SECTION : 307-01b ZF 6HP26/X 6 Speed Automatic Transmission

VEHICLE APPLICATION : 2008.0 Falcon

CONTENTS PAGE

SPECIFICATIONS

Fluid Specifications

Description	Specification	Product
Automatic Transmission Fluid	WSS-M2C919-D	Shell R128 Specification M1375.4

Torque Specifications

Description	Fastener dimension	Torque (Nm)
(Transmission Replacement)		
6 Cylinder Upper Bellhousing to Engine	M12 Bolt	60
6 Cylinder Lower Bellhousing to Engine	M10 Bolt	40
V8 Upper Bellhousing to Engine	M10 Bolt	60
V8 Lower Flywheel Cover	M10 Bolt	15
Flex plate to Torque Converter	M10 Bolt	60
Selector shaft/shift lever	M8 Nut	14
V8 Shifter Cable abutment bracket	M8 Bolt	25
Cooler tube retaining plate to transmission	M8 Bolt	25
Rear mount adaptor bracket to transmission	M10 Bolt	50
Rear cross member to chassis	M10 Bolt	48
Rear transmission mount to adaptor bracket	M8 Nut	25
Driveshaft coupling to Output flange	M12 Bolt	120
Driveshaft coupling to Driveshaft	M12 Bolt	75
(Transmission Repair)		
Oil level plug	M18 Threaded Plug	35
Parking lock seal plug	M12 Threaded Plug	23
Mechatronic unit to Transmission	M6 Bolt	8
Oil pan to Transmission	M6 Bolt	12
Output flange nut		80

DESCRIPTION AND OPERATION

The ZF 6HP26 automatic transmission has been developed for vehicles with an engine torque of up to 600 Newton-metres (Nm). This transmission uses planetary gears with hydraulic-electronic control. The transmission control module (TCM) and the main control valve body units form a composite element that is installed as a single unit inside the automatic transmission.

Gear Train

This transmission features a world-class lepelletier gear train which is light-weight and high-efficiency with a high-torque capacity.

The low first gear ratio and high top gear ratio ensure a livelier and more energetic performance with excellent launch feel and wide open throttle performance, with the added benefits of smooth shift quality and low fuel consumption.

Driver Characterisation

Driver Characterisation matches transmission performance to the current driving style by considering acceleration rates, brake application and cornering speed to ensure the vehicle is in the right gear at the right time without undesired gear shifts.

The transmission "learns" the driver's style, from a "base" fuel economy bias (0 counts) up to a "sporty" driver (100 counts). By shifting the selector lever across the gate from D to Performance mode (the "manual" mode position), the driver characterisation increases by 100 points instantly, making the advanced features more available (i.e. if it had learnt to 40 counts in D, when you push the lever to the "manual" mode position it would become 140 counts). In Performance mode, the driver characterisation can learn from "sporty" (100 counts) up to "enthusiast" (200 counts).

Enhanced Adaptive Shift Strategy

The shift strategy is adapted according to vehicle speed and load on the vehicle. Modes include: economy, performance, sports, up-hill, down-hill and trailer towing.

When towing, the transmission perceives the load as a hill and employs gear hold logic e.g. if towing a caravan on a highway, the transmission will cruise in 5th gear and only change to 6th for downhill (or for a large caravan/float/trailer it will hold 4th gear while cruising). This results in improved performance and reduced fuel consumption.

Advanced 6-Speed Features

Upshift prevention going down steep hill with zero accelerator pedal application (not in "manual" mode)

This feature prevents upshifts beyond 2nd gear with zero accelerator pedal application to prevent a running away feeling when travelling down steep enough hills.

Emergency downshifts in Sequential Sports Shift ("manual") mode only

When driving in "manual" mode, if the accelerator pedal kickdown switch is activated the transmission will downshift to 3rd gear (or even 2nd if vehicle speed is slow enough) to provide good acceleration when the driver forgets that they are in "manual" mode, which would be useful when overtaking.

Downshift on braking downhill (excluding XR6 Turbo & XR8) (not in "manual" mode)

When braking sufficiently when driving downhill, the transmission will downshift to provide increased engine braking.

Advanced Features Dependent on Driver Characterisation

NOTE: The availability of the following advanced features is dependent on the driver characterisation (refer to Driver Characterisation).

Gearhold around corners (not in "manual" mode)

This feature prevents upshifts when cornering fast to prevent busyness when cornering and provide improved response when exiting the corner.

Early downshifts with hard braking (not in "manual" mode)

When heavy braking is detected, the transmission downshifts early to provide increased engine braking and be in the right gear for acceleration.

Gearhold going uphill/downhill (not in "manual" mode)

If the accelerator pedal is released when travelling uphill, upshifts are prevented to reduce busyness on grades. If the accelerator pedal is released when travelling downhill, if steep enough, upshifts are prevented to reduce running away feeling.

DESCRIPTION AND OPERATION (Continued)

Upshift prevention with fast-off accelerator pedal (not in "manual" mode)

Upshifts are prevented when the throttle is backed off very quickly to reduce busyness in sporty driving.

Shift Lever

The Selector Button must be depressed when shifting from Drive to Neutral to prevent inadvertently pushing the shifter into Neutral.

Drive and Reverse Engagement

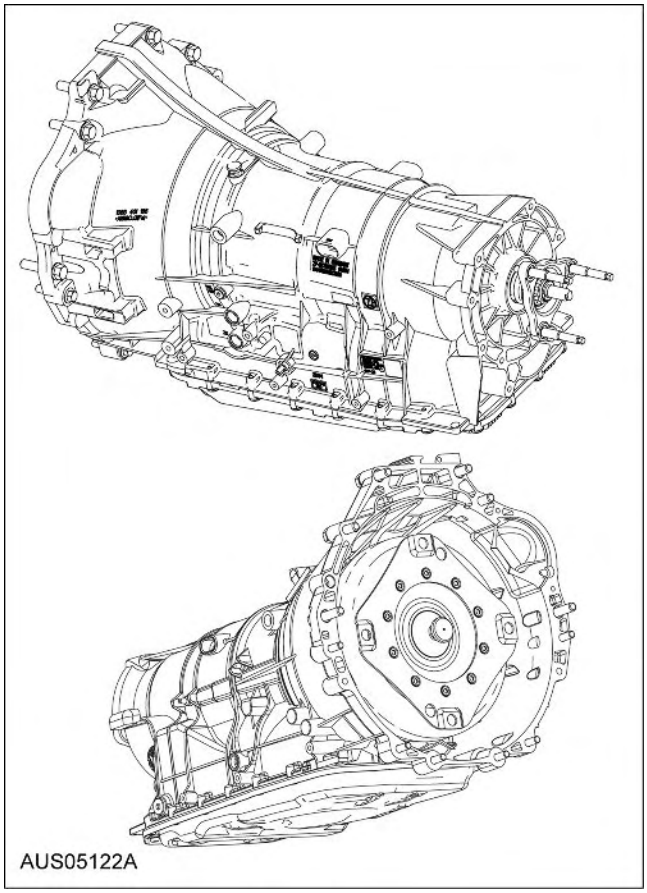
A "soft" engagement feature avoids harsh take up of drive when selecting Drive or Reverse. This is achieved by limiting engine speed to 3000 rpm (6000 rpm for XR6. XR8 and redline for FPV) and provides for a rapid, but progressive, engagement of either Drive or Reverse when moving from the Park or Neutral positions.

Sequential Sports Shift

The Sequential Sports Shift feature allows the driver to manually select his or her desired gear (within certain speed ranges) by moving the lever to the left. This feature enhances the driving experience by enabling the driver to have complete control of the transmission for occasions when manual gear selection is preferred over the automatic function.

Internal Transmission Control Module (TCM)

The internal TCM is matched to the transmission's valve bodies during the transmission's assembly ensuring refined shift quality.



The 6HP26 has the following features:

- Six forward speeds.
- A torque converter with an integral converter lock up clutch.
- Electronic shift and pressure controls.
- A single planetary gear set.
- A double planetary gear set.
- Two fixed multi-disc brakes.
- Three multi-plate clutches.

All hydraulic functions are directed by electronic solenoids to control:

- Engagement feel.
- Shift feel.
- Shift scheduling.
- Modulated torque converter clutch (TCC) applications.
- Engine braking utilising the coast clutch.

Engine power reaches the transmission by a torque converter with integral converter lock up clutch.

The 6 forward gears and 1 reverse gear are obtained from a single planetary set followed by a double planetary set also known as Lepelletier-type gear sets, these gear sets make it possible to obtain 6 forward gears.

The 6HP26 Automatic Transmission is a six speed electronically controlled transmission comprising the

DESCRIPTION AND OPERATION (Continued)

basic elements of a TCM and main control valve body unit, a torque converter, one solenoid valve and six pressure regulators. Gear selection is achieved by the control of Automatic Transmission Fluid (ATF) flow to operate various internal clutches. The TCM operates the electrical components and provides for the control of gear selection shift pressure which increases refinement and torque converter slip control.

In the event of a system fault the TCM also provides for Failure Mode Effect Management (FMEM) to maintain maximum functional operation of the transmission with a minimum reduction in driver, passenger or vehicle safety. In the event of a total loss of control or electrical power the basic transmission functions Park, Reverse, Neutral and Drive are retained. Also 3rd or 5th gear is retained by the hydraulic system; the gear retained is dependant upon the gear selected at time of the failure.

The transmission also contains turbine and output shaft speed sensors, an internal P, R, N, D selector shaft position sensor, and a transmission fluid temperature sensor. The TCM also requires information from the Shifter, via the Printed Circuit Board (PCB), to determine when the driver has initiated manual gear selection. The TCM communicates with other electronic control modules by the controller area network (CAN).

The TCM also provides for legislated transmission diagnostics, which meet the requirements EOBD III legislation, monitoring all components, which may effect vehicle emissions. Additional diagnostic functions are also supported to ensure fast repairs of all failures in the service environment.

Upshifts

Transmission upshifting is controlled by the TCM. The TCM receives inputs from various engine or vehicle sensors and driver demands to control shift scheduling, shift feel and torque converter clutch (TCC) operation.

The TCM has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel.

Downshifts

Under certain conditions the transmission will downshift automatically to a lower gear range (without moving the gearshift lever). There are three categories of automatic downshifts, coastdown, torque demand and forced or kickdown shifts.

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. If applied, the transmission will disengage the TCC to provide added acceleration.

Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tyre size and engine and transmission calibration requirements.

The Accelerator Pedal Position (APP) sensor has a slight tight spot near the Wide Open Throttle (WOT) position. This allows the driver to "feel" the approximate kickdown position. However kickdown is dependant on a number of variables so kickdown can take place either side of the tight spot.

Sequential Sports Shift (Range Selection)

The standard positions are; P, R, N, D, Sport, + and -

To engage the "sport" mode the shifter needs to be pushed to the left from the D position. The redesign of the shifter provides a positive engagement of sport mode position. The shifter can be left in this position and the transmission will respond to the values the TCM has identified from the drivers style. This means there are no specific characteristics associated with sport mode.

NOTE: When driving in sport mode 6th gear will not automatically be selected. It can be selected manually but then the gearbox assumes manual operation.

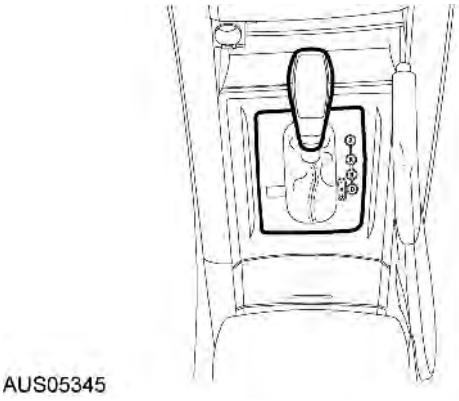
Manual operation is achieved by moving the shifter from the sport position forward (-) or rearward (+) when driving. Up-shifting is achieved by moving the shifter rearwards (+) and then release the shifter. The shifter is spring loaded and will then return to the sport position but not into sport mode. Down-shifting is achieved by pushing the shifter forward (-) and then release.

Operating the 6-speed transmission

The Sequential Sports Shift transmission can be operated in 3 different modes:

- Adaptive Automatic Mode (D)
- Performance Automatic Mode (S)
- Manual Mode (+/-)

DESCRIPTION AND OPERATION (Continued)



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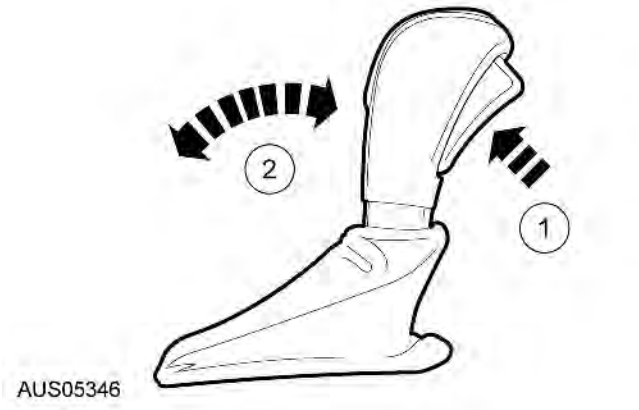
Gear Selection

To select a gear, depress the button (1) and move selector to the desired position.



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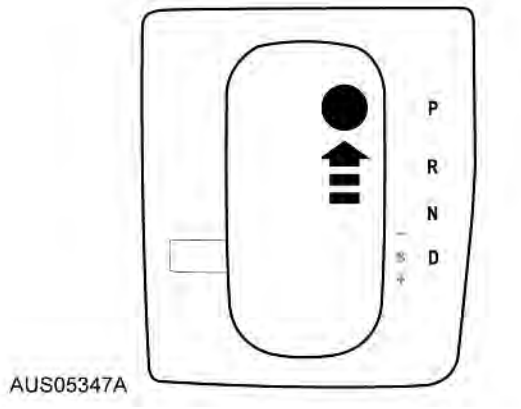
WARNING: The vehicle must be brought to a complete stop before shifting from reverse to forward or from forward to reverse gear.

Adaptive Automatic Mode

P = Park

This position should only be selected when the vehicle is stationary. In this position, the transmission is locked. **P** is displayed on the instrument cluster display when the engine is running and **P** is illuminated on the gear selector console. Park is fully engaged when the selector lever cannot be moved without first releasing the locking mechanism.



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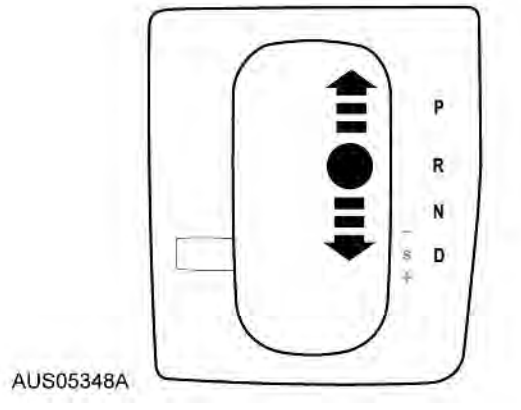
NOTE: Do not use the Park position in place of the park brake. Always ensure the park brake is firmly applied before leaving a parked vehicle.

R = Reverse

This gear should be selected only when the vehicle is stationary and the engine idling. R will be displayed in the instrument cluster display and R is illuminated on the gear selector console when reverse is selected.



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N = Neutral

This gear should be selected when starting the engine or when idling. No power is transmitted to the drive wheels. The engine will not operate over 3000 rpm (6000 rpm FPV) when neutral **(N)** or Park **(P)** is selected. **N** or **P** will be displayed on the instrument cluster and **N** or **P** is illuminated on the gear selector console.

