provided in the vehicle fuse box for taking extra electrical connections for items like music system, additional lamps etc.
- Only specified alternator and horn with capacitor to be used when ever replacement is made.
- ECU must be connected/ disconnected to the wiring harness only when the ignition is OFF. Don't remove battery, sensor & actuator connections when key in ON.
- Don't let ECU body touch any metallic part while ECU is powered ON.
- Check the battery condition weekly and keep the battery in a fully charged condition.

- Ensure proper connection of ECU positive cable directly from Battery positive and connectivity of ECU/Sensor connectors with wiring Harness. Any loose connections in the circuit will result in malfunctioning of engine.
- Fix ECU connector branch properly while transporting engine.
- Fuses with correct specifications should be used and Keep Spare fuses in Fuse box cover.
- Check for any faults/ malfunctioning in the system using diagnostic tool before cranking engine after any repair.
- Don't let the vehicle run with 'MIL' or 'CEL' lamp ON.
- Check the Engine Lamp Indicator (CEL) for ON/Blinking, if so keep the vehicle a side and switch off the Ignition and wait for 30seconds. Then crank the engine again and check whether CEL Indicator is ON/Blinking, if it exists then the faults in Engine Management system are to be analyzed.
- Drain water from fuel-water separator whenever water in fuel indicator light ON
- Don't interchange wheel discs and brake drums (front to rear also) with other models of TATA, leads to brake drum failure.

All the Depot Managers and Maintenance In-charges are advised to follow the above circular instructions, educate the maintenance staff and ensure that the TATA BS-IV Buses are maintained in good condition.

Dy.CMEs are advised to ensure implementation of the Circular guidelines and pay special attention on this during their inspection of depots.

EXECUTIVE DIRECTOR (E&IT)

To

All Dy. Chief Mechanical Engineers of Regions.

Copy to: Dir (V&S), ED (O &MIS), ED (A&P), ED (T&C) & Secretary to Corporation.

Copy to: FA and CAO for information.

Copy to: All EDs (ZONES) for information & necessary action

Copy to: CME(O),CCOS, CME(C&B) and CE(IT) for information

Copy to: All RMs for information and necessary action

Copy to: Dy CME(O),Dy CME(P) and Dy CME(C&B) for information

Copy to: All WMs & COSs for necessary action

Copy to: Principal, TA/VDPM & all ZSTCs for information

Copy to: All DMs & Maintenance Incharges for necessary action

Copy to: Incharge Manual section for record.

TATA BS IV SENORS FUNCTION & FAILURE SYMPTOMS

S. NO.	Name of the sensor	Location of the sensor	Purpose of the sensor	Vehicle response
1	Engine speed sensor	Mounted on flywheel	it provideds information of engine speed	Vehicle can be operated with limited speed
2	Cam Position sensor	Mounted on timing gear cover	To determine fuel injection timing	Vehicle can be operated with limited speed
3	Coolant Tempature sensor	mounted on coolant return line from cylinder head	It measures the tempature of the coolant	Vehicle can be operated with limited torque
4	Hot Air Mass Flow Sensor	it is mounted in between the air filter and turbo charger	Measures the density of atmospheric air	Vehicle can be operated. No limatation
5	Rail Pressure Sensor	Mounted on the common Rail	It helps to maintain the pressure in common rail	Vehicle can be operated with limited speed/ torque
6	Accelerator pedal sensor	Mounted on Accelerator pedal bra	Gives the signal of accelerator pedal position to the ECU	Vehicle can be operated with limited speed
7	Fuel tempature Sensor	mounted on the fuel filter head	it gives the information about the fuel tempature	Vehicle can be operated. No limatation
8	Water in fuel Sensor	It is mounted on the fuel filter cum water saporator on the bottom side	This sensor gives the indication of water present in fuel,	Vehicle can be operated with limited torque
9	Vehicle speed sensor	On gear box at rear side	It gives the information to ECU about the vehicle speed and also input to the speedometer for display of vehicle speed.	Poor pickup, Vehicle can be operated with limited speed
10	Boost pressure sensor	Mounted on intake manifold	Determines the pressure and temperature of air going into the combustion chamber	Vehicle can be operated with limited torque
11	Differential pressure sensor	Mounted on DOC/POC	Measures pressure difference betwen intake & exit of DOC-POC	Max speed limits to 1900 rpm after 50 hours.
ACTUATORS				
1	Injector	On cylinder head	To atomise and inject correct quantity of fuel in timing	Vehicle can be operated with limited speed. Some times may lead to engine shut-off
2	Metering Unit (MeUn)	On high pressure Pump	Supplies fuel to common rail based on the pressure available in the common rail.	Poor pickup. Engine vibration in case of high pressure.
3	EGR valve	On EGR cooler assembly. Noramly clsoed	Controls inflow of exhaust gas to EGR cooler assembly as per the ECU signal.	Vehicle can be operated.No limitation
SWITCHES				
1	Oil pressue switch	On engine oil filter bed	To measure the oil pressure	Vehicle can be operated with limited speed. Some times may lead to engine shut-off
2	Clutch switch	Below clutch pedal		Vehicle can be operated.No limitation
3	Brake switch	Below brake pedal		Vehicle can be operated.No limitation

