Andhra Pradesh State Road Transport Corporation
Office of the Managing Director, Bus Bhavan, Hyderabad – 500 624.

No: OP2/462(1)/2010-MED

CIRCULAR No.30/2011 - MED, Dt 02-08-2011

Sub : **MAINTENANCE** – Introduction of BS–III compliant Low Floor Buses by M/s Tata Motors Ltd – Salient features and maintenance aspects communicated - Reg.

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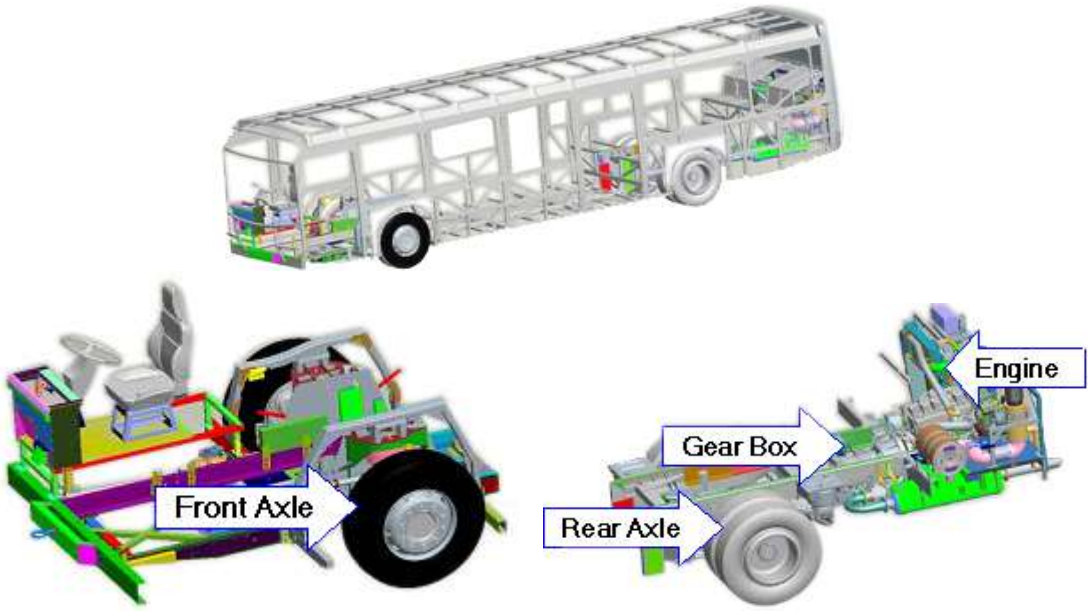
1.00 Corporation has procured **fully built LPO 1624TC BS-III compliant Low entry A.C. buses and LPO 1618 TC Low entry Non-A.C. buses with rear mounted Cummins Diesel Engine** supplied by M/s Tata Motors Ltd under JnNURM Scheme. The salient features of these buses are

- Integral type chassis frame with 12 mtr overall body length
- Fully built monocoque design bus body with wide pneumatic operated doors and wheel chair ramp. Sensitivity mechanism for doors to retract immediately when any obstruction is sensed between the doors.
- Kneeling mechanism on the left side to lower the floor height
- Human Machine Interface (HMI) LCD screen on Dash board
- Rear mounted ISBe Cummins Diesel engine with Electronic Control Module (ECM) for A.C. buses.
- Common Rail Diesel Injection system for A.C. buses and Rotary FIP for Non-A.C. buses.
- Allison Automatic Transmission with integral Retarder and torque converter mechanism controlled by Transmission Control Module (TCM)
- Air operated Disc brakes in front and S'cam brakes in Rear
- ZF/Meritor Front axle with Air suspension
- Tata RA 109 Rear axle with Wheels India Air suspension
- Multiplex Wiring with Diagnostic features on HMI screen for indicating various faults and warning indications
- Webasto make Air conditioner (optional) with Engine driven compressor for A.C.buses.



2.00 TECHNICAL SPECIFICATIONS OF LOW FLOOR REAR ENGINE VEHICLES:

The features and specifications of engine for 1618 Non-A.C. Low Entry bus are similar to those of 1618 FE SLF buses which were supplied earlier by M/S Tata Motors. The features and specifications were already communicated vide circular no. 29/2009-MED, Dt.24.12.2009. The unique features of Low Floor buses and the features of ISBe engine are furnished below.

ENGINE	
Engine for A.C. buses	
Model	Cummins ISBe Bharat Stage-III
Type	Water cooled Turbocharged Inter-cooled Diesel engine with 6 inline Cylinders
Bore x stroke & capacity	107 x 124mm, 6.7 liters
Max Engine out put	242 HP at 2500 rpm
Max.Torque	925 N-m at 1700 rpm
Air Filter	Dry type engine mounted
Oil Filter	Full flow spin-on type paper
Fuel System	Common Rail Fuel Injection with Electronic Control
Coolant	Water and Ethylene glycol mix in 1:1 ratio
Coolant capacity	9.4 liters (Engine), 27 liters(Total)
Engine oil capacity	14.3 max and 12.3 min
GEAR BOX for 1624 A.C. RELE	
Model	Allison Auto transmission
Type	T280R Deep sump
No.of Gears	5 forward + 1 reverse
Gear ratios	Forward: 3.49, 1.86, 1.41,1.00, 0.75; Reverse: 5.03, Stall Torque ratio – 2.44

GEAR BOX for 1618 Non-A.C. RELE	
Model	Allison Auto transmission
Type	T270R Deep sump
No.of Gears	5 forward + 1 reverse
Gear ratios	Forward: 3.49, 1.86, 1.41,1.00, 0.75; Reverse: 7.91, Stall Torque ratio – 2.44
FRONT AXLE	
Model	ZF/Meritor Front Axle with Disc brakes and Air Suspension
REAR AXLE	
Model	Tata RA 109 RR
Type	Single reduction Hypoid gears, fully floating axle shafts
Crown-Pinion ratio	41/6
BRAKES & STEERING	
Service Brake	Dual full air S'cam brakes in rear and disc brakes in front
Brake drum size	419mm
Parking brake	Hand operated spring actuated parking brake in rear with graduated hand brake valve
Steering	Hydraulic power, Ratio-20.2:1
CHASSIS FRAME & SUSPENSION	
Frame type	Integral type low floor frame
Suspension	Air suspension in front and rear with hydraulic double acting telescopic type shock absorbers
WHEELS	
Tyres	11R22.5 Radial
Wheel Rims	8.25 x 22.5
ELECTRICAL	
Voltage	24 volts
Alternator Capacity	90 Amps
Battery capacity	180 A-h
OTHERS	
Fuel tank capacity	150 liter
Turning circle Dia	20200
Wheelbase, total length, width	6300, 12000, 2600
Gradeability	21%

3.01. **ENGINE**

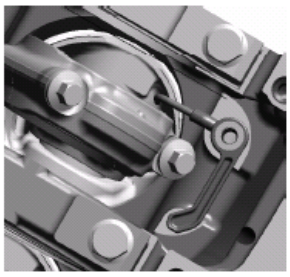
The type of the Engine fitted to the 1624 RELE A.C. buses is designated as 24 Valve ISBe **(Interact System B series electronic)** Cummins BS-III with following features

- Common Rail Fuel Injection with Electronic Diesel Control
- Turbocharged charged & inter-cooled
- High pressure injection pump with injection pressure 1600 bar
- Cylinder head with 4 valves per cylinder and centrally mounted solenoid injectors

The Engine block casting is a skirted design which incorporates ribs for superior strength and noise reduction. The cylinder block uses bored cylinders as opposed to liners. In the event of damage or wear out, the cylinders can be repaired. Unlike the majority of previous B series cylinder blocks, the cylinder block is of a conjoined bore design. Other important design features are the integral ladder frame (block stiffener plate) and the enclosed tappet cavity.

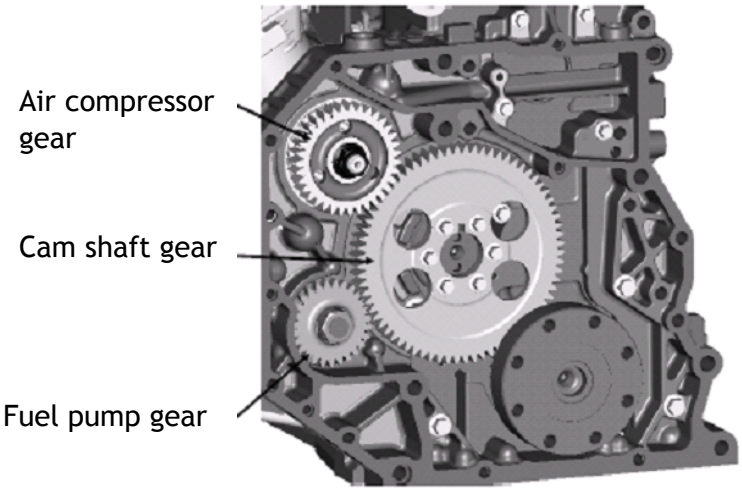
Externally the engine appears very similar to other Cummins "B" series engines, but there are major differences in coolant flow capabilities within the block.

<u>Gallery cooled Pistons & J' type Piston cooling nozzles</u>

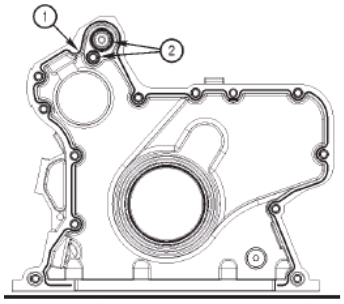


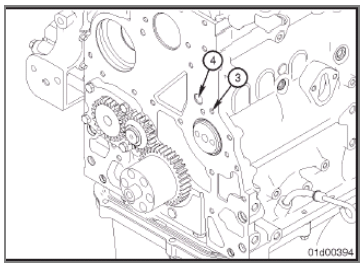
The other important features are Sliding Tappets, Cast Iron Camshaft, Camshaft speed indicator ring mounted to the end of the camshaft at the front of the engine and bolted Camshaft Gear with thrust plate between camshaft gear mounting flange and the cylinder block

Rear Gear Train



Front Gear Cover: The front gear cover houses the lubricating oil pump, front crankshaft seal, and camshaft speed indicator ring.

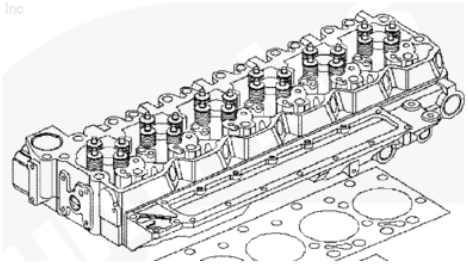


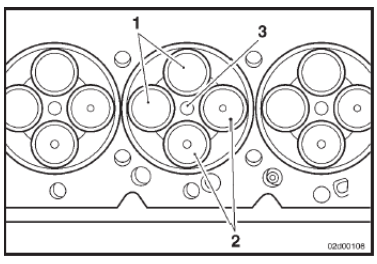


The front gear covers also contains the oil pressure switch, camshaft speed/position sensor, and crankshaft speed/position sensor.

Cylinder Head: As with previous 24 valve B series engines, the cylinder head is one-piece cast iron, cross flow design with four valves per cylinder.

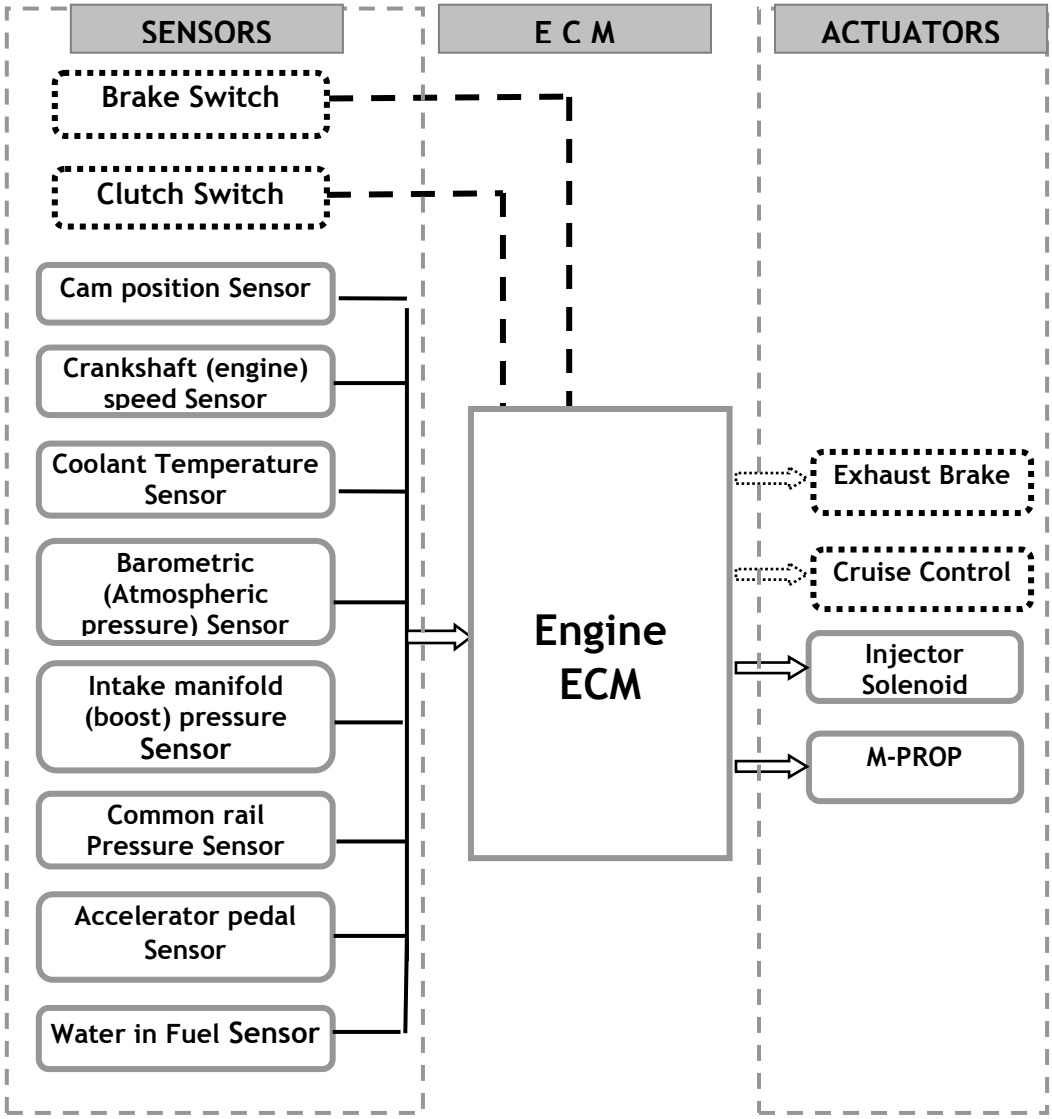
- The cylinder head has an integral Intake manifold and Thermostat housing
- The four valve per cylinder design allows for a centered injector in the cylinder head





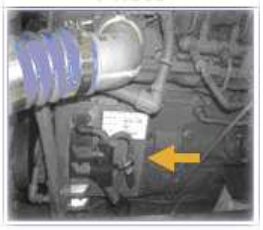
3.02. ENGINE ELECTRONIC CONTROLS:

The complete engine operation and performance are governed by the Electronic Control Module (ECM). The electronic engine control is achieved with the aid of following sensors and ECM



i) ELECTRONIC CONTROL MODULE (ECM):

ECM is a micro processor that receives signals from input sensors and sends signals to output sensors/switches to control the engine and get the optimum output.



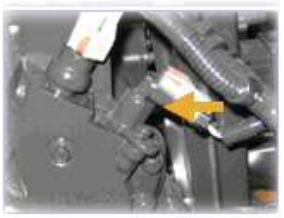
ii) INPUT SENSORS:

- **OIL PRESSURE SWITCH**

  This is a single wire normally close type switch (NC). This determines Engine oil pressure and gives signal to the ECM. The switch contacts open at 7-10 psi of oil pressure. Engine shuts down if the oil pressure detected below 7 psi.

- **CAM POSITION SENSOR**

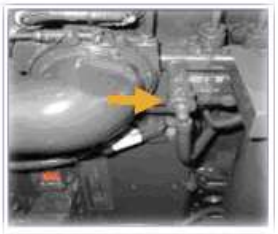
  This is three wire sensor. This determines 1st Cylinder TDC position and provides signal to ECM for fuel timing. This also acts as a backup for crankshaft speed sensor in case of malfunction of crankshaft speed sensor.



- **CRANKSHAFT POSITION SENSOR**
  This is three wire sensor. This determines Engine speed and provides signal to ECM for fuel timing. This also acts as a backup for Cam Position sensor in case of its malfunction.

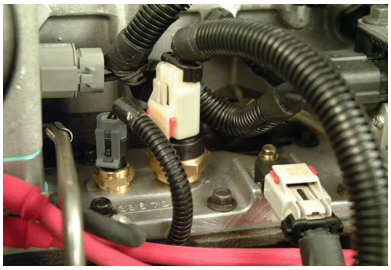
- **COOLANT TEMPERATURE SENSOR**
  This is a two wire sensor which operates between 0.2 to 4.8 volts. This determines Coolant temperature and gives signal to the ECM. This is located on Cylinder head between the Rocker cover and Engine water outlet.

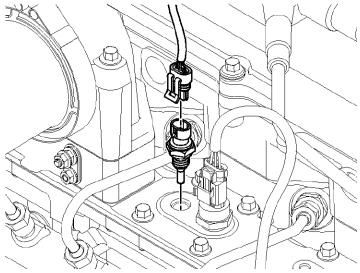
- **BAROMETRIC PRESSURE SENSOR**
  This is a three wire sensor which determines the ambient atmospheric pressure. This is mounted on Fuel pump side of engine near ECM.



- **COMMON RAIL PRESSURE SENSOR**
  This is three wire sensor used to determine the fuel pressure in Common Rail. Its input voltage is 5V. It works on metal thin film strain gauge principle. Operates between 0 to 1600 bar pressure and 30^{O} to 60^{O}C temperature.

- **INTAKE MANIFOLD PRESSURE & TEMPERATURE SENSOR**





This is a four wire combination sensor which is used to determine the Intake Air pressure and temperature and gives signal to ECM. Depending on the Intake Air pressure and temperature, ECM decides the fuel quantity. This is mounted on the Intake Manifold cover.

- **WATER IN FUEL SENSOR**
  This is a two wire sensor which determines the water level in the Primary Fuel Filter and sends signal to ECM. ECM then provides an indication on the instrument cluster. This is located on the Primary Fuel Filter on RHS longmember.