D = Drive

The transmission will automatically select the appropriate gear required by the driving conditions. When the gear selector lever is in D (Drive), Adaptive Automatic Mode is active. The transmission will automatically select the appropriate gear and adapt to your driving style.

A spirited driving style will yield high performance transmission shift patterns and firmer feel. Easy driving will result in economical shift patterns.

NOTE: The transmission will automatically up-shift at 5000 rpm to prevent engine overspeed when driven in the D position and 5500 rpm when driven in the sport

DESCRIPTION AND OPERATION (Continued)

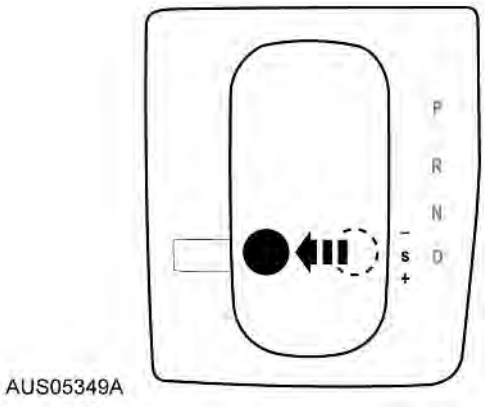
position. However if the transmission has identified a sporty or enthusiastic driver it may delay the up-shift up to any point up to red line.

Forced downshifting - kickdown.

To obtain greater acceleration for overtaking, hill climbing, etc. press the accelerator pedal firmly toward the floor. The transmission will downshift to a lower gear if required.

Performance Automatic (Sport) Mode

When the gear selector lever is moved to the left, the transmission is in **Performance Automatic Mode**. The transmission will automatically select the appropriate gear for spirited driving. **PERF** will be displayed on the instrument cluster for 5 seconds (dependent on model, **PERF** can be permanently displayed in the corner of the LCD screen or it can flash) and **S** is illuminated on the gear selector console. The transmission will now adopt a more "sporty" option with regard to gear selection based on identifying the driving style.



NOTE: When operating in "sport" mode, 6th gear will not be automatically selected.

Manual Mode

From the **Performance Automatic Mode** you can use the Sequential Sports Shift to allow you to manually select the gears. This is achieved by either moving the gear lever backwards (+) to upshift or forward (-) to downshift. The gear selector lever returns to the mid (default) position when not pushed backwards or forwards. Once a gear is selected manually the transmission is in **Manual Mode**.

If the car is in 3rd gear and the gear selector lever is pushed forward, the instrument cluster will show ’2’ indicating 2nd gear. Likewise, if from 2nd gear the gear selector lever is pulled backwards twice, the instrument cluster will show ’4’ indicating 4th gear.

If stationary, 1st gear will be automatically selected.

If trying to pull away in adverse weather conditions, i.e. ice or snow, it is possible to manually select 2nd gear to provide greater traction to the road wheels from stationary.

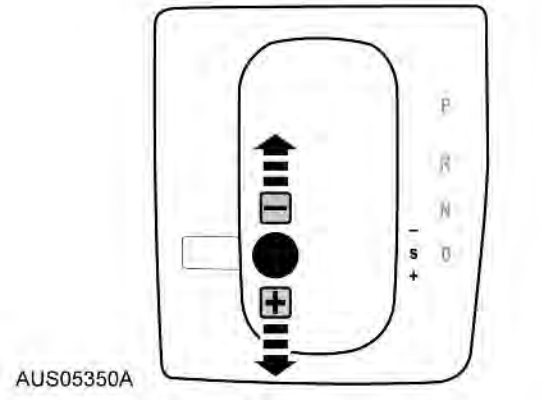
If when driving in manual mode and coasting to a stop, the transmission will downshift to 2nd gear.

Returning to Adaptive Automatic Mode:

Shifting the gear selector lever back to the ’D’ position returns the transmission to the Adaptive Automatic Mode. Depending on vehicle specifications ’ADP’ will be displayed on the instrument cluster display for 5 seconds.

NOTE: Any gear may be selected however the Powertrain Control Module will only downshift to a lower gear if the vehicle is travelling below a predetermined speed to prevent engine overspeed.

NOTE: When decelerating, the transmission will downshift automatically when a low threshold speed is reached.



1 = First

This gear should be selected for descending extreme gradients to provide heavy engine braking. 1 will be displayed on the instrument cluster display.

NOTE: It is recommended not to exceed 50 km/h in this gear.

2 = Second

This gear should be selected for ascending or descending steep grades or for responsive acceleration or increased engine braking. 2 will be displayed on the instrument cluster display.

NOTE: It is recommended not to exceed 75 km/h in this gear.

3 = Third

This gear should be selected for ascending or descending moderate grades or when you wish to lock out 4th, 5th and 6th gear for responsive acceleration or increased engine braking. 3 will be displayed on the instrument cluster display.

NOTE: It is recommended not to exceed 115 km/h in this gear.

DESCRIPTION AND OPERATION (Continued)

4 = Fourth

This gear should be selected for near constant moderate driving conditions on the urban cycle. It will provide economy and moderate engine braking if required. 4 will be displayed on the instrument cluster.

NOTE: It is recommended not to exceed 160 km/h in this gear.

5 & 6 = Fifth and Sixth

These gears provide economic driving at high speed. 5 or 6 will be displayed on the instrument cluster.

Forced downshifting - emergency kickdown

When driving in Manual Mode, emergency kickdown allows the transmission to automatically select a lower gear for rapid acceleration in an emergency situation without needing to manually select the gear. The Powertrain Control Module controls kickdown by sensing factors including vehicle speed, accelerator position and selected gear.

Above 70kph it will kick down to 4th gear

Below 70kph it will kick down to 3rd gear

Transmission fault

If a major fault develops, the transmission may automatically operate in a 'limp home' mode to enable the vehicle to be driven to an Authorised Ford Dealer for repair. During 'limp home' mode, the transmission will still operate but with a limited operation dependant up on the fault detected and the transmission selector indicator on the instrument cluster will flash. Limp home mode may also be engaged if the battery charge falls below 9V.

With limp home, dependant up on the fault, the shift patterns can change and some of the gears may not be available.

Transmission overheat

If the transmission overheats it will automatically change the shift patterns to enable improved transmission cooling. During transmission overheat, the instrument cluster display indicating transmission selector position and the engine temperature warning indicator will flash until normal transmission operating temperature is reached.

Torque Converter

The torque converter is a three element unit containing a single plate lock up clutch. The lock up clutch can be controlled and engaged in any gear 1 to 6.

NOTE: There are three variations of torque converter used

- I6 260mm rated at 278Nm @ 2000 rpm
- I6 Turbo 280mm rated at 297Nm @ 2000 rpm
- V8 - 4 valve 280mm rated at 297Nm @ 2000 rpm

It is vitally important that in the event of torque converter replacement they are replaced "like-for-like". In the event an incorrectly rated torque converter is fitted it will seriously affect transmission performance.

Gear Ratio

All models have the same internal ratios.

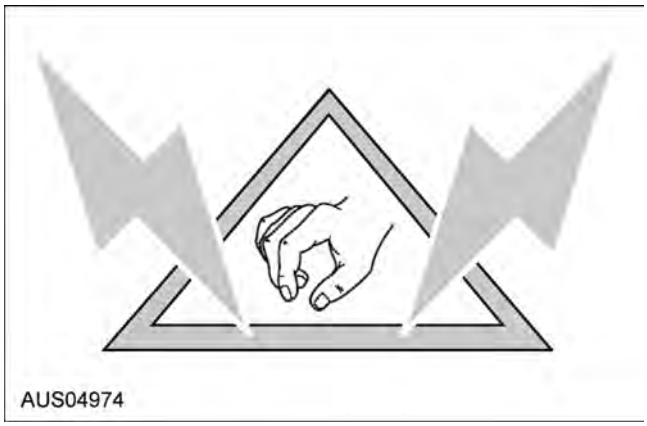
Gear	Ratio
1st	4.17:1
2nd	2.34:1
3rd	1.52:1
4th	1.14:1
5th	0.87:1
6th	0.69:1
Reverse	3.40:1

Fluid Pan, Gasket and Filter

The steel transmission fluid pan is sealed to the transmission housing via a flat fibre gasket. 2 magnets sit in the oil pan to remove ferrous particles from the transmission fluid. The filter is a separate unit retained by the fluid pan. All transmission fluid is drawn from the transmission fluid pan by the fluid pump and passes through the fluid filter.

Transmission Control Module (TCM) and Main Control Valve Body

Electrostatic Discharge (ESD)



⚠ CAUTION: When working with the transmission control module (TCM) and main control valve body, all suitable safety precautions must be taken to protect the component against electrostatic discharge (ESD). Failure to follow these instructions may result in component damage.

Make sure all possible safety precautions are taken to protect the TCM and main control valve body unit against ESD.

DESCRIPTION AND OPERATION (Continued)

Personal Wrist-Band Earthing

Earthing (grounding) by means of a wrist band or strap is the most reliable method of diverting electrostatic charges away from working personnel, and should therefore be used wherever possible, particularly if the person concerned is working while seated. The wrist band earthing (grounding) device consists of a bracelet closely attached to the wrist and a spiral earthing (grounding) cable connecting it to the earthing (grounding) contact point. This system must include a quick-release device so that the wrist can be released in the event of danger.

Shoes and Foot Earthing Straps

Electrically conductive shoes should be worn by persons who mainly work standing up or either standing or sitting in ESD protection zones, particularly if wrist band earthing (grounding) is impracticable. The standard calls for ESD shoes to record values between 0 and 35 Mega-ohms (MOhm) resistance. However, for antistatic working shoes resistance values between 0.1 and 1000 MOhm are called for, and a through-conducting resistance for protective shoes of 0.1 to 100 MOhm. A lower limit value of not less than 0.1 MOhm must be maintained on account of the contact voltage risk. For this reason the minimum value has been set contrary to the standard at the higher figure of 0.75 MOhm.

Transmission Control Module (TCM) and Main Control Valve Body

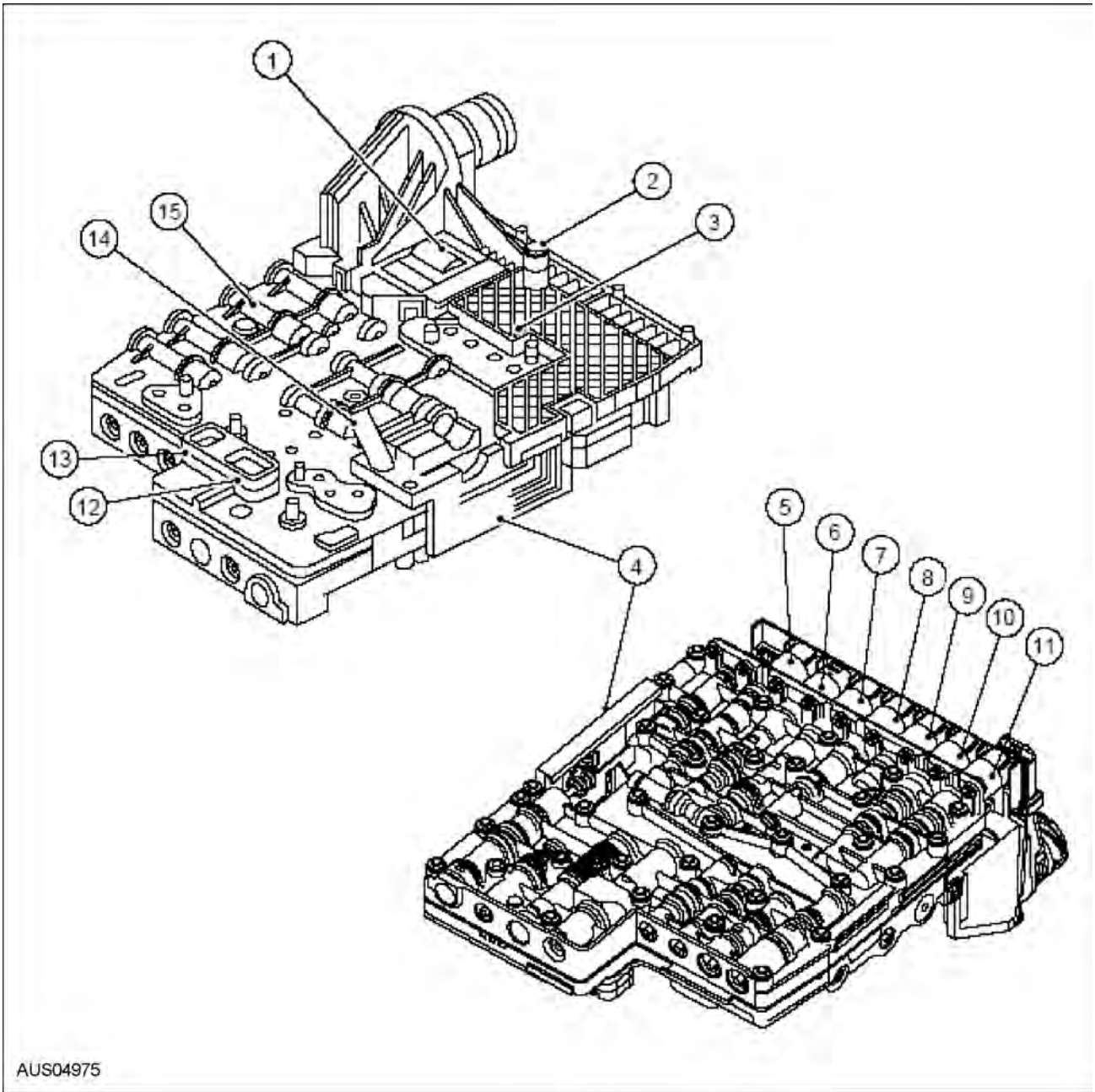
The transmission control module (TCM) and main control valve body is a combination of hydraulic and electronic control units. Both these modules are installed in the transmission, in the fluid pan.

This technical principle has the following advantages:

- Minimum tolerances (TCM is mated to solenoids)
- Better coordination of gear shifts
- Increased refinement
- Optimised shift quality
- Good reliability, since the number of plug connections and interfaces is reduced.

DESCRIPTION AND OPERATION (Continued)

Transmission Control Module (TCM) and main Control Valve Body



Item	Description
1	TCM
2	Output speed sensor
3	Transmission fluid temperature sensor
4	Position switch
5	Pressure regulator 6
6	Solenoid valve
7	Pressure regulator 5
8	Pressure regulator 4
9	Pressure regulator 3
10	Pressure regulator 2

Item	Description
11	Pressure regulator 1
12	Discharge port
13	Suction port
14	Turbine speed sensor
15	Main control valve body

DESCRIPTION AND OPERATION (Continued)

Transmission Electronic System

The transmission control module (TCM) and its input/output network control the following transmission operations:

- Shift timing.
- Line pressure (shift feel).
- Torque converter clutch.

In addition, the TCM receives input signals from certain transmission-related sensors and switches. The TCM also uses these signals when determining transmission operating strategy.

Using all of these input signals, the TCM can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the pressure needed to optimise shift feel. To accomplish this, the TCM uses six pressure control solenoids and one shift solenoid to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

TCM

⚠ CAUTION: Should you be required to reprogram the TCM the following criteria must be observed:-

- The transmission fluid temperature must be below 80°C
- Park (P) or Neutral (N) selected
- The handbrake firmly applied

The TCM for the transmission is mounted on top of the main control valve body. The control module for the transmission has been designed to operate correctly in the environment in which the TCM is located.