MAINTENANCE SCHEDULES

Description of Activity	Sch-I	Sch-II	Sch-III	Sch-IV
	Daily	Weekly		
ENGINE				
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	Whenever there is indication of water in fuel in Instrument Panel			
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	✓	✓	✓	✓
Lubricate engine exhaust brake linkages with oil		✓	✓	✓
Remove engine breather cap, clean & refit		✓	✓	✓
ELECTRONIC DIESEL CONTROL				
Check for engine full acceleration(Thr. 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 the help of diagnostic tool			✓	✓
Check tightness of engine speed sensors and clean the sensor tip for any dirt/dust deposits		✓	✓	✓
Check functioning of CEL Indicator light	✓	✓	✓	✓
TURBOCHARGER & INTERCOOLER				
Check for any leakages/damages in lubrication return hose of Turbo Charger to engine		✓	✓	✓
Check Turbo Charger waste gate rubber hose for any cracks or damages			✓	✓
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 ²)				✓
CLUTCH				
Check function of clutch system		✓	✓	✓
Check Clutch pedal free play		✓	✓	✓
TRANSMISSION				
Check Gear box oil leakages/level	✓	✓	✓	✓
Check Looseness in gear control mechanism		✓	✓	✓

PROPELLER SHAFT				
Check Propeller shaft nuts tightness	✓	✓	✓	✓
Check C.J Bearing & rubber bed condition	✓	✓	✓	✓
Check Universal joint cross & bits for wear	✓	✓	✓	✓
Universal joint crosses and splines Greasing		✓	✓	✓
SUSPENSION				
Check Suspension U-bolt / nuts tightness		✓	✓	✓
Check Wavellar Brackets/Bolts for tightness	✓	✓	✓	✓
Check for broken/sagging spring leaves	✓	✓	✓	✓
Check wavellar rubber elements for damage		✓	✓	✓
REAR AXLE				
Check Differential gear oil leakages/level	✓	✓	✓	✓
Check for tightness of Pinion Check nut	✓	✓	✓	✓
FRONT AXLE				
Lubricate King Pins		✓	✓	✓
Check grease leakages of King pin Sealing Cap / 'O' rings & attend if necessary			✓	✓
STEERING				
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 for Steering linkage for damage, looseness and excessive play		✓	✓	✓
Check Clearance between knuckle, King Pin and front axle		✓	✓	✓
Check & adjust Wheel alignment		✓	✓	✓
SERVICE BRAKE				
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		
ELECTRICAL EQUIPMENT				
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			✓	✓
CHASSIS LUBRICATION				
Lubricate all Grease points*		✓	✓	✓