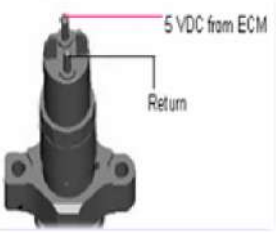
- **ACCELERATOR PEDAL SENSOR**

It consists of 2 position sensors. Position sensors measure the actual throttle position. Both sensors receive 5 Volt supply from ECM. When Accelerator pedal is at 0% position, ECM receives low signal voltage. When Accelerator pedal is at 100% position the ECM receives high signal voltage.

iii) OUTPUT SENSORS:

- **SOLENOID INJECTORS**

Injectors consist of Solenoid valves which control the fuel injection depending on signal from ECM. Injector receives input signal 5 VDC from ECM which controls the opening of the Solenoid valve. High pressure fuel then passes through Solenoid into combustion chamber in atomized form.

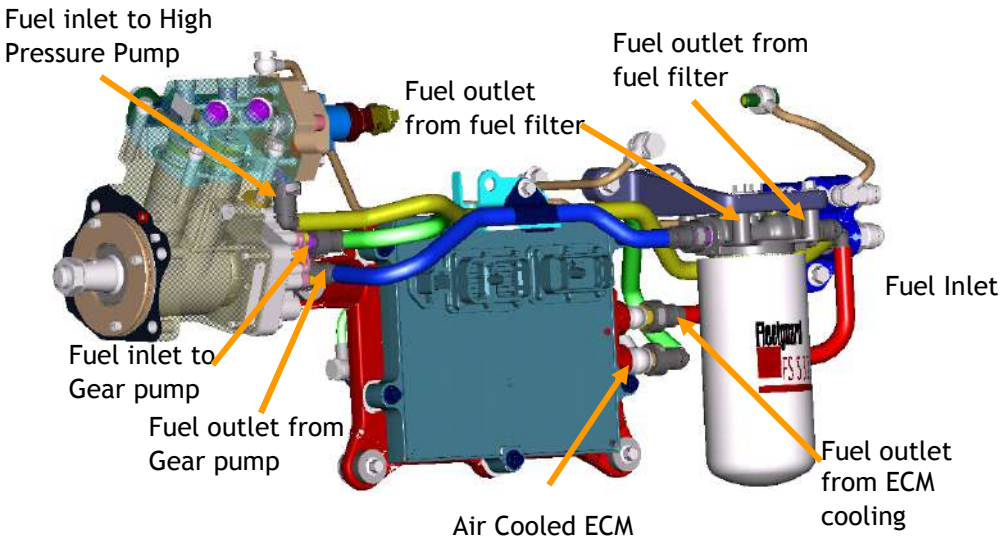


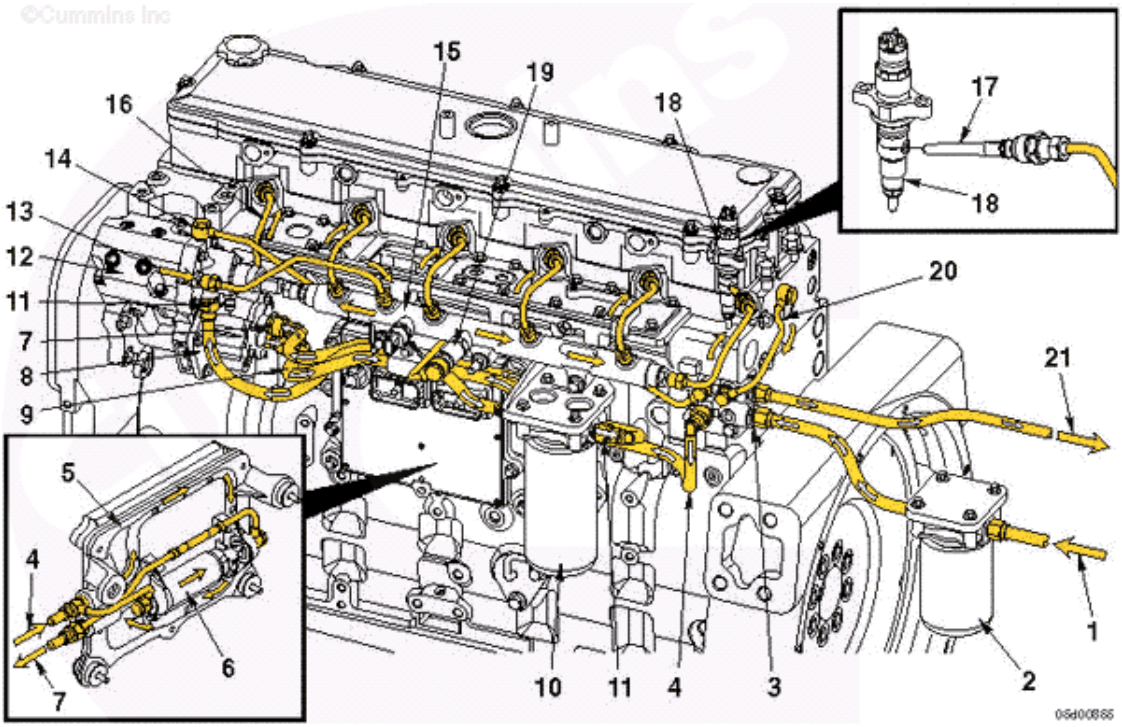
- **M-PROP (METERING UNIT)**

Fuel is pressurized by low pressure gear pump in combination with high pressure Radial Piston Pump. This actuator (M-Prop) is fixed on the Common Rail Pump. ECM provides signal to the M-Prop to regulate the fuel from low pressure circuit to high pressure circuit to attain desired common rail pressure.

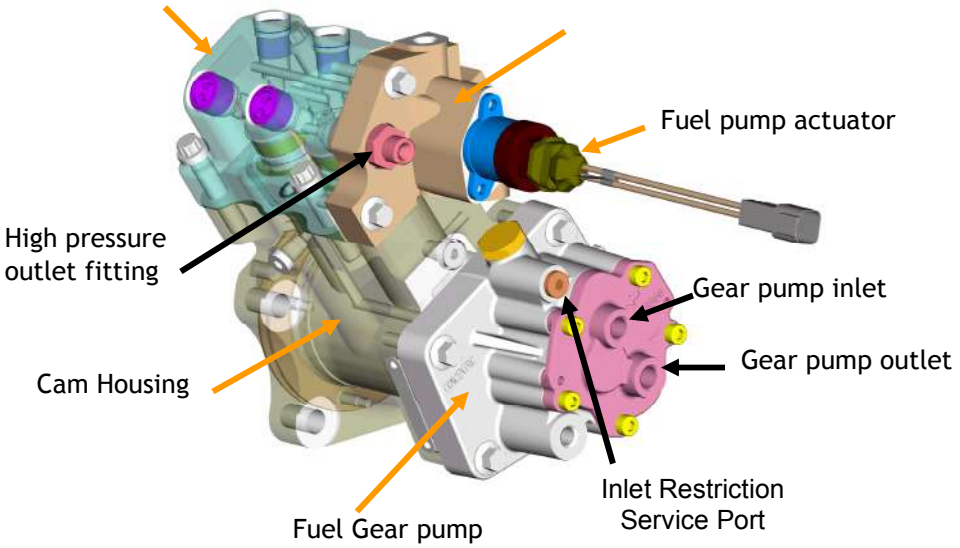
3.03. FUEL SYSTEM:

Common Rail Diesel Injection system is introduced in ISBe Engines fitted to 1624 RE LE (A/c Buses), while there is no change in the fuel system of 1618RE LE (Non-A/c buses) which is same as that of 1618 FE SLF buses presently under operation.

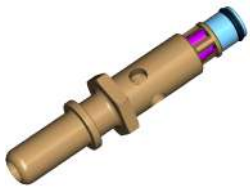




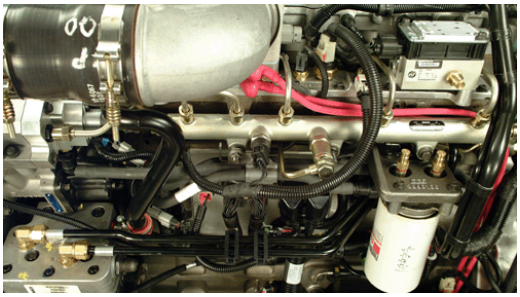
1. Fuel from supply tank
2. Fuel filter and water separator
3. OEM Fuel supply connection
4. Fuel supply to ECM mounted fuel lift pump
5. ECM Cooling plate
6. ECM mounted fuel lift pump
7. Fuel outlet from ECM mounted fuel lift pump
8. Fuel gear pump
9. Fuel from gear pump to fuel filter
10. Primary fuel filter
11. Fuel inlet to fuel pump actuator
14. High pressure pump drain flow connection
15. Fuel rail
16. High pressure injector supply lines
17. High pressure fuel connector
18. Fuel injector
19. Fuel pressure relief valve
20. Fuel injector drain flow line
21. Fuel return to supply tanks



ECM Cooling: Without the ECM cooling plate check valve, fuel would continuously circulate through the ECM cooling plate when the lift pump is not running. The check valve can become damaged upon installation. Inspect the check valve for damage or debris when troubleshooting low power and performance problems. High fuel inlet restriction will be measured at the gear pump inlet if the check valve is damaged.



High pressure relief valve : High pressure relief valve acts like a 'fuse' in the fuel system. If fuel pressure exceeds the relief valve pop-off pressure, fuel rail pressure will be regulated to 900 bar and the excess fuel will be returned to drain.



If the high pressure relief valve opens, fault code 449 or 2311 will activate indicating a pressure overshoot occurred.

If the control system still has pressure control, the valve will reseat through a momentary pressure interruption (3x max) and normal operation will continue.

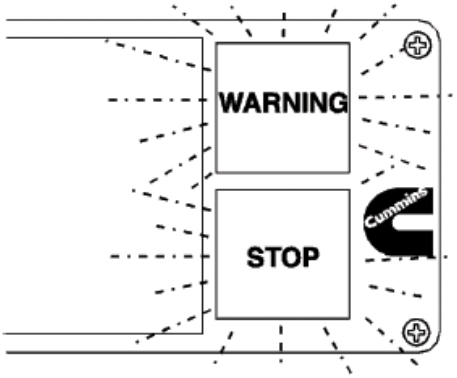
Injector:

The opening of injector nozzle is achieved by a Solenoid which is energized by the electric current received from ECM. The timing and duration of opening is totally controlled by the ECM.

- Fuel System cleanliness is very important for High Pressure Common Rail Systems
- Contaminants can lodge in the small passages in the injector preventing critical flows.
- If the contaminate particle lodges in the passage to the plunger area, the result is the injector will remain in the open position and cause engine damage due to uncontrolled fueling of the cylinder

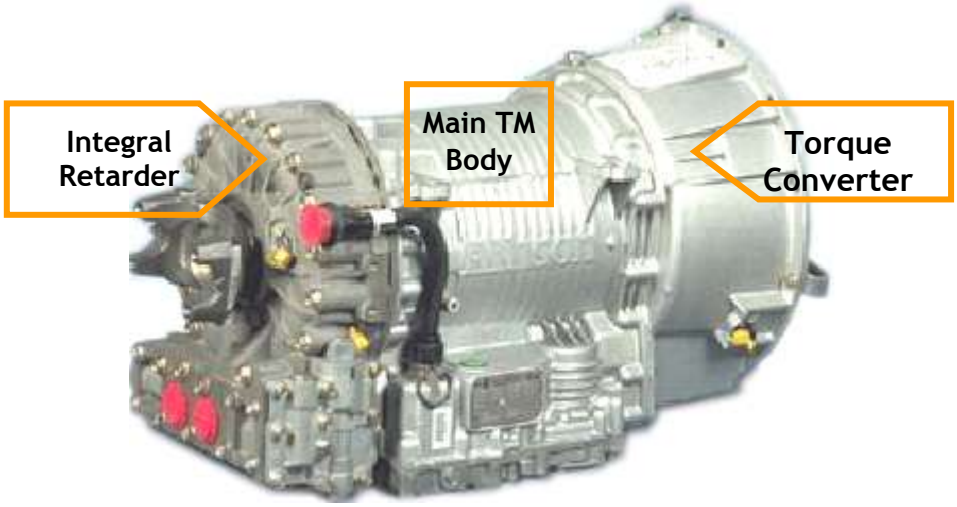
Engine Protection Shutdown

This feature automatically shuts off the engine when the temperature, pressure, or coolant level sensors indicate the engine is operating over or under normal operating conditions. The red "STOP" lamp in the cab will flash for 30 seconds prior to shutdown to alert the driver. The engine protection shutdown feature can be enabled or disabled using the INSITE™ service tool if the feature is availablein the calibration.



4.00. AUTOMATIC TRANSMISSION:

The transmission system ALLISON T280R is fitted for 1624 RELE A.C. buses and ALLISON T270R is fitted to 1618 RELE Non-A.C. buses which consist of Torque converter, planetary gears and clutches and retarder.



Auto transmission System consists of epicyclical gear train with hydraulically operated mechanisms for changing gears. Torque converter is provided to smoothly connect engine to transmission and multiply torque. There is a lockup clutch in the system which engages automatically at a particular rpm after reaching certain pressure and uses a solenoid to direct pressurized oil. Torque converter, in built brake retarder are pneumatically actuated, hydraulically operated. All are controlled by Transmission Control Module (TCM)

4.01. Torque Converter:

- The torque converter consists of following four elements
- Pump- Input element driven directly by the engine
- Turbine- output element hydraulically driven by the pump
- Stator- reaction (torque multiplying) element
- Lockup clutch- mechanically couples the pump and turbine when engaged; controlled by TCM consist of following five major components connected by wiring harnesses.

4.02. Transmission Control Module (TCM):

- Three speed sensors
- Remote shift selector
- Control Module (oil sump containing solenoids, pressure switch, filters, oil level sensor)
- Throttle position sensor, if installed.
- The TCM is programmed to provide the most suitable operating characteristics for specific application.

4.03. Planetary gears and Clutches:

A series of three helical planetary gear sets and shafts provides the mechanical gear ratios and direction of travel of the vehicle. The clutches are applied and released hydraulically in response to the electronic signals from the TCM to the appropriate solenoids.

4.04. Retarder:

The transmission has integral output retarder, when applied slow down or limit the vehicle speed. This is accomplished by forcing the fluid to the retarder cavity through and external accumulator.

4.05. Gear Shift Mechanism:

Gear shift selector positions: R – Reverse, N- Neutral, D- Drive, 3 - Third range, 2- Second range, 1- First range

Note: D mode is to be usually used. Modes 3/ 2/ 1 can used to negotiate steep gradient when lower gear is required than automatically selected.

The gear selection is displayed in LCD display panel adjacent to the Gear lever

4.06. Procedure for dismounting/ mounting of Transmission:

- Install Hub Adapter to engine flywheel and torque 12 nos. mounting bolt to 3.6 mkg.
- Align 8 holes of flex plates assy. with Adapter Hub, taking care that the 6 holes of Flex plate assy. also align with 6 holes of Fly wheel.
- Ensure that the Flex plate with welded strip washer faces towards the engine flywheel side
- Assemble and align Wear plate onto Flex plates.
- Tighten the Wear plate mounting bolts (8 nos.) with washers and torque to 7.2 - 8.9 mkg
- Lubricate pilot bore with molybdenum disulfide high temp. grease
- Lubricate Torque converter pilot also with molybdenum disulfide high temp. grease
- Install Adapter Transmission onto torque converter after aligning mounting holes, ensuring that the Torque converter is not rotating
- Tighten the Adapter Transmission mounting bolts (10 nos.) to 3.3 - 3.9 mkg
- Install Spacer housing onto Engine Flywheel housing. Retain position with guide bolts long enough to pass through transmission main housing mounting bolt holes
- Remove cover plate on flywheel housing
- Rotate and align engine flywheel
- Properly position guide studs in Spacer housing and Adapter transmission. Make sure there are no exposed threads in these guide bolts
- Align engine and transmission using guide studs
- Slide engine and trans together. Install and finger tighten Spacer housing mounting bolts and remove guide studs. Install mounting bolts where guide studs were there.
- Properly torque mounting bolts (12 nos.) to 5.6 mkg torque
- Rotate engine crankshaft to align flex plate bolt holes with inspection cover. Install and hand tighten flex plate to flex plate adapter bolts, first removing guide studs where used.
- After hand tightening each flex plate bolt, properly torque each bolt to 6.3 – 7.3 mkg torque, rotating crank until bolts are aligned with inspection cover

- Lubricate both o-rings on output flange bolt and washer with TranSynd oil
- Lubricate with TranSynd oil the output flange where it contacts output seal
- Lubricate output shaft splines of G.box with TranSynd oil
- Insert flange bolts into flange and install flange onto output shaft of G. box.
- Hold output flange from rotation and properly torque output flange bolt
- Fasten the G. box at rear end with the cross member
- Removal of trans cooling protective caps from Gear box at rear end & oil cooler box
- Fitment of trans cooling adaptor on outlet part of Gear box Rear end. (check point - o ring to be ensured before fitment of adaptor (No sealant to be used).
- Fitment of trans cooling adaptor on inlet part at gear box rear end. (No sealant to be used)
- Fitment of adaptor on oil Cooler (Kept hand loose till hose fitment for better alignment)
- Fit Trans cooler hoses and provide adequate vehicle ground clearance.
- Fittings and hoses at trans cooler must be adequately torqued.
- Trans cooler hose fitting at G. box end
- Fitment of accumulator on long member. Make sure solenoid exhaust points down.
- Fitment of Retardar accumulator socket at gear box end
- Tighten all the 4 joints of hoses at gear box and oil cooler end.
- Route hoses to avoid kinks. Do not tie wrap hoses together. Hoses should not touch each other. Use P clamp mounting on cooler hoses.

4.07. Electrical connection at G.Box End:

- Out put speed sensor at gear box rear face (white lock to be removed before fitment and to be fitted after fitment of cable).
- Engine speed sensor cable fitment (near engine).
- Retarder Temperature sensor cable fitment (U/R/S G, Box) (towards engine).
- Retarder Activator / solenoid Sensor (towards engine)
- Main Connector fitment (Torque 3.2 Nm)
- No over torquing. Special torque wrench required

Do's:

1. 1.Fluid Level:
   - Always maintain proper fluid level in the transmission.
   - Check fluid level by using dipstick provided or by display in shift selector on daily basis.
2. Transmission fluid grade: Always use Allison approved TRANSYND™
3. Transmission Oil and Filter change (Two filters to be changed) at specified intervals.