The transmission control module is activated and deactivated by the ignition supply and is connected to the transmission link harness by a 16-way connector.

The TCM controls the operation of the transmission. The TCM processes information received in both analogue and digital form such as:

- Transmission input speed
- Output speed
- Throttle pedal position
- Gear selector position
- Engine torque
- Engine speed
- Transmission fluid temperature
- Brake pedal status
- Engine oil temperature
- Coolant temperature
- ABS wheel speed

This information is then used by the TCM to decide which shift pattern to select and for shift energy management. Electro-hydraulic solenoid valves and pressure regulators control the transmission gear changes.

Five pressure regulators and one solenoid valve are used to control direct transmission fluid flow to select internal clutches and control the fluid pressure at the clutch. A separate pressure regulator is used exclusively for torque converter clutch control.

The TCM monitors all TCM inputs and outputs to confirm correct system operation. If a fault occurs the TCM is able to perform default action and inform the driver of the problem, this is by the instrument cluster message centre.

Solenoids

The hydraulic module contains one solenoid valve. The solenoid valve is actuated by the TCM and has two positions of open or closed, it is used to switch the position valve.

There are six electronic pressure control valves, these convert an electric current into a proportional hydraulic pressure. They are energised by the TCM and actuate the valves belonging to the relevant switching elements.

Controller Area Network (CAN) Interface

For the TCM to be able to perform shift point and shift quality management a number of external signals are required. For shift point management alone the TCM requires output speed sensor, throttle pedal position, brake pedal status and gear selector position. The controller area network (CAN) bus is used to share information between control modules. The TCM obtains most of its required data over the CAN bus from the electronic engine controls, Sequential Sport Shifter and ABS, Instruments pack and diagnostic tools.

Brake Pedal Position (BPP) Switch

The brake pedal position (BPP) switch tells the TCM when the brakes are applied, and disengages the torque converter clutch. The BPP switch closes when the brakes are applied and opens when they are released. The BPP is also used to disengage the brake shift interlock and stops gradient calculations.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor detects engine coolant temperature and supplies the information to the TCM. The ECT sensor is used to control the torque converter clutch (TCC) operation.

DESCRIPTION AND OPERATION (Continued)

Accelerator Pedal Position (APP) Sensor

The accelerator pedal position (APP) sensor is a potentiometer mounted on the accelerator pedal. The APP sensor detects the position of the accelerator pedal and sends this information to the electronic control module (ECM). The APP sensor is used for shift scheduling and TCC lock-up.

Input Shaft Speed (ISS) Sensor

The input shaft speed (ISS) sensor is a Hall Effect type sensor.

The ISS sensor is mounted internally on the transmission and is located on the TCM and main control valve body unit.

Output Shaft Speed (OSS) Sensor

The output shaft speed (OSS) sensor is a Hall Effect type sensor.

The OSS sensor is mounted internally on the transmission and is located on the TCM and main control valve body unit and is used for shift scheduling.

Transmission Fluid Temperature (TFT) Sensor

The TCM utilises one transmission fluid temperature sensor located on the main control valve body. The TCM uses the sensor input to activate various shift strategies. The sensor is in the form of a temperature dependent resistor.

The temperature sensor performs plausibility checks on each sensor reading. Obviously, the transmission oil temperature should not jump in value excessively between sensor readings. If the inputs from the temperature sensor are outside the working range it possible that the sensor is short or open circuit.

Position sensor

The TCM uses the position of this switch housed on the TCM and main control valve body, to determine the selected gear range on the Automatic side of the selector lever.

The selector lever is connected to the transmission by a cable, which operates the transmission selector shaft between positions Park, Reverse, Neutral and Drive. The TCM detects the driver's choice of manual range selection (+ or -) by means of a 3-bit code generated by the printed circuit board (PCB) housed within the selector assembly. This 3-bit code is then transformed in to a CAN message by the PCB and transmitted on to the CAN bus where it is detected by the TCM.

3-Bit Code

Position	3-Bit Code		
2nd Gear	0	1	0
3rd Gear	0	1	1
4th Gear	1	0	0
5th Gear	1	0	1
P,R,N,D	1	1	1

The TCM uses this information to generate the CAN message "Gear Position Selected", which must not be confused with the similar message "Gear Position Actual" indicating the current mechanical gear ratio activated by the TCM.

Movement of the lever between Park, Reverse, Neutral and Drive manually controls the flow of transmission fluid, the TCM having control of the forward gear selected in Drive. Additional movement of the lever to 5, 4, 3 and 2 positions does not manually modify the fluid flow, the TCM detects these positions, and controls the gear selected electronically.

Sport mode shifter position

The sport mode:

- Allows the driver to select or de-select the automatic transmission sport mode.
- Allows the automatic transmission to operate normally when the sport mode is selected, but under acceleration the gear shift points are extended to make full use of the engine's power reserves.
- Allows the driver to drive the vehicle in the "D" position with the full automatic transmission shift or manually shift the gears through 2nd, 3rd, 4th, 5th and 6th gear by using the + and - positions.
- "S" is illuminated when Sport mode is selected.
- Communicates with the TCM through the CAN network to show the sport mode switch status.

TCM Monitoring Functions

As explained above the TCM monitors all input and outputs to identify possible failures. If a fault is detected the TCM takes the appropriate action to ensure the transmission enters a safe mode of operation, without sacrificing transmission durability or driver safety.

Supply Monitoring

If the battery voltage is either too great or too low, the TCM will detect a fault condition. For the TCM to be able to identify this fault the engine must be running and the transmission fluid temperature sensor must be functioning correctly.

DESCRIPTION AND OPERATION (Continued)

Solenoid Supply Monitoring

While the solenoid operating transistors are being activated, checks are run for open circuits, shorts circuits to ground and short circuits to supply. The monitoring function evaluates the voltage characteristics during the switch on process checking for the above faults.

All solenoid outputs are fully protected. The processor and the appropriate fail-safe action taken can quickly identify open and short circuit faults.

Sensor Supply Monitoring

The sensor supply voltage is a stabilised supply. This supply is monitored by the micro-processor by an Analogue to Digital Converter (ADC). If the voltage is out of the valid tolerance a raise a diagnostic trouble code (DTC) is set and the appropriate fail-safe action is performed.

Electronically Erasable Program Read Only Memory (EEPROM) Monitoring

⚠ CAUTION: Should you be required to reprogram the TCM the following criteria must be observed:-

- The transmission fluid temperature must be below 80°C
- Park (P) or Neutral (N) selected
- The handbrake firmly applied

To diagnose errors with the electronically erasable program read only memory (EEPROM) the TCM calculates 4 checksums continuously: If the processor identifies discrepancies in any of the four checksums the TCM will engage mechanical limp-home mode.

The TCM can diagnose errors within the EEPROM. Diagnosis is only performed during TCM initialisation. There is no fail-safe mechanism associated with this function as the EEPROM is mainly used for the storage of fault codes and transmission calibration adaptations. If a fault occurs the TCM is able to perform default action and inform the driver of the problem, this is by the instrument cluster message centre.

Watchdog Monitoring

The watchdog monitoring function has two functions. Firstly it checks that it is possible to inhibit output control by the activation of the solenoid supply transistor. Secondly the watchdog checks that the safety circuit is functioning correctly.

During initialisation the watchdog checks that it is possible to inhibit control of the pressure regulator and solenoid valves by switching the solenoid supply transistor. There is a fault if activation of the solenoids cannot be inhibited by the watchdog (NB. The supply to the solenoids can still be inhibited by the high side switch responsible for control of each solenoid i.e. One safety path is lost).

Monitoring the Substrate Temperature Sensor

The TCM is situated within the transmission on the valve body. As the TCM controls a number of high power solenoids and is surrounded by ATF, the TCM can obviously get very hot. If the temperature of the hardware rises above a pre-determined level the TCM will be shut down. Prior to the TCM shutting down the TCM will log a fault code, during shutdown the transmission will enter mechanical limp-home mode. Monitoring of the substrate temperature is performed by a temperature dependent resistor mounted on the processor.

Plausibility Checking

The TCM detects a fault if an excessive voltage jump is identified between any two consecutive measurements. Also, with the engine started from cold the transmission fluid temperature will start to rise. Therefore the substrate or fluid temperature will also start to rise because the TCM is surrounded by transmission fluid. If the engine and output shaft speed is higher than a set threshold for a predetermined length of time without the substrate temperature rising above a set threshold a fault will be detected.

Pressure Regulator/Solenoid Monitoring

Each pressure regulator and solenoid is monitored for open circuits and short circuits. The TCM also checks that the current being delivered to each solenoid valve or pressure regulator is within valid limits. When each solenoid is being driven with minimum current the TCM checks that the current is not above a threshold value. If a solenoid is being driven with maximum current, it checks that the current is not below a valid threshold. If either of these two errors occur, a plausibility error is logged and the appropriate fail-safe action is performed.

Output Speed Monitor

It is possible for the TCM to diagnose electrical errors associated with the output speed sensor while the vehicle is stationary as well as moving. Plausibility monitoring is performed on the sensor output when the vehicle is moving.

Input Speed Monitor

It is possible for the TCM to diagnose electrical errors associated with the input shaft speed sensor while the vehicle is stationary as well as moving. Plausibility monitoring is performed on the sensor output when the vehicle is moving.

Transmission Fluid Temperature Sensor Monitoring

The TCM monitors for faults associated with the transmission fluid temperature sensor in the following ways:

1. Open and short circuit fault detection.

DESCRIPTION AND OPERATION (Continued)

2. The temperature cannot alter by more than a predefined differential between any two consecutive measurements.
3. The transmission fluid temperature must rise after the engine has been started provided that the fluid temperature was low enough to begin with (The vehicle must be driven and the diagnostic test condition met).

Position Sensor Monitoring

The TCM can identify errors with the position switch located within the transmission. If an unrecognised position code is read by the TCM a plausibility fault will be logged. (A code is checked between positions).

The position switch outputs a 4-bit code to the TCM, the bits being labelled L1-L4. For the transmission, the following codes are used to identify the selector position.

Only for the automatic side of the shifter P, R, N, D

Position	Code			
	L1	L2	L3	L4
Park	0	0	1	0
Reverse	0	0	0	1
Neutral	0	1	0	0
Drive	1	1	1	0

Gear Ratio Monitoring

The gear ratio diagnostic checks that each gear ratio is correctly engaged. Also, following a gear shift the diagnostic checks that the transmission has engaged the target gear within the allowed time.

Torque Converter Monitoring

The TCM checks that the torque converter can be locked correctly. If torque converter lock-up does not occur correctly the TCM performs the appropriate fail-safe action of opening the Torque converter clutch.

Torque Converter Lock-up Control

The TCM controls how the torque converter clutch is engaged as a function of the accelerator pedal position, output speed, transmission fluid temperature, gear selected and shift program. Lock-up is possible in all forward gears, but usually it is restricted to fourth, fifth and sixth gears. To make use of the comfort enhancing effect of the torque converter, the converter clutch can be disengaged prior to a downshift or up-shift. The torque converter lock up clutch is always modulated to allow for controlled slip, to further improve the shift quality.

Shift Energy Management

This function involves reducing or increasing the engine output torque during shifting. The aim when up-shifting is to reduce the energy that is dissipated in the friction elements of the transmission. This is done by reducing the engine torque during synchronisation without interrupting the tractive drive. This function may be used for:

- Increasing the transmission service life by shortening the slipping time.
- Improving the shift comfort by reducing the step change in torque caused by the gearshift.
- Transferring a higher engine power, this is allowed by the mechanical in-gear strength of the transmission.

Real-time control of engine torque is required to maintain maximum shift quality and transmission durability. The TCM has the ability to control the engine output torque during the gearshift to synchronise with the operation of the transmission clutches.

Pressure Modulation

To provide a high level of shift comfort and durability, the hydraulic pressure in the shift related friction elements of the transmission must be matched very accurately to the transmission input torque. This hydraulic pressure is composed of a hydraulically pre-set basic pressure and a controlling pressure that is set by one of the electro-hydraulic pressure regulators.

The transmission input torque can be directly calculated from the following operating parameters: engine torque signals, engine speed or any signals transmitted from the PCM by CAN, and converter slip. Separate pressure characteristics for each gear change make it possible to adapt precisely to the particular shift operation. A further improvement in shift comfort is achieved by individual treatment of special cases, such as manual shifts.

Shift Quality Adapts

The shift quality adapts are used to obtain a high quality and consistent shift feel. This is achieved through monitoring shift quality and then adapting the shift pressures and shift energy management to overcome hardware variability and "in service wear".

It will typically take a new transmission approximately 160 kilometres of use to fully adapt.

Shift Point Selection

The gearshift points are selected by the TCM, as a function of the output speed, accelerator pedal position, selector position and shift program selected. The driver has control over the shift points by the selector lever, accelerator pedal movement and mode switch.

DESCRIPTION AND OPERATION (Continued)

Transmission Shift selection

Shift Map Selection

The transmission control system utilises a number of driver selectable operating modes and also a number of adaptive/automatically selectable modes. Sport, Normal and Cruise Control mode are all driver selectable. Hot mode, traction control mode and trailer towing mode are all adaptive modes i.e. the transmission will automatically select this mode dependent upon the current driving conditions.

Normal Mode

Normal mode can be selected by selection of the D position on the shifter.

Once activated this mode will remain engaged until the driver deselects the mode or engages the cruise control system. If the driver engages cruise control when Normal mode is active upon deactivation of the cruise system the transmission will automatically re-engage Normal mode. This mode can be over-ridden by a number of adaptive modes.

The mode switch is of the momentary type.

Cruise Mode

When the driver engages the cruise control system the TCM receives a CAN message transmitted by the Adaptive Cruise Control (ACC) or engine electronic controls which informs the TCM that cruise control is currently active. Upon receipt of this message the TCM selects a new transmission shift map. This map has been developed to reduce busy gearshift during cruise mode. It has also been developed to increase fuel economy.

Hot Mode

This is one of the adaptive modes the transmission can enter when conditions are correct. When the transmission fluid temperature, chip temp, engine oil temp or coolant temperature becomes hot enough to reach threshold values, the TCM will cause the transmission to enter Hot mode. This mode will automatically engage new shift and lock-up maps to reduce heat generated within the transmission. The shift map will enable the transmission to change to higher gears at lower vehicle speeds and the lock-up map will engage the lock-up clutch at lower vehicle speeds and in lower gears. The effect of this is that less heat will be generated within the transmission due to the effects of lock-up clutch slip and churning effects. There will be forced upshift strategy used in hot mode. To exit hot mode the selector lever must be moved or the brake pedal applied or the accelerator pedal applied 100%, during all of these methods of exiting from hot mode the fluid temperature must be lower than the threshold values.

Traction Control Mode

Traction Control Mode is an adaptive mode, which is automatically engaged when a traction event occurs. When driving on slippery surfaces (i.e. sand, ice) it is possible for the driven wheels to begin to spin. The TCM believes the vehicle speed is increasing and therefore it may begin to upshift. These upshifts reduce the torque at the wheel and so tend to reduce wheel slip. The downshift lines are forced downwards to prevent unwanted shifts. To reduce the effects of this, if a traction event occurs a signal is transmitted by the ABS module to the TCM over the CAN network, the TCM uses this signal to change the currently selected shift map. The new shift map will have gearshift lines further apart, thus inhibiting the transmission shifting to a lower gear.

