# 44 - Automatic Gearbox

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### ZF Auto

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3. Electronic Automatic Transmission (EAT) ECU
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5. Oil cooler
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1. Transmission high/low switch
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3. Gear position switch connector
4. Solenoid valve/speed sensor connector
5. Electronic Automatic Transmission (EAT) ECU
6. Engine Control Module (ECM)
7. Diagnostic socket
8. Instrument pack
9. Transmission fluid temperature sensor
10. Body electrical Control Module (BeCM)
11. Battery power supply
12. Ignition power supply
AUTOMATIC TRANSMISSION - DESCRIPTION

General

The ZF4HP22 transmission is used on 2.5 litre Diesel and 4.0 litre petrol models. 4.6 litre petrol models use the ZF4HP24 transmission unit to accommodate the increased power output of the larger engine. Both units are of similar construction with the ZF4HP24 unit being slightly longer. The operation of both units is the same.

Automatic transmission vehicles are fitted with an 'H-gate' selector mechanism. The selector mechanism combines the operation of the transmission selector lever and the transfer box high/low gear range selection. Selections on the selector lever assembly are transmitted by a selector cable to a gear position switch.

The gear position switch on the transmission passes gear selection signals to an Electronic Automatic Transmission (EAT) ECU located below the LH front seat, which outputs the appropriate control signals to an electro-hydraulic valve block in the transmission. A mode switch enables the driver to change the control mode of the EAT ECU between manual, economy and sport. The EAT ECU provides signals to the message centre in the instrument pack to indicate the control mode and system status.

The gearbox features a pressure lubrication system and is cooled by pumping the lubricant through an oil cooler located in front of the engine cooling radiator.

From 99MY onwards, petrol models feature a revised EAT ECU with Controller Area Network (CAN) digital communications between the EAT ECU and the ECM.

H-gate selector lever assembly

The selector lever assembly consists of a lever and a cover attached to a cast base. The base is located on a gasket and secured to the transmission tunnel and has an 'H' pattern for the lever to move in. The lever is hinged to the base and a latch in the lever engages with detents in the base to provide positive location for the lever positions. The latch is disengaged by pressing a release button on the lever knob as shown in the lever illustration below.
Except for lever movement between positions D and 3 (high range) and 4 and 3 (low range), the button must be pressed before the lever can be moved. In some markets, vehicles incorporate an interlock solenoid at the bottom of the lever, which prevents the lever being moved from P unless the ignition switch is in position II and the foot brake is applied.

The cover incorporates LED lever position indicators and the mode switch. The lever position indicators illuminate to show the position of the selector lever. The driver’s side of the H-gate is labelled ‘Hi’ and is used to select the high range gears. The passenger side of the H-gate is labelled ‘Lo’ and is used to select the low range gears. Movement of the selector lever across the H-gate selects high and low transfer box gear ranges.

The LED indicators are controlled by the Body electrical Control Module (BeCM). A mode switch is located on the driver’s side of the cover. The mode switch is used by the driver to select sport mode used in the high range gears and manual mode used in the low range gears. The mode switch is a non-latching hinged switch that, when pressed, connects an earth to the EAT ECU to request a change of mode. Sport and Manual indicator lamps on the cover illuminate to show the mode selected. The message centre in the instrument pack also displays ‘S’ for sport mode and ‘LM’ for manual mode along with the selected gear.

An electrical connector at the rear of the cover connects the selector lever assembly to the vehicle wiring.

Selector cable

The selector cable is a Bowden type cable that connects the selector lever assembly to a selector lever on the gearbox. ‘C’ clips secure the ends of the outer cable to brackets on the selector lever assembly and the selector lever. The inner cable is adjustable at the connection of the inner cable with the gearbox selector lever.
Gearbox

1. Torque converter
2. Torque converter housing
3. Fluid pump
4. Breather tube
5. Intermediate plate
6. Gearbox housing
7. Rear extension housing
8. Electrical connector
9. Snubbing bar
10. Upper mounting bracket
11. Mounting rubber
12. Lower mounting bracket
13. Gasket
14. Sump
15. 'O' ring
16. Drain plug
17. 'O' ring
18. Filler/level plug
19. Bolt
20. Clamp
21. Lower mounting bracket
22. Mounting rubber
23. Selector lever
24. Gear position switch
The gearbox consists of a torque converter housing, an intermediate plate, a gearbox housing and a rear extension housing, bolted together in series. The rear of the gearbox is supported by a rubber mounting installed between a mounting bracket on the gearbox and the LH chassis rail. A heat shield is installed on the mounting to protect it from the exhaust.

Sectioned view of gearbox

1. Lock-up clutch
2. Impeller
3. Turbine
4. Forward drive clutch
5. Reverse drive clutch
6. Brake clutch
7. Brake clutch
8. Brake clutch
9. Epicyclic gear set
10. Epicyclic gear set
11. Clutch
12. Brake clutch
13. Output shaft
14. Freewheel (one way clutch)
15. Freewheel (one way clutch)
16. Freewheel (one way clutch)
17. Stator and one way clutch
Valve block

1. Valve block
2. Pressure regulating solenoid valve (MV 4)
3. Shift control solenoid valve (MV 2)
4. Shift control solenoid valve (MV 1)
5. Lock-up solenoid valve (MV 3)
6. Output shaft speed sensor
7. Bolt
8. Sensor retaining clip
9. Manual valve
10. ‘O’ ring
11. Filter
12. ‘O’ ring
13. Suction pipe
14. Bolt
15. Bolt
16. Washer
**Torque converter housing**

On 2.5 litre Diesel models a 260 mm (10.2 in) diameter torque converter is used. On 4.0 and 4.6 litre petrol models a 280 mm (11 in) diameter torque converter is used. On 4.6 litre petrol models up to 99MY the torque converter is longer than the torque converter used on 4.0 litre petrol models. From 99MY, both the 4.0 and 4.6 litre petrol models use the shorter torque converter previously used on up to 99MY 4.0 litre models.

The torque converter housing attaches the gearbox to the engine and contains the torque converter. The torque converter is connected to the engine drive plate and transmits the drive from the engine to the gearbox input shaft. When engaged, a hydraulic lock-up clutch in the torque converter prevents slippage, to give a direct drive from the engine to the gearbox for improved efficiency.

**Intermediate plate**

The intermediate plate supports the gearbox input shaft and provides the interface between the transmission fluid pump and the lubrication circuit. The pump attaches to the front of the intermediate plate and is driven by an impeller in the torque converter. The pump pressurises transmission fluid drawn from the sump on the gearbox housing. The pressurised fluid then circulates through the torque converter and gearbox housing components for cooling, lubrication and gear shift purposes. Ports around the outer periphery of the intermediate plate provide the inlet and outlet connections to the fluid cooler and a pressure take-off point for servicing.

On ZF4HP24 gearboxes, the intermediate plate is 15 mm (0.6 in) thicker than fitted to the ZF4HP22 gearbox to accommodate a larger fluid pump unit. To compensate for the increased length of the intermediate plate, the rear extension housing is 15 mm (0.6 in) shorter than that fitted to the ZF4HP22 gearbox.

**Gearbox housing**

The gearbox housing contains two epicyclic gear sets on input and output shafts. Hydraulic clutches on the shafts control which elements of the gear sets are engaged, and their direction of rotation, to produce the P and N selections, four forward gear ratios and one reverse gear ratio.

---

**Gear ratios**

<table>
<thead>
<tr>
<th>Gear</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>2.480:1</td>
</tr>
<tr>
<td>2nd</td>
<td>1.480:1</td>
</tr>
<tr>
<td>3rd</td>
<td>1.000:1</td>
</tr>
<tr>
<td>4th</td>
<td>0.728:1</td>
</tr>
<tr>
<td>Reverse</td>
<td>2.086:1</td>
</tr>
</tbody>
</table>

The lock-up and brake clutches are operated by pressurised transmission fluid from the valve block in the sump. A manual valve and four solenoid valves, also known as Motorised Valves (MV), control the supply of pressurised transmission fluid from the valve block:

- The manual valve controls the fluid supply for P, R, N and D selector positions. The four solenoid valves operate accordingly to operate shift control, lock-up and shift quality.
- Solenoid valves MV 1 and MV 2 control the supplies that operate the brake clutches for shift control. They are also used to prevent accidental engagement of reverse when moving forwards and a forward gear when moving backwards.
- Solenoid valve MV 3 controls the supply that operates the lock-up clutch.
- Solenoid valve MV 4 modulates the pressure of the supplies to the brake clutches, to control shift quality.

Operation of the manual valve is controlled by the selector lever assembly. In the gearbox, a selector shaft engages with the manual valve. The selector shaft is connected to the selector lever assembly via the selector cable and a selector lever on the left side of the gearbox. The selector shaft also operates a mechanism that locks the output shaft when P is selected.

Operation of the solenoid valves is controlled by the EAT ECU.
An output shaft speed sensor in the gearbox housing outputs a signal to the EAT ECU. The EAT ECU compares output shaft speed with engine speed to determine the engaged gear and output shaft speed with vehicle speed to confirm the range selected on the transfer box. The speed sensor signal is a diagnostic function and not essential for correct gearbox operation.

A bayonet lock electrical connector in the gearbox casing, to the rear of the selector lever, connects the solenoid valves and the output shaft speed sensor to the vehicle wiring.

A pressed steel sump encloses the valve block and collects transmission fluid draining from the gearbox housing. A suction pipe and filter on the underside of the valve block connect to the inlet side of the fluid pump. A magnet is installed in the sump to collect any magnetic particles that may be present. A level plug and a drain plug are installed in the sump for servicing.

**Rear extension housing**

The rear extension housing provides the interface between the gearbox housing and the transfer box. A splined output shaft transmits the drive from the gearbox to the transfer box. A seal in the rear of the housing prevents leakage past the extension shaft. A breather pipe, attached to the left side of the rear extension housing, ventilates the interior of the gearbox and rear extension housings to atmosphere. The open end of the breather pipe is located in the engine compartment at the right rear corner of the engine, against the bulkhead. On 99MY V8 vehicles, the breather pipe is also located against the bulkhead, but the open end is routed down the bulkhead and located below the converter housing.

**Gearbox power flows**

The following schematics show the power flow through the gearbox for each forward gear when D is selected, and for reverse. The key to the Item numbers on the schematics, and in parenthesis in the accompanying text, can be found on the illustration 'Sectioned view of gearbox' shown earlier in this section of the Workshop Manual.

1st Gear (D selected)

Clutches (4) and (11) are engaged. The front planet gear carrier of gear set (9) locks against the gearbox housing through freewheel (15) when the engine powers the vehicle, and freewheels when the vehicle is coasting. Gear set (10) rotates as a solid unit with the front planet gear carrier.
2nd Gear (D selected)

Clutches (4), (6), (7) and (11) are engaged. Freewheel (15) overruns. The hollow shaft with the sun wheel of gear set (9) is locked. Gear set (10) also rotates as a solid unit.

3rd Gear (D selected)

Clutches (4), (5), (7) and (11) are engaged. Freewheels (15) and (16) are overrun. Gear sets (9) and (10) rotate as a solid unit.

4th Gear (D selected)

Clutches (4), (5), (7) and (12) are engaged. Freewheels (14), (15) and (16) are overrun. Gear set (9) rotates as a solid unit. The hollow shaft with the sun wheel of gear set (10) is locked.
Reverse gear

Clutches (5), (8) and (11) are engaged. Freewheels (14) and (16) are overrun. The front planet gear carrier of gear set (9) is locked. Gear set (10) also rotates as a solid block.