TYRES				
Check Tyre inflation pressures		✓	✓	✓
Remove Trapped stones, replace Tyres at 2mm NSD	✓	✓	✓	✓
Wheel nuts	✓	✓	✓	✓
EGR SYSTEM & DOC & POC EXHAUST SYSTEM				
Check for leakages of coolant/exhaust gas from the EGR	✓	✓	✓	✓
Check for tightness of EGR mounting bolts & nuts		✓	✓	✓
Check for EGR valve stem dust protection cap is intact or not		✓	✓	✓
Check for tightness of EGR valve electrical connector		✓	✓	✓
Check EGR valve proper opening of 5-6 mm by removing it from the engine				✓
Check for DOC/POC rubber mountings for damage, deterioration or out of position.			✓	✓
Check exhausts system for any leakage, loose Connection, dent & damage.	✓	✓	✓	✓

ANNEXURE- III

LIST OF ESSENTIAL SPARES TO BE STOCKED AT DEPOT FOR TATA BS-IV BUSES			
S.No	Part No	Description	Per vehicle Qty
1	3382629	ASSY. BALL JOINT LH	1
2	216541303327	BRACKET(FOR 1ST CENTRE BEARING)	1
3	252501155336	GASKET (CYL.HEAD TO CYL.CRANKCASE)	1
4	252501155355	GASKET - ROCKER ARM COVER	1
5	252501170313	ASSY OIL SEPERATOR	1
6	252501175809	HOSE (OIL SEPARATOR)	1
7	252509110114	ASSY. FUEL FILTER CUM WATER SEPERATOR (M/S BOSCH	1
8	252514605822	HOSE (TC ADAPTER TO PIPE)	1
9	252514606967	PIPE (TC ADAPTER TO IC)	1
10	252515140179	ASSY IDLER	1
11	252515146303	POLY V BELT 8PK 1260L	1
12	252520120248	ASSY.THERMOSTAT(35DIA BYPASS)	1
13	252520125841	RUBBER HOSE (UCWL TO THERMOSTAT)	1
14	252520125842	RUBBER HOSE (THERMOSTAT TO WATER PUMP)	1
15	252520140153	ASSY VISCOUS FAN (550 DIA)	1
16	252520143842	SPACER FOR FAN	1
17	252523140115	ASSY TENSIONER PLATE WITH PULLEY	1
18	252523145807	HOSE : OIL RETURN	1
19	252523145810	RUBBER HOSE (A/C TO EGR OUTLINE)	1

20	252523146313	V-BELT COGGERD (1060L) M/S CONTITECH	1
21	252523146316	V BELT COGGRD (995 mm)	1
22	252550115811	HOSE (RADIATOR TO WP)	1
23	252550115857	RUBBER HOSE (THERMOSTAT TO RADIATOR)	1
24	252550115858	VENT HOSE (RADIATOR TO THERMOSTAT)	1
25	252709119902	EXCHANGE FILTER INSERT (WATER SEPARATOR)	1
26	257332600125	REAR SHOCK ABSORBER	2
27	257533209203	THRUST WASHER UPPER STD	1
28	257533209207	THRUST WASHER LOWER STD	1
29	257624100101	ASSY RUBBER SUPPORT FRONT (Engine Mounting)	1
30	257633203109	TAPERED ROLLER THRUST BEARING	1
31	257635605301	GASKET (COVER TO HUB)	2
32	261832300101	ASSY SHOCK ABSORBER FRONT (WITH EXTENDED LENGTH)	2
33	263224200103	ASSY RUBBER SUPPORT REAR (RH) (Engine Mounting)	1
34	263224200104	ASSY RUBBER SUPPORT REAR (LH) (Engine Mounting)	1
35	266835607703	OIL SEAL (REAR HUB)	1
36	269929100177	REPAIR KIT (MAJOR) CLUTCH MASTER	1
37	270754244901	ACC RELAY - 24V (WITH RESISTOR)	1
38	272425200151	330 DIA ASSY CLUTCH DISC - SETCO	1
39	272425400143	330 DIA COVER ASSY (COIL)	1
40	277046609901	CARTRIDGE STEERING RESERVOIR	1
41	277054244902	RELAY-24V.	1
42	278609139908	PRIMARY CARTRIDGE	1
43	278609139909	SAFETY CARTRIDGE	1
44	278609999951	FUEL STRAI NER(4080720)	1
45	278614605802	HOSE HUMP	2
46	288042990105	MINOR KIT REAR BRAKE LINING SET STD	1
47	501442108701	KIT-S CAM SHAFT & SPRING.	1
48	501442109902	KIT-SPRING CAM END	2
49	502729100101	ASSEMBLY HYDRAULIC PIPE(M CYL TO BOOSTER SECOND)	1
50	502729100116	ASSEMBLY HYDRAULIC PIPE(M CYL TO BOOSTER FIRST)	1
51	503033408303	SHIM For Front Hub 0.85 MM Thick	1
52	503033408304	SHIM For Front Hub 0.90 MM Thick	1
53	581735607702	HUB OUTER SEAL (110 X 128 X 9)	2
54	62123224006	FUSE ATO BLADE 5A ISO8820	9
55	62123224014	FUSE ATO BLADE 10A ISO8820	12
56	62123224022	FUSE ATO BLADE 15A ISO8820	4
57	62123224031	FUSE ATO BLADE 20A ISO8820	4
58	253403107801	OIL SEAL-CRANKSHAFT FRONT	1
59	3520101980	ASSY GASKET OIL SUMP TO CYL BLOCK	1