Hill/Trailer Towing Mode

This is an adaptive mode. When the TCM detects reduced vehicle acceleration for a certain percentage of throttle opening then this mode is automatically engaged by the TCM. When this mode is engaged a new shift map and torque converter lock-up map is selected. This new shift map is designed to reduce the number of gearshifts when towing a trailer or with the car climbing a steep hill. The shift map will cause the transmission to hold on to gears for longer this increases acceleration and reduces the number of gearshifts. This mode can also give an advantage when driving at high altitudes, where the torque produced by an engine is greatly reduced by the effects of reduced ambient pressure and airflow.

It is recommended that the sport position is selected when towing for long distances.

Driving Mode Priority

Each of the above modes has an associated priority i.e. Normal mode cannot over-ride cruise mode etc.

DESCRIPTION AND OPERATION (Continued)

Adaptive Shift Strategies

The TCM of the six speed ZF automatic transmission incorporates adaptive strategies which improve the accessibility of the vehicle's performance in driving conditions while maintaining a relaxed driving experience when cruising.

In "Sport" mode, accelerator pedal usage and cornering behaviour are monitored to assess driving style and road conditions. When an enthusiastic driving style or a demanding road is detected, 6th gear is inhibited and the lower gears are made slightly more accessible in order to prevent unwanted "hunting" between gears. Conversely, when cruising conditions are detected, 6th gear is once again made available to maximise driving refinement and economy.

Under conditions of heavy braking, the transmission will perform one or more downshifts to improve response to a subsequent accelerator pedal application. Similarly if the accelerator pedal is released rapidly following hard acceleration, one or more upshifts are inhibited to increase engine braking and also improve subsequent response.

To complement these features, when a corner is detected transmission upshifts are inhibited. This inhibition is also maintained for a short distance after the corner allowing the driver to achieve a smooth balance through the bend without unwanted shifting mid-corner.

Safety features

The safety functions are designed to safeguard against mis-operation by the driver as well as against system malfunctions. The mis-operation system prevents reverse gear from being engaged at high forward speeds (Above 5 kph) and prevents manual downshifting at excessive engine speeds.

Great attention has been paid to safeguarding against, and detecting, malfunctions in the electronic control system. The design of the electrical and diagnostic system is such that system integrity is protected at all times.

The hydraulic system has "fail-safe" characteristics regarding its electrical energisation, i.e. as a result of the power supply being lost to the electro-hydraulic actuators the transmission engages a reliable emergency gear ratio to facilitate a basic limp-home mode.

Recognition of critical shift operation by monitoring the last element in the signal path, i.e. the solenoid valve, and checking by means of redundant measured variables, i.e. engine speed, input speed and output speed.

Measures are in place which guarantee a high degree of availability of safeguard functions, i.e. monitoring of safety circuits. For this purpose each time the vehicle is started there is a check on the entire safety hardware, this is during TCM initialisation and the associated program parts and signal paths used during the TCM operation status. A malfunction in this part of the system, or triggering of the safety circuit, will be communicated to the driver by the instrument cluster message centre.

DIAGNOSIS AND TESTING

Diagnostic Strategy

The complexity of the electronics involved with the automatic transmission preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the Ford approved diagnostic system for detailed instructions on testing the automatic transmission.

Where a fault involving the automatic transmission is indicated by the Ford approved diagnostic system, some basic diagnostic methods may be necessary to confirm that connections are good and that the wiring is not damaged, before installing new components.

1. Verify the customer concern by operating the vehicle. Refer to the automatic transmission diagnostic drive cycle in the DTC summary section.
2. Check the fluid levels and condition of the fluid.
3. Check for non-factory fitted items.
4. Check the selector lever cable for correct adjustment. REFER to Section 307-05.
5. Visually inspect for obvious signs of mechanical, electrical or hydraulic damage:

Visual Inspection Chart

Mechanical	Electrical	Hydraulic
• Damaged shift mechanism/linkages • Damaged automatic transmission casing	• Blown fuse • Wiring harness • Damaged Transmission Control Module (TCM) • Damaged rotary switch • Damaged, loose or corroded connectors	• Fluid level too high/low • Poor condition of fluid • Fluid leak

DIAGNOSIS AND TESTING (Continued)

Basic Diagnosis

Check Fluid Level & Condition

⚠ CAUTION: The vehicle should not be driven if the fluid level is low as internal failure can result.

NOTE: The transmission oil temperature must not be allowed to exceed 50 °C (122 °F) whilst checking level. Should the temperature rise above this figure, abort the check and allow the transmission oil to cool to below 30°C (86°F).

This vehicle is not equipped with a fluid level indicator. An incorrect level may affect the transmission operation and could result in transmission damage. To correctly check and add fluid to the transmission, REFER to Transmission Fluid Level Check in this section.

High Fluid Level

A fluid level that is too high may cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission damage. If an overfill reading is indicated, refer to Transmission Fluid Drain and Refill in this section.

Low Fluid Level

A low fluid level could result in poor transmission engagement, slipping, or damage. This could also indicate a leak in one of the transmission seals or gaskets. REFER to Transmission Fluid Level Check in this section.

Adding Fluid

⚠ CAUTION: The use of any other type of transmission fluid than specified can result in transmission damage.

If fluid needs to be added, add fluid in 0.50 litre increments through the fill hole opening. Do not overfill the fluid. For fluid type, refer to the General Specification chart in this section. REFER to Transmission Fluid Level Check in this section.

Fluid Condition Check

1. Check the fluid level. For additional information, REFER to Transmission Fluid Drain and Refill in this section.
2. Observe the colour and the odour. The colour under normal circumstances should be reddish, not brown or black.
3. Allow the fluid to drip onto a facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.

NOTE: In the event of a transmission unit replacement for internal failure, the oil cooler and pipes must also be replaced.

Shift Linkage Check

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted; for selector lever cable adjustment, REFER to Section 307-05.

DIAGNOSIS AND TESTING

TRANSMISSION QUICK REFERENCE DTC LIST

This list has been devised as a basic guide to direct you to the relevant area of concern as quickly as possible.

The Diagnostic Trouble Codes (DTCs) are listed numerically and are not necessarily grouped by fault and or system.

NOTE: Not all the DTCs listed here may be active on the vehicle; it is dependant up on vehicle specification.

Although this section is primarily concerned with TCM related DTCs reference is made to other modules to which TCM performance is either directly or indirectly related.

NOTE: Before commencing any electrical diagnostic procedure, assess the general condition of the associated mechanical components for serviceability.

Carry out a preliminary inspection of the condition of the electrical system for damage to wiring and/or connectors.

Ensure the vehicle battery is in good condition

NOTE: If you disconnect a sensor or actuator with the ignition switched ON, you may induce further DTCs. Therefore when carrying out your preliminary inspection ensure the ignition is in the OFF position.

This section has been devised as a quick reference guide and consists of general diagnostic procedures. **For specific diagnostics, refer to the relevant sections within this manual.**

You will notice many of the comments in the **"POSSIBLE CAUSE"** sections indicate **"DEFECTIVE TCM"**. Modern TCM's are extremely reliable and are rarely the primary cause of the concern.

NOTE: The TCM should only be replaced after all the other diagnostic procedures have been completed

⚠ **CAUTION: Should you be required to reprogram the TCM the following criteria must be observed:-**

- The transmission fluid temperature must be below 80°C
- Park (P) or Neutral (N) selected
- The handbrake firmly applied

DTCs can be recorded at various times and under differing conditions

These are DTCs that are monitored at all times during vehicle operation.

In the event a customer complains of a potential performance related issue, and there are no current DTCs recorded, it is recommended to run a KOEO test and a KOER test.

KEY-ON ENGINE-OFF (KOEO)

This is carried out with WDS with a view of checking a number of specific components and systems for condition and integrity.

To access the KOEO test. Connect the WDS to the vehicle and ensure it correctly identifies the vehicle. From the toolbox icon select self test and follow the relevant instructions. Failure to follow the instructions on WDS can lead to additional DTCs being recorded.

Simplified procedure TOOLBOX > SELF TEST > POWERTRAIN > ENGINE > KOEO

This self-test is normally completed within 20 seconds.

KEY-ON ENGINE-RUN (KOER)

This is carried out with WDS with a view of checking a number of specific components and systems for condition and integrity.

To access the KOER test. Connect the WDS to the vehicle and ensure it correctly identifies the vehicle. From the toolbox icon select self test and follow the relevant instructions on WDS. Failure to follow the instructions on WDS can lead to additional DTCs being recorded.

Simplified procedure **TOOLBOX > SELF TEST > POWERTRAIN > ENGINE > KOER**

If the KOER test fails to complete **P1001** will be stored

This self-test is normally completed within 34 seconds

MIL ON Y/N

Currently transmission related DTCs do not activate the Malfunction Indicator Lamp (MIL) as transmission failures do not cause the engine to operate outside the Australian Emission regulations.

DIAGNOSIS AND TESTING (Continued)

However some of these DTCs may become MIL related as the emission standards are reviewed

General note when encountering multiple DTCs

If when retrieving DTCs it is found there are a large number of them, it is suggested to identify and **record the DTCs**. Attempt to identify any common theme i.e. "reference voltage" or "temperature" related defects; this can aid the diagnostic process.

Clear all the DTCs.

Run both a KOEO and a KOER test. Investigate any recorded DTCs during this process before preceding to carryout a road test with WDS

Then monitor the appropriate systems using WDS/PDS under road test conditions. The first DTCs that occur are normally the primary areas of concern and may have triggered further DTCs in associated systems.

Using the World-wide Diagnostic System (WDS)

If you encounter problems establishing communication between WDS and the vehicle, this does not necessarily indicate there is a problem with the vehicle.

Attempt to establish communication using the TEAR TAG, Calibration Code or PCM Part Number.

If you are having difficulty, carryout the WDS diagnostic procedure for cables and check the serviceability of the 16 pin DLC cable B-280.

Also ensure WDS is running the latest software.

Transmission Fluid Level Checks

NOTE: The ZF 6HP26/X transmission is very sensitive to transmission fluid concerns. Contamination or incorrect levels seriously affect transmission performance. If you are required to check the level and condition of the fluid it is vital the described procedure is correctly followed. Any deviation from the approved procedure will lead to further transmission operational concerns, further DTCs and damage to the transmission. Refer to TRANSMISSION FLUID LEVEL CHECK - 307-01

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0218 - Transmission overheating (above 130°C)	Cont KOER	**N**	Incorrect transmission fluid level or fluid contaminated Damaged transmission cooling Transmission breather blocked Torque converter not locking Defective wiring or connections between the PCM, shifter PCB and connection to the transmission multi-plug. Defective TFT sensor **NOTE:** Transmission may be in "LIMP-HOME" mode	Check the transmission fluid level and condition (refer to TRANSMISSION FLUID LEVEL CHECK - 307-01) Carryout a system check with WDS. Select PID TFT. Road test the vehicle trying to replicate a wide range of operating conditions. If the DTC returns, check the condition of the PCB in the shifter (P0710 may also be stored) Check the condition of the transmission cooling system. Ensure the breather is not blocked Torque converter not engaging correctly (P0740, P2763 and P2764 may also be stored). Monitor TCC with WDS. This DTC may be triggered by driver abuse This DTC can also be stored if the transmission has repeatedly exceeded 130°C. If this is the case, check the transmission cooling system. **NOTE:** The transmission oil should be replaced. (Refer to TRANSMISSION FLUID - RENEW - 307-01)

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0219 - Engine over speed condition (above 6000rpm) **PID** RPM	Cont KOER		Defective wiring and or connectors between **CKP** sensor and the PCM. Defective sensor Incorrect calibration in PCM and/or TCM **NOTE:** Transmission may be in "LIMP-HOME" mode	Check the condition of the wiring between the PCM and CKP sensor. Monitor the **RPM** signal and carryout a wiggle test at idle. **Always exercise great care when working around a running engine** If **P0300, P0315, P0316 or P0320** are recorded, this is a concern with the **CKP circuit or sensor** Using **WDS datalogger** monitor engine speed **(RPM)**, transmission speed signals (**OSS, TCCMACT and TSS**, if available) and vehicle speed (**VSS**). Road test the vehicle, ensure the RPM approximates the true engine speed. This DTC may be recorded if the vehicle has been driven enthusiastically over uneven road surfaces.
P0562 - The TCM has detected low battery voltage (below 9 volts)	Cont	**N**	Defective battery/charging system Defective connections to the TCM Loose connections between the battery or PCM Defective TCM **NOTE:** Transmission may be in **"LIMP-HOME"** mode Engine may be operating in **"Guard Mode"**	Check the condition of the battery and charging circuit. Battery voltage can be monitored with **WDS datalogger, B+** Carryout **Battery and Charging** system checks section **414-01 and 414-02** Check the connections to the battery and PCM Check the condition of the wiring and connections to the transmission multi-plug. Check voltage supply to Pin 14 on C-14 VPWR (12v ignition off) Check the voltage at pin 9 on C-14 ignition signal (12v ignition on) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. **SEE NOTE RE- TCM reprogramming at the beginning of this list**
P0563 - High battery voltage	Cont	N	Defective charging system Defective PCM (PCM is sensing 18 volts) **NOTE:** Transmission may be in "LIMP-HOME" mode Engine may be operating in "Guard Mode"	Carry out charging system checks section 414-02 Battery voltage can be monitored with WDS datalogger, B+ Check the condition of the wiring and connections between the PCM, alternator and battery If charging system and supply voltage to PCM is correct. Replace the PCM

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0603 - PCM - KAM error (Possible engine operating FMEM and/or transmission limp home)	Cont	N	Blown KAM fuse Loose battery connections Loose connections between the PCM/TCM Defective PCM **NOTE:** Transmission may be in "LIMP-HOME" mode Engine may be operating in "Guard Mode"	Check KAM fuse Check wiring between battery, PCM and TCM If supply voltage to the PCM is correct and the engine is running an FMEM strategy, suspect internal PCM fault. If the supply voltage to the PCM is correct and the transmission is operating in limp home mode, suspect the TCM Ensure latest software is being used in both the PCM and TCM CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, replace the PCM.
P0605 - PCM - ROM error (Possible engine operating FMEM and/or transmission limp home)	Cont	N	PCM/TCM programming error Incorrect software programmed Defective PCM **NOTE:** Transmission may be in "LIMP-HOME" mode Engine may be operating in "Guard Mode"	Check PCM/TCM has latest calibration. Ensure WDS lead and 16 pin DLC are fully engaged. Check connections between the DLC, PCM and TCM **NOTE:** If DTC has been logged after a new TCM has been fitted and flashed, an error has occurred during the process. Check the file used for flashing process is correct and repeat the flash process. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0613 - TCM error	Cont KOEO KOER		Defective wiring between the PCM, TCM and shifter PCB Defective TCM (Incorrect software or hardware concern) VID incorrectly programmed **NOTE:** Transmission may be in "LIMP-HOME" mode	Check the condition of the wiring and connections between the PCM, PCB and multi-plug connection on the transmission. Ensure relevant ground (GRND) and supply voltages (VPWR) are correct. Ensure the VID parameters are correct Ensure the PCM and TCM are operating with the latest software calibrations. Clear all DTCs and re-test. If DTC returns, replace the TCM and Main Control Valve Body. Re-flash with the latest calibration SEE NOTE RE- TCM reprogramming at the beginning of this list

Reprogramming the VID block

NOTE: Ensure that the most up-to-date software version is installed in WDS.