Gear position switch

The gear position switch outputs signals that are related to the position of the selector lever assembly. The switch is installed on the selector shaft on the left side of the gearbox. Slotted mounting holes allow the switch to be turned relative to the shaft for adjustment. A fly lead connects the switch to the vehicle wiring.

Movement of the selector lever assembly turns the selector shaft, which connects with three sliding contacts in the switch. The contacts are identified as the X, Y and Z. When closed:

- The X, Y and Z contacts output a combination of earth signals to the EAT ECU as shown in the table below.

- The outputs of the X, Y and Z contacts are monitored by the EAT ECU, ECM and the BeCM to determine the position of the selector lever assembly.

The signals are interpreted by the EAT ECU for the correct gear selection. The ECM uses the signals to control engine idle speed etc. The BeCM uses the signals to illuminate the gear selection display on the selector cover, operate the reverse lamps, wiper reverse operation and message centre display etc.

<table>
<thead>
<tr>
<th>Position switch</th>
<th>ECU pin</th>
<th>P</th>
<th>R</th>
<th>N</th>
<th>D</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1 (X)</td>
<td>36</td>
<td>0V</td>
<td>0V</td>
<td>-</td>
<td>-</td>
<td>0V</td>
<td>0V</td>
<td>0V</td>
</tr>
<tr>
<td>Line 2 (Y)</td>
<td>8</td>
<td>-</td>
<td>0V</td>
<td>0V</td>
<td>0V</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Line 3 (Z)</td>
<td>37</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0V</td>
<td>0V</td>
<td>0V</td>
<td>-</td>
</tr>
</tbody>
</table>
Fluid Cooler

1. Outlet connection
2. Fixing bracket
3. Inlet connection
4. Fixing bracket
5. Temperature sensor

Transmission fluid from the gearbox is circulated through a cooler located at the front of the radiator. Fluid lines from the transmission are connected to each end tank of the fluid cooler. A temperature sensor on the LH end tank provides the instrument pack with an input of transmission fluid temperature. If the temperature exceeds between 120 and 130 °C (248°F and 266°F), the instrument pack message centre displays 'GEARBOX OVRHEAT'. The message remains displayed until the temperature of the fluid returns to between 82 and 88 °C (180°F and 190°F).

EAT ECU

The EAT ECU operates the solenoid valves in the gearbox to provide automatic control of gear shifts and torque converter lock-up. The EAT ECU is attached to a bracket which is secured to the cabin floor below the LH front seat.

Diesel vehicles from 95MY and petrol vehicles up to 99MY

A 55 pin connector links the EAT ECU to the vehicle wiring. Software in the ECU monitors hard wired inputs and exchanges information via hard wired connections with the ECM, BeCM and instrument pack.

Petrol vehicles from 99MY

A 75 pin connector links the EAT ECU to the vehicle wiring. Software in the EAT ECU monitors hard wired inputs and exchanges information with the ECM on a Controller Area Network (CAN) bus to determine gear shift and torque converter lock-up requirements. Resultant control signals are then output to the gearbox solenoid valves.
The CAN bus, introduced on 99MY petrol vehicles, provides the communication link between the ECM and the EAT ECU. Inputs and outputs to and from each control unit are transmitted via two twisted wire connections, CAN high and CAN low.

The CAN bus allows more engine data to be passed to the EAT ECU which, on earlier vehicles, would require a number of additional hardwired connections.

The additional engine data is used by the EAT ECU to give improved transmission quality and allows the EAT ECU to operate in a greater number of default modes in the event of sensor failure. Inputs and outputs on the CAN communication bus are listed in the table that follows.

**CAN communications between EAT ECU and ECM - Petrol vehicles from 99MY**

<table>
<thead>
<tr>
<th>Inputs from ECM</th>
<th>Outputs to ECM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN version identifier</td>
<td>Calculated gear</td>
</tr>
<tr>
<td>Emissions (OBDII) control</td>
<td>Diagnostic information</td>
</tr>
<tr>
<td>Engine air intake temperature</td>
<td>Emission (OBDII) fault status</td>
</tr>
<tr>
<td>Engine speed</td>
<td>Engine torque reduction request</td>
</tr>
<tr>
<td>Engine speed fault flag</td>
<td>Gear position switch information</td>
</tr>
<tr>
<td>Engine temperature</td>
<td>Output shaft speed</td>
</tr>
<tr>
<td>Engine torque</td>
<td>Mode information</td>
</tr>
<tr>
<td>Engine torque fault flag</td>
<td>Shift information</td>
</tr>
<tr>
<td>Friction torque</td>
<td>Torque converter lock-up solenoid</td>
</tr>
<tr>
<td>Maximum engine torque</td>
<td></td>
</tr>
<tr>
<td>Reduced engine torque</td>
<td></td>
</tr>
<tr>
<td>Road speed</td>
<td></td>
</tr>
<tr>
<td>Status of engine speed torque reduction</td>
<td></td>
</tr>
<tr>
<td>Throttle position</td>
<td></td>
</tr>
</tbody>
</table>
EAT ECU connector - Diesel vehicles from 95MY and petrol vehicles up to 99MY

EAT ECU connector pin details - Diesel vehicles from 95MY and petrol vehicles up to 99MY

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Description</th>
<th>Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ignition supply</td>
<td>Input</td>
</tr>
<tr>
<td>2</td>
<td>Vehicle speed sensor (positive)</td>
<td>Input</td>
</tr>
<tr>
<td>3</td>
<td>Engine speed</td>
<td>Input</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Shift control solenoid valve (MV1)</td>
<td>Output</td>
</tr>
<tr>
<td>6</td>
<td>Pressure regulator solenoid valve (MV4)</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Electronics earth</td>
<td>-</td>
</tr>
<tr>
<td>8 to 13</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Gear position switch, Y contacts</td>
<td>Input</td>
</tr>
<tr>
<td>15</td>
<td>Diagnostics, L line</td>
<td>Input/Output</td>
</tr>
<tr>
<td>16</td>
<td>MES 1 - message centre display</td>
<td>Output</td>
</tr>
<tr>
<td>17/18</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>Solenoid valves power supply</td>
<td>Output</td>
</tr>
<tr>
<td>20</td>
<td>Earth (screen)</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>Engine torque PWM</td>
<td>Input</td>
</tr>
<tr>
<td>22/23</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>24</td>
<td>Shift control solenoid valve (MV2)</td>
<td>Output</td>
</tr>
<tr>
<td>25</td>
<td>Not used</td>
<td>-</td>
</tr>
</tbody>
</table>
## EAT ECU connector pin details - Diesel vehicles from 95MY and petrol vehicles up to 99MY (continued)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Description</th>
<th>Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Power earth</td>
<td>-</td>
</tr>
<tr>
<td>27/28</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>29</td>
<td>Mode switch</td>
<td>Input</td>
</tr>
<tr>
<td>31</td>
<td>MES 2 - message centre display</td>
<td>Output</td>
</tr>
<tr>
<td>30</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>32</td>
<td>Torque reduction request</td>
<td>Output</td>
</tr>
<tr>
<td>33</td>
<td>Gear position switch, Z contacts</td>
<td>Input</td>
</tr>
<tr>
<td>34 to 37</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>38</td>
<td>Vehicle speed sensor (negative)</td>
<td>Input</td>
</tr>
<tr>
<td>39</td>
<td>Battery supply</td>
<td>Input</td>
</tr>
<tr>
<td>40/41</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>42</td>
<td>Torque converter solenoid (MV3)</td>
<td>Output</td>
</tr>
<tr>
<td>43 to 45</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>46</td>
<td>Transmission high/low switch</td>
<td>Input</td>
</tr>
<tr>
<td>47</td>
<td>Throttle position PWM</td>
<td>Input</td>
</tr>
<tr>
<td>48/49</td>
<td>Not used</td>
<td>-</td>
</tr>
<tr>
<td>50</td>
<td>Gear position switch, X contacts</td>
<td>Input</td>
</tr>
<tr>
<td>51</td>
<td>Diagnostics, K line</td>
<td>Input/Output</td>
</tr>
<tr>
<td>51 to 55</td>
<td>Not used</td>
<td>-</td>
</tr>
</tbody>
</table>
## EAT ECU connector - Petrol vehicles from 99MY

![Diagram of EAT ECU connector](image)

## EAT ECU connector pin details - Petrol vehicles from 99MY

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Description</th>
<th>Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 4</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Pressure regulator solenoid valve (MV 4)</td>
<td>Output</td>
</tr>
<tr>
<td>6</td>
<td>Power earth</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Gear position switch, Y contacts</td>
<td>Input</td>
</tr>
<tr>
<td>9 to 12</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Transmission high/low switch</td>
<td>Input</td>
</tr>
<tr>
<td>14</td>
<td>Gearbox output shaft speed sensor, negative</td>
<td>Input</td>
</tr>
<tr>
<td>15</td>
<td>Gearbox output shaft speed sensor, cable screen</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>CAN high</td>
<td>Input/Output</td>
</tr>
<tr>
<td>17 to 24</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>MES 1 - message centre display</td>
<td>Output</td>
</tr>
<tr>
<td>26</td>
<td>Battery supply</td>
<td>Input</td>
</tr>
<tr>
<td>27</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Electronics earth</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Shift control solenoid valve (MV 1)</td>
<td>Output</td>
</tr>
</tbody>
</table>
### EAT ECU connector pin details - From 99MY (continued)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Description</th>
<th>Input/Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Diagnostics, K line</td>
<td>Input/Output</td>
</tr>
<tr>
<td>32</td>
<td>Converter lock-up solenoid valve (MV 3)</td>
<td>Output</td>
</tr>
<tr>
<td>33</td>
<td>Shift control solenoid valve (MV 2)</td>
<td>Output</td>
</tr>
<tr>
<td>34/35</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Gear position switch, X contacts</td>
<td>Input</td>
</tr>
<tr>
<td>37</td>
<td>Gear position switch, Z contacts</td>
<td>Input</td>
</tr>
<tr>
<td>38 to 41</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Gearbox output shaft speed sensor, positive</td>
<td>Input</td>
</tr>
<tr>
<td>43</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>CAN low</td>
<td>Input/Output</td>
</tr>
<tr>
<td>45</td>
<td>Mode switch</td>
<td>Input</td>
</tr>
<tr>
<td>46 to 50</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>MES 2 - message centre display</td>
<td>Output</td>
</tr>
<tr>
<td>52</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Solenoid valves power supply</td>
<td>Output</td>
</tr>
<tr>
<td>54</td>
<td>Ignition power supply</td>
<td>Input</td>
</tr>
<tr>
<td>55 to 75</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>
OPERATION

General

The gear position switch outputs are monitored by the BeCM and the EAT ECU. The BeCM outputs gear position signals to illuminate the position indicators each side of the gear selector lever and on the message centre in the instrument pack.

In D, 3, 2, and 1, the EAT ECU outputs control signals to the gearbox to select the required gear.

In D, all forward gears are available for selection by the EAT ECU. In 3, 2 and 1, a corresponding limit is imposed on the highest gear available for selection. When R is selected, reverse gear only engages if the vehicle is stationary or moving at 5 mph (8 km/h) or less.

Selector Lever Interlock (where fitted)

The interlock solenoid on the selector lever is de-energised unless the foot brake is applied while the ignition is on. While de-energised, the interlock solenoid allows the selector lever to move through the range unless P is selected.