Don’ts:

1. DO NOT WELD on the vehicle/chassis without disconnecting all control system wiring harness Connectors from ECU and ECU battery power and ground leads.
2. DO NOT WELD on any transmission control components. DO NOT CONNECT welding cables to any Transmission control components.
3. DO NOT use containers or fillers for transmission fluid that have been used for any antifreeze/coolant Solution. Antifreeze and coolant contain ethylene glycol, which if introduced into the transmission can cause the clutch plates to fail.

CAUTION: Do not spray steam, water, or cleaning solution directly at electrical connectors or the breather. Fluids forced into electrical connectors can cause false codes and cross talk. Steam, water, or cleaning solution forced into the breather will contaminate the transmission fluid. Seal all openings, the breather, and electrical connections before spraying steam, water, or cleaning solution on the transmission.

4.08. Periodic Inspection Of Transmission :

Clean and inspect the exterior of the transmission at regular intervals. Severity of service and operating conditions determine the frequency of these inspections. Inspect the transmission for the following:

- Loose bolts — transmission and mounting components
- Fluid leaks—repair immediately
- Loose, dirty, or improperly adjusted throttle sensor or shift selector linkage
- Damaged or loose hoses
- Worn, frayed, or improperly routed electrical harnesses
- Worn or damaged electrical connectors
- Worn or out-of-phase driveline U-joints and slip fittings
- Clogged or dirty breather
- Check the vehicle cooling system occasionally for evidence of transmission fluid (which would indicate a faulty oil cooler) and for blocked or restricted airflow through the radiator or transmission cooler.

4.09. Transmission Fluid Check :

IMPORTANCE OF PROPER TRANSMISSION FLUID LEVEL:
Transmission fluid cools, lubricates, and transmits hydraulic power. Always maintain proper fluid level. If fluid level is too low, the torque converter and clutches do not receive an adequate supply of fluid and the transmission overheats. If the fluid level is too high, the fluid aerates — causing the transmission to shift erratically and overheat. Fluid may be expelled through the breather or dipstick tube when the fluid level is too high.

Follow the following procedure before checking the fluid level:

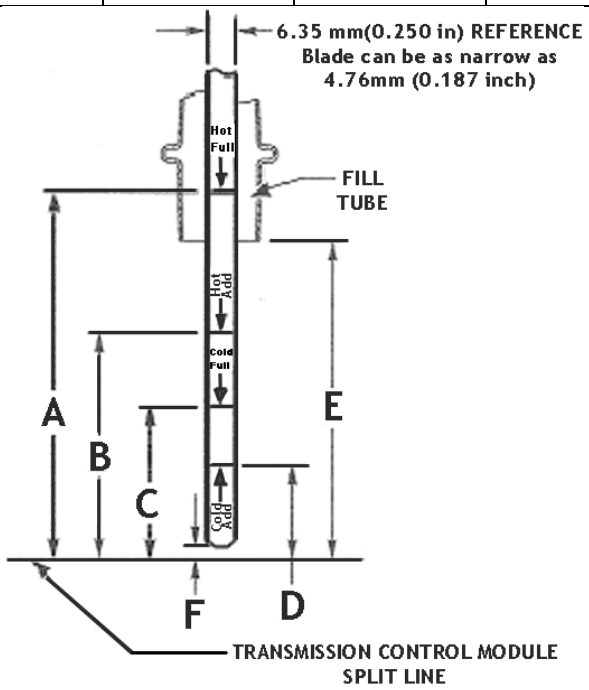
1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm.
3. Put the transmission in N (Neutral).
4. Apply the parking brake and make sure they are properly engaged.

5. If the operator's station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move unexpectedly and cause injury and/or property damage.

Fluid Check Procedure.
Clean all dirt from around the end of the fluid fill tube before removing the dipstick. Do not allow dirt or foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may cause undue wear of transmission parts, make valves stick, and clog passages. Check the fluid level and report any abnormal fluid levels to Authorised service station.

Dimension-A	Dimension-B	Dimension-C	Dimension-D	Dimension-E	Dimension-F
101.6 mm	63.5 mm	45.7 mm	.	86.6mm	5.9 mm



Cold Check Procedure. The purpose of the cold check is to determine if the transmission has enough fluid to be operated safely until a hot check can be made.

CAUTION: The fluid level rises as fluid temperature rises. DO NOT fill the transmission above the "COLD CHECK" band if the transmission fluid is below normal operating temperatures. During operation, an overfull transmission can become overheated, leading to transmission damage.

Check the fluid level as follows:
1. Bring the vehicle to a complete stop on a level surface using the service brake.
2. Make sure the engine is at low idle rpm (with fast idle disabled).
3. Put the transmission N (Neutral).

4. Apply parking brake, if present, and make sure it is properly engaged.
5. Chock the wheels and take any other steps necessary to keep the vehicle from moving.
6. Run the engine at 1000—1500 rpm for at least one minute to purge air from the system. Apply the service brakes and shift to D (Drive), then to N (Neutral), and then shift to R (Reverse) to fill the hydraulic system. Finally, N (Neutral) and allow the engine to idle (500—800 rpm). Slowly release the service brakes.
7. With the engine running, remove the dipstick from the tube and wipe the dipstick clean.
8. Insert the dipstick into the tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.
9. If the fluid level is within the “COLD CHECK” band , the transmission may be operated until the fluid is hot enough to perform a “HOT RUN” check. If the fluid level is not within the “COLD CHECK” band, add or drain as necessary to bring it to the middle of the “COLD CHECK” band.

Perform a hot check at the first opportunity after the normal operating sump temperature of 71°C—93°C (160°F—200°F) is reached.

Hot Check Procedure.

Typical Dipstick Markings

Check the fluid level as follows:

Bring the vehicle to a complete stop on a level surface using the service Brake.

1. Make sure the engine is at low idle rpm (with fast idle disabled).

   CAUTION: When performing the Hot Check procedure, the fluid must be at operating temperature to be sure of an accurate check and help prevent transmission damage. The fluid rises as temperature increases. During operation, an overfull transmission can become overheated, leading to transmission damage

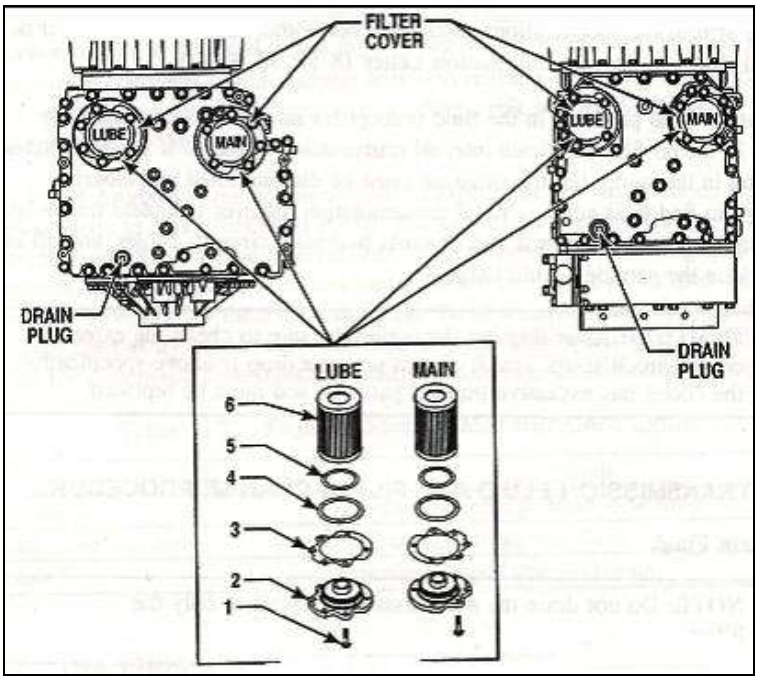
2. Put the transmission in N (Neutral).
3. Apply parking brake and make sure it is properly engaged.
4. Chock the wheels and take any other steps necessary to keep the vehicle from moving.
5. With the engine running, remove the dipstick from the tube and wipe the dipstick clean.
6. Insert the dipstick into the tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.
   NOTE: Safe operating level is within the “HOT RUN” band on the dipstick . The width of the “HOT RUN” band represents approximately 1.0 liter (1.06 quart) of fluid at normal operating sump temperature.
7. If the fluid level is not within the “HOT RUN” band, add or drain as necessary to bring the fluid level to within the “HOT RUN” band.
   Check level more than once for consistent reading by using the procedure described above.

Consistency (repeatable readings) is important to maintaining proper fluid level. If inconsistent readings persist, check the transmission breather to be sure it is clean and unclogged. If readings are still inconsistent, contact Allison distributor or dealer.

CAUTION: Containers or fillers that have been used for antifreeze solution or engine coolant must NEVER be used for transmission fluid.
Antifreeze and coolant solutions contain ethylene glycol which, if put into the transmission, can cause the clutch plates and some seals to

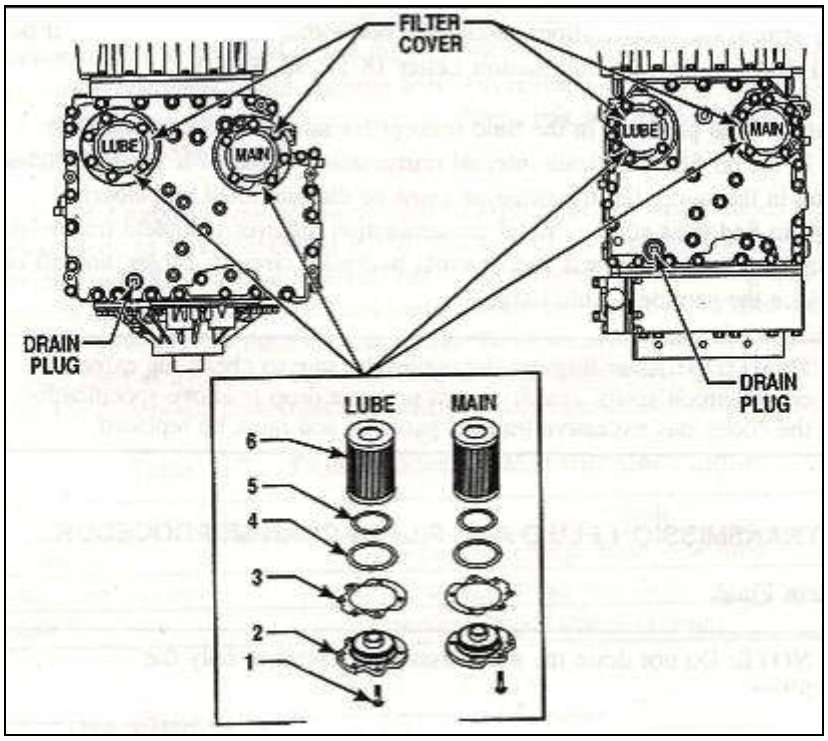
4.10. Transmission Fluid And Filter Change Procedure :

Replace Transmission oil/ filter in the following manner at the specified intervals as furnished in the preventive maintenance schedules at annexure



Drain Fluid.

1. Drain the fluid when the transmission is at normal operating sump temperature of 71—93°C (160—200°F). Hot fluid flows quicker and drains more completely.
2. Remove the drain plug from the oil pan and allow the fluid to drain into a suitable container.



Replace Control-Main & Lube Filter.

1. Remove the 12 bolts (1), two filter covers (2), two gaskets (3), two O –rings (4), two O – rings (5) and two filters (6) from the bottom of the control module.
2. When reinstalling parts lubricate and install new o rings (4) and (5) on each cover. Lubricate O ring inside filter (6) and push filter on to each cover (2). Install new gaskets (3) on each cover (2) and align bolt holes in gasket with holes in cover.
3. Install filter cover assemblies into the filter compartments. Align each filter/ cover assembly with the holes in the bottom of the control module. Push the cover assemblies in by-hand to seat the seals

CAUTION

Do not use the bolts to draw the filter covers to the control module. Do not use an impact wrench to tighten the bolts. Using may cause stripped threads and expensive part replacement. Use torque wrench to tighten the bolts.

4. Install six bolts into each cover assembly and tighten to 51-61 Nm (38-45 lb-ft)
5. Replace the drain plug O ring. Install the drain plug and tighten to 25-32 Nm (18-25 lb-ft).

4.11. BREATHER :

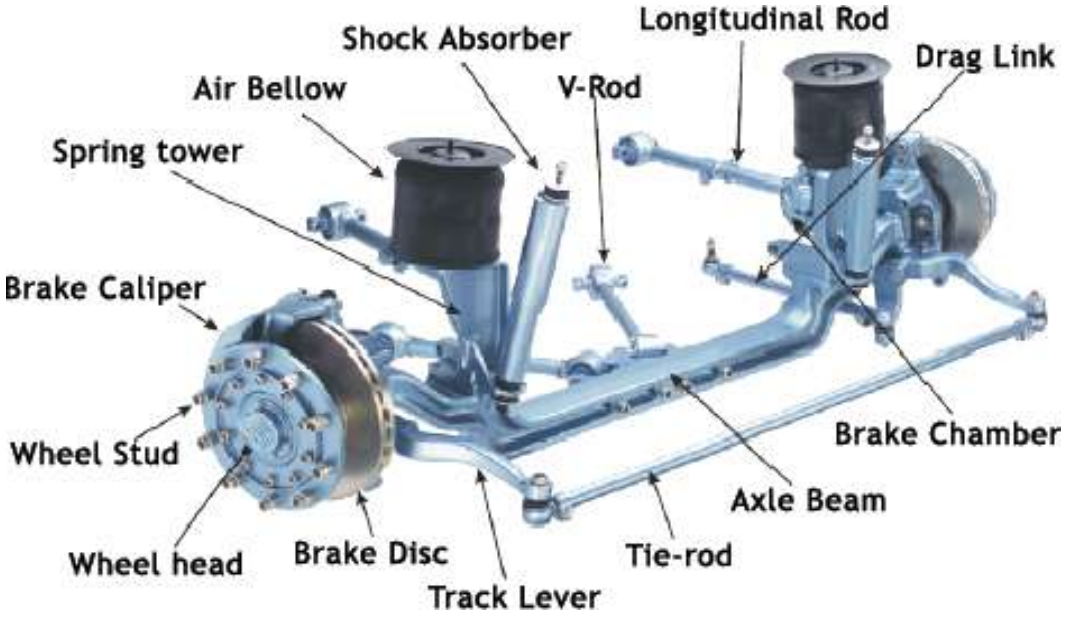
The breather is located at the top left rear of the transmission main housing. The breather prevents air pressure build-up within the transmission and its passage must be kept clean and open.

4.12. DIAGNOSTIC CODES AND TOOLS :

The illumination of the CHECK TRANS indicator light any time after start-up indicates that the TCM has registered a Diagnostic Trouble Code (DTC).
DTCs are used to identify the nature of a malfunction. Use any **Allison** DOC™ **diagnostic tool to access DTCs and troubleshoot transmission complaints.**

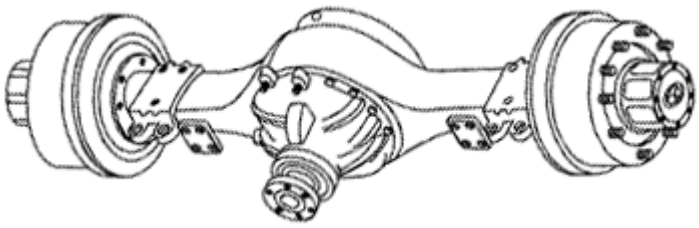
5.00. Front Axle:

Deep drawn axle to accommodate low floor (380 mm) height. Special features include air disc brakes for efficient control and long life grease for wheel hub bearings:



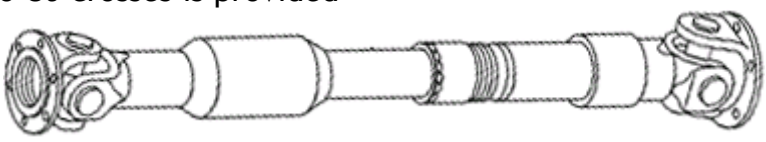
6.00. Rear Axle:

RA 109RR Axle is provided to both 1618 RE LE (Non-A/c) and 1624 RE LE (A/c) buses. This is same as that of 1618 FE SLF vehicles supplied earlier



7.00. Propeller Shaft:

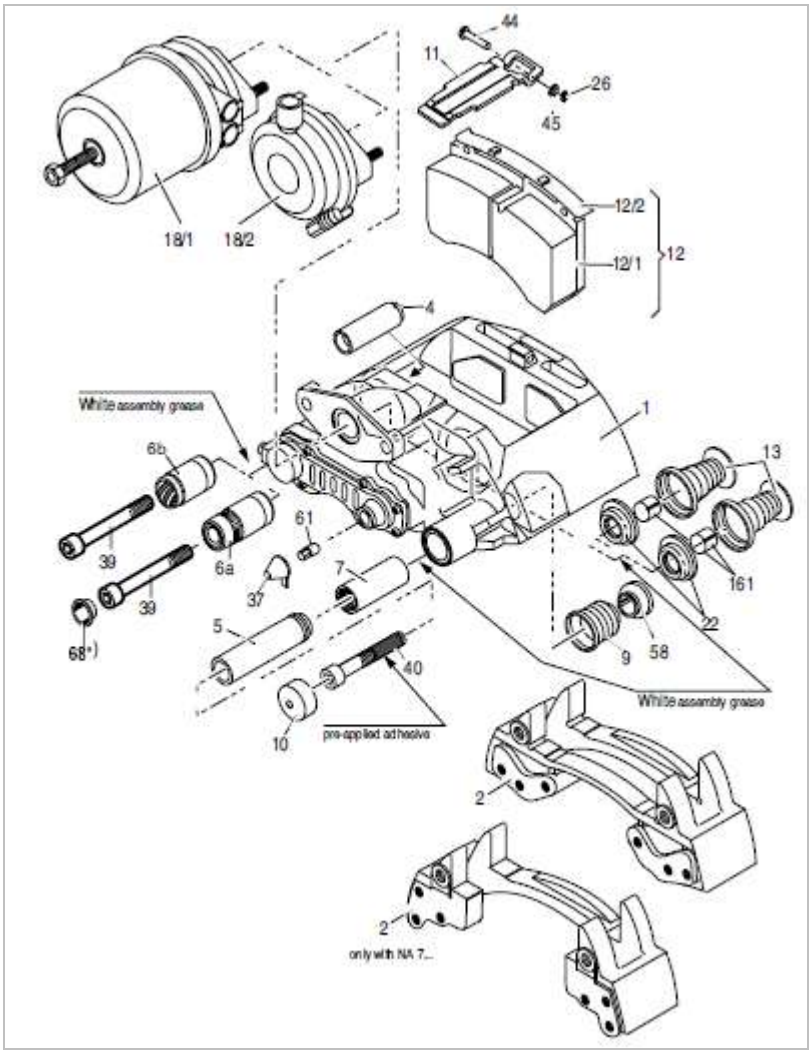
Single piece Propeller shaft with Slip yoke assy, with one tube yoke, two flange yokes and two UJ crosses is provided