NOTE: In the case of engine running concerns, module-reprogramming of the PCM may be required. For this purpose, a revised software version is transferred to the PCM using WDS

Select the "Module reprogramming" submenu in the "Module programming" menu tool box and then follow the instructions.

NOTE: Following installation of a wheel/tyre combination, for which the tyre-tread circumference does not correspond to that of standard tyres, the tyre size must be changed in the powertrain control module (PCM) using WDS.

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
Select the "Programmable parameters" submenu in the "Module programming" menu tool box and enter the corresponding tyre size under the "tyre size" menu item				
P062F - EEPROM Error (Possible engine operating FMEM and/or transmission limp home or Crank non start)	Cont KOEO KOER	N	Software concern **NOTE:** It is unlikely this DTC will be displayed as there may be difficulty communicating with the PCM **NOTE:** Transmission may be in "LIMP-HOME" mode Engine may be operating in "Guard Mode" May also have a crank non-start situation	Ensure WDS 16 pin cable is in serviceable condition and latest calibrations are installed. (Confirm 16 pin cable is serviceable by running WDS diagnostics) If unable to establish communication with PCM attempt identify PCM with the TEAR TAG or PCM PART NO. If successful, ensure both the PCM and TCM are running the current software. If unable to communicate, replace the PCM. If communication to PCM is possible but communication to transmission is not possible, check condition of wiring between TCM and PCM. If unable to communicate with transmission replace the TCM and re-flash. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0634 - Internal module overheat detected	Cont KOEO KOER	N	Damaged circuitry within a module **NOTE:** Transmission may be in "LIMP-HOME" mode Engine may be operating in "Guard Mode" May also have a crank non-start situation	An internal overheat has been detected in either the PCM/TCM or PCB. Record all relevant DTCs. Identify any common theme, clear the DTCs and recheck. It may require an extended test period in an attempt to replicate as many operating conditions as possible. If DTC returns replace the relevant module and re-flash with latest software.
P0641 - Transmission sensors, incorrect voltage	Cont KOEO KOER	N	Damaged or defective wiring/connectors between the PCM and transmission multi-plug Defective TCM. **NOTE:** Transmission may be in "LIMP-HOME" mode	Check condition of wiring and connectors between the PCM and TCM Check if any other DTCs are recorded; if so attempt to identify a common theme i.e. incorrect voltage to engine sensors. If P0562 or P0563 are recorded this would indicate a concern with the charging system If incorrect voltage to a range of engine sensors is indicated, suspect PCM fault. If only DTCs indicated relates to transmission faults, suspect TCM CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0657 - Shifter supply voltage open circuit	Cont	N	Damaged or defective wiring to shifter Defective shifter PCB Defective TCM **NOTE:** Transmission may be operating in "LIMP-HOME"	Check the condition of the wiring and connections between the PCM, PCB and multi-plug connection on the transmission. Ensure relevant ground (GRND) and supply voltages (VPWR) are correct to the shifter PCB. Visually inspect the shifter PCB checking for damage or contamination. Any evidence of damage or contamination replace the PCB. Ensure the PCM and TCM are operating with the latest software calibrations. Clear all DTCs and re-test. If DTC returns, replace the PCB and re-flash with the latest calibrations Clear all DTCs and re-test. If DTC returns, replace the TCM and Main Control Valve Body. Re-flash with the latest calibration SEE NOTE RE- TCM reprogramming at the beginning of this list
P0658 - Shifter supply voltage short to ground	Cont	N	Damaged or defective wiring to shifter Defective shifter PCB Defective TCM **NOTE:** Transmission may be operating in "LIMP-HOME"	Check the condition of the wiring and connections between the PCM, PCB and multi-plug connection on the transmission. Ensure relevant ground (GRND) and supply voltages (VPWR) are correct to the shifter PCB. Visually inspect the shifter PCB checking for damage or contamination. Any evidence of damage or contamination replace the PCB. Ensure the PCM and TCM are operating with the latest software calibrations. Clear all DTCs and re-test. If DTC returns, replace the PCB and re-flash with the latest calibrations Clear all DTCs and re-test. If DTC returns, replace the TCM and Main Control Valve Body. Re-flash with the latest calibration SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0659 - Shifter supply voltage short to power	Only during TCM initialisation	N	Damaged or defective wiring to shifter Defective shifter PCB Defective TCM **NOTE:** Transmission may be operating in "LIMP-HOME"	Check the condition of the wiring and connections between the PCM, PCB and multi-plug connection on the transmission. Ensure relevant ground (GRND) and supply voltages (VPWR) are correct to the shifter PCB. Visually inspect the shifter PCB checking for damage or contamination. Any evidence of damage or contamination, replace the PCB. Ensure the PCM and TCM are operating with the latest software calibrations. Clear all DTCs and re-test. If DTC returns, replace the PCB and re-flash with the latest calibrations Clear all DTCs and re-test. If DTC returns, replace the TCM and Main Control Valve Body. Re-flash with the latest calibration. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0667 - Internal module overheat detected	Cont KOEO KOER	N	Damaged circuitry within the TCM **NOTE:** Transmission may be in "LIMP-HOME" mode Engine may be operating in "Guard Mode" May also have a crank non-start situation	An internal overheat has been detected in the TCM. Clear all DTCs and re-test. If DTC returns, replace the TCM and Main Control Valve Body. Re-flash with the latest calibration. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0701 - TCM out of range.	Cont	N	Communications error between TCM and PCM or defective TCM **NOTE:** Transmission may be in "LIMP-HOME" mode Engine may be operating in "Guard Mode" May also have a crank non-start situation	Check the condition of the wiring between the PCM and TCM multi-plug. This could be caused by multiple faults in the transmission. Record all DTCs and clear. Test vehicle and monitor with WDS, noting DTCs as they occur. Ensure TCM and PCM are operating current software If a number of PCM related DTCs are recorded, investigate and rectify these prior to replacing transmission components. If only P0701 is indicated this indicates a concern with the TCM. Replace the TCM and Main Control Valve Body. Re-flash with the latest calibration. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0705 - Shifter not registering correct position	Cont KOEO KOER	N	Defective shifter PCB Defective wiring or connections to shifter PCB Mechanical defect with shifter mechanism **NOTE:** Transmission may be operating in "LIMP-HOME"	Ensure the connections are in good condition between the shifter PCB and the gearbox multi-plug. Check and record all DTCs Check the PCB for damage, contamination or evidence of overheating Ensure all mechanical linkages are correctly adjusted. Clear all DTCs and test transmission operation. If DTC returns replace the shifter PCB. Clear all DTCs and test transmission operation. If DTC returns replace the TCM and re-flash with the latest calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0706 - Shifter PCB out of range	Cont	N	Indicates a fault with the printed circuit board (PCB) in the shifter. **NOTE:** Transmission may be operating in "LIMP-HOME"	Ensure the connections are in good condition between the shifter and gearbox. Ensure all the VPWR and GRND connections are in good condition Check the PCB for damage or evidence of overheating Note and clear all the DTCs. Retest the vehicle of the DTC returns, replace the PCB.
P0707 - Shifter low voltage input	Cont KOEO	N	Low voltage supply to shifter (PCB) (4 speed only)	Check supply voltage to PCB in shifter. Check wiring for shorts to ground.
P0708 - Shifter high voltage	Cont KOEO	N	High voltage supply to shifter (PCB) (4 speed only)	Check supply voltage to PCB in shifter. Check wiring for shorts to VPWR.
P0710 - Shifter sensing high gearbox temperature	Cont	N	Defective transmission temperature sensor. Wiring between transmission and shifter defective **NOTE:** Transmission may be operating in "LIMP-HOME"	Retrieve all stored DTCs. If P0218 is also stored this indicates a hard fault within the transmission. (Refer to P0218 diagnostics) Check condition of wiring and connectors between transmission and shifter. Ensure PCM and TCM are operating current calibrations. Monitor transmission temperature sensor (TFT) with WDS/PDS for range and performance. If P0710 DTC is stored again and the true transmission temperature is recorded as correct. This would indicate a defective PCB.

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0711 - Shifter sensing high gearbox temperature	Cont KOER	N	Defective transmission temperature sensor. Defective wiring or connections between the TCM, PCM, PCB. **NOTE:** Transmission may be operating in "LIMP-HOME"	Retrieve all stored DTCs. If P0218 is also stored this indicates a hard fault within the transmission. Refer to P0218 diagnostics before continuing. Check condition of wiring and connectors between transmission and shifter. Ensure PCM and TCM are operating current calibrations. Clear all DTCs Monitor transmission temperature sensor (TFT) with WDS/PDS for range and performance. It is recommended this test is carried out with the transmission at ambient temperature at the start of this test. If during this test, the temperature appears to "jump" and then no longer increase, this is due to the TCM substituting a stored value. P0711 will be stored again. Repeat the test to confirm and then replace the TCM and re-flash with latest calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0712 - Transmission temperature sensor outside self-test range (too low) TFT	Cont KOER	N	Improper connection; TFT sensor shorted to ground Faulty sensor. Wiring and/or connectors defective	Check condition of wiring and connectors on gearbox Monitor transmission temperature sensor (TFT) with WDS/PDS for performance Ensure PCM and TCM are running current software Clear all DTCs and re-test. If DTC returns, replace the TCM and Main Control Valve Body. Re-flash with the latest calibration. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0713 - Transmission temperature sensor outside self-test range (too high) TFT	Cont KOER	N	Improper connection; TFT sensor shorted to Vehicle Power (VPWR) or Vehicle Reference Voltage (VREF), Sensor open circuit	Check condition of wiring and connectors on gearbox Monitor transmission temperature sensor (TFT) with WDS/PDS for performance Ensure PCM and TCM are running current software Clear all DTCs and re-test. If DTC returns, replace the TCM and Main Control Valve Body. Re-flash with the latest calibration. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0714 - Transmission oil temperature sensor intermittent fault (open circuit) TFT	Cont KOER	N	Defective wiring and/or connections between PCM, TCM or shifter PCB Defective sensor or TCM	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable. Using WDS datalogger select TFT PID and carryout a wiggle test. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0715 - Turbine shaft speed sensor circuit TSS	Cont	N	Defective wiring and/or connections Defective sensor **NOTE:** Possible "LIMP-HOME" active	Check condition of wiring and connectors on gearbox Monitor turbine speed sensor (TSS) with WDS/PDS for range and performance Ensure PCM and TCM are operating current software CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0716 - Turbine speed sensor operating outside range TSS	Cont	N	Defective wiring between PCM and TCM Defective TCM module Incorrect software installed Defective sensor **NOTE:** Possible "LIMP-HOME" active	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0717 - No turbine speed sensor	Cont	N	Defective wiring between PCM and TCM (TSS open circuit or ground) Defective TCM module **NOTE:** Transmission may be operating in "LIMP-HOME"	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0718 - Turbine shaft speed sensor circuit intermittent fault TSS		N	Defective wiring and/or connections Defective sensor	Check condition of wiring and connectors on gearbox Monitor turbine speed sensor (TSS) with WDS/PDS for performance Multiple intermittent transmission DTCs indicating a loose connection in the circuit. Use a wiggle test for a general connection test. Select a range of transmission signals TSS, SS1, SS2, TR, TFT etc. Using WDS datalogger monitor the signals and gently shake the wiring loom, particularly near connectors or where the wire is routed through an angle. Variations in the signals would indicate the area of defective wiring. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0720 - Output shaft speed sensor circuit	Cont	N	Defective wiring between PCM and TCM Defective TCM module Defective sensor **NOTE:** Possible "LIMP-HOME" active	Check condition of wiring and connectors on gearbox Compare output shaft speed sensor speed to wheel speed sensor speed. REFER to Section 206-09A. CLEAR ALL DTCs. TEST the system for normal operation. Carry out a drive cycle test. This fault can cause noticeable harsh gearshifts Monitor VSS, TSS, OSS and RPM with WDS datalogger CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0721 - Output shaft speed sensor circuit range	Cont	N	Defective wiring between PCM and TCM Defective TCM module Defective sensor **NOTE:** Possible "LIMP-HOME" active	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select OSS PID and check PID parameters. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0722 - Output shaft speed sensor circuit no signal	Cont	N	Defective wiring between PCM and TCM Defective TCM module Defective sensor **NOTE:** Possible "LIMP-HOME" active	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select OSS PID and check the PID parameters. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0723 - Intermittent signal from transmission output shaft (OSS)	Cont	N	Defective wiring between PCM and TCM Defective TCM module Defective sensor	Check condition of wiring and connectors on gearbox Monitor the output shaft speed (OSS) signal with WDS/PDS for performance Multiple intermittent transmission DTCs indicate a loose connection in the circuit. Use a wiggle test for a general connection test. Select a range of transmission signals TSS, SS1, SS2, TR, TFT etc. Using WDS datalogger monitor the signals and gently shake the wiring loom, particularly near connectors or where the wire is routed through an angle. Variations in the signals would indicate the area of defective wiring. A road test may produce better results looking for multiple intermittent DTCs CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0729 - 6th Gear incorrect ratio	Cont	N	Fluid contamination within the transmission Incorrect calibrations PCM/TCM Incorrect torque converter fitted Mechanical defects with clutch packs Contaminated or defective TCM / solenoids	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. If there is no apparent contamination in the transmission and other DTCs are stored relating to sensor reading or solenoid actuation, investigate these first. Typical DTCs P0658, P0715, P0721 etc Ensure the PCM and TCM are operating on current calibrations Ensure the VID details are correct If the transmission has been replaced it is vitally important the torque converter is the correct one for the engine/transmission combination. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new transmission.
P0731 - 1st Gear incorrect ratio	Cont	N	Fluid contamination within the transmission Incorrect calibrations PCM/TCM Incorrect torque converter fitted Mechanical defects with clutch packs Contaminated or defective TCM / solenoids	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. If there is no apparent contamination in the transmission and other DTCs are stored relating to sensor reading or solenoid actuation, investigate these first. Typical DTCs P0658, P0715, P0721 etc Ensure the PCM and TCM are operating on current calibrations Ensure the VID details are correct If the transmission has been replaced it is vitally important the torque converter is the correct one for the engine/transmission combination. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new transmission.

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0732 - 2nd Gear incorrect ratio	Cont	N	Fluid contamination within the transmission Incorrect calibrations PCM/TCM Incorrect torque converter fitted Mechanical defects with clutch packs Contaminated or defective TCM / solenoids	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. If there is no apparent contamination in the transmission and other DTCs are stored relating to sensor reading or solenoid actuation, investigate these first. Typical DTCs P0658, P0715, P0721 etc Ensure the PCM and TCM are operating on current calibrations Ensure the VID details are correct If the transmission has been replaced it is vitally important the torque converter is the correct one for the engine/transmission combination. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new transmission.
P0733 - 3rd Gear incorrect ratio	Cont	N	Fluid contamination within the transmission Incorrect calibrations PCM/TCM Incorrect torque converter fitted Mechanical defects with clutch packs Contaminated or defective TCM / solenoids	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. If there is no apparent contamination in the transmission and other DTCs are stored relating to sensor reading or solenoid actuation, investigate these first. Typical DTCs P0658, P0715, P0721 etc Ensure the PCM and TCM are operating on current calibrations Ensure the VID details are correct If the transmission has been replaced it is vitally important the torque converter is the correct one for the engine/transmission combination. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new transmission.