On entering the P position, the interlock solenoid engages a latch which locks the selector lever. When the ignition is on and the foot brake is applied, the BeCM energises the interlock solenoid, which disengages the latch and allows the selector lever to be moved out of P.

Economy, Sport and Manual Modes

During the power-up procedure after the ignition is switched on, the EAT ECU defaults to an economy mode. Pressing the mode switch causes the EAT ECU to change between the economy mode and the sport or the manual mode, depending on the range selected on the transfer box:

- If the transfer box is in high range, the EAT ECU changes to the sport mode and illuminates the sport mode lamp on the selector cover and displays ‘S’ in the instrument pack message centre. In the sport mode the gearbox is more responsive to accelerator pedal movement. Downshifts occur earlier and upshifts occur later.

- If the transfer box is in low range, the EAT ECU changes to the manual mode and illuminates the manual mode lamp on the selector cover and displays ‘LM’ in the instrument pack message centre. Kickdown is disabled and the EAT ECU maintains the gearbox in the gear selected on the selector lever (D = 4th gear) to give improved off road performance. Downshifts occur only to prevent the engine stalling.

From a standing start, the vehicle pulls away in 1st gear and, if a higher gear is selected, upshifts almost immediately to the selected gear (shifts of more than one gear can occur).

- After a second press of the mode switch the EAT ECU reverts to the economy mode, for the range selected on the transfer box, and extinguishes the related mode lamp on the selector cover and removes the ‘S’ or ‘LM’ display in the instrument pack message centre.

- When the vehicle is in the default mode (i.e. high range and economy) and towing or driving up steep gradients, the EAT ECU will select a shift pattern appropriate to the driving conditions. If a heavy trailer is being towed or a steep gradient is encountered, the transmission will hold in the gears longer than in normal operation.

Shift Control

To provide the different driving characteristics for each mode of operation, the EAT ECU incorporates different shift maps of throttle position/road speed. Base shift points are derived from the appropriate shift map. When a shift is required, the EAT ECU sends a request to the ECM for a reduction in engine torque, in order to produce a smoother shift. The percentage of torque reduction requested varies according to the operating conditions at the time of the request.
When the EAT ECU receives confirmation of the torque reduction from the ECM, it then signals the shift solenoid valves in the gearbox to produce the shift. To further improve shift quality, the EAT ECU also signals the pressure regulating solenoid valve to modulate the hydraulic pressure and so control the rate of engagement and disengagement of the brake clutches.

With time, the components in a gearbox wear and the duration of the gear shifts tends to increase, which has an adverse affect on the brake clutches. To counteract this, the EAT ECU applies a pressure adaptation to each shift. To calculate the adaptations, the EAT ECU monitors the pressure modulation used, and time taken, for each shift. If a subsequent shift of the same type, in terms of throttle position and engine speed, has a longer duration, the EAT ECU stores an adaptation for that type of shift in a volatile memory. The adaptation is then included in future pressure calculations for that type of shift, to restore shift duration to the nominal.

**Kickdown**

The EAT ECU monitors the input of the throttle position sensor to determine when kickdown is required and select a gear to give the best available acceleration. When it detects a kickdown situation, the EAT ECU immediately initiates a down shift of one or two gears or will maintain the current gear to avoid engine overspeed.

**Torque Converter Lock-Up**

The EAT ECU energises the lock-up solenoid valve to engage the lock-up clutch. Lock-up clutch operation is dependent on throttle position, engine speed, operating mode and the range selected on the transfer box.

**High Range**

Unique lock-up maps, similar to the shift maps, are incorporated in the economy and sport modes for all forward gears. Engagement and disengagement of the lock-up clutch is dependent on throttle position and engine speed.

**Low Range**

To enhance off road control, particularly when manoeuvring at low speeds, torque converter lock-up does not occur when there is any degree of throttle opening. When the throttle is closed above a preset engine speed, the lock-up clutch engages to provide maximum engine braking.

### Increased Load/Reduced Torque Compensation

To aid performance and driveability in the high range economy mode, the EAT ECU has three adaptive shift and lock-up maps. These maps delay upshifts and torque converter lock-up similar to the sport mode if the inputs from the engine indicate:

- A sustained high load on the engine, such as occurs when the vehicle is ascending a steep gradient or towing a trailer.
- The EAT ECU monitors the engine inputs and selects the most appropriate adaptive map for the prevailing conditions.
- On vehicles from 99MY, a lower than normal engine torque, such as occurs at altitude or high ambient temperatures.

### Diagnostics

While the ignition is on, the EAT ECU diagnoses the system for faults. The extent of the diagnostic capability at any particular time depends on the prevailing operating conditions, e.g. it is not possible to check torque converter lock-up while the vehicle is stationary, or to check for a short circuit to earth if the circuit concerned is already at a low potential.

If a fault is detected, the EAT ECU immediately stores a fault code and the values of three operating parameters associated with the fault. Depending on the fault, there are four possible effects:

- The fault has little effect on gearbox operation or vehicle emissions. The driver will probably not notice any change and the warning lamps remain extinguished.
- All gears are available but kickdown does not function. ‘GEARBOX FAULT’ will be displayed on the instrument pack message centre. The MIL remains extinguished.
- Limp home mode is selected and vehicle performance is greatly reduced. ‘GEARBOX FAULT’ will be displayed on the instrument pack message centre. If the fault is detected on a second consecutive drive cycle, the MIL illuminates.
# Fault effects and warning indications - Diesel vehicles from 95MY and petrol vehicles up to 99MY

<table>
<thead>
<tr>
<th>Fault code</th>
<th>Fault description</th>
<th>Effect</th>
<th>MIL Warning lamp</th>
<th>‘GEARBOX FAULT’ message</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>* Solenoid supply malfunction</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>* EAT ECU data corrupted (ROM and checksum values disagree)</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On †</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>* Throttle angle malfunction</td>
<td>Substitute throttle angle of 30% used.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>* Shift solenoid MV1 malfunction</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>* Shift solenoid MV1 short</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>* Shift solenoid MV2 malfunction</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>* Shift solenoid MV2 short</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>* MES 1 fault</td>
<td>No default condition. BeCM recognises sport mode as a fault, economy as low range manual and manual as economy.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>* MES 2 fault</td>
<td>No default condition. BeCM recognises sport mode as a fault, economy as low range manual and manual as economy.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>12</td>
<td>* Throttle angle electrical short</td>
<td>Substitute throttle angle of 30% used.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td>* EAT ECU circuit output state does not match command state</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>20</td>
<td>* Solenoid supply malfunction</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On †</td>
<td>Yes</td>
</tr>
<tr>
<td>21</td>
<td>* Engine speed signal out of range</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On †</td>
<td>Yes</td>
</tr>
<tr>
<td>21</td>
<td>* Engine speed, no signal</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On †</td>
<td>Yes</td>
</tr>
<tr>
<td>22</td>
<td>* Pressure control regulator malfunction</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*= Emissions (OBDII) relevant

†= MIL illuminates immediately (in all other faults, MIL on illuminates in the 2nd consecutive drive cycle if the fault is still present)
Fault effects and warning indications - Diesel vehicles from 95MY and petrol vehicles up to 99MY (continued)

<table>
<thead>
<tr>
<th>Fault code</th>
<th>Fault description</th>
<th>Effect</th>
<th>MIL Warning lamp</th>
<th>'GEARBOX FAULT' message</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>* Pressure control regulator electrical short</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>23</td>
<td>* Engine torque reduction</td>
<td>Shift pressure to maximum, no shift ignition retard, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>24</td>
<td>* Output speed sensor signal out of range</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>26</td>
<td>* Engine torque signal out of range</td>
<td>Shift pressure to maximum, harsh, erratic or elongated shifts can occur.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>27</td>
<td>* Output speed sensor, no signal</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>28</td>
<td>* EAT ECU data corrupted (ROM and EEPROM values disagree)</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On †</td>
<td>Yes</td>
</tr>
<tr>
<td>30</td>
<td>* Gear position switch status inaccurate with engine running</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>31</td>
<td>* Gear position switch status inaccurate when starting engine</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The following fault codes apply to Diesel vehicles from 97MY onwards and petrol vehicles up to 99MY only

<table>
<thead>
<tr>
<th>Fault code</th>
<th>Fault description</th>
<th>Effect</th>
<th>MIL Warning lamp</th>
<th>'GEARBOX FAULT' message</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>* First gear ratio incorrect</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>41</td>
<td>* Second gear ratio incorrect</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>42</td>
<td>* Third gear ratio incorrect</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>43</td>
<td>* Fourth gear ratio incorrect</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>44</td>
<td>* Torque converter lock-up gear ratio incorrect</td>
<td>Limp home mode in third if stationary, fourth if moving.</td>
<td>On</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*= Emissions (OBDII) relevant

†= MIL illuminates immediately (in all other faults, MIL on illuminates in the 2nd consecutive drive cycle if the fault is still present)
## Fault effects and warning indications - Petrol vehicles from 99MY

<table>
<thead>
<tr>
<th>Fault code</th>
<th>Fault description</th>
<th>Effect</th>
<th>MIL Warning lamp</th>
<th>‘GEARBOX FAULT’ message</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0705 (14, 23)</td>
<td>* Gear position switch, incorrect outputs</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P7021 (21)</td>
<td>* Downshift safety monitor prevented downshift which would have caused engine overspeed</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P0722 (22)</td>
<td>* Torque converter slipping</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P0731 (29)</td>
<td>* Ratio monitoring, implausible 1st gear ratio</td>
<td>No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P0732 (30)</td>
<td>* Ratio monitoring, implausible 2nd gear ratio</td>
<td>No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P0733 (31)</td>
<td>* Ratio monitoring, implausible 3rd gear ratio</td>
<td>No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P0734 (32)</td>
<td>* Ratio monitoring, implausible 4th gear ratio</td>
<td>No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P0741 (5)</td>
<td>* Torque converter lock-up clutch fault</td>
<td>May affect driveability.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P0743 (7, 25)</td>
<td>* Torque converter lock-up solenoid (MV 3), open or short circuit</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P0748 (10, 28)</td>
<td>* Pressure regulating solenoid (MV 4), open or short circuit</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P0753 (8, 26)</td>
<td>* Shift solenoid (MV 1), open or short circuit</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* = Emissions (OBDII) relevant

† = MIL illuminates immediately (in all other faults, MIL on illuminates in the 2nd consecutive drive cycle if the fault is still present)
## Fault effects and warning indicators - Petrol vehicles from 99MY (continued)

<table>
<thead>
<tr>
<th>Fault code OBDII (TestBook)</th>
<th>Fault description</th>
<th>Effect</th>
<th>MIL Warning lamp</th>
<th>‘GEARBOX FAULT’ message</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0758 (9, 27)</td>
<td>* Shift solenoid (MV 2), open or short circuit</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1562 (24)</td>
<td>* Battery supply below 9 V while engine running</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>Off</td>
<td>Yes</td>
</tr>
<tr>
<td>P1601 (4)</td>
<td>* ECU, EEPROM checksum</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>P1602 (36)</td>
<td>* Transmission calibration selection incorrect or invalid</td>
<td>Default to 4.0 litre calibration.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1606 (3)</td>
<td>* ECU fault, EEPROM communication</td>
<td>No apparent effect.</td>
<td>On †</td>
<td>No</td>
</tr>
<tr>
<td>P1606 (6)</td>
<td>* Watchdog check, ECU fault</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1612 (2)</td>
<td>* Solenoid valves power supply relay, sticking closed or open circuit</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1613 (1)</td>
<td>* Solenoid valves power supply relay, sticking open or short circuit</td>
<td>Limp home mode in low and high ranges. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1705 (39)</td>
<td>Transmission high/low range, implausible input</td>
<td>No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P1810 (12, 13)</td>
<td>BeCM to message centre circuit fault</td>
<td>Message centre does not display ‘S’ or ‘LM’. No effect on gearbox operation.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P1841 (16)</td>
<td>* CAN bus fault</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1842 (15)</td>
<td>* CAN level monitoring</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*= Emissions (OBDII) relevant