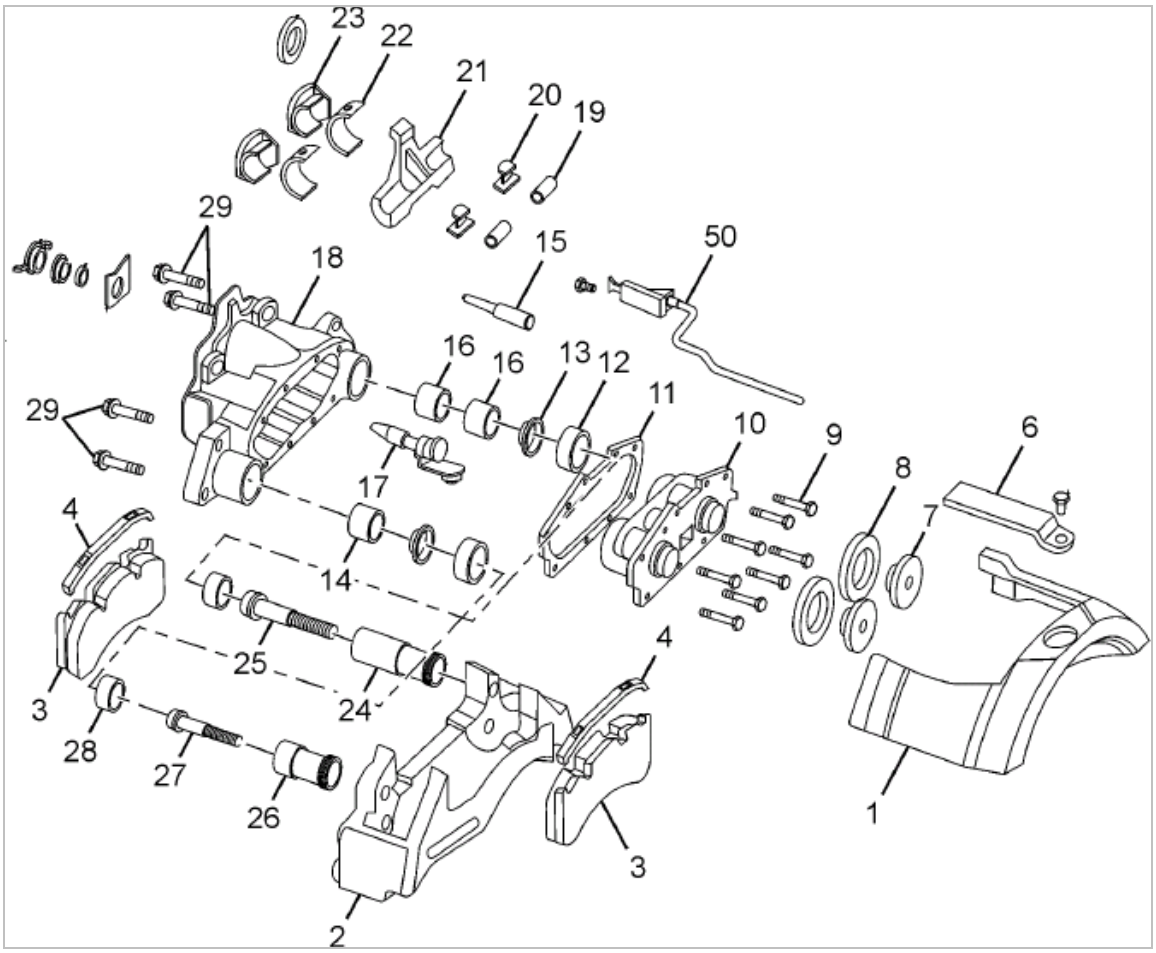
8.00. Brake System:

Conventional S'cam Full Air brake system for Rear wheels and air operated Disc brake system for front wheels is provided.

DISC BRAKE COMPONENTS FOR ZF FRONT AXLE



1. Caliper
2. Carrier
4. Guide Pin
5. Guide Pin
6a. Rubber Bush
6b. Rubber Bush
7. Brass Bush
9. Inner Boot
10. Cover
11. Pad Retainer
12. Pad (complete)
12/1. Pad
12/2. Pad holder spring
13. Tappet & Boot Assy
18/1. Spring Brake
18/2. Brake Chamber
22. Inner seal
26. Spring clip
37. Adjuster cap
39. Caliper Bolt
40. Caliper Bolt
44. Pad Retainer Pin
45. Washer
58. Ring



1. **Bridge**
2. **Carrier**
3. **Pad**
4. **Pad Spring**
6. **Pad retaining plate**
7. **Piston head**
10. **Piston housing assy**
11. **Gasket**
12. **Guide sleeve for dust excluder**
13. **Guide sleeve retainer for dust excluder**
14. **Guide sleeve bush - OVAL**
15. **Visual Wear indicator**
16. **Guide sleeve bush (ROUND)**
17. **Manual adjuster stem**
18. **Housing**
19. **Roller**
20. **Half bearing**
21. **Operating shaft**
22. **Needle bearing**
23. **Saddle (Half bearing)**
24. **Guide sleeve (Long)**
25. **Screw Guide Sleeve (Long)**
26. **Guide Sleeve (short)**
27. **Screw Guide Sleeve (short)**
28. **End Cap**
29. **Bridge Screws**

8.01. Disc brake Pad Wear Check:

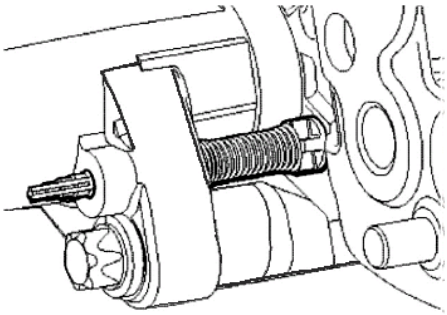
The Pad wear indicating devices include either, or a combination of

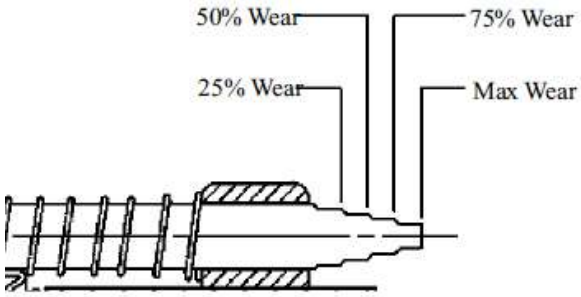
a) PWWI (Pad Wear Warning Indictor) which is fitted to the pad/s

b) An electronic CWS (Continuous wear sensor or switch within the brake)

c) A Visual wear indicator

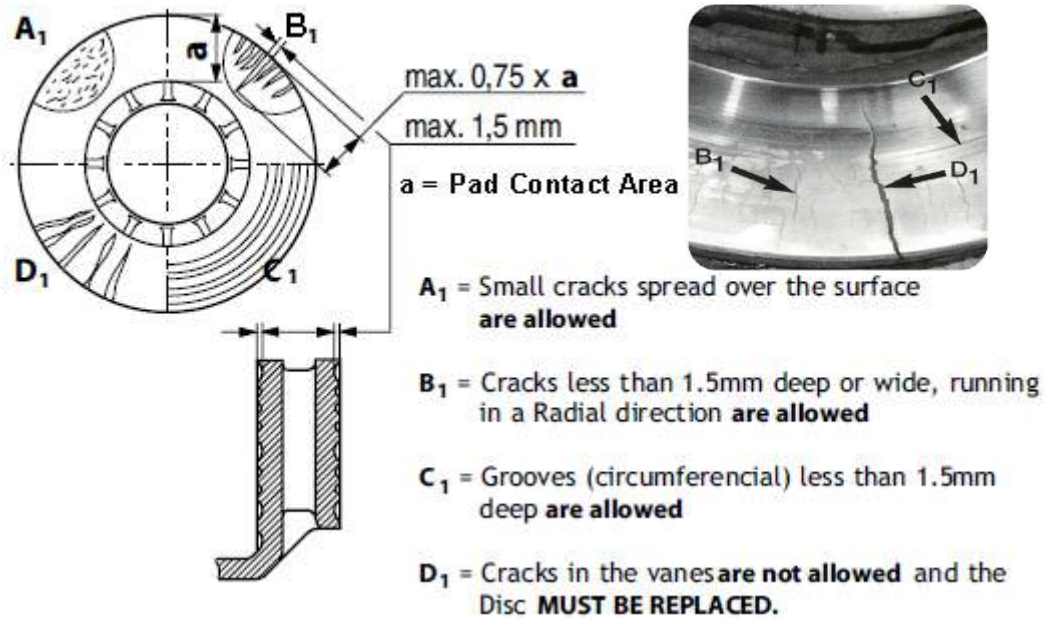
- Both options a & b above will illuminate a warning lamp on the vehicle instrument panel to indicate that a pad change is required.
- Brake pad should be replaced when the lining thickness has worn to 3 mm
- Where a visual pad wear indicator is incorporated into the brake it provides a quick and simple method of assessing the pad life remaining.
- In a new pad condition the end of the indicator stem will extend past the edge of the housing casting
- As the pads wear the length of the indicator past the edge of the casting will reduce. The indicator is incremented with each increment equating to a level of pad wear.





Note: The brake pads on both wheels of the axle shall always be replaced simultaneously

At the time of changing the Pads, the disc condition shall be checked thoroughly.



In case of surface conditions A_1, B_1, C_1 in the above diagram, the disc can be used until a minimum thickness of 37mm is reached. In case of condtion D_1, the disc must be replaced.

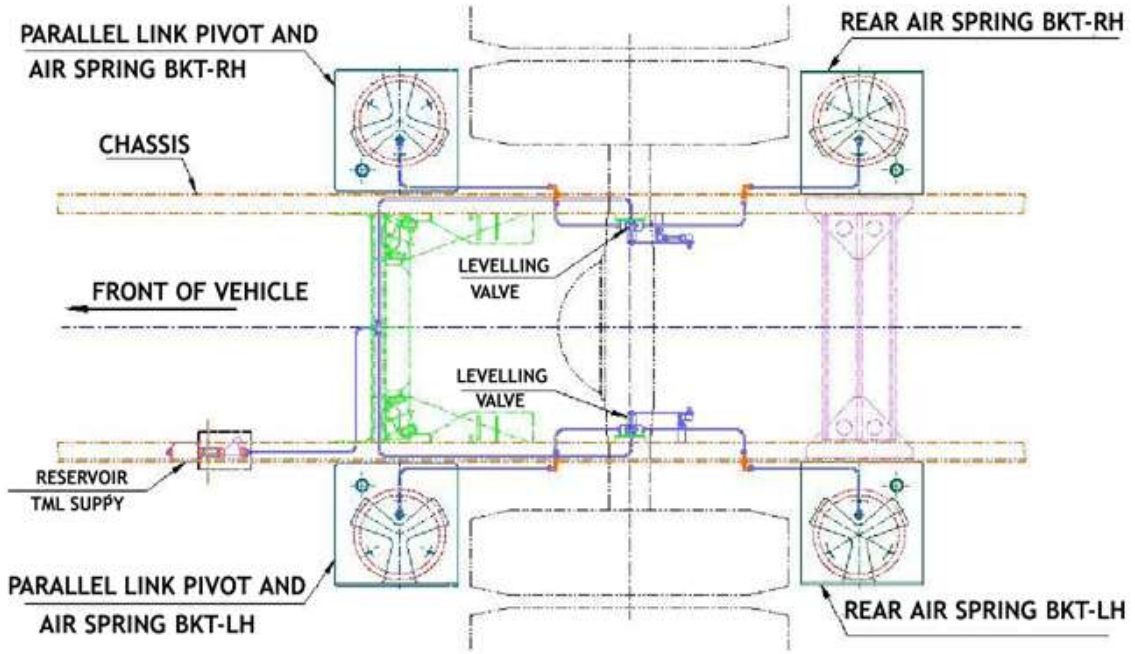
8.02. Troubleshooting In Disc Brake System:

Condition	Possible Cause	Check for	Corrections
Brake Drag	Incorrect initial adjustment	Correct Pad-to-rotor clearance	Re-adjust to set the correct rotor-to-pad clearance
	Incorrect Pad-to-rotor clearance	Automatic adjuster function	Replace adjuster, housing or brake assembly
	Spring or service brake not releasing	Correct operation of air system or air chamber	Refer to the vehicle manufacturer's instructions. Repair or replace parts as required
	Brake not releasing	Damaged guide pin excluders; Housing should move back and forth by hand with linings removed. Water entry or seized operation shaft, internal	Replace Guide pins, Excluders and Bushes
			Replace the Brake assembly
			Replace Operating shaft & air chamber. Replace housing or brake assembly and air chamber
		Tappets not releasing; Damaged tappet excluders	Replace Tappets, Bushes and Excluders
			Replace housing or Brake assy
Shorter life of Brake Pad	Refer to Brake Drag	Refer to Brake Drag	Refer to Brake Drag
	Damaged rotor surface	Cracks or heavy heat spotting/ banding	Refer to the vehicle manufacturer's instructions. Repair or replace parts as required
	Companion brakes do not work correctly	Inspect companion vehicle brakes and air system	Adjust or repair as required
Smoking Brakes	High brake temperature	Refer to Brake Drag and Short brake pad lining life	Refer to Brake Drag and Short brake pad lining life; Can be a temporary situation with new or low mileage pads
	Contamination on the linings or rotor	Grease, oil undercoating paint etc, on the lining or rotor	Inspect the hub seal. Replace as required. Clean rotor and brake assembly. Replace the axle set of pads

Condition	Possible Cause	Check for	Corrections
Poor stopping power ▪ Long stopping distances ▪ High brake pressures ▪ Poor driver feel ▪ Vehicle pulls to one side	Vehicle air system malfunction	Correct air pressure at the chamber inlet	Have the air system evaluated thoroughly
	Contamination on linings or rotor	Grease, oil or undercoating paint, etc., on the lining or rotor	Inspect the hub seal, replace as required. Clean the rotor and brake assembly. Replace the axle set of pads
	Companion brakes not working correctly	Inspect the companion vehicle brakes and air system	Adjust or repair as required
	Brakes out-of-adjustment	Excessive pad-to-rotor clearance	Readjust to set the correct pad-to-rotor clearance
		Automatic adjuster function	Replace adjuster or housing assy
	Pads not sliding in carrier/ saddle	Excessive dirt/ corrosion in pad locations	Clean pads and carrier/ saddle locations
		Excessive wear in pad locations	Fit new carrier/ saddle
	Incorrect pads installed	Refer to the vehicle manufacturer for the correct pads	Replace the axle set of pads
	Spreader/ Thrust Plate not sliding smoothly in carrier/ saddle	Spreader/ Thrust Plate not sliding smoothly in carrier saddle	Loosen plat fixing screw/s. Reposition plate on pistons/tappets. RE-tighten screw/s to specified torque
	Brake seized or sticking on guide pins	Damaged guide pin excluders	Replace guide pins, excluders and bushes
		Housing should move back and forth by hand with linings removed	Replace the brake assembly
Brake noise/ Judder	Incorrect pad installation	Friction material facing the brake not the rotor surface	Correct the pad installation. Replace the pads and rotor, if necessary
	Incorrect pad installation	Refer to the vehicle manufacturer for correct pads	Replace the axle set of pads
	Brake pads not free to move in the brake	Corrosion or debris on the pads or carrier/ saddle pad locations	Clean or repalce the pads, if necessary. Clean the pad locations on the carrier/ saddle
		Excessive wear in Pad locations	Fit new carrier/ saddle
	Worn brake pads, Loose pads	Lining thickness. Bent pad retainer or loose pad retainer screw	Replace the axle set of pads, if necessary. Replace or tighten the pad retainer
	Pad spring damaged or not installed	Correct pad spring installation	Install the pad springs
	Rotor cracks or excessive run-out/ thickness variation	Excessive cracking, heat spotting/ banding or run-out/ rotor thickness variation	Refer to vehicle manufacturer's instructions or brakes repair manual. Repair or replace parts as required
	Brake component attachments are not installed to specification	Check for loose connections and fasteners	Tighten the connections and fasteners to the specified torque

9.00. Air Suspension:

2 bellows at front and 4 bellows air suspension at rear to ensure smooth travel. It also maintains vehicle ride height under all road & load conditions.



9.01. Kneeling :

This is integrated with air suspension pneumatic circuit. It is provided to lower down the LHS floor height at front and rear which facilitates easy entry & exit for the passengers & also wheel chair for the handicapped passengers. It is pneumatically actuated via magnetic valves which function through the switches operated by driver on dash board panel.

10.00. Electrical System :

Both 1624 RE LE (A/c) and 1618 RE LE(Non-A/c) are provided with Multiplex Electrical wiring system

10.01. Multiplex Electrical Wiring System:

Multiplex wiring is the concept of using just two/ three (CAN) wires to perform the task of many wires.

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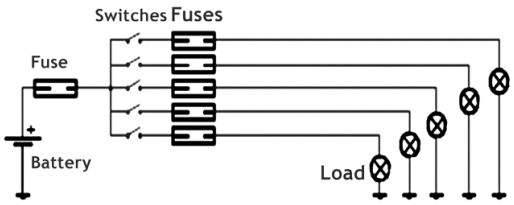

Conventional circuit :

1. "Heavy current circuit" at switch area Which is in driver / passenger compartment
2. Multiple wires passing from front to rear

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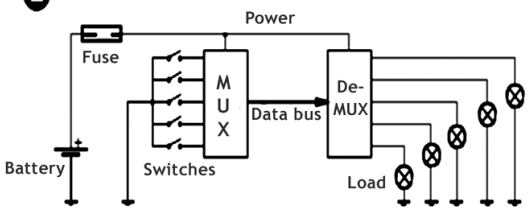


Circuit with Multiplex wiring :

1. " Light current" at switch area
2. Just one CAN cable passing from Front to rear carrying light current Signals

- The multiplex wiring system allows multiple electronic messages to travel back and forth through the same data link wire, just as broadband cable allows telephone, television and internet connections to travel through the same line. The multiplex wiring system's electronic control modules remotely send information back and forth, monitoring vehicle components and interpreting messages transmitted through the wires.
- Multiplexing integrates electronic control units ECU's into a network where coded digital information is transmitted through a single data cable.
- Common sensor data, such as vehicle speed, engine temperature etc. are available on the network - so data can be shared - thus eliminating the need for extra / redundant sensors.