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0734 - 4th Gear incorrect ratio	Cont	N	Fluid contamination within the transmission Incorrect calibrations PCM/TCM Incorrect torque converter fitted Mechanical defects with clutch packs Contaminated or defective TCM / solenoids	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. If there is no apparent contamination in the transmission and other DTCs are stored relating to sensor reading or solenoid actuation, investigate these first. Typical DTCs P0658, P0715, P0721 etc Ensure the PCM and TCM are operating on current calibrations Ensure the VID details are correct If the transmission has been replaced it is vitally important the torque converter is the correct one for the engine/transmission combination. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new transmission.
P0735 - 5th Gear incorrect ratio	Cont	N	Fluid contamination within the transmission Incorrect calibrations PCM/TCM Incorrect torque converter fitted Mechanical defects with clutch packs Contaminated or defective TCM / solenoids	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. If there is no apparent contamination in the transmission and other DTCs are stored relating to sensor reading or solenoid actuation, investigate these first. Typical DTCs P0658, P0715, P0721 etc Ensure the PCM and TCM are operating on current calibrations Ensure the VID details are correct If the transmission has been replaced it is vitally important the torque converter is the correct one for the engine/transmission combination. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new transmission.

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0736 - Reverse Gear incorrect ratio	Cont	N	Fluid contamination within the transmission Incorrect calibrations PCM/TCM Incorrect torque converter fitted Mechanical defects with clutch packs Contaminated or defective TCM / solenoids	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. If there is no apparent contamination in the transmission and other DTCs are stored relating to sensor reading or solenoid actuation, investigate these first. Typical DTCs P0658, P0715, P0721 etc Ensure the PCM and TCM are operating on current calibrations Ensure the VID details are correct If the transmission has been replaced it is vitally important the torque converter is the correct one for the engine/transmission combination. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new transmission.
P0740 - Torque converter solenoid open circuit	Cont KOER	N	Defective wiring and/or connections to transmission multi-plug. (Would normally be multiple DTCs stored) If only P0740 stored, suspect defective wiring within transmission or defective sensor	Check the wiring and connections on the transmission loom. If multiple DTCs present carryout a wiggle test. Select a range of transmission signals TSS, TCC, SS2, TR, TFT etc. Using WDS datalogger monitor the signals and gently shake the wiring loom, particularly near connectors or where the wire is routed through an angle. Variations in the signals would indicate the area of defective wiring. If P0740 only is stored, clear the DTC. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE-TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0741 - Torque converter lock-up clutch (TCC) not working	Cont	N	Defective torque converter Defective torque converter lock-up clutch solenoid.	Check the wiring and connections on the transmission loom. Check the operation of the torque converter lock-up clutch (TCC) under road-test conditions with WDS/PDS A simple check for TCC mechanical operation during a road test. Monitor the TCC with WDS datalogger until it indicates a lock-up. Gently touch the brake pedal just enough to illuminate the brake lights. This initiates the TCC disengagement. At this point the engine RPM momentarily increases and then returns to its original speed. If this does not take place, it would indicate a mechanical defect with the TCC Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. It is recommended the transmission is replaced, including the torque converter and the transmission cooling system is cleaned. If there is no evidence of mechanical concerns within the transmission, clear the DTC. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0743 - Torque converter lock-up clutch solenoid defective	Cont	N	Defective or damaged wiring to the TCC solenoid. Defective TCC solenoid	Check the condition of the wiring and connections to the transmission multi-plug Check the operation of the torque converter lock-up clutch solenoid under road-test conditions with WDS/PDS CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0751 - Shift solenoid A stuck off	Cont	N	Defective solenoid.	Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSA/SS1) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0752 - Shift solenoid A stuck on	Cont	N	Defective solenoid.	Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSA/SS1) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0753 - Shift solenoid A, circuit fault	Cont KOEO	N	Defective or damaged wiring to the shift solenoid. Defective solenoid Defective TCM	Check the wiring and connections on the transmission loom Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSA/SS1) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0756 - Shift solenoid B stuck off	Cont	N	Defective solenoid.	Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSA/SS2) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0757 - Shift solenoid B stuck on	Cont	N	Defective solenoid.	Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSA/SS2) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0758 - Shift solenoid B circuit fault	Cont KOEO	N	Defective or damaged wiring to the shift solenoid. Defective solenoid Defective TCM	Check the wiring and connections on the transmission loom Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSA/SS2) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0761 - Shift solenoid C stuck off	Cont	N	Defective solenoid.	Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSA/SS3) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0762 - Shift solenoid C stuck on	Cont	N	Defective solenoid.	Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSC/SS3) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0763 - Shift solenoid C circuit fault	Cont KOEO	N	Defective or damaged wiring to the shift solenoid. Defective solenoid Defective TCM	Check the wiring and connections on the transmission loom Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSC/SS3) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0768 - Shift solenoid D circuit fault	Cont KOEO	N	Defective or damaged wiring to the shift solenoid. Defective solenoid Defective TCM	Check the wiring and connections on the transmission loom Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSC/SS4) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0770 - Shift solenoid E circuit fault	Cont	N	Defective or damaged wiring to the shift solenoid. Defective solenoid Defective TCM	Check the wiring and connections on the transmission loom Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSC/SS5) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0773 - Shift solenoid E circuit fault	Cont	N	Defective or damaged wiring to the shift solenoid. Defective solenoid Defective TCM	Check the wiring and connections on the transmission loom Carry out preliminary transmission condition checks Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Monitor solenoid operation with WDS/PDS. (SSC/SS5) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0781 - 1-2 shift	Cont	N	Internal fault with transmission Damaged or defective clutch packs Defective TCM Incorrect TCM/PCM software, including VID parameters Incorrect torque converter fitted	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01. If during this check a high level of contamination is evident, suspect internal gearbox failure. Check the PCM and TCM are operating on current software, including VID parameters. If a new torque converter has been fitted, ensure it is the correct specification CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new Transmission.
P0782 - 2-3 shift	Cont	N	Internal fault with transmission Damaged or defective clutch packs Defective TCM Incorrect TCM/PCM software, including VID parameters Incorrect torque converter fitted	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01. If during this check a high level of contamination is evident, suspect internal gearbox failure. Check the PCM and TCM are operating on current software, including VID parameters. If a new torque converter has been fitted, ensure it is the correct specification CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new Transmission.

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0783 - 3-4 shift	Cont	N	Internal fault with transmission Damaged or defective clutch packs Defective TCM Incorrect TCM/PCM software, including VID parameters Incorrect torque converter fitted	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01. If during this check a high level of contamination is evident, suspect internal gearbox failure. Check the PCM and TCM are operating on current software, including VID parameters. If a new torque converter has been fitted, ensure it is the correct specification CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new Transmission.
P0784 - 4-5 shift	Cont	N	Internal fault with transmission Damaged or defective clutch packs Defective TCM Incorrect TCM/PCM software, including VID parameters Incorrect torque converter fitted	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01. If during this check a high level of contamination is evident, suspect internal gearbox failure. Check the PCM and TCM are operating on current software, including VID parameters. If a new torque converter has been fitted, ensure it is the correct specification CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new Transmission.
P0801 - Reverse inhibit control circuit	Cont	N	Defective or damaged wiring to the reverse inhibit solenoid Defective solenoid Defective TCM	Check condition of wiring and connectors to the transmission Monitor solenoid operation with WDS/PDS. (If available) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0812 - Reverse gear in-put circuit	Cont	N	Damaged or defective wiring and/or connections. Defective reversing lamps. (Reversing lights may be illuminated in forward gears)	Check the condition of the wiring to the transmission - particular attention to shorts to ground or VPWR. Check the condition of the wiring to the rear lamps (Check the reversing light relay has not failed) CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0826 - Sport shift performance concerns	Cont	N	Wiring between shifter printed circuit board (PCB) and TCM defective or damaged. Incorrect software programmed TCM/PCM PCM parameters incorrect i.e. tyre size, axle ratio etc Defective shifter mechanism Defective PCB Defective TCM Defective PCM	Check the correct parameters are programmed into the PCM including the VID. Check the condition of the wiring between the PCB, TCM and PCM. Check the mechanical operation of the shifter Ensure the latest calibrations are installed in all modules. SEE NOTE RE- TCM reprogramming at the beginning of this list For additional checks refer to SECTIONS 307-05
P0827 - Sport shift performance concerns	Cont	N	Wiring to the shifter printed circuit board (PCB) shorted to ground. Defective PCB	Check the wiring to the PCB for correct power supply and ground connections. Check the operation of the shifter mechanism Inspect the PCB for evidence of damage or contamination. For additional checks refer to SECTIONS 307-05
P0829 - 5-6 shift	Cont	N	Internal fault with transmission Damaged or defective clutch packs Defective TCM Incorrect TCM/PCM software, including VID parameters Incorrect torque converter fitted	Carry out a transmission level and condition check: refer to section AUTOMATIC TRANSMISSION - FLUID LEVEL CHECK - 307-01 If during this check a high level of contamination is evident, suspect internal gearbox failure. Check the PCM and TCM are operating on current software, including VID parameters. If a new torque converter has been fitted, ensure it is the correct specification CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new Transmission.

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0960 - Pressure Control Solenoid A Control Circuit / Open	Cont	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select PC_A PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0962 - Pressure Control Solenoid A Control Circuit Low	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select PC_A PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0963 - Pressure Control Solenoid A Control Circuit High	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select PC_A PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0972 - Shift Solenoid A Control Circuit Range/ Performance	Cont	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_A (or SS1) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0973 - Shift Solenoid A Control Circuit Low	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_A (or SS1) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0974 - Shift Solenoid A Control Circuit High	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_A (or SS1) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0975 - Shift Solenoid B Control Circuit Range/ Performance	Cont	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_B (or SS2) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0976 - Shift Solenoid B Control Circuit Low	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_B (or SS2) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0977 - Shift Solenoid B Control Circuit High	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_B (or SS2) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0978 - Shift Solenoid C Control Circuit Range/ Performance	Cont	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_C (or SS3) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0979 - Shift Solenoid C Control Circuit Range/ Performance	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_C (or SS3) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0980 - Shift Solenoid C Control Circuit High	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_C (or SS3) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0981 - Shift Solenoid D Control Circuit Range/ Performance	Cont	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_D (or SS4) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0982 - Shift Solenoid D Control Circuit Low	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_D (or SS4) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0983 - Shift Solenoid D Control Circuit High	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_D (or SS4) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P0985 - Shift Solenoid E Control Circuit Low	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_E (or SS5) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P0986 - Shift Solenoid E Control Circuit High	Cont KOER	N	Defective wiring or connections to the transmission multi-plug Defective TCM/valve body assembly Defective solenoid	Check condition of wiring to multi-plug on the transmission ensuring all power (VPWR) and ground (GRND) connections are serviceable Using WDS select SS_E (or SS5) PID (if available) and monitor signal. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P1707 - Transmission range sensor not indicating P or N during self test	Cont	N	Gear selector not in P or N during self test. Selector cables incorrectly adjusted Defective wiring or connections between transmission range (TR) sensor and PCM Defective TR sensor	Check gear selector cables are correctly fitted and adjusted KOEO/KOER and follow instructions as per WDS Check wiring and connections between PCB, TCM and PCM (If there is a fault with the TR sensor, there may be other TR related DTCs stored.)
P1910 - Reverse lamp control circuit / open	Cont	N	Defective wiring in the reverse lamp circuit Defective reverse lamp relay Damaged or defective wiring to connector C-14 on transmission.	Check the condition of the reversing lamp wiring including the reverse lamp relay and reverse lamp fuse. Check the condition of the wiring to the transmission multi-plug including all ground, VPWR and ignition supplies. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. **NOTE:** ALL PRELIMINARY CHECKS MUST HAVE BEEN COMPLETED CORRECTLY BEFORE REPLACING THE TCM AND VALVE BODY
P1911 - Reverse lamp control circuit short to ground	Cont	N	Defective wiring in the reverse lamp circuit Defective reverse lamp relay Damaged or defective wiring to connector C-14 on transmission.	Check the condition of the reversing lamp wiring including the reverse lamp relay and reverse lamp fuse. Check the condition of the wiring to the transmission multi-plug including all ground, VPWR and ignition supplies. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. **NOTE:** ALL PRELIMINARY CHECKS MUST HAVE BEEN COMPLETED CORRECTLY BEFORE REPLACING THE TCM AND VALVE BODY

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P1912 - Reverse lamp control circuit short to VPWR	Cont	N	Defective wiring in the reverse lamp circuit Defective reverse lamp relay Damaged or defective wiring to connector C-14 on transmission.	Check the condition of the reversing lamp wiring including the reverse lamp relay and reverse lamp fuse. Check the condition of the wiring to the transmission multi-plug including all ground, VPWR and ignition supplies. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. **NOTE:** ALL PRELIMINARY CHECKS MUST HAVE BEEN COMPLETED CORRECTLY BEFORE REPLACING THE TCM AND VALVE BODY
P1934 - Incorrect VSS signal	Cont	N	Communication error between VSS, PCM and TCM Damaged VSS (Possible ABS DTCs also recorded)	Retrieve all DTCs. Note all VSS related DTCs. If there are a range of VSS related DTCs i.e. to the Instrument Cluster (IC) or PCM. This would indicate a corrupted signal at source. (Suspect ABS concern) Ensure all modules are operating on correct software and VID details are correct. Carryout a NETWORK test and rectify any DTCs recorded Monitor VSS signal with WDS datalogger. If VSS is correctly recording on WDS suspect communication error to TCM CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P2762 - Torque Converter Clutch Pressure Control Solenoid Control Circuit low current	Cont KOER	N	Defective torque converter Defective wiring/connectors between PCM and TCM (normally indicated with multiple DTCs) Defective TCM Defective solenoid	Ensure the battery and charging system is operating correctly. Check the operation of the torque converter lock-up clutch under road-test conditions with WDS/PDS Check the wiring and connections on the transmission loom. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
P2763 - Torque Converter Clutch Pressure Control Solenoid Control Circuit High	Cont KOER	N	Defective torque converter Defective wiring/connectors between PCM and TCM (normally indicated with multiple DTCs) Defective TCM Defective solenoid	Check the operation of the torque converter lock-up clutch under road-test conditions with WDS/PDS Check the wiring and connections on the transmission loom. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
P2764 - Torque Converter Clutch Pressure Control Solenoid Control Circuit low	Cont KOER	N	Defective torque converter Defective wiring/connectors between PCM and TCM (normally indicated with multiple DTCs) Defective TCM Defective solenoid	Retrieve all DTCs and try and identify a common theme i.e. low voltage to a range of actuators. Check the wiring and connections on the transmission loom. Ensure all VPWR, ignition and GRND supplies are correct Check the operation of the torque converter lock-up clutch under road-test conditions with WDS/PDS CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
U0073 - CAN bus error	Cont	N	Defective wiring between the PCM and TCM (normally indicated with multiple DTCs) Defective TCM	Check the wiring and connections between the PCM and transmission connection. Particular attention should be given to the connection on the transmission. If stored with multiple DTCs, attempt to identify a common theme and which module they are associated with. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets and you have access to a break out box (BOB). Check the resistance across pins 2 and 6. Resistance is a nominal 40k Ω(±10%). (0Ω indicates short circuit, Infinity indicates, open circuit) If you do not have access to a BOB and the DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
U0100 - CAN error	Cont KOEO KOER	N	Defective wiring between the PCM and TCM (normally indicated with multiple DTCs) Defective PCM	Check the wiring and connections between the PCM and transmission connection. If stored with multiple DTCs, attempt to identify a common theme and which module they are associated with. CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, replace the relevant module and re-flash all modules with latest calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
U0121 - Lost Communication With Anti-Lock Brake System (ABS) Control Module	Cont KOEO KOER	N	Defective wiring or connections between ABS, PCM, IC, BEM and TCM	Carryout network test with WDS Check condition of wiring and connectors between ABS, PCM, IC, BEM and TCM modules. This DTC may be recorded with multiple ABS DTCs CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, replace the relevant module and re-flash all modules with latest calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
U0155 - Lost Communication With instrument cluster	Cont KOEO KOER	N	Defective wiring or connections between ABS, PCM, IC, BEM and TCM	Carryout network test with WDS Check condition of wiring and connectors between ABS, PCM, IC, BEM and TCM modules. This DTC may be recorded with multiple instrument cluster DTCs CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, replace the relevant module and re-flash all modules with latest calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list
U301 - TCM incorrect communication with other modules	Cont	N	Incorrect software programmed in to TCM Incorrect TCM fitted	Ensure the PCM, TCM, BEM; ABS and IC are correctly programmed with the latest calibrations.
U2050 - Incorrect strategy (TCM)	Set during Re-flash proced-ure	N	TCM programmed strategy does not fit vehicle specification.	Ensure latest software is programmed in all modules Ensure the VID data is correctly programmed CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, install a new TCM and Main Control Valve Body. Re-flash module with current calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

DIAGNOSIS AND TESTING (Continued)

DTC (PID)	Condition Cont KOEO KOER	MIL ON Y/N	Possible Cause	Diagnostic procedures
U2051 - Incorrect calibration (TCM)	Set during Re-flash proced-ure	N	TCM calibration outside parameters or unable to communicate correct data	Ensure latest software is programmed in all modules CLEAR ALL DTCs. TEST the system for normal operation. If DTC resets, replace the relevant module and re-flash all modules with latest calibrations. SEE NOTE RE- TCM reprogramming at the beginning of this list

General Notes with reference to DTCs with a "U" pre-fix
DTCs with a "U" pre-fix indicate a communication error.