†= MIL illuminates immediately (in all other faults, MIL on illuminates in the 2nd consecutive drive cycle if the fault is still present)
### Fault effects and warning indicators - Petrol vehicles from 99MY (continued)

<table>
<thead>
<tr>
<th>Fault code OBDII (TestBook)</th>
<th>Fault description</th>
<th>Effect</th>
<th>MIL Warning lamp</th>
<th>’GEARBOX FAULT’ message</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1843 (17)</td>
<td>* CAN time-out monitoring</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1884 (11)</td>
<td>* CAN message: Engine friction invalid</td>
<td>No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P1884 (18)</td>
<td>* CAN message: Throttle position invalid</td>
<td>Substitute throttle angle of 50% adopted. No kickdown. Operates in Economy mode only.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1884 (19)</td>
<td>CAN message: Engine temperature invalid</td>
<td>Substitute engine temperature derived from other inputs. No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P1884 (20)</td>
<td>CAN message: Road speed invalid</td>
<td>No apparent effect.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P1884 (33, 34)</td>
<td>CAN message: Engine torque invalid</td>
<td>Substitute engine torque derived from other inputs. May affect shift quality.</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P1884 (35)</td>
<td>CAN message: Engine speed invalid</td>
<td>Maintains current gear in low range, limp home mode in high range. Shift pressure to maximum, harsh gear shifts/engagement.</td>
<td>On</td>
<td>Yes</td>
</tr>
<tr>
<td>P1884 (37)</td>
<td>CAN message: Engine air intake temperature invalid</td>
<td>No apparent effect</td>
<td>On</td>
<td>No</td>
</tr>
<tr>
<td>P1884 (38)</td>
<td>Altitude shift control invalid</td>
<td>No reduced torque compensation, possible reduction in performance/driveability at altitude or high ambient temperatures.</td>
<td>On</td>
<td>No</td>
</tr>
</tbody>
</table>

*= Emissions (OBDII) relevant

†= MIL illuminates immediately (in all other faults, MIL on illuminates in the 2nd consecutive drive cycle if the fault is still present)
The fault codes can be accessed using TestBook. On vehicles up to 99MY the automatic transmission fault codes are a numeric code recognised by TestBook. On V8 vehicles from 99MY the automatic transmission fault codes are both numeric and OBDII ‘P’ codes recognised by TestBook and other suitable scantools.

After the detection of a fault, the effects remain active for the remainder of the drive cycle. In subsequent drive cycles, as soon as the EAT ECU diagnoses the fault is no longer present, it resumes normal control of the gearbox. The conditions required to diagnose that the fault is no longer present depend on the fault. Some faults require the engine to be started, others require only that the ignition is switched on.

After a fault has not recurred for forty warm-up cycles, the fault is deleted from the EAT ECU memory. Only five different faults can be stored in the memory at any one time. If a further fault occurs, the fault with the lowest priority will be replaced by the new fault.

**Mechanical Limp Home**

In the mechanical limp home mode in high range, gear engagement is controlled by the manual valve. The gearbox is fixed in 4th gear if the fault occurs while the vehicle is moving, or 3rd gear if the fault occurs while the vehicle is stationary. 3rd gear is also engaged if a vehicle is brought to a stop and the selector lever is moved out of, and back into, D.

Neutral and reverse gear are also available.

In the mechanical limp home mode in low range, depending on the severity of the fault, the engaged gear is held until the vehicle is brought to a stop. The gearbox then selects and holds 3rd gear.

**Calibration Selection**

EAT ECU’s differ between NAS, UK/Europe and ROW markets and are identified by differentiation between the part numbers.

On V8 vehicles from 99MY, the ECU contains two calibrations for 4.0 and 4.6 litre engines. When a replacement ECU is fitted, the correct ECU calibration must be selected or the ECU will store a gearbox fault and ‘GEARBOX FAULT’ will be displayed in the message centre. The vehicle can still be driven and is not in 'limp home mode'.

Removed EAT ECU’s remember their calibration setting and if re-fitted to the same vehicle will not require calibration. A new EAT ECU will require calibration using TestBook.

If an ECU is fitted from another vehicle, the message centre will not display the 'GEARBOX FAULT' message. The correct calibration level must be selected or premature gearbox failure will occur.
USING THE H-GATE

To make a change from high to low or vice versa, the vehicle must be stationary.

- Apply the brakes and select 'N'
- Move the selector lever into the cross-piece of the 'H-gate' and select the new gear range, the panel illumination will flash before becoming constant and an audible warning will sound.
- When the illumination is constant select the gear required.

**CAUTION:** If a gear is selected before the gear transfer is complete, a 'clunk' or grinding sound will be heard because the electric shift motor has not completed the operation.

If this occurs and the panel illumination continues to flash, reselect neutral and try again when the illumination becomes constant.

If the vehicle is moving when a transfer gear change is attempted, the message centre will display 'SLOW DOWN'.

If an attempt is made to change the gear range with the gear selector out of neutral, 'SELECT NEUTRAL' will be displayed.

High Range Gears

Use the high range for all normal road driving and off-road driving across dry, level terrain. An audible warning will sound, the selector lever illumination will flash and the transfer box warning lamp will flash while the range change is taking place. The message centre will momentarily display 'HIGH' as soon as high range is selected, and then display the gear selected.

*Selector lever positions:

**'P' Park**

In this position the wheels are locked to prevent the vehicle from moving. Select only with the vehicle stationary.

**'R' Reverse**

Select only when the vehicle is stationary.

**'N' Neutral**

Use this position when the vehicle is stationary and the engine is to idle for a short period.

**'D' Drive**

Select 'D' for all normal driving on good road surfaces. Fully automatic gear changing occurs on all forward gears according to vehicle speed and accelerator position.

**'3'**

Automatic gear changing is limited to first, second and third gears only. Use in congested traffic conditions and for town driving.

**'2'**

Automatic gear changing is limited to first and second gear ratios only. Use when driving up steep gradients and for negotiating very narrow, twisting roads. This position also provides moderate engine braking for descending slopes.

**'1'**

First gear should only be used on very severe gradients, especially when towing or when maximum engine braking is required.

**NOTE:** If position '2' or '1' is selected from 'D' or '3' while the vehicle is travelling at high speed, then third gear will immediately engage. Progressive deceleration will then cause downshifts into second and then first gear when appropriately low road speeds are reached.
'Sport' Mode

In 'Sport' mode gear changing is delayed to make optimum use of the engine's power when increased acceleration is required or when negotiating long inclines or twisting roads. Press the mode switch, with the gearbox in high range, to select 'Sport' mode. The message centre will momentarily display 'SPORT' and then 'S' along with the selected gear. Pressing the switch a second time returns the gearbox to its normal operation within the high range.

Low Range Gears

Use low range gears in any situation where low speed manoeuvring is necessary, such as reversing a trailer or negotiating a boulder strewn river bed; also use low range for extreme off-road conditions. An audible warning will sound, the selector lever illumination will flash and the transfer box warning lamp will flash while the range change is taking place. The message centre will momentarily display 'LOW' when the low range is selected, and then 'L' along with the relevant gear selected.

Selector lever positions:

'P' Park
As high range.

'R' Reverse
As high range

'N' Neutral
As high range

'4'
Select '4' to optimize vehicle performance for good off-road conditions; fully automatic gear changing occurs on all forward gears according to vehicle speed and accelerator position.

'3'
Automatic gear changing is limited to first, second and third gears only and should be used for reasonable off-road conditions and ascending gradients.

'2'
Automatic gear changing is limited to first and second ratios only when maximum engine performance is required to ascend steep gradients. This position also provides moderate engine braking for descending slopes.

'1'
Select '1' on very severe gradients, particularly when towing, when maximum engine performance and engine braking is required.
'Manual' Mode

This mode enables the transmission to function as a manual gearbox in low range, providing maximum vehicle control and engine braking - ideal for use in severe off-road conditions. Press the mode switch, to select 'Manual' mode; the message centre momentarily displays 'LOW' and then 'LM' along with the selected gear. Pressing the switch a second time returns the gearbox to its normal function within the low range.

'Transfer Neutral'

If it is necessary for the vehicle to be towed on all four wheels, 'Transfer neutral' MUST be selected. For full details. See INTRODUCTION, Information.

WARNING: Always leave the vehicle with the gear selector in 'P' (Park) position when parked, even when the starter key is not removed. Failure to do so will result in the battery discharging.
SELECTOR CABLE

Service repair no - 44.30.04

Adjust

1. Raise the vehicle.

WARNING: Support on safety stands.

3. Select 'P'. Position lever on transmission fully forward.
4. Adjust trunnion until a sliding fit in transmission lever is achieved.
5. Connect trunnion to lever. Fit split pin. Tighten locknut.
6. Remove safety stands. Lower vehicle.

GEARBOX - DRAIN AND REFILL - FROM 99MY

Service repair no - 44.24.02

Drain

1. Position vehicle on ramp.
2. Apply handbrake and position chocks under front and rear wheels.
3. Position container under gearbox.
4. Remove gearbox drain plug and discard sealing washer.
5. Refit drain plug using new sealing washer and tighten to 15 Nm (11 lbf.ft).
6. Remove filler/level plug and discard sealing washer.

Refill

7. Refill gearbox to bottom of filler/level plug hole with correct grade of fluid.
8. Ensure gear lever in the 'P' position, start engine and move selector lever through all gear positions and back to 'P' position.
9. With the engine idling, continue filling gearbox until a small thread of fluid runs from filler/level orifice.
10. Refit filler/level plug using a new sealing washer and tighten to 30 Nm (22 lbf.ft).
11. Lower vehicle.
**SELECTOR LEVER ASSEMBLY**

Service repair no - 44.15.04

**Remove**


**CAUTION:** Do not attempt to start vehicle with selector cable disconnected, incorrectly adjusted, or selector interlock solenoid overridden.

2. Remove centre console. *See CHASSIS AND BODY, Repair.*
3. Remove sound deadener pad.

4. Select ‘1’. Disconnect selector cable from lever.

**NOTE:** North American and Japanese vehicles are fitted with a gear selector interlock mechanism. To move selector lever from ‘P’, activate interlock solenoid manually with 3 mm screwdriver as shown.

5. Remove ‘C’ clip securing cable outer to selector lever bracket.
6. If selector lever assembly is to be refitted, mark relationship of lever bracket to transmission tunnel.
7. Disconnect multiplug.
8. Remove 6 bolts securing selector lever assembly to transmission tunnel.

Refit

10. Ensure mating faces are clean.
12. Fit bolts, finger tight. Align selector lever assembly with marks.
13. New lever only. Temporarily fit selector knob. Secure with screw. Select 'P'. Adjust position of lever assembly to give dimension 'A' as shown. Dimension A = 100 mm (3.9 in)

14. Tighten selector lever assembly fixings.
15. Connect multiplug.
17. Align cable to lever. Secure with clevis and split pins.
18. Fit sound deadener pad.
19. Fit centre console. See CHASSIS AND BODY, Repair.
21. Adjust selector cable. See this section.
SELECTOR CABLE

Service repair no - 44.15.08

Remove

1. Select 'P'. Remove ignition key.

   CAUTION: Do not attempt to start vehicle with selector cable disconnected, incorrectly adjusted, or selector interlock solenoid overridden.