10.02. Benefits of Multiplex Wiring:

Improved Reliability

The multiplex wiring system

- Reduces the number of wires by over 40 percent there by reducing possible failure points.
- Improves vehicles integration process by reducing the number of parts that make up the vehicle cabling.
- Complex knobs and switches can be replaced by cheaper touch keys.
- Information like Engine oil temp, engine oil pressure, coolant temperature, engine rpm, vehicle speed, current gear and requested gear signals are available on the network.
- Safety relays in the starter circuit to avoid engine re-cranking are not required.
- Complex logics involving door controllers, air conditioning system have been realized without any additional hardware.
- Additional fuse and relay box for Automatic transmission (VIM) is not required since all the information available on the network
- Reduced Complexity
- Lesser number of relays, fuses, sensors means lesser failure modes, therefore improved reliability of the system.
- Better Diagnostics - Reduced vehicle downtime

Easier to modify

It is easier to add or remove certain additional features from the vehicle by just reprogramming the processor without actually changing the hardware. So the vehicle spends less time in the shop and more time on the road.

Improved Diagnostic capabilities

Multiplex wiring system introduces the concept of on board diagnostics, which is a desirable feature in view of growing demands of safety and easy maintenance. Software can be easily programmed to handle many diagnostic features from the detection of blown light bulbs to the failure of emission control systems in an automobile.

- A major highlight of a multiplex system is the ease of fault finding. Fault may be :
  - An open circuit
  - A short circuit
  - Communication error

10.03. Working mechanism:

The main control unit at front i.e. Central Body Control unit (CBCU) forms the node to digitally exchange information with the following :

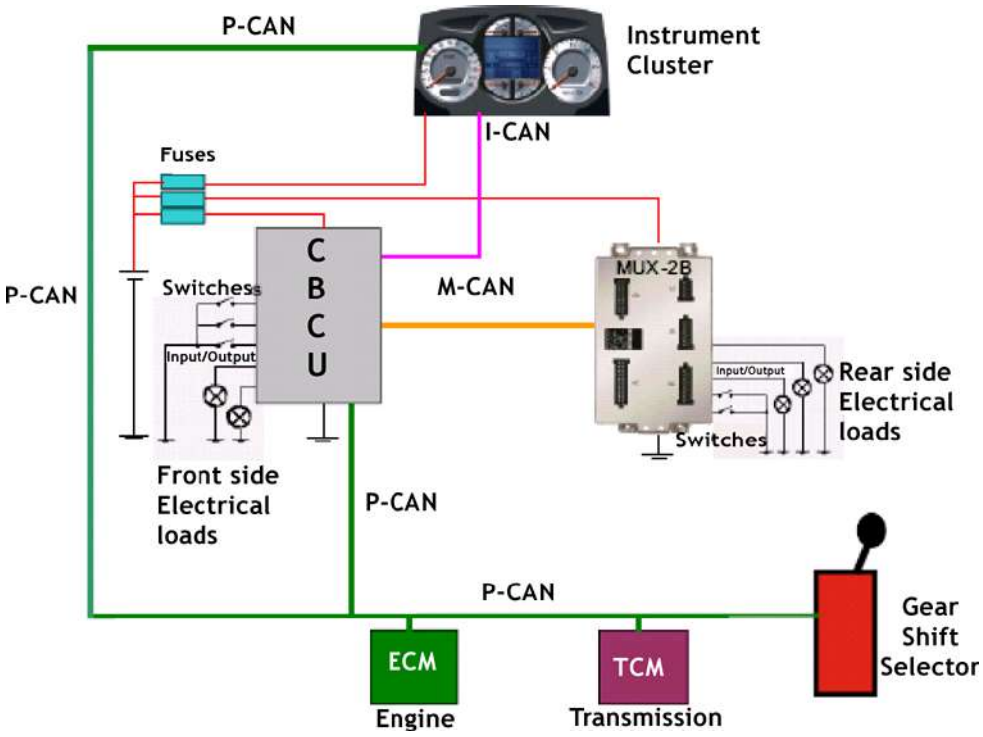
(a) Instrument cluster (b) Engine ECU (c) Transmission ECU (d) Communication unit MUX-2B .

MUX-2B located at rear of vehicle communicates digitally with rear electrical load.This enables complete information by CBCU & MUX-2B, on the electrical load, to be displayed on instrument cluster through HMI (Human machine interface) screen in front of driver. Interconnecting digital lines are called as

(a) M-Can (between CBCU & MUX-2B)

(b) P-CAN (between CBCU & engine / transmission)

(c) I-CAN (between CBCU & instrument cluster)



10.04. Detection of a Short Circuit :

By sensing current / power - If the load is switched ON and the load current is above the preset limit then a SHORT CIRCUIT is reported.

SHORT CIRCUIT cannot be detected if the load is switched off.

10.05. Detection of a Open Circuit :

By sensing current / power - If the load is switched ON and the load current is zero or below the preset limit then an OPEN CIRCUIT is reported.

OPEN CIRCUIT can be detected if the load is switched off.

10.06. Human Machine Interface (HMI) for Diagnostic:

HMI Switch

HMI Switch:

There are six buttons provided on HMI switch to enable the driver / technician to read various diagnostic information.

Enter - To select an item from diagnostic Menu.

Page Up - To scroll pages upward.

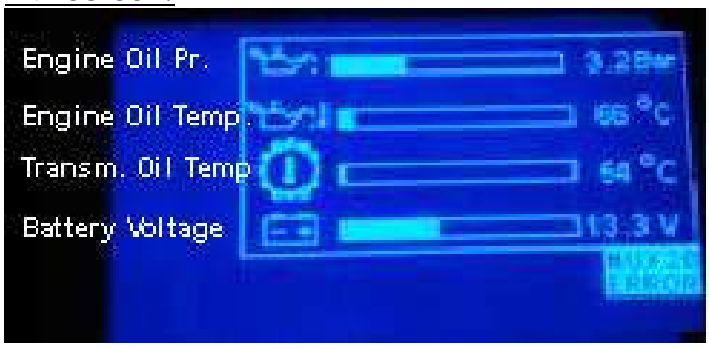
Page Down - To scroll pages down.

Mode - To go to diagnostic Menu from Default screen.

Esc - To go back to previous screen.

Trip - Not in use.

HMI Screen:



Default Screen gives following information to the driver:

- Engine oil pressure.
- Engine oil temperature.
- Transmission oil temperature.
- Battery voltage

This screen also provides various Alarming indications and Error information like CBCU Error, MUX 2B Error and ECU Error.

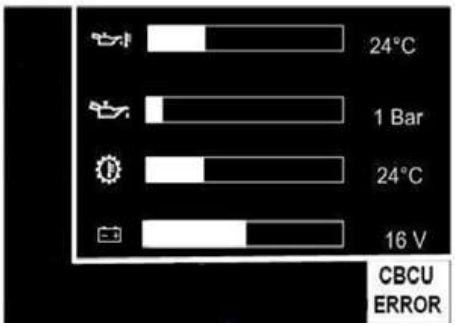
To see the Error details, press Mode button of HMI switch.
Default screen changes to Main Menu screen, the following Menu Table is displayed:

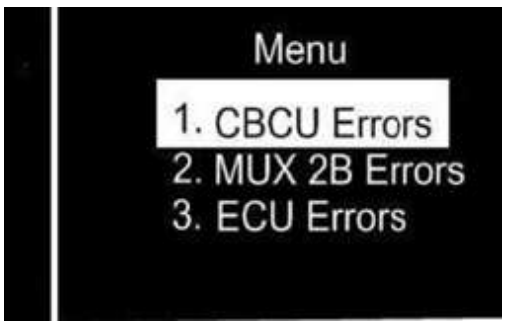
1. CBCU Error
2. MUX 2B Error
3. ECU Error

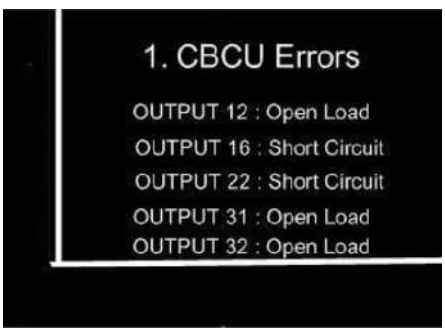
By using Page Down and Page Up buttons, select Error and then press Enter button.

In case, CBCU Error is displayed on the screen, select CBCU Errors, all active CBCU Errors will be displayed on the screen.

In case, MUX 2B Error is displayed on the screen, select MUX 2B Errors, all active MUX 2B Errors will be displayed on the screen.





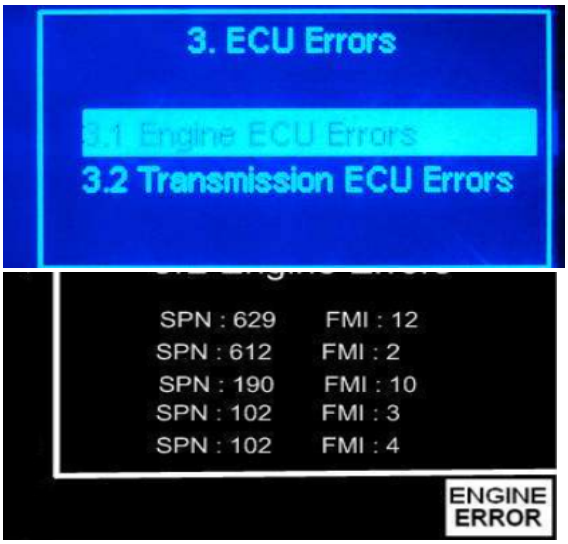


In case, ECU Error is displayed on the screen, select ECU Errors.

On selecting ECU Errors, ECU Errors Menu will be displayed with following two options:

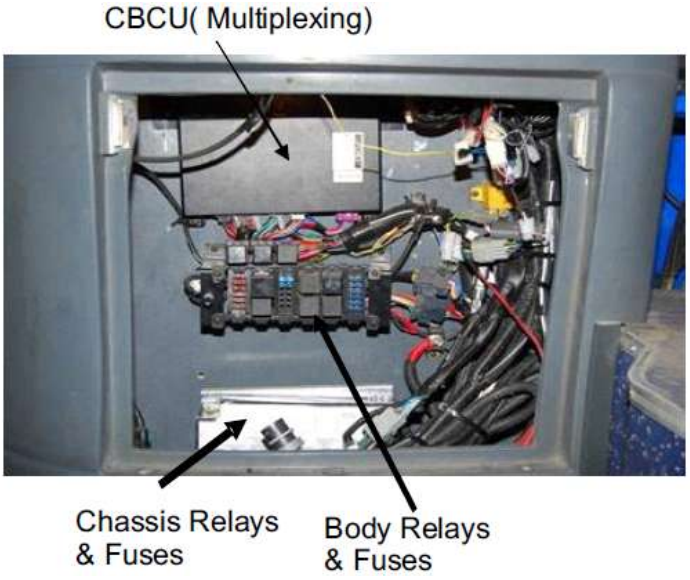
1. Engine ECU Errors
2. Transmission ECU Errors.

Engine Errors

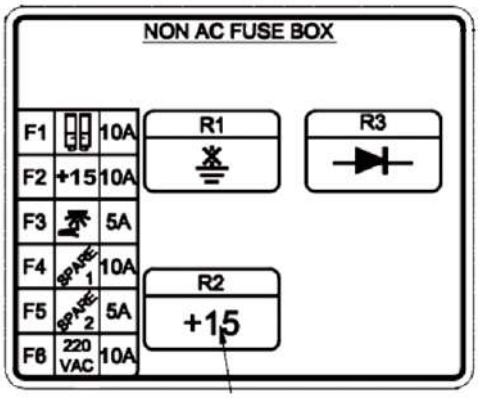


On selecting Engine ECU Errors option, by pressing Enter button of HMI switch, the Error code(if any active) relating to Engine will be displayed on the screen.

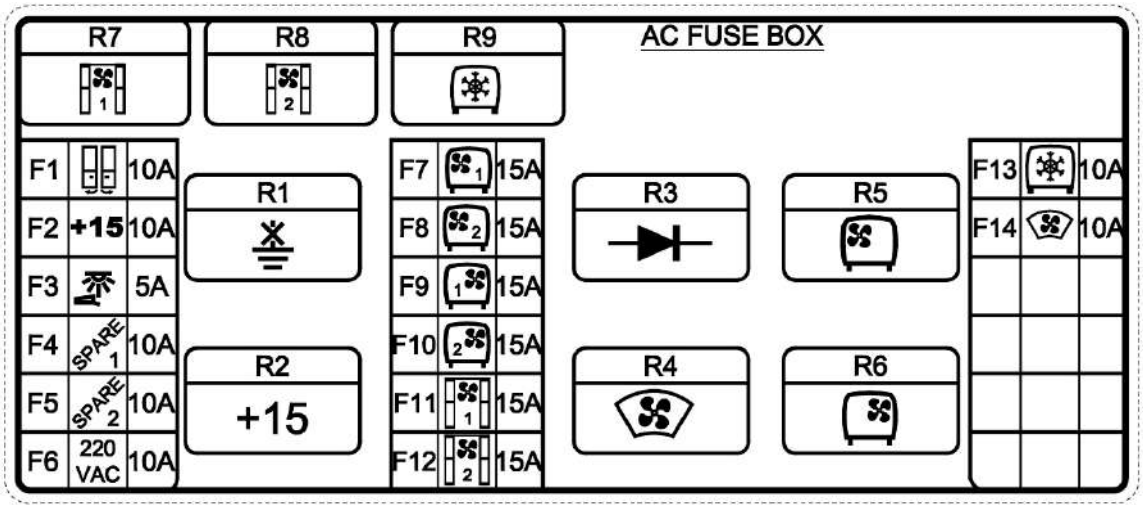
Using the Table, illustrating Fault description, based on SPN & FMI no., one can come to know the nature of fault existing. If the fault is of minor nature, the same can be resolved easily without using the software. Otherwise, Cummins In-site soft ware is to be used for trouble shooting the fault.



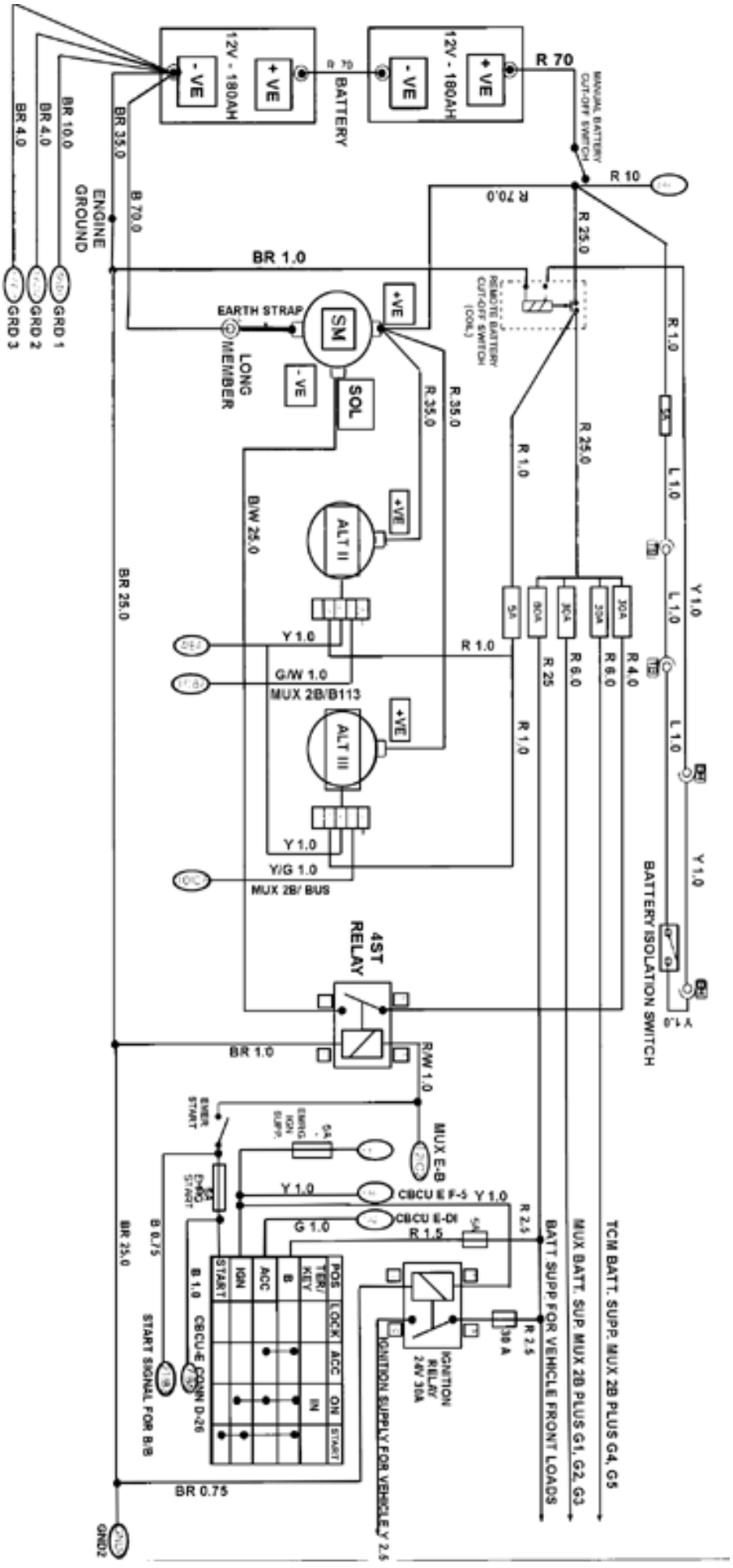
FUSE BOX LAY OUT



F1	Door System
F2	.+15 line after ignition
F3	Drivers Lamp
F4	Spare
F5	Spare
F6	Inverter 24V DC to 240V AC
R1	Blocked Ground
R2	.+15 line after ignition
R3	Diodes



F1	Door System	F8	LH side fan 2	R1	Blocked Ground
F2	.+15 line after ignition	F9	RH side Fan 1	R2	.+15 line after ignition
F3	Drivers Lamp	F10	RH side Fan 2	R3	Diode
F4	Spare	F11	Air curtain front	R4	Demister
F5	Spare	F12	Air curtain rear	R5	LH side Fan
F6	Inverter 24V DC to 240V AC	F13	Air forced Fan	R6	RH side Fan
F7	LH side Fan 1	F14	Demister Fan	R7	Air curtain front
				R8	Air Curtain Rear


12V - 180AH
- VE
+ VE
BATTERY
R 70
MANUAL BATTERY CUT-OFF SWITCH
R 10
R 70.0
R 25.0
BR 1.0
ENGINE GROUND
BR 35.0
B 70.0
BR 10.0
BR 4.0
BR 4.0
GRD 1
GRD 2
GRD 3
EARTH STRAP
LONG MEMBER
SM
SOL
+VE
- VE
R 35.0
REMOTE BATTERY CUT-OFF SWITCH (COIL)
R 1.0
L 1.0
Y 1.0
B/W 25.0
ALT II
ALT III
BR 25.0
Y 1.0
G/W 1.0
MUX 2B/B113
Y/G 1.0
MUX 2B/ BUS
5A
80A
30A
30A
30A
R 4.0
R 6.0
R 25
BATTERY ISOLATION SWITCH
4ST RELAY
BR 1.0
R/W 1.0
MUX E-B
CBCU E F-5
CBCU E-DI
G 1.0
R 1.5
R 2.5
B 0.75
B 1.0
CBCU-E CONN D-26
START SIGNAL FOR B/B
POS
BATT
KEY
LOCK
ACC
ON
START
IGN
ACC
B
IN
IGNITION RELAY 24V 30A
30 A
IGNITION SUPPLY FOR VEHICLE
BATT SUPP FOR VEHICLE FRONT LOADS
MUX BATT. SUP. MUX 2B PLUS G1, G2, G3
TCM BATT. SUPP. MUX 2B PLUS G4, G5
GND2

11.00. Driving Controls :

11.01. Steering Lock cum Ignition Switch:

This switch is located on Steering column with the following positions.
'LOCK" Normal position. Key has to be removed in this position only.
'ACC' under this position, Radio and other accessories can operate.
'ON' Normal operating position when all electrical systems are 'ON'
'START' Engine starting position.