When using WDS you may run a complete self-test which records a number of "U" codes. Example U0301 TCM communication with other modules. Most of the diagnostic procedures within the PCM are generic; therefore the PCM will "look" for the TCM during a KOEO test, even though the vehicle is fitted with a manual transmission, hence the stored DTC. DTCs of this nature do affect the normal operation of the vehicle.

Most "U" codes are associated with incorrect software programming or, more commonly, the signal being corrupted between modules due to wiring or connection problems.

"U" codes can also occur during module reprogramming. WDS should clear these codes when reprogramming is complete. WDS fails to do this, it indicates there is a "hard" fault with the system However if a module is suspected one of the easiest ways to identify the area of the concern is to use the out-put state control (OSC) function on WDS datalogger.

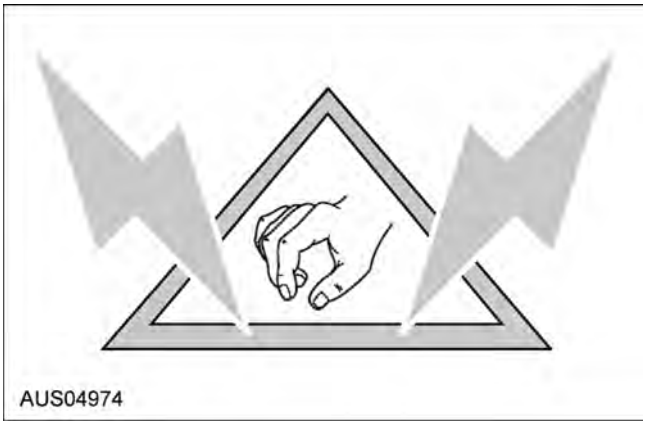
The OSC is identified with a # symbol.
Example: A customer complaining of an erratic tacho (RPM) gauge

- Select WDS datalogger
- Select IC (instrument cluster)
- Select TACHO#
- Select the # key on the right-hand side of WDS screen
- Below this button another 3 buttons will appear, one a finger pressing a button, the next a + sign and the third a - sign
- Press the finger button, then press the + sign. The RPM gauge will then start to sweep across the gauge.
- Further presses of this button will cause the gauge to travel further
- If as the gauge moves it can be seen to fluctuate, this would indicate a fault with the gauge itself. If it produces a smooth movement, it would indicate a communication error between the PCM and the IC.

DIAGNOSIS AND TESTING

Transmission Link Harness Electrical Connector Layout

Electrostatic Discharge (ESD)



⚠ CAUTION: When working with the transmission control module (TCM) and main control valve body, all suitable safety precautions must be taken to protect the component against electrostatic discharge (ESD). Failure to follow these instructions may result in component damage.

Make sure all possible safety precautions are taken to protect the TCM and main control valve body unit against ESD.

Personal Wrist-Band Earthing

Earthing (grounding) by means of a wrist band or strap is the most reliable method of diverting electrostatic charges away from working personnel, and should therefore be used wherever possible, particularly if the person concerned is working while seated. The wrist band earthing (grounding) device consists of a bracelet closely attached to the wrist and a spiral earthing (grounding) cable connecting it to the earthing (grounding) contact point. This system must include a quick-release device so that the wrist can be released in the event of danger.

Shoes and Foot Earthing Straps

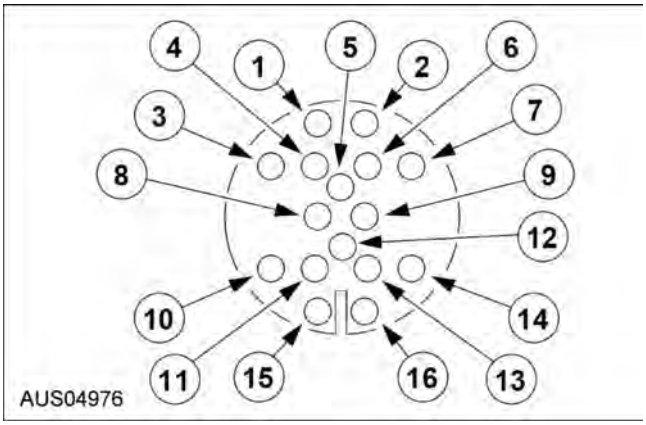
Electrically conductive shoes should be worn by persons who mainly work standing up or either standing or sitting in ESD protection zones, particularly if wrist band earthing (grounding) is impracticable. The standard calls for ESD shoes to record values between 0 and 35 Mega-ohms (MOhm) resistance. However, for antistatic working shoes resistance values between 0.1 and 1000 MOhm are called for, and a through-conducting resistance for protective shoes of 0.1 to 100 MOhm. A lower limit value of not less than 0.1 MOhm must be maintained on account of the contact voltage risk. For this reason the minimum value has been set contrary to the standard at the higher figure of 0.75 MOhm.

Transmission Link Harness Electrical Connector Layout

⚠ CAUTION: When working with the transmission control module (TCM) and main control valve body, all suitable safety precautions must be taken to protect the component against electrostatic discharge.

⚠ CAUTION: Do not carry out any electrical tests on the TCM and main control valve body. Failure to follow these instructions may result in component damage.

⚠ CAUTION: Make sure all suitable safety precautions are taken to protect the transmission control module (TCM) and main control valve body electrical connector pins against electrostatic discharge.



Loom Connector View

Pin Number	Description
1	M Gate
2	CAN Low
3	Diagnostic K-line
4	TIP -
5	TIP +
6	CAN High
7	UDRMV
8	Not used
9	Ignition Supply
10	Park/Neutral Signal
11	Not used
12	Not used
13	Ground
14	Power supply +V
15	Reverse Light
16	Ground

DIAGNOSIS AND TESTING (Continued)

⚠ CAUTION: When working with the transmission control module (TCM) and main control valve body, all suitable safety precautions must be taken to protect the component against electrostatic discharge.

⚠ CAUTION: Do not carry out any electrical tests on the TCM and main control valve body. Failure to follow these instructions may result in component damage.

The hydraulic module contains one solenoid valve. The solenoid valve is actuated by the TCM and has two positions (open or closed); it is used to switch the position valve.

There are six electronic pressure control valves, these convert an electric current into a proportional hydraulic pressure. They are energised by the TCM and actuate the valves belonging to the relevant switching elements.

Two types of electronic pressure regulator are installed:

1. Pressure regulator with a rising characteristic (1,3,6 green cap) i.e. as current increases pressure increases (0mA = 0 bar / 700mA = 4.6 bar)
2. Pressure regulator with a falling characteristic (2,4,5 black cap) i.e. as current increases the pressure drops (0 mA = 4.6 bar / 700 mA = 0 bar)

Both types of regulator have a resistance value of approximately 5 Ohms at 20°C.

Solenoid Application Chart

Selected Gear	Solenoids Activated During Selected Gear						
	SV1	PR1	PR2	PR3	PR4	PR5	PR6
D1	-	*	-	-	*	*	*
D2	-	*	-	*	-	*	*
D3	-	*	*	-	-	*	*
D4	*	*	-	-	*	*	*
D5	*	-	*	-	*	*	*
D6	*	-	-	*	*	*	*

* SV1: Solenoid valve
* PR1: Clutch A
* PR2: Clutch B
* PR3: Clutch C
* PR4: Clutch D& E
* PR5: System Pressure
* PR6: Torque Converter Clutch

DIAGNOSIS AND TESTING (Continued)

Clutch Application Chart

Transmission State	Clutch/Clutches Applied During Selected Gear					
	A	B	C	D	E	CC
D1	*	-	-	*	-	*
D2	*	-	*	-	-	*
D3	*	*	-	-	-	*
D4	*	-	-	-	*	*
D5	-	*	-	-	*	*
D6	-	-	*	-	*	*
P	-	-	-	*	-	-
R	-	*	-	*	-	-
N	-	-	-	*	-	-

System inputs and outputs

System inputs

The TCM uses the permanent voltages supply to support and to maintain data in the random access memory (RAM). (Pin 14)

The TCM receives a "wake-up" signal from the ignition relay via pin 9. Once awake the TCM commences its initialisation sequence. This input is not a power supply input to the TCM. For initialisation to commence the ignition must be switched to the "II" position and VBAT above 9V but below 16V (30ms after ignition signal on, the initialisation of the TCM starts). Initialisation time is 500ms max. When initialisation is finished, the Drive Program is started and TCM has full functionality.

The TCM has one internal solenoid ground for all internal solenoids (SV and PR).

This internal input acts as the ground for position switch. The TCM requires two vehicle ground supplies, (pins 13 and 16 respectively). Both ground wires are linked to one grounding point on the vehicle. The TCM incorporates polarity reversal protection.

System outputs

The P/N signal (from the internal position sensor) is used to ensure that the engine is only started with the transmission gear selector in either the Park or Neutral position. When the selector is in either Park or Neutral this output is activated. This in turn closes a relay that allows the starter to be engaged if allowed by the Engine management system. If this output fails the electronic engine controls system uses a CAN bus signal supplied by the TCM to allow the engine to start.

Transmission control

The selector lever can be used to engage Park through to drive (D) mechanically. The link between the lever and the transmission is by a cable.

The manual side of the shifter, 1 through to position 6 are selected electronically by the CAN bus.

Integrated with this are functions for gear selected illumination, brake shift interlock and keylock interlock system. For additional information, REFER to Section 307-05.

GENERAL PROCEDURES

Transmission fluid level check

The fluid level check is of vital importance. Under-filling or over-filling the transmission adversely affects the vehicle performance and can result in damage to the transmission.

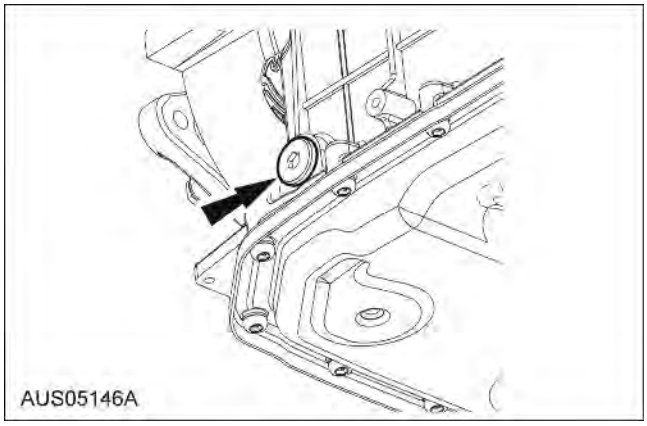
Never operate a transmission with an incorrect fluid level.

Special Tool(s)

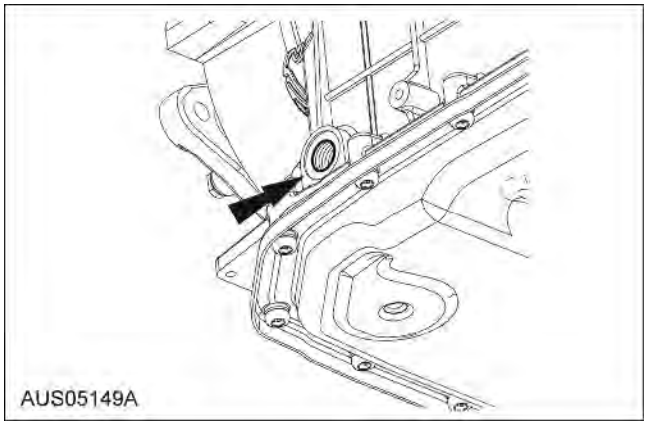
 SST418-FS317	**Integrated Diagnostic System (IDS)** --

1. Place the vehicle on a suitable lifting device. For additional information, refer to: Lifting (100-02, DESCRIPTION AND OPERATION).
2. The following steps must be observed before starting the transmission fluid level checks
   - The vehicle must be horizontal when the fluid is checked
   - The parking brake must be firmly applied
   - The engine should have been running for 2 minutes with the transmission selector in position "P"
3. Connect WDS and select the "TFT" (transmission fluid temperature) PID
4. Ensure the transmission shifter is in the **P** position
5. Check the transmission fluid temperature and ensure it is at or below 30°C
6. With the engine running and the footbrake firmly applied, circulate the fluid through the transmission this is achieved by:
   - Moving the transmission selector to the "R" position
   - Wait 3 seconds
   - Moving the transmission selector to the "D" position
   - Wait 3 seconds
   - Moving the transmission selector to the "S" position and select 2nd
   - Wait 3 seconds
   - Moving the transmission selector to the "D" position
   - Wait 3 seconds
   - Moving the transmission selector to the "R" position
   - Wait 3 seconds
   - Moving the transmission selector to the "P" position
7. Raise and support the vehicle
8. Place a suitable container under the transmission fluid filler plug

   WARNING: Make sure care is taken when near rotating parts. Failure to follow this instruction may result in personal injury.
9. With the engine running and the TFT indicating between 30°C and 50°C, remove and discard the oil filler plug and seal.



10. If the fluid level is correct it should just run from the bottom of the oil level hole.



11. If there is insufficient fluid in the transmission fluid, top up the level through the oil level hole using 250mls (0.25 litre) at a time, until the fluid runs slowly from the bottom.
    If more than 500mls (0.5 litres) is required. Temporarily refit the oil level plug repeat the process from point 5 to ensure correct temperature and full fluid circulation.
    NOTE: The transmission fluid temperature must not exceed 50°C during this procedure. If it does exceed 50°C, stop the transmission fluid level check and allow the transmission to cool to below 30°C.
12. Fit a new transmission level plug to the correct specified torque (35Nm). Failure to tighten to the specified torque can result in damage to the transmission.