2. Raise the vehicle.

   WARNING: Support on safety stands.

3. Remove split pin and washer securing cable trunnion to transmission lever.

4. Remove 'C' clip securing cable to transmission abutment bracket. Remove cable.

5. Remove centre console. See CHASSIS AND BODY, Repair.

6. Remove sound deadener pad.

7. Select '1'. Disconnect selector cable to lever.

   NOTE: North American and Japanese vehicles are fitted with a gear selector interlock mechanism. To move selector lever from 'P', activate interlock solenoid manually with 3 mm screwdriver as shown.

8. Remove 'C' clip securing cable to underside of vehicle. Remove cable.
SELECTOR INDICATOR & MODE SWITCH

Service repair no - 44.15.10 - Selector Indicator

NOTE: The EAT Mode switch is integral with the selector indicator assembly and cannot be serviced separately.

Remove

1. Remove electric window switch pack. See ELECTRICAL, Repair.
2. Remove screw at rear of gear lever applique. Raise rear of applique. Disengage 2 spring clips at forward end.

Refit

10. Adjust selector cable. See Adjustment.

4. Remove screw securing selector knob. Remove knob.
SELECTOR POSITION SWITCH

Service repair no - 44.15.19

Remove

2. Remove nut securing selector lever to selector shaft. Release lever.
4. Remove nut and bolt securing position switch.
5. Release switch from selector shaft. Remove breather hose.
6. Remove switch.

Refit


5. Remove 3 screws securing selector indicator.

7. Remove selector indicator.

5M7016

44M7015

44M7012

44M7016

44M7015
Refit

7. Ensure 'P' is selected by rotating selector shaft fully clockwise.
8. Engage 'N' by rotating selector shaft anti-clockwise by 2 detents.
10. Engage switch on selector shaft. Fit nut to stud, fit bolt. Do not tighten.
11. Fit setting tool LRT-44-011 to shaft.
12. Insert setting pin into tool. Rotate switch until setting pin engages with hole in switch as shown.
13. Tighten nut and bolt. Remove setting tool.
14. Fit selector lever to shaft. Secure with nut.
15. Lower vehicle.

SEAL - SELECTOR SHAFT

Service repair no - 44.15.34

Remove

1. Position vehicle on a four post lift.
2. Release fixings from battery cover and remove cover.
3. Disconnect battery earth lead.
5. Petrol models: Remove 3 bolts securing engine RH lifting eye to cylinder head and position earth strap and lifting eye aside.
6. Remove window switch pack. See ELECTRICAL, Repair.
7. With the handbrake released, remove clip and clevis pin securing handbrake cable to handbrake.

8. Raise vehicle and release handbrake cable and grommet from tunnel.


10. Diesel models: Remove chassis crossmember. See CHASSIS AND BODY, Repair.

11. Remove 4 bolts securing transmission mounting assembly and remove assembly.

12. Remove 4 bolts securing rear propeller shaft guard and remove guard.

13. Raise one wheel on each axle to allow rotation of propeller shafts.

14. Mark transfer box and propeller shaft flanges to aid re-assembly.
15. Remove 4 bolts from each propeller shaft flange.
17. Lower gearbox for access.

18. Remove split pin securing gear selector cable trunnion to gear selector lever and release trunnion.
19. Remove 2 bolts securing gear selector cable abutment bracket and harness support bracket to gearbox.

20. Position selector cable and bracket aside.
21. Lower gearbox support to gain access to selector shaft.
22. Remove valve block. See this section.

23. Disconnect harness from gear selector switch multiplug and release multiplug from bracket.
24. Remove nut securing selector shaft lever and release lever from shaft.
25. Remove bolt and nut securing gear selector switch to gearbox and remove switch.

26. Drift out and discard selector quadrant roll pin. Remove selector shaft.
27. Remove selector quadrant and connecting rod.
28. Remove oil seal taking care not to damage seal housing.
Refit

29. Clean shaft and seal housing.
30. Using a suitable adapter, fit new seal.
31. Fit selector quadrant and connecting rod.
32. Fit selector shaft and secure to quadrant using new roll pin.
33. Fit valve block. See this section.
34. Position selector switch and tighten nut and bolt.
35. Position selector shaft lever and tighten nut.
36. Fit selector switch multiplug to bracket and connect harness to multiplug.
37. Align harness support bracket and gear selector cable abutment bracket to gearbox and secure with bolts.
38. Connect gear selector cable trunnion to lever and fit split pin.
39. Adjust gear selector cable. See this section.
40. Raise gearbox on transmission jack.
41. Fit handbrake cable through transmission tunnel.
42. Clean propeller shaft and transfer box flanges.
43. Fit shafts to transfer box flanges, align marks and tighten nuts and bolts to 48 Nm (35 lbf.ft).
44. Fit rear propeller shaft guard and secure with bolts.
45. Fit transmission mounting assembly and tighten bolts to 45 Nm (33 lbf.ft).
46. Diesel models: Fit chassis crossmember. See CHASSIS AND BODY, Repair.
47. Petrol models: Fit exhaust front pipe. See MANIFOLD AND EXHAUST SYSTEM, Repair.
48. Connect handbrake cable to lever and fit clevis pin and clip.
49. Fit window switch pack. See ELECTRICAL, Repair.
50. Petrol models: Fit engine RH lifting eye, align earth strap and secure with bolts.
51. Petrol models: Fit cooling fan cowl and secure with clips.
52. Connect battery earth lead.
53. Fit and secure battery cover.

FLUID COOLER - V8 - UP TO 99MY

Service repair no - 44.24.10

Remove

1. Disconnect battery negative lead.
2. Remove engine oil cooler. See ENGINE, Repair.
3. Remove 4 trim studs securing air deflectors. Remove deflectors.
4. Position container to collect fluid spillage.
5. Unscrew container to collect fluid spillage.
6. Plug cooler and pipes.
7. Remove 4 bolts securing fluid cooler to radiator mounting bracket.
8. Remove fluid cooler.

Refit

9. Fit fluid cooler.
10. Fit and tighten 4 bolts securing cooler to mounting bracket.
11. Remove plugs from cooler and pipes.
12. Ensure pipe unions are clean.
13. Lubricate new 'O'rings with clean fluid and fit to pipes.
14. Connect pipes to cooler. Tighten union nuts to 22 Nm (16 lbf.ft)
15. Remove container.
16. Fit air deflectors and secure with studs.
17. Fit engine oil cooler. See ENGINE, Repair.
18. Reconnect battery negative lead.
19. Top up gearbox fluid. See SECTION 10, Maintenance.
Service repair no - 44.24.10

Remove

1. Remove engine oil cooler. See ENGINE, Repair.
2. Position absorbent cloth under each gearbox cooler pipe connection to collect spillage.

CAUTION: Plug the connections.

3. Loosen unions and release pipes from cooler, discard 'O' rings.

Refit

6. Clean fluid cooler and pipe connections.
7. Fit new fluid cooler to radiator, engage in locations, fit and tighten bolts.
8. Position fluid temperature sensor and secure with screws.
9. Using new 'O' rings connect pipes to cooler and tighten unions to 22 Nm (16 lbf.ft).
10. Top up gearbox fluid.
11. Fit engine oil cooler. See ENGINE, Repair.

4. Remove 2 screws securing fluid temperature sensor to cooler.
5. Remove 4 bolts securing fluid cooler to radiator mounting brackets and remove cooler.
FLUID COOLER - DIESEL

Service repair no - 44.24.10

Remove

1. Disconnect battery negative lead.
2. Raise vehicle on four post lift.
3. Position container to collect fluid spillage.
4. Unscrew fluid pipe union nuts and discard 'O' rings.

Refit

8. Fit fluid cooler.
9. Fit and tighten 3 bolts securing cooler to chassis bracket.
10. Remove plugs from cooler and pipes.
11. Ensure pipe unions are clean.
12. Lubricate new 'O' rings with clean fluid and fit to pipes.
13. Connect pipes to cooler. Tighten union nuts to 22 Nm (16 lb.ft).
14. Remove container.
15. Lower vehicle.
16. Reconnect battery negative lead.
17. Top up gearbox fluid, See SECTION 10, Maintenance.

5. Plug cooler and pipes.
6. Remove 3 bolts securing fluid cooler to chassis bracket.
7. Remove fluid cooler.
AUTOMATIC GEARBOX - UP TO 99MY

Service repair no - 44.20.02/99

Remove

1. Position vehicle on four post lift.
2. Disconnect battery negative lead.
4. Remove bolt securing gearbox filler tube to engine.
5. Remove window switch pack. See ELECTRICAL, Repair.
7. Release hand brake cable from grommet in tunnel.
8. Raise lift. Drain gearbox and transfer box fluids. See SECTION 10, Maintenance.
   Diesel Vehicles: Remove chassis cross member. See CHASSIS AND BODY, Repair.
12. Remove 4 bolts securing rear propeller shaft guard. Remove guard.

13. Mark transfer box and propeller shaft flanges to aid re-assembly.

14. Raise one wheel on each axle to allow rotation of propeller shafts.

15. Remove 4 bolts from each flange. Disconnect propeller shafts. Tie aside.

16. Lower gearbox for access.

**CAUTION:** Place wooden block between axle case and sump to support engine.

17. Disconnect gear selector cable trunnion from gearbox lever. Remove 2 bolts securing selector cable abutment bracket to gearbox. Place selector cable aside.

18. Disconnect 2 Lucars from transfer box fluid temperature sensor.
19. Disconnect multiplugs from High/Low motor and output shaft speed sensor.

20. Disconnect multiplugs from gear selection position switch and gearbox speed sensor.


22. Remove bolt from clamp securing gearbox cooler pipes to engine.


25. Disconnect breather pipes from gearbox and transfer box. Plug Pipes and connections.


27. Remove 9 bolts securing converter drive plate access cover. Remove cover.

28. Mark drive plate and converter to aid re-assembly.

29. Remove 4 bolts securing drive plate to converter.
30. Remove 8 bolts securing converter housing to engine.

31. Remove transmission assembly.

**CAUTION:** Ensure converter does not become detached from gearbox.

32. Fit retaining strap to converter. Secure with 2 nuts and bolts.

*Do not carry out further dismantling if component is removed for access only.*

33. Lower transmission assembly from vehicle.

34. Attach lifting eyes to transmission.

35. Attach hoist to lifting eyes. Take weight of transmission.

36. Remove lift adaptor. Hoist transmission assembly onto bench.

37. Fit lifting eye to transmission brake drum. Raise gearbox on end.

**CAUTION:** Position packers beneath bell housing extension to provide clearance for input shaft.

38. Remove 6 bolts securing transfer box to gearbox. Release from 2 ring dowels. Remove transfer box.

39. Ensure mating faces are clean.

40. Place gearbox on end. Position transfer box.

41. Engage transfer box to ring dowels. Secure to gearbox with bolts. Tighten to **45 Nm (33 lbf.ft)**

**CAUTION:** Ensure that gearbox is located on both dowels, or transmission damage may occur.

42. Place transmission on side. Fit lifting eyes.

43. Attach transmission to lift adaptor. Secure with bolts.

44. Detach hoist. Remove lifting eyes.
Refit

45. Ensure converter spigot and mating faces are clean.
46. Remove converter retaining strap.
47. Position transmission to engine. Secure with bolts. Tighten to 45 Nm (33 lbf.ft)
48. Position drive plate to converter. Align marks. Secure with bolts. Tighten to 50 Nm (37 lbf.ft)
49. Position converter access panels. Use a new gasket with lower panel. Secure panels with bolts.
50. Remove plugs from breather pipes and connections.
51. Using new sealing washers, secure breather pipes to gearbox and transfer box with banjo bolts.
52. Fit new seals to fluid filler and cooler pipes. Connect pipes to transmission. Tighten to 22 Nm (16 lbf.ft)
53. Fit clamp to cooler pipes. Secure to engine with bolt.
54. Route gearbox harness. Secure with clips.
55. Connect multiplugs to High/Low motor and output shaft speed sensor.
56. Connect multiplugs to gear selection position switch and gearbox speed sensor.
57. Connect Lucars to transfer box fluid temperature sensor.
58. Align harness bracket to gearbox.
59. Position selector cable abutment bracket to gearbox. Secure with bolts.
60. Raise transmission. Support under brake drum with transmission jack.
61. Remove transmission lift adaptor. Remove lift.
62. Position transmission mounting assembly. Secure with bolts. Tighten to 45 Nm (33 lbf.ft)
63. Adjust gear selector cable. See Adjustment.