CAUTION:
Do not hold the key in the 'START' position for more than 15 seconds. Do not leave the ignition switch in the 'ON' position if the engine is not running.

WARNING:
Never remove the key, while the bus is in motion
Always remove the key when parked to prevent unintentional operation of the vehicles.

11.02. Gear Shift Selector:

The Gear shift lever is mounted on the dash board control pane on left side of the driver having 5 forward gears and one reverse gear. They are

R (Reverse), N(Neutral), D(Drive), 4(Fourth Range), 3(Third Range), 2(Second Range) and 1(First Range) gears. Ranges have to be selected by moving the lever to the desired selection position (R, 4, 3, 2 or 1).

The LCD pane mounted on the gear shift unit displays the currently engaged gear and also the fault codes

11.03. Retarder Operation:

Two step reatrders apply through pressure switches is provided and is coupled with the service brakes. For operating the retarder, press retarder switch on the dash board and then press slowly the brake pedal. Then, the retarder will get activated and will be indicated on the HMI LCD Screen.

11.04. Pedals and Parking Brakes:

1. **Brake Pedal:** To activate the retarder operation after enabling the retarder switch, press the brake pedal slowly. On further pressing of brake pedal, the service brake comes into effect. Press the brake pedal fully to bring the vehicle to a complete stop.
2. **Accelerator pedal**: To increase the power out put and speed, depress this pedal slowly.
3. **Parking Brake Flick Valve:** Use this brake when vehicle is in parking condition.

11.05. Pneumatic Door operation switches:

1. **Emergency door reset switch:** This switch is required to be pressed by the driver to reset the pneumatic door operation whenever the door is opened.
2. **Front Passenger door open/close switch**: This switch is to open and close front passenger door.
3. **Rear passenger door open/ close switch:** This switch is to open and close rear passenger door.
4. **Both passenger door open/close switch**: This switch is to open and close both front and rear passenger doors.
5. **Disable switch for rear leaf of front door:** On pressing this switch, only front leaf of front door can be operated, disabling operation of rear leaf only for Masats ref. view E.
6. **Combi Switch:** This is mounted on steering column having two levers. One lever is for operating turn signals, head lamps. Parking lamps and number plate lamps.

Head lights
Position 1 – Low beam
Position 2 – High beam
Position 3 – High beam (flash)

(High beam flash (no.3 position) will be 'ON' as long as lever is held in position '3' irrespective of the knob position. This is spring loaded position and can be used in day time for giving signal to on coming traffic).

11.06. Turn Signals:

Position 4 – Turn signals right: 5-left. The selfcancellation turn signals arrangement is provided. When turn signal option is used, this lever will return to neutral position on its own when steering wheel is brought back to straight ahead position.

Lights:
Lights are operated by turning the knob of this lever as indicated below.
First notch (PL position)
Parking lights, instrument panel lights, number plate lights, control back lights and top marker lights are switched 'ON'
Second notch (HL position)
In addition to parking, instrument panel, control back lights, number plate lights and top marker lights , head lights are also switched ON.

OFF – position
All lights are switched off in this position

11.07. Hazard warning switch:

Combi switch assembly also has a switch for operating hazard warning device.

To switch ON hazard warning , pull the knob located on steering wheel column as shown. All turn signals lights will flash simultaneously to warn other users about the hazardous condition of vehicles.
Push back this knob to original position when hazard warning requirement is over.

11.08. Windshield wiper and washer:

The lever on other side is for operating windshield wiper and washer.

Position:
'OFF' – Wiper motor
Switched 'OFF'
'INT' –Wiper sweeps intermittently
'LO' – Low speed of Wiper motor
'HI' –High speed of wiper motor
To operate windshield washer, lift the lever. Windshield washer will remain in operation as long as the lever is held in this position.
When windshield washer is actuated, wipers are also switched on. Windshield washer fluid reservoir is accessible after opening front centre flap. Top up reservoir with clean water regularly. Do not use soap solution. In cold climate, use anti-frost mixed with soft water for prevention of ice formation.
Do not operate windshield washer more than ten seconds at a time.

11.09. Stop request Switch:

Switches are suitably provided in the passenger cabin, to alert the driver that the driver that the passenger wishes to disembark.

12.00. Bus Body :

12.01. Cleaning the Interiors:

- Prepare a solution of soap or mild detergent mixed in warm water.
- Apply the solution to the vinyl with a sponge of soft cloth and let it soak for a few minutes to loosen the dirt.
- Rub the surface with clean, damp cloth to remove the dirt and soap solution.
- I some dirt remains on the surface, repeat the procedure.

12.02. Fabric Upholstery:

Remove the dirt with vacuum cleaner.
Using mild soap solution, rub stained area with a damp cloth.
To remove soap, rub the area again with cloth dampened with water.
Repeat this until the stain is removed.

12.03. Paint Inspection & Maintenance :

All paint damages due to abrasion should be touched up immediately by poly-urethane air dry surfacer/putty, it required and thereafter finish painting is done by polyurethane air dry paints to avoid corrosion of base metal.
While painting the buses with spraying method, following points should be adhered to.

a) Use correct type of paint
b) Maintain correct thickness of paint.

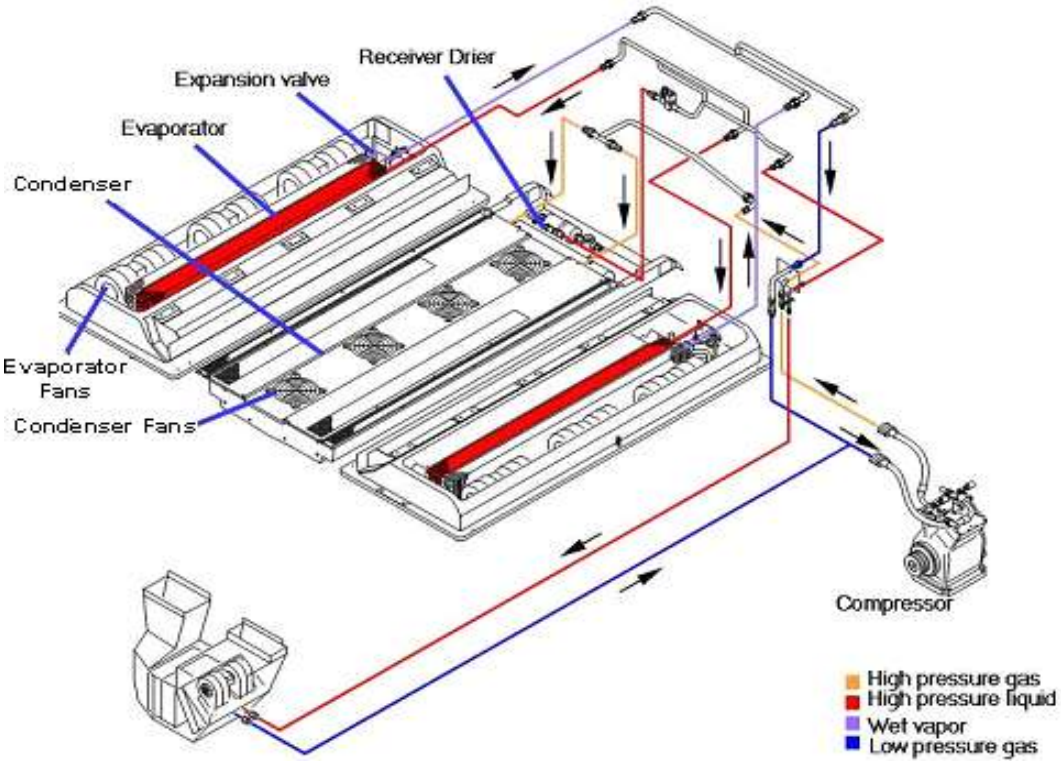
To maintain the quality of paint, the bus should be painted in well ventilated and dust proof indoor garage.

13.00. Air Conditioning :

Webasto make Air Conditioning system is provided in the 1624 A/c Buses. A/c works with engine driven Air compressor and roof mounted condenser.

Location of roof mounted condenser

Schematic Layout of the Air Conditioning system



A/C Operational Controls

1 - Numeric Display
2 - Ventilation control key
3 - Cooling control key
4 - Fresh air flow control key
5 - Temperature increase key
6- Temperature increase key
7 - Indicator "cooling mode"
8 - Indicator "automatic mode"
9 - Indicator "ventilation mode low velocity"
10 -Indicator "ventilation mode high velocity"
11 -Indicator "refreshment mode" shut off
12 -Indicator "refreshment mode "on

14.00. Preventive Maintenance Schedules :

The Preventive Maintenance schedules as per the recommendations of OEMs are furnished at Annexure-1

15.00. Tools & Equipment :

The tools, Plants and other equipment required for maintenance of Low Floor Buses are furnished at Annexure-2

16.00. Spare Parts to be Stocked at Depots :

The list of important Spare Parts for maintenance of Low floor buses to be stocked at Depots is furnished at Annexure-3.

The Controllers of Stores concerned are advised to take action for procurement and stocking of the essential spares in consultation with the respective Dy.CMEs

The Depot Managers & Dy.CMEs concerned are advised to educate the maintenance staff on the features, maintenance and repair practices at the depots for effective utilization of these prestigious vehicles.

The RMs/Dy.CMEs are advised to organize necessary training programmes to the Drivers, Safety Instructors, Mechanics and Artisans by the Service Personnel of OEMs to make them familiarized with these new model vehicles.

EXECUTIVE DIRECTOR (E&IT)

Encl : As above.

To
All Depot Managers for necessary action.

Copy to: VC & MD for favour of information.
Copy to: Dir (V&S), ED (E&IT), ED (O&MIS), ED (A), ED (HRD & Med.) and Secretary to the Corporation, FA and CAO for information.
Copt to: All EDs of Zones for information.
Copy to: All HODs for information
Copy to: All RMs for necessary action.
Copy to: DyCME (O), DyCME (P), DyCME(C&B), DyCME (IED), DyCAO (SP&A), CSTO, COS(C) I & II for information.
Copy to: All DyCMEs, WMs, COSs & DyCAOs for necessary action.
Copy to: All Principals of ZSTCs, BTC, HPT & TA/HPT for information.
Copy to: All AOs & AMEs (T) for information & n/action.
Copy to: All Maintenance In-charges for necessary action.
Copy to: In-charge, Manual Section for record.

PREVENTIVE MAINTENANCE SCHEDULE FOR TATA LOW FLOOR BUSES Annexure-I

S.No	Schedule-I Maintenance (Daily)
1	Check Service Indicator for red band. Replace primary filter if red band appears. Replace secondary filter during every 3rd replacement of primary filter
2	Check condition & tension of driver belts for water pump, Alternator, Fan/ AC Compressor. Adjust or replace if necessary
3	Check function of switches, gauges , warning lamps, all lights , buzzers and all electrical and pneumatic controls for the driver.
4	Check for leakage of : 1. Oil (at engine /gearbox / rear axle/ power steering) 2. engine coolant 3. engine exhaust 4. Pneumatic circuit (door / suspension / brakes)
5	Check & top up levels of : 1.Oil (at engine / gearbox / rear axle/ power steering) 2. engine coolant 3. windshield washer tank
6	Check tyre pressure
7	Check and tighten all fasteners if necessary as per the check list * below
8	Wash vehicle

*** List of Fasteners requiring periodic checking & tightening**

Engine compartment: engine mounting & accessories mountings , clamps

Fuel: Fuel Tank Brackets/clamps

Driveline : Gearbox mounting / propeller shaft coupling flange / rear axle carrier housing mounting

Electricals : Starter motor / wiper motor / alternator / switches & gauges / tail lamp / head lamp / blinker lamp

Steering : Steering box, Bevel gear box mounting /drag link/ pitman arm/Tie rod

Suspension: Anti roll bar mounting / air bellow mounting / shock absorber mounting / 'U' bolt rear suspension , top & bottom link rods of rear suspension

Wheels & tyres : wheel mounting nuts (also after 100 kms of any wheel replacement)

Brakes : Torque plate mounting , disc brake caliper mounting , brake chambers mounting , all brake valves mounting

Bus Body : Seats / Stanchions / grab rails / floor cutouts / pneumatic door rollers, guides, brackets / fasteners & clamps underneath the bus , fasteners & clamps on the rooftop / destination board mounting / RVM mounting / roof hatch

General : Apart from above pl check visually any other fasteners for loosening

S.No	Schedule-II Maintenance (Weekly)
1	All Activities as per Sch-I Maintenance
2	Grease front axle kingpin bearing (upper & lower)
3	Grease ball joints of Tie rod (both ends) ,draglink (both ends)
4	Check if wear limit has reached (without removing wheels) : Front brake pads (looking through wheel rim cut outs) , rear brake lining (looking through inspection holes) . Also check for oil oozing from rear axle hub
5	Clean all breathers and re-fit
6	Grease / lubricate as per the list #
7	Apply Oil as per list ##

 # List of items requiring periodic greasing / lubrication

Brake system: slack adjuster / S-cam shaft bushes & roller end ,

Prop shaft: U-joints, sliding yoke
Others: Fan belt tensioner swing arm bush

List of items requiring periodic greasing / lubrication

Electricals : lubricate with oil can pinion of starter motor , wiper motor linkages
Body: Top door guiding channel, door hinges , roof hatch with oil

S.No	Schedule-III Maintenance
1	All Activities as per Sch-I and Sch-II Maintenance
2	Check proper sealing of air intake system by checking hose & pipe condition/ proper tightness of clamps
3	Check for external clogging of intercooler & radiator, clean if necessary with compressed air
4	Check crown wheel thrust pad and adjust, if necessary.
5	Rotate tyre position adhering as per recommended procedure
6	Check tyres condition. If abnormal wear noticed, check wheel alignment and adjust as required .
7	During tyre rotation (with the wheels removed) , check that front disc brake rubber boots are intact and not punctured & adjuster cap is intact . Check for front & rear brakes uneven wear of pads / linings and grease spilling on linings or rubber boots. Attend if necessary
8	Drain off air from all air tanks (including for retarder , door , suspension,etc) . If condensed water is found, replace air drier desiccant cartridge.
9	Check for oil droplets / excessive oil accumulation (slight traces of oil are acceptable) at air drier exhaust port . If yes, carry out following activities : (a) check / replace compressor piston rings , (b) clean compressor head , (c) check / replace compressor outlet pipe in case of carbon formation, (d) Clean oil separator
10	Conduct brake system routine checks-Type I
11	Check condition (leak / damage) of shock absorber & its rubber bushes and replace, if necessary.
12	Check for any damage to air bellows Check mounting and static height Check function of level control valve
13	Check head lamp focusing. Adjust if necessary.(Additionally to be done after every bulb change).
14	(a) Check battery mountings, (b) Clean battery posts and terminals. Tighten terminals & smear vaseline/petroleum jelly. Check battery condition like voltage / specific gravity / electolyte level . Check with indicator on battery (wherever available)
15	Check the air filter for door system .Top up with SAE 10 oil with 5 % Molybedeum Bisulphide.

S.No	Sch-IV Maintenance
1	All Activities as per Sch-I , Sch-II and Sch-III Maintenance
2	Check following for free rotation/damage; (a) Water pump. (b) Water pump tensioner pulley, (c) Idler pulley (d) Fan bearing tensioner (e) Fan pulley (f) AC belt tensioner (g) Alternator pulley
3	Remove Strainer in fuel tank, clean and refit
4	Remove rear wheel hubs. Dismantle and clean bearings and other components. Replace damaged/worn-out parts. Repack with fresh wheel bearing grease and refit. Adjust wheel hub bearing play.
5	Conduct brake system routine checks-Type II (also during each brake overhaul)
6	Check electrical system health: Ensure usage of genuine fuses with correct rating , Condition of fuse and relay holding base, Extra load tapping from un-authorised point, earthing connections
7	Check sealing of Air cylinder, solenoids Valve, emergency switch valves, sensors
8	Check condenser and clean if necessary.
9	Check evaporator drain tubes for dirt or restriction.
10	Check for proper functioning of evaporator & blower fans
11	Check refrigerant level sight glass for sufficient quantity of refrigerant .