60	252515209903	CAM PHASE SENSOR : 697 BSIV	1
61	252515209902	SPEED SENSOR : 697 BSIV	1
62	252507140291	SET:ASSY FUEL PRESSURE LINES 1&2	1
63	252507140243	ASSEMBLY FUEL PRESSURE LINE 1	1
64	252507140244	ASSEMBLY FUEL PRESSURE LINE 2	
65	252507140245	ASSEMBLY FUEL PRESSURE LINE 3	1
66	252507140246	ASSEMBLY FUEL PRESSURE LINE 4	1
67	252507140247	ASSEMBLY FUEL PRESSURE LINE 5	1
68	252507140248	ASSEMBLY FUEL PRESSURE LINE 6	1
69	252509120260	ASSY INJECTOR LEAK OFF LINE	1
70	252509110114	ASSY. FUEL FILTER CUM WATER SEPERATOR (M/S BOSCH)	1
71	3521310280	GASKET(94 DIA A.C.HEAD)	1
72	250526255301	GASKET (FR. COVER TOP TO HSG.)	1
73	252515209901	BOOST PRESSURE SENSOR : 697 BS IV	1
74	252514110281	ASSEMBLY EGR VALVE 24V (M/S	1
75	252515143701	BRACKET (ALTERNATOR & PSTRG MTG.)	1
76	252518130164	ASSY.OIL FILTER ELEMENT(SPINON)	1
77	272425600160	ASY.CL.RELEASE BRG-LHS(SELF	1
78	272425605106	CLUTCH RELEASE FORK (REINFORCED)	1
79	250526257808	OIL SEAL DRIVE SHAFT	1
80	250526207803	OIL SEAL	1
81	264126800224	ASSY.BALL JOINT RH	1
82	264126800225	ASSY.BALL JOINT LH	1
83	264129100117	CLUTCH MASTER CYL (19.05 DIA)	1
84	269930100138	ASSY. ACCELERATOR PEDAL COMP.(M/S BOSCH)	1
85	277642103701	FRONT BRAKE DRUM	2
86	288042990101	MINOR KIT FRONT BRAKE LINING SET	1
87	257633403101	TAPER ROLLER BEARING, INNER	2
88	257633403103	TAPER ROLLER BEARING, OUTER	2
89	257535303102	TAPER ROLLER BEARING	2
90	257335307705	OIL SEAL (PINION) DOUBLE LIP	1
91	288042108701	SPRING CAM END	2
92	288042108702	SPRING ABUTMENTEND	4
93	252550100320	ASSY.RADIATOR WITH FRAME	1
94	252514600109	ASSY.INTERCOOLER(TATA TOYO)	1