64. Raise one wheel on each axle to allow rotation of propeller shafts.
65. Position shafts to transfer box flanges. Align marks.
66. Secure shafts with nuts and bolts. Tighten to 48 Nm (35 lbf.ft)
67. Fit propeller shaft guard. Secure with bolts.
68. Guide hand brake cable through grommet in transmission tunnel.
69. Diesel Vehicles: Fit chassis cross member. See CHASSIS AND BODY, Repair.
70. Fit exhaust front pipe. See MANIFOLD AND EXHAUST SYSTEM, Repair.
71. Fill transfer box with oil. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
72. Lower Vehicle
73. Connect handbrake cable to lever.
74. Fit window switch pack. See ELECTRICAL, Repair.
75. Position gearbox filler tube to engine. Secure with bolt.
77. Fill gearbox with fluid. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
78. Reconnect battery negative lead.
AUTOMATIC GEARBOX - FROM 99MY

Service repair no - 44.20.04.99

Remove

1. Position vehicle on a four post lift.
2. Release fixings from battery cover and remove cover.
3. Disconnect battery earth lead.


5. Petrol models: Remove 3 bolts securing engine RH lifting eye to cylinder head and position earth strap and lifting eye aside.


7. Remove window switch pack. See ELECTRICAL, Repair.

8. With the handbrake released, remove clip and clevis pin securing handbrake cable to handbrake.

9. Raise vehicle and release handbrake cable and grommet from tunnel.

10. Drain gearbox See this section. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.

11. Drain transfer gearbox fluid. See SECTION 10, Maintenance. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.


14. Remove 4 bolts securing transmission mounting assembly and remove assembly.

15. Fit LRT-99-007, to transmission jack and secure to transmission mounting bracket location holes with bolts.

16. Remove transmission jack from under brake drum.

17. Remove 4 bolts securing rear propeller shaft guard and remove guard.

18. Raise one wheel on each axle to allow rotation of propeller shafts.

19. Mark transfer box and propeller shaft flanges to aid re-assembly.
20. Remove 4 nuts from each propeller shaft flange.
22. Lower gearbox for access.

CAUTION: Position jack and wooden block under sump to support engine.

23. Remove split pin securing gear selector cable trunnion to gearbox lever and release trunnion.
24. Remove 2 bolts securing gear selector cable abutment bracket and harness support bracket to gearbox, and position selector cable and brackets aside.

25. Disconnect multiplugs from gear selection position switch and gearbox speed sensor.
26. Disconnect 2 Lucars from transfer box fluid temperature sensor.
27. Disconnect multiplugs from High/Low motor and output shaft speed sensor.
29. Remove 2 banjo bolts securing breather pipes to gearbox and transfer box, remove and discard sealing washers.

CAUTION: Plug the connections.
30. Remove 2 bolts and release 1 clip securing fuel and purge pipe retaining brackets to gearbox and transfer box.

31. Remove bolt from clamp securing gearbox fluid cooler pipes to engine.

32. Loosen unions and release gearbox oil cooler pipes, discard ‘O’ rings.

**CAUTION:** Plug the connections.

33. Remove 3 bolts securing converter housing lower access cover, remove cover and discard gasket.

34. Remove access plug and mark drive plate and torque convertor to aid re-assembly.

35. Rotate engine to gain access and remove 4 bolts securing drive plate to convertor.

36. Remove 14 bolts securing gearbox to engine and collect crash bracket.

37. With assistance remove transmission assembly.

**CAUTION:** Ensure convertor does not become detached from gearbox.

38. Fit retaining strap to convertor and secure with 2 nuts and bolts.
Refit

40. Ensure drive plate and converter mating faces are clean.
41. Remove 2 nuts and bolts and remove converter retaining strap.
42. With assistance, fit transmission assembly to engine.

CAUTION: Ensure that gearbox is located on both dowels, or transmission damage may occur.

43. Fit crash bracket to gearbox flange and fit and tighten engine to gearbox bolts to 45 Nm (33 lbf.ft).
44. Align drive plate to converter and tighten bolts to 50 Nm (37 lbf.ft).
45. Fit access plug.
46. Fit new gasket and lower access cover. Secure cover with bolts.
47. Clean gearbox fluid cooler pipe unions, fit new ‘O’ rings and tighten union nuts to 22 Nm (16 lbf.ft).
48. Clean breather pipe bolts and banjos, fit new sealing washers and tighten bolts to 15 Nm (11 lbf.ft).
49. Fit gearbox fluid cooler pipe clamp and secure with bolt.
50. Align fuel and purge pipe brackets to gearbox and transfer box and secure with 2 bolts and 1 clip.
51. Connect multiplugs to output shaft speed sensor and High/Low motor.
52. Connect Lucars to transfer box temperature sensor.
53. Connect multiplugs to gearbox selection position switch and gearbox speed sensor.
54. Secure harness to clips.
55. Align harness support bracket and gear selector cable abutment bracket to gearbox and secure with bolts.
56. Connect gear selector cable trunnion to lever and fit split pin.
57. Adjust gear selector cable. See this section.
58. Raise gearbox on transmission jack.
59. Fit and engage handbrake cable grommet in transmission tunnel.
60. Clean propeller shaft and transfer box flanges.
61. Fit shafts to transfer box flanges, align marks and tighten nuts to 48 Nm (35 lbf.ft).
62. Fit rear propeller shaft guard and secure with bolts.
63. Position transmission jack under brake drum.
64. Remove 4 bolts securing LRT-99-007 to transmission and remove support.
65. Fit transmission mounting assembly and tighten bolts to 45 Nm (33 lbf.ft).
66. Diesel models: Fit chassis crossmember. See CHASSIS AND BODY, Repair.
68. Connect handbrake cable to lever, fit clevis pin and secure pin with clip.
69. Fit window switch pack. See ELECTRICAL, Repair.
70. Diesel models: Fit starter motor. See ELECTRICAL, Repair.
71. Petrol models: Fit engine RH lifting eye, align earth strap and secure with bolts.
72. Petrol models: Fit cooling fan cowl and secure with clips.
73. Connect battery earth lead.
74. Fit and secure battery cover.
75. Fill transfer box with oil. See SECTION 10, Maintenance. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
76. Fill gearbox with fluid. See this section.
TORQUE CONVERTER OIL SEAL

Remove

1. Remove gearbox. *See this section.*

2. Remove retaining strap.

3. Fit LRT-44-010 to torque converter and remove torque converter from gearbox. Remove LRT-44-010 from torque converter.

4. Position container beneath torque converter housing to catch fluid spillage.

5. Remove oil seal from torque converter housing.

Refit

6. Clean oil seal running surfaces.

7. Lubricate oil seal with transmission fluid.

8. Fit new seal using LRT-44-001 into converter housing.

9. Fit LRT-44-010 to torque converter.

10. Align oil pump drive and fit torque converter to gearbox.

11. Remove LRT-44-010 from torque converter.

12. Fit torque converter retaining strap.

13. Fit gearbox. *See this section.*
Service repair no - 44.17.01

Remove

1. Remove torque converter oil seal. See this section.

M44 1343

2. Remove 18 bolts and plain washers securing torque converter and intermediate plate to gearbox casing. Note the position of the 4 bolts that have sealant applied to the bolt threads and 6 bolts, (outer ring), which are shorter.

3. Hold input shaft in position and carefully remove the converter housing and intermediate plate from gearbox casing. Note

M44 1345

4. Note the position of the Torrington race on the forward clutch hub and the thrust washer which will stay attached to the intermediate plate by fluid adhesion.

M44 1358

5. Remove and discard intermediate plate gasket.
6. Remove thrust washer from intermediate plate.
7. Separate converter housing from intermediate plate.

Refit

8. Clean converter housing, intermediate plate and gearbox casing mating faces.
9. Clean bolts and plain washers and sealant from 4 bolt threads.
10. Apply Petroleum Jelly to new gasket and position on gearbox casing.
11. Apply Petroleum Jelly to thrust washer and torrington race.
12. Correctly position Torrington race and thrust washer to forward clutch hub.
13. Position intermediate plate and converter housing to gearbox casing.
14. Apply High Formula Hylomar sealant to 4 longer bolt threads and fit bolts in the positions shown.
15. Fit remaining bolts and tighten progressively in a diagonal sequence to 50 Nm (37 lbf. ft).
16. Place LRT-44-003/1 into pump housing, tighten screws to secure LRT-44-003/1 to input shaft.
17. Clamp a suitable steel base to converter housing flange.
18. Mount DTI gauge and position gauge probe onto LRT-44-003/1 and zero gauge.
19. Check that the axial end-float is between 0.2 to 0.4 mm. If end-float is not within limits, replace existing thrust washer, positioned at rear of intermediate plate, with a suitable thickness thrust washer to give the required end-float.
20. Remove DTI gauge and base plate.
21. Fit torque converter oil seal. See this section.

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GASKET - INTERMEDIATE PLATE

Service repair no - 44.20.11

Remove

1. Remove torque converter oil seal. See this section.

2. Remove 12 bolts and plain washers securing converter housing and intermediate plate to gearbox casing. Note the position of the 4 bolts that have sealant applied to the bolt threads.
3. Hold input shaft in position and carefully lift off converter housing and intermediate plate as an assembly.

4. Note the position of the torrington race on the forward clutch hub, and the thrust washer which will stay attached to the intermediate plate by fluid adhesion.
5. Remove and discard intermediate plate gasket.
6. Remove thrust washer from intermediate plate.
Refit

7. Clean intermediate plate and mating face on gearbox casing.
8. Apply Petroleum Jelly to new gasket and position on gearbox casing.
9. Apply Petroleum Jelly to thrust washer and torrington race.
10. Correctly position torrington race and thrust washer to forward clutch hub.
11. Position converter housing and intermediate plate assembly to gearbox casing.
12. Clean bolts and plain washers and old sealant from 4 bolt threads.

13. Apply High Formular Hylomar sealant to 4 longer bolt threads and fit bolts in position shown.
14. Fit remaining bolts and tighten progressively in a diagonal sequence to 45 Nm (33 lbf. ft).