S.No	Alternate Sch-IV Maintenance
1	All Activities as per Sch-I , Sch-II, Sch-III and Sch-IV Maintenance
2	Check end play of Turbocharger shaft and radial clearance between turbine wheel and housing
3	Check/ replace if required rubber hoses of engine lubrication/ Coolant
4	Drain off hydraulic oil of power steering. Replace filter cartridge. Fill in fresh oil. Test the system with test equipment.
5	Check air suspension bushes . Replace if required
6	Change air filter mats (change earlier if the filter get damaged / cannot be cleaned)
7	Change filter drier

S.No.	FC (or) Alternate FC Maintenance	Periodicity
1	Check Cylinder head valve clearance and adjust if necessary – For inlet valves – 0.25 mm; for exhaust valves – 0.508mm	Every 2 years
2	Remove front wheel hubs. Dismantle wheel bearings and other components. Replace damaged/worn out parts Repack with fresh wheel bearing. Grease and refit . Adjust wheel hub bearing play.	Every 2 years
3	Dismantle pneumatic aggregates of brake system. Clean / inspect & replace parts if necessary	144000 kms or 2 years which ever is earlier
4	Condenser Oil Separator (Concep unit) : Replace Rubber parts, Spring and Filter	Every year
5	Replace air drier desiccant cartridge	Every 2 years
6	Replace AC compressor oil	Every 3 yrs

OILS, FILTERS & COOLANT CHANGES

S.N	AGGREGATE	SPECIFICATION	CAPACITY	PERIODICITY
1	Engine for 1618 RELE	SAE 15w40 CH4 oil	16.5 ltr	9,000 kms
	Engine for 1624 RELE	Valvoline premium Blue – 15w40	17.5 lts	9,000 kms
2	Allison Automatic Transmission	Transynd TES 295 oil	27.4 ltr for initial fill + 3 ltr in hoses; for refill 18 ltr	2,34,000 kms
3	Rear Axle RA 109RR	SAE 85W140 oil with special Anglamol additive	14 Ltr	72,000 kms
4	Power Steering	ATF-Type A oil	7 Ltr	80,000 kms
5	Rear Hub Wheel Bearing	RR3 Grease	650 gm per hub	36,000 kms
6	King pin bush (Meritor Axle)	IS 122203/ NLGI2 Grease		Sch-II
7	Ball Joints (Meritor Axle)	IS 122203/ NLGI2 Grease		Sch-II
8	Chassis	Lithium MP grease		Sch-II
9	Air Conditioner Compressor Oil	BES 55 oil with 55 CSt at $40^{O}C$	2.5 ltr for originar charge; 2 ltr for refilling	Every 3 years
10	Cooling System	Non amino base Ethylene Glycol In 1:1 Ratio mix	Total 27 ltrs	90,000 kms or 2 years whichever earlier
11	Engine oil filter			9,000 kms
12	Allison main & auxiliary filters			1,17,000 kms
13	Fuel Filters Primary & secondary			18,000 kms
14	Air Filter Primary			On appearance of redband
15	Air Filter Secondary			at third replacement of Primary filter
16	A/c Air fiter mats			72,000 kms
17	A/c Filter dryer			36,000 kms
18	Masats Door - filter oil change			54,000 kms
19	Humin Door - Filter cartridge			54,000 kms

Annexure-II

LIST OF TOOLS REQUIRED FOR 1624 RE LE A/C AND 1618 RE LE (NON-AC)

S No	AGREEGATE	TOOL TYPE	TML Part No.	Description	Qty
1	REAR AXLE RA 109 RR	REPAIR	257658903509	Holder For Coupling Flange	1
2	REAR AXLE RA 109 RR	REPAIR	278258903502	Drift-Insta. Outer Race Of Hub Inner Brg.	1
3	REAR AXLE RA 109 RR	REPAIR	278258903503	Puller-Coupling Flange & Hub Assy.	1
4	REAR AXLE RA 109 RR	REPAIR	278258903504	Puller-Outer Race Of Hub Outer Tr Brg.	1
5	REAR AXLE RA 109 RR	REPAIR	278258903505	Puller- Removal Of Axle Shaft	1
6	REAR AXLE RA 109 RR	REPAIR	263258903501	Wrench For Hub Lock Nut	1
7	REAR AXLE RA 109 RR	REPAIR	278258903506	Drift-Insta. Inner Race Of Hub Outer Brg	1
8	REAR AXLE RA 109 RR	REPAIR	257658903514	Dial Gage Holder For Wheel Bearing Adjustment	1
9	REAR AXLE RA 109 RR	REPAIR	278258903507	Puller-Rear Hub Inner Brg With Seal	1
10	REAR AXLE RA 109 RR	REPAIR	257458903502	Drift For Installation Of Inner Race Of Differential Side Brngs And Outer Race Of Hub Outer Brgs	1
11	REAR AXLE RA 109 RR	REPAIR	257658903506	Puller For Differential Side Brgs	1
12	REAR AXLE RA 109 RR	REPAIR	257658903507	Drift For Removal And Installation Of Outer Race Of Cylinder Roller Brgs	1
13	REAR AXLE RA 109 RR	REPAIR	3125891439	Drift	1
14	REAR AXLE RA 109 RR	REPAIR	278258903509	Puller For Removal Of Spacer With Inner Race Of Outer Brg And Oil Seal	1
15	REAR AXLE RA 109 RR	REPAIR	257658903513	Depth Measurement Gage For Tail Pinion	1
16	REAR AXLE RA 109 RR	REPAIR	257658903516	Fixture For Differential Assembly	1
17	REAR AXLE RA 109 RR	REPAIR	257658903518	Support For Removal And Installation Of Tail Pinion Taper Roller Bearings	1
18	REAR AXLE RA 109 RR	REPAIR	257658903520	Wrench For Slotted Rings On Differential Side Brgs	1
19	REAR AXLE RA 109 RR	REPAIR	257358903701	Stand Carrier Hsg	1
20	REAR AXLE RA 109 RR	REPAIR	3385890021	Device	1
21	REAR AXLE RA 109 RR	REPAIR	257658903525	Tension Jaws For Holding Split Spacer Ring In Assembly	1
22	REAR AXLE RA 109 RR	REPAIR	3175891533	Puller For Removal And Installation Of Tail Pinion Assy With Brgs	1
23	REAR AXLE RA 109 RR	REPAIR	257658903521	Pronged Wrench For Tail Pinion Threaded Ring	1
24	REAR AXLE RA 109 RR	REPAIR	5893763	Torque Multiplier	1
25	REAR AXLE RA 109 RR	REPAIR	425830067	Holder For Torque Multiplying Wrench	1

LIST OF TOOLS REQUIRED FOR 1624 RE LE A/C AND 1618 RE LE (NON-AC)

S No	AGREEGATE	TOOL TYPE	SUPPLIER PART NO	TML Part No.	Description	Qty
26	REAR AXLE RA 109 RR	REPAIR		257558903501	Drift For Installation Of Coupling Flange On Tail Pinion Splines	1
27	REAR AXLE RA 109 RR	REPAIR		257658903523	Hook For Lifting Carrier Housing Assy	1
28	REAR AXLE RA 109 RR	REPAIR		278258903508	Drift-Tail Pinion Oil Seal Installation	1
29	REAR AXLE RA 109 RR	REPAIR			Rear Axle Work Stand	1
30	REAR AXLE RA 109 RR	REPAIR		3125891123	Gauge Ra Bend Checking	1
31	SUSPENSION	REPAIR		55511000100	Compound Link Puller	1
32	SUSPENSION	REPAIR		55511000400	Pivot Bolt Puller	1
33	SUSPENSION	REPAIR		55511000200	Shock Absorber Clamp	1
34	ZF FRONT AXLE	REPAIR	5870080041	35100000014	Abdruecker	1
35	ZF FRONT AXLE	REPAIR	5870048295	35100000049	Locating Pad	1
36	ZF FRONT AXLE	REPAIR	5870610002	35100000057	Insert	1
37	ZF FRONT AXLE	REPAIR	5870610010	35100000065	Radbolz Anzieh	1
38	ZF FRONT AXLE	REPAIR	5870058089	35100000073	Locating Pad	1
39	ZF FRONT AXLE	REPAIR	5870260002	35100000081	Handle	1
40	ZF FRONT AXLE	REPAIR	5870058061	35100000090	Locating Pad	1
41	ZF FRONT AXLE	REPAIR	5870651071	35100000103	Schlupfbuchse	1
42	ZF FRONT AXLE	REPAIR	5870221500	35100000111	Heissluftgebl	1
43	ZF FRONT AXLE	REPAIR	5870221501	35100000120	Blower	1
44	ZF FRONT AXLE	REPAIR	5873012018	35100000138	Schnellgreifer	1
45	ZF FRONT AXLE	REPAIR	5873002001	35100000146	Grundgeraet	1
46	ZF FRONT AXLE	REPAIR	5870280004	35100000154	Hammer	1
47	ZF FRONT AXLE	REPAIR	5870230006	35100000162	Spring Balance	1
48	ZF FRONT AXLE	REPAIR	5870281043	35100000171	Hebelbuegel	1
49	ZF FRONT AXLE	REPAIR	5870300019	35100000189	Extractor	1
50	ZF FRONT AXLE	REPAIR	5870300020	35100000197	Counter Support	1
51	ZF FRONT AXLE	REPAIR	5870281058	35100000332	Lifting Tackle	1
52	ZF FRONT AXLE	REPAIR	5870080050	35100000341	Bremsen-Set	1
53	WIL SUSPENSION	REPAIR	55511000100		Compound Link Puller	1
54	WIL SUSPENSION	REPAIR	55511000400		Pivot Bolt Puller	1
55	WIL SUSPENSION	REPAIR	55511000200		Shock Absorber Clamp	1

LIST OF TOOLS REQUIRED FOR 1624 RE LE A/C AND 1618 RE LE (NON-AC)

S No	AGREEGATE	TOOL TYPE	SUPPLIER PART NO	TML Part No.	Description	Qty
56	BSIII CUMMINS ENGINE	REPAIR	3377259		Bosch® Timing Tool (VE Pump)	1
57	BSIII CUMMINS ENGINE	REPAIR	3377822 / 27510903		Fuel Pump Gear Puller	1
58	BSIII CUMMINS ENGINE	REPAIR	3397929 / 275153901805		Oil Filter Wrench	1
59	BSIII CUMMINS ENGINE	REPAIR	275158900902		13 Mm Rings Spanner MODIFIED	1
60	BSIII CUMMINS ENGINE	REPAIR		3125890123	Feeler Guage	1
61	BSIII CUMMINS ENGINE	REPAIR	275158900614		Engine Barring Gear	1
62	BSIII CUMMINS ENGINE	REPAIR	275158900701		Injector Remover	1
63	BSIII CUMMINS ENGINE	REPAIR	3125890231		Valve Spring Compressor	1
64	BSIII CUMMINS ENGINE	REPAIR	ST-647		Standard Puller	1
65	BSIII CUMMINS ENGINE	REPAIR	ST-755		Piston Ring Compressor	1
66	ISBE ENGINE		3824498		Oil Seal Installation Tool	1
67	ISBE ENGINE		3824591		Engine Baring Gear	1
68	ISBE ENGINE		3164659		Crankshaft Seal Replacer	1
69	ISBE ENGINE		3164660		Crankshaft Seal Replacer Rear	1
70	ISBE ENGINE		3164055		Valve Stem Seal Installer	1
71	ISBE ENGINE		3163293		Boot Plier	1
72	ISBE ENGINE		3164329		Valve Spring Compressor	1
73	ISBE ENGINE		3165170		Valve Seat Extrator Collet	1
74	ISBE ENGINE		3164025		Fuel Connector Remover	1
75	ISBE ENGINE		3823208		Torqe Wrench Injector Terminal Nuts	1
76	ISBE ENGINE		3823024		Injecto Rpuller	1
77	ISBE ENGINE		3164027		Wiring Repair Kit	1
78	ISBE ENGINE		3822930		Wire Crimp Toll	1
79	ISBE ENGINE		3822759		Amp Terminal Removal Tool	1
80	ISBE ENGINE		3822608		Weather Pack Terminal Removal Tool	1

SOFTWARE

S No	AGREEGATE	TOOL TYPE	SUPPLIER PART NO	Description	Qty
81	ISBE ENGINE		3886388	Insite Lite/Pro Software CD	1
82	ISBE ENGINE		4918416	Inline 5-Datalink Adapter Kit For Electronic Engine Testing	1
83	ISBE ENGINE		4918857	Cable Electrical (16 Pin Connector)	1
84	ISBE ENGINE		3886391	Insite 5.4 Pro Client Reg	1
85	ISBE ENGINE		4091852	CVC Library (Virtual College Cd)	1
86	MULTIPLEX WIRING		NA	KIBES 32 Runtime Software With Dongle	1
87	MULTIPLEX WIRING		NA	K Line Aaptor	1
88	ATT GEAR BOX	DIAGNOSTIC	J 44950 I	Allison DOC FOR PC DOC V 8.0 CD	1
89	ATT GEAR BOX	DIAGNOSTIC	J47943A	DPA Connector Usb	1

SOURCE FOR SUPPLY OF ABOVE SOFTWARE:

1. For supply of Engine software: Mr MUKUND SHITOLE, Cummins India Ltd., Distribution business centre, 35A/1/2 Erandawana, PUNE 411 038, E-Mail: mukund.v.shitole@cummins.cor
2. For supply of Multiplex Wiring Software: Manish Dharmadhikari, Continental Automotive Components (India) Pvt.Ltd, 140, Hosur Road, Koramangala, BANGALORE- 560 095, Phone 080 66471185, Fax 080 25532311, E-mail: manish.dharmadhikari@continental-corporation.com
3. For supply of Gear Box Diagnostic Software: Mr.Summit khanna, SPX India Pvt. Ltd, Level 2, Elegence Tower, Jasola, New Delhi-110 025, Phone 011 40601540, Fax 011 4060123

Annexure-III

SPARE PARTS TO BE STOCKED

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
1	1618 RE	AIR INTAKE SYSTEM	14280598446	HOSE CLAMP TB-106 SAE J 1508	1
2	1618 RE	AIR INTAKE SYSTEM	14280598501	HOSE CLAMP TB 154 SAE J1508	1
3	1618 RE	AIR INTAKE SYSTEM	278609134204	CLAMP-FOR ASSY. PIPE	1
4	1618 RE	AIR INTAKE SYSTEM	278609135853	COBRA TYPE HOSE-LPO1616TC	1
5	1618 RE	AIR INTAKE SYSTEM	278614605802	HOSE HUMP	1
6	1618 RE	AIR INTAKE SYSTEM	286614609901	INTERCOOLER	1
7	1618 RE	AIR INTAKE SYSTEM	410342900101	HOSE ASSY (FROM AIR DUCT TO COMPRESSOR)	1
8	1618 RE	AIR INTAKE SYSTEM	410342903301	HOSE CLAMP(AIR INTAKE TO COMPRESSOR)	1
9	1618 RE	BODY	257354440133	ASSY. HEAD LAMP RH (24 V)	2
10	1618 RE	BODY	257354440134	ASSY. HEAD LAMP LH (24 V)	2
11	1618 RE	BODY	409001000601	FRONT BUMPER LHS PART	1
12	1618 RE	BODY	409001000602	FRONT BUMPER MIDDLE PART	1
13	1618 RE	BODY	409001000603	FRONT BUMPER RHS PART	1
14	1618 RE	BODY	409002000601	REAR BUMPER MIDDLE PART 1	2
15	1618 RE	BODY	409002000602	REAR BUMPER LHS PART 1	2
16	1618 RE	BODY	409002000603	REAR BUMPER RHS PART	2
17	1618 RE	BODY	409009700201	SKIRT PANEL (AHEAD OF FRONT AXLE)	1
18	1618 RE	BODY	409009700202	SKIRT PANEL (BEHIND FRONT AXLE)	1
19	1618 RE	BODY	409009700205	SKIRT PANEL (MIDDLE)	1
20	1618 RE	BODY	409009700205	SKIRT PANEL (MIDDLE)	1
21	1618 RE	BODY	409009700214	SKIRT PANEL (AHEAD OF FRONT AXLE)	1
22	1618 RE	BODY	409009700216	SKIRT PANEL (BEHIND FRONT AXLE)	1
23	1618 RE	BODY	409009700230	SKIRT PANEL (BELOW DRIVER DOOR)	1
24	1618 RE	BODY	409009700233	SKIRT PANEL (ATTACHED TO FRONT FACE)	1
25	1618 RE	BODY	409016100314	URBAN WINDOW GLASS (LHS 1)	1
26	1618 RE	BODY	409016100317	URBAN WINDOW GLASS (RHS 1, 2, 3, LHS 2 & 3)	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
27	1618 RE	BODY	409016100318	URBAN WINDOW GLASS (RHS 6 and LHS 6)	1
28	1618 RE	BODY	409016100319	URBAN WINDOW GLASS (LHS 4)	1
29	1618 RE	BODY	409016100320	URBAN WINDOW GLASS (RHS 5 and LHS 5)	1
30	1618 RE	BODY	409016100321	URBAN WINDOW GLASS (RHS 4)	1
31	1618 RE	BODY	409017100304	D-60 CYLINDER 140 STROKE 1	1
32	1618 RE	BODY	409017100305	MANUAL VALVE 3V	1
33	1618 RE	BODY	409017100306	ELECTROVALE 5/5 (1 COIL) 1	1
34	1618 RE	BODY	409017100307	ELECTROVALVE 3V NV 1	1
35	1618 RE	BODY	409017100308	5/2 ELECTOVALVE 1	1
36	1618 RE	BODY	409017100309	ELECTROVALVE 2V NV 1	1
37	1618 RE	BODY	409017100310	ELECTROVALVE 2V NV	1
38	1618 RE	BODY	409017100311	ANTI RETURN VALVE	1
39	1618 RE	BODY	409017100312	SENSITIVITY VALVE	1
40	1618 RE	BODY	409017100313	SENSITIVITY MICROSWITCH	1
41	1618 RE	BODY	409017100314	CONTACTOR FAE 1807	2
42	1618 RE	BODY	409017100315	SLIDING COMPONENT WITH BEARING	1
43	1618 RE	BODY	409017100316	CONTACTO NA 0.2 KG	2
44	1618 RE	BODY	409017100317	CONNECTING ROF R-90	1
45	1618 RE	BODY	409017100318	ELECTRONIC RELAY WITH CONNCET	1
46	1618 RE	BODY	409017100319	SENSITIVITY MICROSWITCH	1
47	1618 RE	BODY	409017100320	BEARING	1
48	1618 RE	BODY	409017100321	PLASTIC PUSH BUTTON PROTECTOR	1
49	1618 RE	BODY	409017100322	BUZZER	1
50	1618 RE	BODY	409017100323	CLOSING TEMPORISER	1
51	1618 RE	BODY	409017100325	CIRCUIT SELECT VLAVE	1
52	1618 RE	BODY	409017100326	ELECTRIC PUSH BUTTON (BLACK) 1	1
53	1618 RE	BODY	409017100327	ELECTRIC PUSH BUTTON (RED) 1	1
54	1618 RE	BODY	409017100328	ELECTRIC PUSH BUTTON (GREEN)	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
55	1618 RE	BODY	409017100329	SWITCH 2 POSITIONS	1
56	1618 RE	BODY	409024000104	COMPLETE RHS BATTERY FLAP	1
57	1618 RE	BODY	409024000105	COMPLETE RHS RADIATOR FLAP	1
58	1618 RE	BODY	409024000106	COMPLETE LHS AIR FILTER FLAP	1
59	1618 RE	BODY	409025090301	GAS SPRINGS FOR FRONT FLAP	1
60	1618 RE	BODY	409025990301	GAS SPRINGS FOR RHS BATTERY FLAP	1
61	1618 RE	BODY	409029100401	FRONT ROOF MARKER LAMP	2
62	1618 RE	BODY	409031000103	FRONT RHS HEAD LAMP BEZEL	1
63	1618 RE	BODY	409031000104	FRONT LHS HEAD LAMP BEZEL	1
64	1618 RE	BODY	409031100201	FRONT WINDSHIELD 1	1
65	1618 RE	BODY	409031100202	DESTINATION BOARD GLASS 1	1
66	1618 RE	BODY	409031100203	REAR WINDSHIELD 1	1
67	1618 RE	BODY	409031400201	RUBBER FOR FRONT WINDSHIELD 1	1
68	1618 RE	BODY	409031400202	RUBBER FOR DESTINATION BOARD	1
69	1618 RE	BODY	409031400203	RUBBER FOR REAR WINDSHIELD	1
70	1618 RE	BODY	409039000202	Rear view mirror bracket/arm RHS	1
71	1618 RE	BODY	409039400201	Rear view mirror bracket/arm LHS	1
72	1618 RE	BODY	409039400202	Rear view mirror LHS	1
73	1618 RE	BODY	409039400203	Rear view mirror RHS	1
74	1618 RE	BODY	409041100322	CYLINDER LINE RIGHT	1
75	1618 RE	BODY	409041100323	CYLINDER LINE LEFT	1
76	1618 RE	BODY	409041100336	MAGNET	1
77	1618 RE	BODY	409041100337	CYLINDER ROLLER	1
78	1618 RE	BODY	409047100101	internal lock	3
79	1618 RE	BODY	409047100102	EXTERNAL LOCK	3
80	1618 RE	BODY	409047800102	GAS SPRINGS FOR LHS AIR FILTER FLAP	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
81	1618 RE	BODY	409047800102	GAS SPRINGS FOR RHS RADIATOR FLAP	1
82	1618 RE	BODY	410354209901	Speedometer	1
83	1618 RE	BODY	410354209902	RPM meter	1
84	1618 RE	BRAKES	14280500306	HOSE CLAMP 30 IS4762-SS8451S2-Y	1
85	1618 RE	BRAKES	218643900199	ASSY HOSE 3/8"	1
86	1618 RE	BRAKES	219143700102	CONSEP UNIT (SCL) M304780	1
87	1618 RE	BRAKES	257342420118	GRADUATED HAND CONTROL VALVE (SCL-M302860	1
88	1618 RE	BRAKES	264046203103	SRDG.BEARING (SHIELED)20 BC 10 JPP	1
89	1618 RE	BRAKES	278243700147	RELAY VALVE VOSS PORTS	1
90	1618 RE	BRAKES	278243700148	DUAL BRAKE VAVLE VOSS (SCL)	1
91	1618 RE	BRAKES	278243700149	QUICK RELEASE VALVE VOSS-WT ADAPTOR	1
92	1618 RE	BRAKES	278613135802	HOSE (AIR COMPRESS 18 ID,200L)LPT2516BSI	1
93	1618 RE	BRAKES	284643700105	NON-RETURN VALVE(M306100) VOSS-SCL	1
94	1618 RE	BRAKES	288443700104	QUICK RELEASE VALVE (3 PORT VOSS)-SCL	1
95	1618 RE	BRAKES	288443700105	GRADUAT HAND CONTROL VALVE (VOSS&LP SWT)	1
96	1618 RE	BRAKES	288443700105	GRADUAT HAND CONTROL VALVE (VOSS&LP SWT)	1
97	1618 RE	BRAKES	289243900113	ASSY. 3/8" HOSE WITH L12 COUPLINGNUT BOT	1
98	1618 RE	CONTROLS	17271201001	BALL END ASSY B10 TS15624	2
99	1618 RE	CONTROLS	17271601000	BALL PIN A10 TS 15622	2
100	1618 RE	CONTROLS	216830106701	PIVOT PIN	1
101	1618 RE	CONTROLS	216830106701	PIVOT PIN	2
102	1618 RE	CONTROLS	260030103404	BUSH	1
103	1618 RE	CONTROLS	260030103404	BUSH	2
104	1618 RE	CONTROLS	289230100106	ASSY.BELL CRANK WITH BUSH	1
105	1618 RE	CONTROLS	410330100114	ASSY CABLE ACCELERATOR	2
106	1618 RE	COOLING SYSTEM	278650006304	RUBBER BUFFER	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
107	1618 RE	COOLING SYSTEM	278650100384	ASSEMBLY RADIATOR COMPLETE	1
108	1618 RE	COOLING SYSTEM	278650100392	ASSY.RADIATOR(BANCO)	1
109	1618 RE	COOLING SYSTEM	278650105829	HOSE (RADIATOR BOTTOM TANK)	1
110	1618 RE	COOLING SYSTEM	278650115816	REDUCER HOSE# (RAD TO ENG)	1
111	1618 RE	ELECTRICAL	206654209902	BEEPER ALARM UNIT M/S. PRAKANT ELECT.	1
112	1618 RE	ELECTRICAL	207354209906	HORN-DIA 125,24V,RIS CAPACITOR M/s PRAKA	1
113	1618 RE	ELECTRICAL	207354209909	HORN 24V TABLE M/S ROOTS IND.LTD.	1
114	1618 RE	ELECTRICAL	207454209901	HIGHTEMP.SENSING BUZZER UNIT 12V M/S IIL	1
115	1618 RE	ELECTRICAL	207854209903	HIGH TEMP. BUZZER UNIT (OFFER DRG.)	1
116	1618 RE	ELECTRICAL	207854209906	HIGH TEMP. WARNING BUZZER UNIT 12V	1
117	1618 RE	ELECTRICAL	215754209965	REMOTE BATTERY CUT-OFF SW M/s UNIQUE SPW	1
118	1618 RE	ELECTRICAL	216354209959	VEHICLE SPEED SENSOR (12/24V) M/S-MINDA	1
119	1618 RE	ELECTRICAL	218654660108	Starter InterLock Relay 24V	1
120	1618 RE	ELECTRICAL	219154509901	BATT. CUT OFF SW (1-POLE) SHUTHAM	1
121	1618 RE	ELECTRICAL	219754209910	VEHICLE SPEED SENSOR (12/24V) M/S-IIL	1
122	1618 RE	ELECTRICAL	257354209960	BEEPER ALARM UNIT (OFFER DRG.)	1
123	1618 RE	ELECTRICAL	257354209963	BEEPER ALARM UNIT	1
124	1618 RE	ELECTRICAL	257354242001	HORN (24V) (M/s.MUNCHUR)	1
125	1618 RE	ELECTRICAL	257354249903	DISK TYPE HORN (M/s.HELLA)	1
126	1618 RE	ELECTRICAL	257354509937	BATTERY CUT OFF SWITCH (M/s.SHUTHAM)	1
127	1618 RE	ELECTRICAL	257454249914	VOLTMETER [24 VOLTS].M/S INDI.INSTS.LTD	2
128	1618 RE	ELECTRICAL	257454509985	LOW AIR PRESSURE SW. M/s.SUNDARAM CYLTN.	1
129	1618 RE	ELECTRICAL	257654509909	STOP LIGHT SWITCH M/S S C	1
130	1618 RE	ELECTRICAL	260854504901	RELAY (24V) M/s.LUCAS-TVS	1
131	1618 RE	ELECTRICAL	263254209903	TEMPERATURE TRANSDUCER - OFFER	1
132	1618 RE	ELECTRICAL	269854509901	REVERSE LIGHT SWITCH:--M/s.SRICHARAN.	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
133	1618 RE	ELECTRICAL	270254509950	REVERSE LIGHT SWITCH (OFFER)	1
134	1618 RE	ELECTRICAL	270254509960	REVERSE LIGHT SW.-SHUTHAM	1
135	1618 RE	ELECTRICAL	270254509968	REVERSE LIGHT SWITCH M/S PMP	1
136	1618 RE	ELECTRICAL	270654244902	ACC RELAY 24V -ED	1
137	1618 RE	ELECTRICAL	275054504901	RELAY (24) M/S PRAKANT ELECT.	1
138	1618 RE	ELECTRICAL	277054209905	HIGH TEMP.BUZZER UNIT(12V/24V) M/s.SRICHN	1
139	1618 RE	ELECTRICAL	277054209906	HIGH TEMP.WARN. BUZZER UNIT(12/24V) OFFER	1
140	1618 RE	ELECTRICAL	284354509917	REVERSE LIGHT SW (REV) - M/S. MINDARIKA	1
141	1618 RE	ELECTRICAL	410354209903	INST. CLUSTER WITH ELEC.SPEEDO	1
142	1618 RE	ELECTRICAL	410354660104	W/H MAIN, LE1618 RE DIESEL; ELEC.SPEEDO	1
143	1618 RE	ELECTRICAL	410354660105	W/H TAIL LE1618 RE DIESEL ELEC.SPEEDO	1
144	1618 RE	ELECTRICAL	410354660106	W/H BODY LE1618 RE DIESEL BSIII ELE.SPD	1
145	1618 RE	ELECTRICAL	G207854209903	HIGH TEMP. BUZZER UNIT (OFFER DRG.)	1
146	1618 RE	ELECTRICAL	G257354209963	BEEPER ALARM UNIT	1
147	1618 RE	ELECTRICAL	G257354242001	G-PART-HORN 24 V	1
148	1618 RE	ELECTRICAL	G270754244901	ACC RELAY (NO CONTACT) 24V M/s.BOSCH	1
149	1618 RE	ENGINE	207620150118	SWING ARM ASSY.	1
150	1618 RE	ENGINE	207620158701	COMPRESSION SPRING.	1
151	1618 RE	ENGINE	257649007502	RUBBER BUFFER	1
152	1618 RE	ENGINE	257649007502	RUBBER BUFFER	1
153	1618 RE	ENGINE	257654209901	PRESSURE TRANSDUCER (VDO-GERMANY)	1
154	1618 RE	ENGINE	257654209927	PRESSURE TRANSDUCER (M/s.IIL)	1
155	1618 RE	ENGINE	264142900172	ASSY.CLAMP	1
156	1618 RE	ENGINE	276349205301	GASKET	1
157	1618 RE	ENGINE	277054249904	ASSY.MAGNETIC VALVE-24V (EXH.B)	1
158	1618 RE	ENGINE	278254600108	ASSY.CLAMP	1
159	1618 RE	BELT	278620156318	COGGED 'V' BELT TWIN GROOVE	1
160	1618 RE	ENGINE	278620157004	PULLEY- FAN DRIVE. (ON ENGINE)	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
161	1618 RE	ENGINE	418101000103	6BTAA 180@2500 24V LMFO BS-3	1
162	1618 RE	KNEELING	219132100120	KIT LEVELLING VALVE -FRONT SUSPENSION	1
163	1618 RE	SPEED LIMITER	218654209915	WIRING HARNESS M/S PRICOL	2
164	1618 RE	SPEED LIMITER	218654209917	ELCTRIC ACTUATOR 24V M/S PRICOL	2
165	1618 RE	SPEED LIMITER	218654209918	ELECTRONIC CONTROL UNIT -24V M/S PRICOL	2
166	1618 RE	SPEED LIMITER	218654209921	BOOSTER BOX FOR AUTO TRANS VEHICLE	2
167	1618 RE	STEERING SYSTEM	218646306001	PITMAN ARM	1
168	1618 RE	STEERING SYSTEM	218646600101	ASSY DRAG LINK	1
169	1618 RE	STEERING SYSTEM	218646600102	STG G.BOX ASSY	1
170	1618 RE	STEERING SYSTEM	218646600103	ASSY VANE PUMP	1
171	1618 RE	STEERING SYSTEM	218646600104	ASSY BEVEL G.BOX	1
172	1618 RE	STEERING SYSTEM	218646800102	HOSE ASSY (TANK TO VANE PUMP)	1
173	1618 RE	STEERING SYSTEM	218646800103	HOSE ASSY. (PUMP TO STG. G/BOX)	1
174	1618 RE	STEERING SYSTEM	218646800104	HOSE ASSY (G/B TO TANK)	1
175	1618 RE	STEERING SYSTEM	257346200106	ASSY U J STEERING	1
176	1618 RE	STEERING SYSTEM	265146600102	ASSY.UNIVERSAL JOINT	1
177	1618 RE	STEERING SYSTEM	275446600103	STG.PUMP(INDIGENOUS-DIRECT DRIVE)-M/S ZF	1
178	1618 RE	COOLING SYSTEM	278650006302	RUBBER BUFFER (38 DIA x 12THK)8/LP/LPT	1
179	1618 RE	ZF FRONT AXLE	218640100101	ASSY.WHEEL NUT (M22 X 1.5)	5
180	1618 RE	WIL SUSPENSION	219132407701	ROLLING DIAPHRAGM	1
181	1618 RE	WIL SUSPENSION	610000000089	12" ROLLING DIAPHGRM	1
182	1618 RE	WIL SUSPENSION	620000000027	AIR FILTER	1
183	1618 RE	WIL SUSPENSION	620000000035	NON RETURN VALVE	1
184	1618 RE	WIL SUSPENSION	620000000063	SPHERILASTIC BUSH - TAPER BUSH	1
185	1618 RE	WIL SUSPENSION	620000000232	SPHERILASTIC BUSH-PIN TYPE - PARALLEL LINK	1
186	1618 RE	WIL SUSPENSION	620000000539	SPHERILASTIC BUSH -RADIUS ROD	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
187	1618 RE	WIL SUSPENSION	620000000639	BUMP STOP (BIG)	1
188	1618 RE	WIL SUSPENSION	620000000704	MR SPLIT BUSH -PER PCS	1
189	1618 RE	WIL SUSPENSION	620000000790	SPHERILASTIC BUSH (ARB)	1
190	1618 RE	WIL SUSPENSION	620000000933	PNEUMATIC HOSE CONNECTION KIT	1
191	1618 RE	WIL SUSPENSION	620000001093	SHOCK ABSORBER	1
192	1618 RE	WIL SUSPENSION	620000100086	LEVELLING VALVE	1
193	1618 RE	MERITOR FRONT AXLE	219132100120	KIT LEVELLING VALVE FRONT SUSPENSION	1
194	1618 RE	MERITOR FRONT AXLE	410332800102	ASSY FRONT ANTI ROLL BAR	1
195	1618 RE	MERITOR FRONT AXLE	218632800102	ASSY. BALL JOINT FOR FRONT ARB	2
196	1618 RE	MERITOR FRONT AXLE	218632807101	CLAMP FRONT ANTI ROLL BAR	2
197	1618 RE	MERITOR FRONT AXLE	218632807701	BUSH FRONT ANTI ROLL BAR	4
198	1618 RE	MERITOR FRONT AXLE	410332106301	RUBBER BELLOW	2
199	1618 RE	MERITOR FRONT AXLE	410332107901	PISTON	2
200	1618 RE	MERITOR FRONT AXLE	410332100106	ASSY AIR SPRING	2
201	1618 RE	MERITOR FRONT AXLE	218632100104	ASSY SHOCK ABSORBER	2
202	1618 RE	MERITOR FRONT AXLE	410332100108	ASSY. BUSH	8
203	1618 RE	MERITOR FRONT AXLE	410333106001	ROD ASSY-END AND TIE	1
204	1618 RE	MERITOR FRONT AXLE	278042100103	BRAKE DISC-VENTILATED (434X45)	2
205	1618 RE	MERITOR FRONT AXLE	410333403101	BEARING ASSY	2
206	1618 RE	MERITOR FRONT AXLE	410333406501	SPINDLE NUT	2
207	1618 RE	MERITOR FRONT AXLE	410333409202	WASHER-WHEEL BRG NUT	2
208	1618 RE	MERITOR FRONT AXLE	278042100104	BRAKE ASSY. ELSA225H-LH	1
209	1618 RE	MERITOR FRONT AXLE	278042100105	BRAKE ASSY. ELSA225H-RH	1
210	1618 RE	MERITOR FRONT AXLE	278042100106	KIT-PAD (MERITOR DISC BRAKE),	1
211	1618 RE	MERITOR FRONT AXLE	278042100116	KIT-SERVICE CALIPER LH(MERITOR)	1
212	1618 RE	MERITOR FRONT AXLE	278042100117	KIT-SERVICE CALIPER RH(MERITOR)	1

S No	Model	AGREEGATE	TML Part No.	Description	Initial Qty to be stocked
213	1618 RE	MERITOR FRONT AXLE	278042100104	BRAKE ASSY. ELSA225H-LH	1
214	1618 RE	MERITOR FRONT AXLE	278042100105	BRAKE ASSY. ELSA225H-RH	1
215	1618 RE	AUTOMATIC TRANSMISSION	23019664	O-RING, DRAIN PLUG, 16.4 MM ID	1
216	1618 RE	AUTOMATIC TRANSMISSION	29507437	O-RING,COVER,75.9 MM ID	1
217	1618 RE	AUTOMATIC TRANSMISSION	29524449	GASKET, FILTER COVER	1
218	1618 RE	AUTOMATIC TRANSMISSION	29538232	FILTER (LUBE & MAIN)	1
219	1618 RE	AUTOMATIC TRANSMISSION	29542755	HOUSING ASSEMBLY, C3 CLUTCH, COMPLETE	1
220	1618 RE	AUTOMATIC TRANSMISSION	29543926	O-RING, 85.3 MM ID	1
221	1618 RE	AUTOMATIC TRANSMISSION	218627600104	HOSE - TRANS. TO COOLER (2200MM)	1
222	1618 RE	AUTOMATIC TRANSMISSION	218627600105	HOSE - COOLER TO TRANS. (2300MM)	1
223	1618 RE	AUTOMATIC TRANSMISSION	218627600106	HOSE ASSY ACCUMULATOR	1
224	1618 RE	PROP SHAFT	410341100111	ASSY PROPELLER SHAFT COMPLETE M/S SPICER	1
225	1618 RE	PROP SHAFT	885441014018	UJ KIT	1