15. Place LRT-44-003/1 into pump housing, tighten screws to secure LRT-44-003/1 to input shaft.
16. Clamp a suitable steel base to converter housing flange.
17. Mount DTI gauge and position gauge probe onto LRT-44-003/1 and zero gauge.
18. Check that the axial end-float is between 0.2 to 0.4 mm. If end-float is not within limits, replace existing thrust washer, positioned at rear of intermediate plate, with a suitable thickness thrust washer to give the required end-float.
19. Remove DTI gauge and base plate.
20. Fit torque converter oil seal. See this section.
INTERMEDIATE PLATE

Service repair no - 44.17.20

Remove

1. Remove intermediate plate gasket. See this section.
2. Remove selective thrust washer from intermediate plate.
3. Remove 2 M14 Allen plugs from intermediate plate, remove and discard sealing washers.
4. Remove 2 M20 plugs from intermediate plate, remove and discard sealing washers.
5. Remove 2 oil cooler pipe adaptors from intermediate plate.
6. Remove 8 bolts securing fluid pump to intermediate plate and carefully remove pump from intermediate plate.
7. Note position and remove pump locating dowel.
8. Remove and discard 'O' ring from pump housing.
9. Remove 6 bolts securing converter housing to intermediate plate, and release intermediate plate from converter housing.
Refit

10. Clean intermediate plate and mating faces with a lint free cloth.
11. Position intermediate plate to converter housing, fit bolts and tighten evenly to **50 Nm (37 lbf.ft)**
12. Fit new sealing washers to M14 allen plugs, fit plugs and tighten to **40 Nm (30 lbf.ft)**.
13. Fit new sealing washers to M20 plugs, fit plugs and tighten to **50 Nm (37 lbf.ft)**.
14. Fit oil cooler adaptors and tighten to **42 Nm (30 lbf.ft)**.
15. Clean pump housing and mating face on intermediate plate with lint free cloth.
16. Lubricate new ‘O’ ring with transmission fluid and fit to pump housing.
17. Position pump locating dowel into intermediate plate.
18. Align pump to dowel and position in intermediate plate.
19. Fit bolts and tighten in a diagonal sequence to **10 Nm (7 lbf.ft)**.

PUMP - FLUID

Service repair no - 44.32.01

Remove

1. Remove intermediate plate gasket. *See this section.*

2. Remove 8 bolts securing fluid pump to intermediate plate and carefully remove pump from intermediate plate.

3. Note position and remove pump locating dowel.
4. Remove and discard ‘O’ ring from pump housing.

20. Position LRT-44-003/1 into pump and check that the pump rotors turn freely.
21. Fit intermediate plate gasket. *See this section.*
Refit

5. Clean pump housing and mating face on intermediate plate with lint free cloth.
6. Lubricate new 'O' ring with transmission fluid and fit to pump housing.
7. Position pump locating dowel into intermediate plate.
8. Align fluid pump to dowel and position in intermediate plate.
9. Fit bolts and tighten in a diagonal sequence to 10 Nm (7lbf.ft).
10. Position LRT-44-003/1 into pump and check that the pump rotors turn freely.
11. Fit intermediate plate gasket. See this section.

OUTPUT SHAFT SEAL

Service repair no - 44.20.18

Remove

1. Disconnect battery negative lead.
2. Remove transfer box. See TRANSFER BOX, Repair.
3. Drain fluid from gearbox. See SECTION 10, Maintenance.
4. Remove seal from gearbox casing using a suitable lever.

CAUTION: Ensure location does not become damaged as seal is levered from casing.

Refit

5. Clean seal location and running surface on transfer gearbox input shaft.
6. Lubricate seal lip with clean transmission fluid.
7. Fit seal to gearbox casing using LRT-44-001
8. Fit transfer box. See TRANSFER BOX, Repair.
9. Reconnect battery negative lead.
10. Replenish transmission fluids. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
GASKET - REAR EXTENSION HOUSING
Service repair no - 44.20.19

Remove

1. Remove transfer gearbox. See TRANSFER BOX, Repair.

2. Remove 9 bolts securing rear extension housing to gearbox case and remove housing.
3. Remove and discard gasket.

Refit

4. Clean rear extension and mating face, dowel and dowel holes.
5. Fit new gasket to gearbox case.
6. Fit rear extension housing and tighten bolts to 25 Nm (18 lbf.ft).
7. Fit transfer gearbox. See TRANSFER BOX, Repair.

PARKING PAWL ASSEMBLY
Service repair no - 44.28.07

Remove

1. Remove rear extension housing gasket. See this section.

2. Remove Torx screw and discard, lift off parking pawl guide and guide plate.
3. Remove ratchet, spring and pivot pin.

4. Diesel and 4.6 models: Remove circlip and bearing track from output shaft.
5. Remove park lock gear.
6. Remove and discard ‘O’ ring from output shaft.
Refit

7. Clean park lock components.
8. Lubricate and fit new 'O' ring to output shaft.
9. Fit park lock gear to output shaft.
10. **Diesel and 4.6 models**: Fit bearing track and a new circlip.
11. Position pivot pin, spring and ratchet.
12. Position parking pawl guide and guide plate, tighten Torx screw to **10 Nm (7 lbf.ft)**.
13. Clean extension housing and gearbox case.
14. Position new gasket to gearbox case.
15. Position extension housing and tighten bolts to **25 Nm (18 lbf.ft)**.
16. Fit rear extension housing gasket. *See this section.*

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**FLUID PAN AND FILTER**

Service repair no - 44.24.04 - Fluid Pan
Service repair no - 44.24.05 - Gasket
Service repair no - 44.24.07 - Fluid Filter

**Remove**

1. Raise vehicle on four post lift.
2. Drain transmission fluid.

---

3. **Up to 99MY**: Release fluid filler tube from pan.

---

From 99MY: Loosen forward bolt securing snubber bar to cross member.
5. Remove gasket and discard.

**NOTE:**
*Do not carry out further dismantling if component is removed for access only.*


7. Remove remaining 2 bolts securing filter to valve block. Remove filter.
8. Remove 'O' rings and discard.

**Refit**

9. Ensure mating faces are clean.
10. Fit new 'O' rings to fluid filter. Lubricate with clean transmission fluid.
12. Position oil pick-up tube and spacer. Secure with bolt. Tighten to 8 Nm (6 lbf.ft).
13. Fit new gasket to fluid pan. Position pan on gearbox. Secure with bolts and retaining plates. Tighten to 8 Nm (6 lbf.ft).
14. Up to 99MY: Fit oil filler tube. Tighten to 70 Nm (52 lbf.ft).
   From 99MY: Tighten forward bolt securing snubber bar to cross member to 45 Nm (33 lbf.ft).
15. Lower vehicle.
VALVE BODY ASSEMBLY

Service repair no - 44.40.01

Remove

1. Remove gearbox fluid filter. See this section.
2. Remove 2 bolts securing speed sensor harness bracket to valve block.

3. Disconnect multiplug from gearbox housing.
4. Using a 30 mm socket, remove nut securing multiplug connector block from gearbox housing.
5. Remove 6 long bolts securing valve block to gearbox.
6. Remove 5 short bolts securing valve block to gearbox.
7. Release speed sensor and remove valve block.
8. Remove and discard ‘O’ ring from multiplug connector.

Refit

10. Fit new ‘O’ ring to multiplug connector block.
11. With assistance, position multiplug to gearbox housing and tighten nut.
12. Align valve block to gearbox, ensure manual valve is correctly located. Position speed sensor retaining bracket, and tighten screws to 8 Nm (6 lbf.ft).
13. Connect multiplug to gearbox connector.
14. Fit gearbox fluid filter. See this section.
SEAL - VALVE BLOCK - SET

Service repair no - 44.20.13

Remove

1. Remove valve body assembly. *See this section.*

2. Remove circlips and springs from gearbox casing noting location of long and short springs.

3. Remove and discard seals using LRT-44-005 from gearbox casing.

Refit

4. Clean gearbox casing, springs and circlips.

5. Fit new seals using LRT-44-005, ensure seals are fully seated.

6. Position springs in their correct locations and secure with circlips.

7. Fit valve body assembly. *See this section.*
PRESSURE REGULATOR

Service repair no - 44.40.22

Remove

1. Remove valve body assembly. See this section.

2. Release and remove clip securing pressure regulator solenoid valve harness to valve body.

3. Disconnect multiplug from pressure regulator solenoid valve.

4. Remove 5 Torx screws securing pressure regulator to valve body and remove pressure regulator.

Refit

5. Clean pressure regulator and mating face with a lint free cloth.

6. Position pressure regulator to valve body, fit Torx screws and tighten to 8 Nm (6lbf. ft).

7. Connect multiplug to pressure regulator solenoid valve, fit clip and secure harness to valve body.
LOCK-UP SOLENOID VALVE (MV 3)

Service repair no - 44.15.35

Remove

1. Remove valve body assembly. **See this section.**
2. Disconnect multiplug from lock-up solenoid valve and release harness from clip.
3. Remove Torx screw and retaining fork securing solenoid valve to valve body.
4. Remove solenoid valve from valve body.

Refit

5. Clean lock-up solenoid valve with lint free cloth.
7. Position retaining fork, fit and tighten Torx screw to 8 Nm (6 lbf. ft).
8. Connect multiplug to lock-up solenoid valve and secure harness in clip.
9. Fit valve body assembly. **See this section.**

SOLENOIDS - SHIFT CONTROL VALVES (MV 1 and 2)

Service repair no - 44.15.45

Remove

1. Remove valve body assembly. **See this section.**
2. Remove 3 Torx screws securing lock-up solenoid valve assembly to valve body and move solenoid aside.

**NOTE:** This is to gain access to remove Torx screw and MV2 shift control valve.

3. Note their fitted position and disconnect multiplugs from shift control valves MV 1 and MV 2.
4. Remove Torx screw and retaining fork securing MV2 shift control solenoid valve to valve body. Note that the tag on the retaining fork faces towards the valve body.
5. Remove shift control valve from valve body.
Refit

6. Clean MV2 shift control solenoid valve with lint free cloth.
7. Position MV2 shift control solenoid valve to valve body.
8. Position retaining fork, fit Torx screw and tighten to 8 Nm (6lbf. ft).
9. Connect multiplugs to both shift control solenoid valves.
10. Clean lock-up solenoid valve assembly with a lint-free cloth.
11. Position lock-up valve assembly, fit and tighten Torx screws to 8 Nm (6lbf. ft).
12. Fit valve body assembly. See this section.

HARNESS - SOLENOID VALVES

Service repair no - 44.15.52

Remove

1. Remove valve body assembly. See this section.

2. Release and remove clip securing pressure regulator solenoid harness to valve body.
3. Disconnect multiplug from pressure regulator solenoid valve.

4. Disconnect multiplugs from lock-up solenoid valve, shift control solenoid valves MV 1 and MV 2.
5. Release harness from 5 clips on valve body and remove harness.
6. Disconnect and remove speed sensor from harness.

**Refit**

7. Connect speed sensor to harness multiplug.
8. Position harness to valve body.
9. Connect multiplugs to shift control solenoid valves MV 1 and MV 2 and lock-up solenoid valve.
10. Connect multiplug to pressure regulator solenoid valve and secure solenoid valve harness with clip to valve body.
11. Position and secure harness in clips on valve body.
12. Fit valve body assembly. *See this section.*

---

**ELECTRONIC CONTROL UNIT**

**Service repair no - 44.15.46**

**Remove**

1. Move left hand front seat fully rearwards. Raise cushion for access.
2. Disconnect battery negative lead.
3. Remove 3 fixings securing trim to seat base. Remove trim.
4. Remove 2 screws securing cover to ECU. Remove cover.
5. Release multiplug from ECU.
6. Remove screw securing ECU. Remove ECU.

Refit

7. Reverse removal procedure.
# 47 - PROPELLER SHAFTS

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PROPELLER SHAFT - FRONT

Service repair no - 47.15.02

Remove

1. Raise vehicle on four post lift.
2. Mark propeller shaft and drive flanges for reassembly.
3. With assistance, remove 4 nuts and bolts securing each propeller shaft flange.

NOTE: Raise 1 front road wheel and rotate propeller shaft as necessary to gain access to all fixings.

CAUTION: Assistance is necessary to support propeller shaft when fixings are removed.

Refit

5. Clean mating faces of flanges.
7. Fit bolts and new Nyloc nuts. Tighten to 48 Nm (35 lbf.ft)

NOTE: Fit bolts with heads toward transfer box and away from differential.

8. Lower vehicle.

4. Remove propeller shaft.
PROPELLER SHAFT - REAR

Service repair no - 47.15.03

Remove

1. Raise vehicle on four post lift.

   NOTE: Raise road wheel to allow rotation of propeller shaft.

2. Mark propeller shaft and drive flanges to aid re-assembly.
3. Remove 4 bolts securing propeller shaft guard to floor pan. Remove guard.
4. Remove 4 nuts securing propeller shaft to brake drum.
5. With assistance, remove 4 nuts and bolts securing propeller shaft to differential drive flange. Remove shaft.

Refit

6. Ensure mating faces are clean.
8. Secure with bolts new Nyloc nuts. Tighten to 48 Nm. (35 lbf.ft)

   NOTE: Bolts fitted with heads away from differential.

9. Position shaft to brake drum. Align marks. Secure with nuts. Tighten to 48 Nm. (35 lbf.ft)
11. Lower lift.
# 51 - REAR AXLE AND FINAL DRIVE

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REAR AXLE AND FINAL DRIVE

REAR AXLE

Service repair no - 51.25.01

Remove

WARNING: When lowering or repositioning axle, an additional two persons are required.

WARNING: Before commencing work, depressurise air suspension. See FRONT SUSPENSION, Repair.

1. Raise the vehicle.

WARNING: Support on safety stands.

2. Support axle with hydraulic jack.
3. Remove rear road wheels.
4. Mark differential and propeller shaft flanges to aid reassembly.
5. Remove 4 nuts and bolts securing propeller shaft to differential. Release shaft and tie aside; discard nuts.

6. Remove 2 nuts securing shock absorbers to axle.
7. Remove 'R' clips retaining air springs to axle.

Up to 97MY:


10. Disconnect brake pipes from body bracket. Plug pipes and connections.
11. Remove 2 clips securing brake pipes to body bracket.
12. At LH and RH ends of axle, release ABS sensor multiplug from chassis rail upper bracket. Disconnect multiplug and release ABS sensor lead from chassis rail lower bracket.


14. Remove banjo bolt and strap securing breather hose to axle. Plug hose and connection.

15. Release height sensors from trailing arms.

16. Slacken 2 nuts and bolts securing trailing arms to chassis.

17. Remove 4 nuts and bolts securing trailing arms to axle.


19. Remove axle from vehicle.

From 97MY:

12. At LH and RH ends of axle, release ABS sensor multiplug from chassis rail upper bracket. Disconnect multiplug and release ABS sensor lead from chassis rail lower bracket.


All models:

14. Remove banjo bolt and strap securing breather hose to axle. Plug hose and connection.

15. Release height sensors from trailing arms.
Refit

20. With assistance, position axle and align suspension units.
21. Raise axle up to trailing arms.
22. Secure axle to trailing arms with nuts and bolts. 
   M16 with 8.8 strength grade - Tighten to 160 Nm (118 lbf.ft),
   M16 with 10.9 strength grade - Tighten to 240 Nm (177 lbf.ft),
   M12 - Tighten to 125 Nm (92 lbf.ft)
23. Remove safety stands. Lower vehicle.
24. Tighten bolts securing trailing arms to chassis. 
    Tighten to 160 Nm (118 lbf.ft)
25. Retain air springs with 'R' clips.
26. Secure height sensors to trailing arms.
    Tighten to 45 Nm (33 lbf.ft)
28. Ensure all pipes and connections are clean.
29. Using new sealing washers, connect breather hose to axle with banjo bolt.
30. Secure hose to axle with strap.

Up to 97MY:

32. Secure pipes with clips.
33. Connect ABS sensor multiplug. Secure multiplug to body bracket. Secure lead to body clips.

From 97MY:

34. At LH and RH ends of axle, locate brake hose in chassis rail lower bracket and secure with clip. 
   Remove plugs and connect brake pipe to brake hose.
35. At LH and RH ends of axle, connect ABS sensor multiplug and secure to chassis rail upper bracket. Secure ABS sensor lead to chassis rail lower bracket. Ensure ABS sensor lead is retained in clips on brake hose.

All models:

36. Position panhard rod to axle. Secure with bolt. 
    Tighten to 200 Nm. (148 lbf.ft)
37. Position propeller shaft. Align marks on flanges.
38. Secure shaft with bolts and new nuts. 
    Tighten to 48 Nm (35 lbf.ft)
39. Replenish axle oil. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
40. Bleed brakes. See BRAKES, Repair.
DIFFERENTIAL ASSEMBLY

Service repair no - 51.15.01

Remove

1. Remove hubs and half shafts. See REAR SUSPENSION, Repair.
2. Drain axle oil.
3. Mark differential and propeller shaft flanges to aid reassembly.
4. Remove 4 nuts and bolts securing propeller shaft to differential. Release shaft and tie aside; discard nuts.
5. Remove 10 nuts securing differential to axle case.

Refit

7. Ensure mating faces are clean.
8. Apply a bead of RTV sealant to axle case.
9. Position differential. Secure with nuts. Tighten to 40 Nm. (30 lbf.ft)
11. Secure shaft with bolts and new nuts. Tighten to 48 Nm. (35 lbf.ft)
12. Refit hubs and half shafts. See REAR SUSPENSION, Repair.
13. Replenish axle oil. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
OIL SEAL - PINION

Service repair no - 51.20.01

Remove

1. Raise the vehicle.

WARNING: Support on safety stands.

2. Mark propeller shaft and differential flanges to aid reassembly.

3. Remove 4 nuts and bolts securing propeller shaft to differential. Release shaft and tie aside; discard nuts.


CAUTION: Vehicles up to 1997.5 Model Year have pinion flanges secured with a nut. Later vehicles use a flange bolt. It is important that each fixing type is tightened to the correct torque.

Refit

6. Ensure mating surfaces are clean.

7. Lubricate oil seal lips with axle oil.


9. Position flange. Hold with LRT-51-003. Tighten nut to 135 Nm (100 lbf.ft). Tighten bolt to 100 Nm (74 lbf.ft).


11. Secure shaft with bolts and new nuts. Tighten to 48 Nm. (35 lbf.ft)

12. Replenish axle oil. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.

13. Remove safety stands. Lower vehicle.
MASS DAMPER

Service repair no - 51.25.10

Remove

1. Raise rear of vehicle.

**WARNING:** Support on safety stands.

2. Remove 2 bolts securing mass damper to rear axle.
3. Remove rear mass damper.

Refit

4. Position mass damper to rear axle, fit bolts and tighten to **45 Nm. (33 lbf.ft)**
5. Remove stand(s) and lower vehicle.
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DIFFERENTIAL ASSEMBLY

Service repair no - 54.10.01

Remove

1. Remove track rod. *See STEERING, Repair.*
2. Drain axle oil.
3. Remove hub assemblies. *See FRONT SUSPENSION, Repair.*
4. Mark differential and propeller shaft flanges to aid reassembly.
5. Remove 4 nuts and bolts securing propeller shaft to differential; discard nuts. Release shaft, tie aside.

Refit

7. Ensure mating faces are clean.
8. Apply a bead of RTV sealant to axle case.
9. Position differential. Secure with nuts. Tighten to 40 Nm (30 lbf.ft)
11. Secure shaft with bolts and new nuts. Tighten to 48 Nm (35 lbf.ft)
12. Refit hub assemblies. *See FRONT SUSPENSION, Repair.*
FRONT AXLE

Service repair no - 54.15.01

Remove

WARNING: When lowering or repositioning axle, an additional two persons are required.

WARNING: Before commencing work, depressurise air suspension. See FRONT SUSPENSION, Repair.

1. Remove brake pads. See BRAKES, Repair.
2. Remove 2 bolts securing each brake caliper assembly to steering knuckles. Release caliper. Tie aside.

CAUTION: If a sensor is removed for any reason, a NEW sensor bush must be fitted.

3. Remove ABS sensors and brake hoses from steering knuckles.
4. Remove nut securing drag link to steering knuckle. Release taper joint.
6. Remove anti roll bar. See FRONT SUSPENSION, Repair.
8. Mark differential and propeller shaft flanges to aid reassembly.

13. Remove bolts securing air spring retaining pins. Remove pins.

10. Release height sensors from radius arms.

14. Release air springs from axle.

16. Remove 2 nuts securing radius arms to chassis brackets.


18. Remove axle from vehicle.

19. Remove 2 nuts and bolts securing each radius arm. Remove radius arms.

20. Ensure mating faces are clean.

21. Position radius arms to axle. Secure with nuts and bolts. Tighten to 125 Nm (92 lbf.ft)

22. Position axle under vehicle.

23. With assistance, raise axle, locating radius arms and rubber bushes into chassis locations.

24. Secure radius arms with nuts. Tighten to 160 Nm (118 lbf.ft)

25. Position shock absorbers with mounting rubbers to axle. Secure with nuts. Tighten to 45 Nm (33 lbf.ft)

26. Align air springs. Fit securing pins. Fit pin retaining bolts. Tighten to 20 Nm (15 lbf.ft)

27. Remove plugs from breather hose and connections. Secure to axle with banjo bolt and new sealing washers.

28. Connect height sensor links to radius arms.


30. Secure propeller shaft with bolts and new nuts. Tighten to 48 Nm (35 lbf.ft)

31. Position track rod to steering knuckles. Secure with nuts. Tighten to 50 Nm (37 lbf.ft)

32. Fit anti roll bar. See FRONT SUSPENSION, Repair.

33. Position panhard rod. Secure with bolt. Tighten to 200 Nm (148 lbf.ft)

34. Position drag link on steering knuckle. Secure with nut. Tighten to 50 Nm (37 lbf.ft)

35. Lightly coat ABS sensors with silicone grease. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.

36. Fit ABS sensors, new bushings and brake hoses to steering knuckles.

37. Position caliper assemblies to steering knuckles. Secure with bolts. Tighten to 220 Nm (162 lbf.ft)

38. Fit brake pads. See BRAKES, Repair.

39. Replenish axle oil. See LUBRICANTS, FLUIDS AND CAPACITIES, Information.
**MASS DAMPER**

Service repair no - 54.15.10

Remove

1. Raise front of vehicle.

**WARNING:** Support on safety stands.

2. Remove 2 bolts securing mass damper to front axle.
3. Remove front mass damper.

**Refit**

4. Position mass damper to front axle, fit bolts and tighten to **45 Nm (33 lbf.ft)**
5. Remove stand(s) and lower vehicle.

---

**FRONT AXLE CASE OIL SEAL**

Service repair no - 54.15.04

Remove

As front hub. *See FRONT SUSPENSION, Repair.*
57 - STEERING

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