GENERAL PROCEDURES

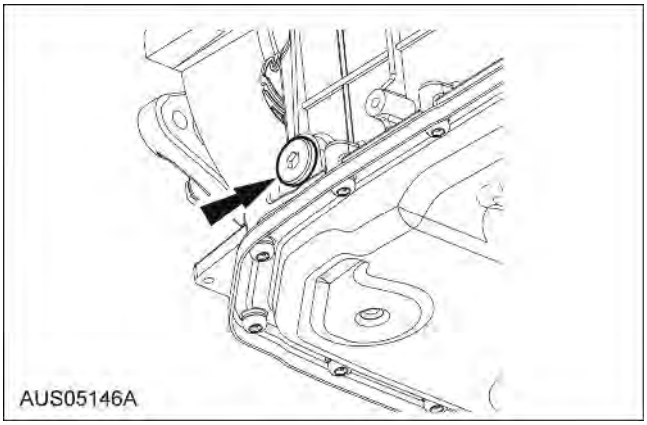
Transmission Fluid Drain and Refill/ Oil Pan & Oil Pan Gasket Replacement

Special Tool(s)

 SST418-FS317	**Integrated Diagnostic System (IDS)** --

Drain

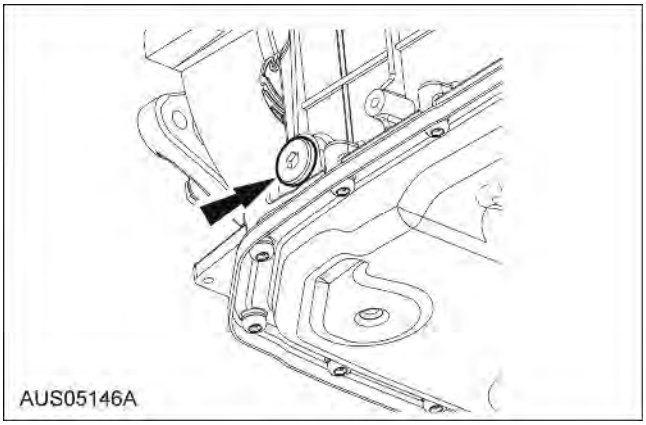
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
2. Raise and support the vehicle. For additional information, refer to: Lifting (100-02, DESCRIPTION AND OPERATION).
3. Place a suitable container under the transmission.
4. Remove and discard the oil level filler plug
   NOTE: If an internal problem is suspected, drain the transmission fluid through a paper filter. A small amount of metallic particles may be found from normal wear. However, if excessive metallic particles are present, internal inspection may be required.



5. Loosen oil pan retaining bolts and drain transmission fluid
6. Remove retaining bolts, drain remaining fluid from pan.
7. Discard the oil pan gasket.
8. Remove the oil filter from the transmission. Remove and replace the 'O'-Ring on the filter stub pipe. Refit the filter into the transmission.
9. Clean the oil pan, magnets and the transmission and oil pan mating surfaces.
10. Place the magnets in the pan as shown, refit the oil pan using a new fibre gasket and hand tighten the 21 retaining bolts.
11. Tighten the bolts to 12Nm, working in turn around the pan.
12. Recheck all retaining bolts are tightened to 12Nm.

Refill

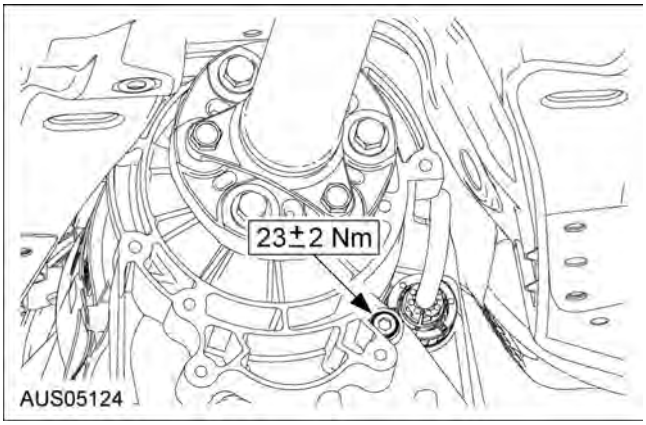
1. Fill the transmission with **8 litres** of transmission fluid through the transmission fluid filler plug hole. Refer to Specifications, at the beginning of this chapter, for correct Transmission Fluid Specification.



2. Carry out a transmission fluid level check. For additional information, refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle, GENERAL PROCEDURES).
3. Lower the vehicle
4. Connect the battery ground cable. For additional information, refer to Section 414-01.

Parking lock seal

1. Apply the parking brake (If using a four post ramp it is recommended a brake depressor is also utilised)
2. Raise and support the vehicle. For additional information, refer to: Lifting (100-02, DESCRIPTION AND OPERATION)
3. Ensure the ignition is off and the shifter is in the Neutral (N) position.
4. Remove and discard the screw plug and sealing ring



5. Ensure the sealing face and threads are in good condition.

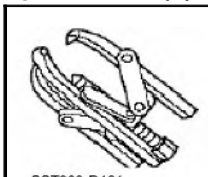
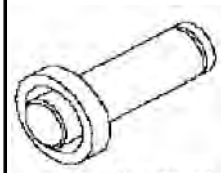
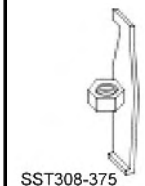
GENERAL PROCEDURES (Continued)

6. Fit the new plug and seal to the correct torque 23 Nm
7. Carry out a transmission fluid level check. For additional information, refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle, GENERAL PROCEDURES).

GENERAL PROCEDURES

Output shaft seal

Special Tool(s)

 SST303-D121	**Crankshaft Damper Remover 303-D121**
 SST205-053	**Output Shaft Flange Holding Tool 205-053**
 SST204-264	**Pinion Seal Replacer 204-264**
 SSTHTJ1200-2	**Powertrain Assembly Jack HTJ1200-2**
 SST308-375	**Seal Remover Input and Output 308-375**
 SST100-012	**Slide Hammer 100-012**
 SST100-012-01	**Slide Hammer Adapter 100-012-01**

Special Tool(s)

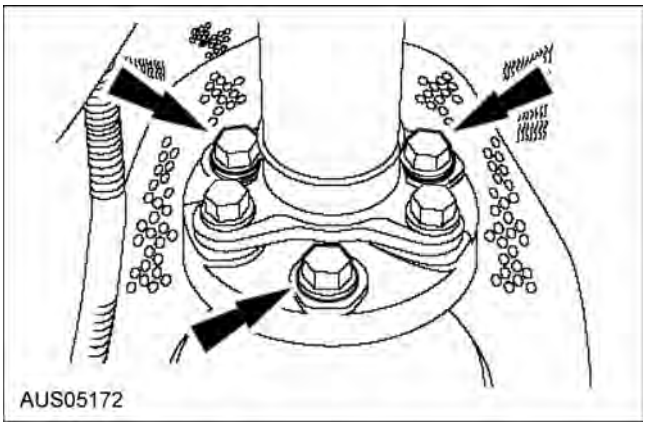
 SST205-789	**Socket Output Flange Remover/Installer 205-789**

CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft. Failure to follow this instruction may result in damage to the vehicle.

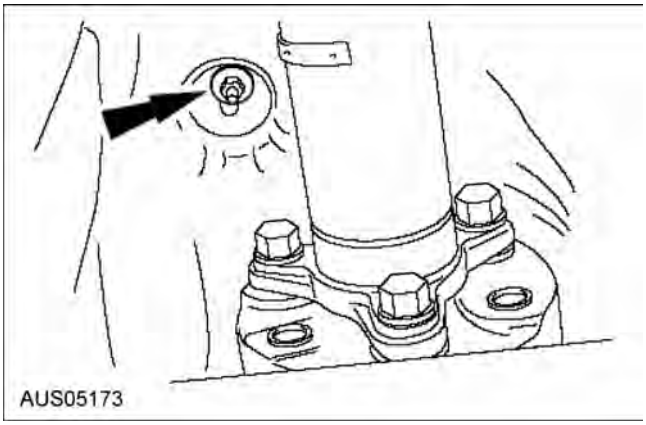
CAUTION: Make sure the front of the driveshaft does not put an excessive load on the centre bearing. Failure to follow this instruction may result in damage to the vehicle.

Removal

1. Mark the position of the driveshaft in relation to the transmission flange.
2. Mark the position of each bolt in relation to the transmission flexible joint.


AUS05172

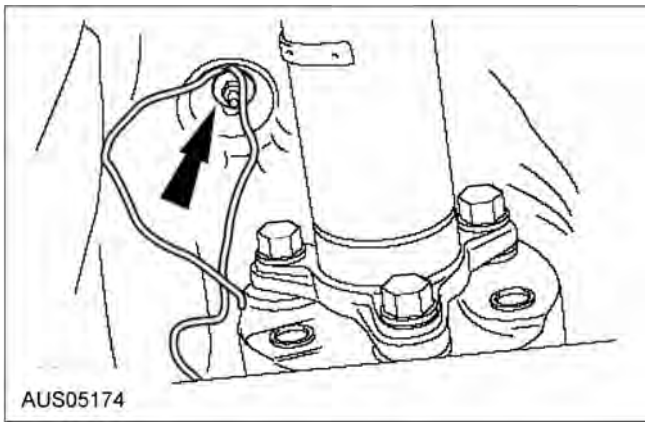
3. Loosen the heat shield retaining nut


AUS05173

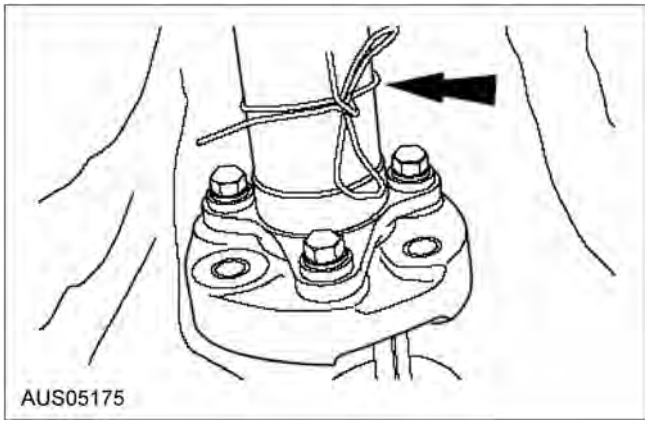
4. Detach the driveshaft from the transmission flange. Discard bolts.

GENERAL PROCEDURES (Continued)

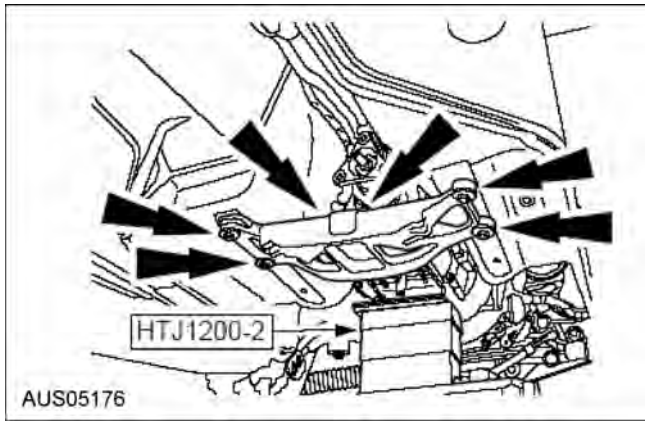
5. Install suitable cord to the heat shield retaining nut stud.



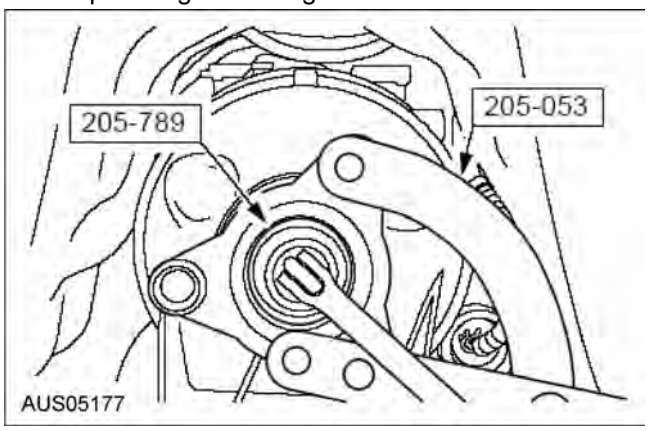
6. Reposition the driveshaft



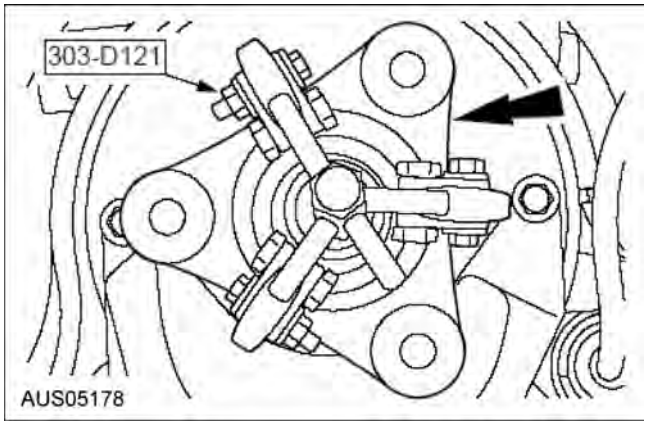
7. Using the special tool, remove the transmission support.
8. Lower the transmission to a suitable working height



9. Using the special tools, remove and discard the output flange retaining nut



10. Using the special tool, remove the output shaft flange

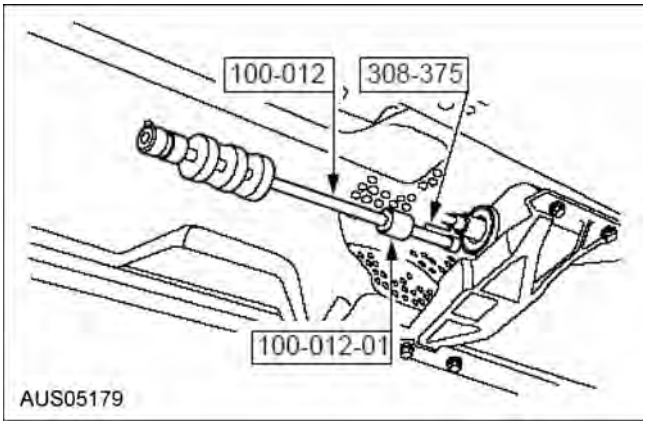


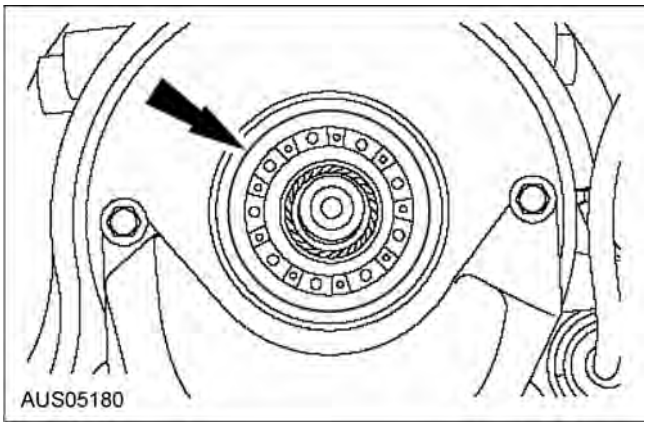
11. Remove the output shaft flange spacing shim, if fitted.

⚠ CAUTION: Make sure the transmission housing seal face is not damaged when removing the extension housing seal. Failure to follow this instruction may result in damage to the vehicle.

GENERAL PROCEDURES (Continued)

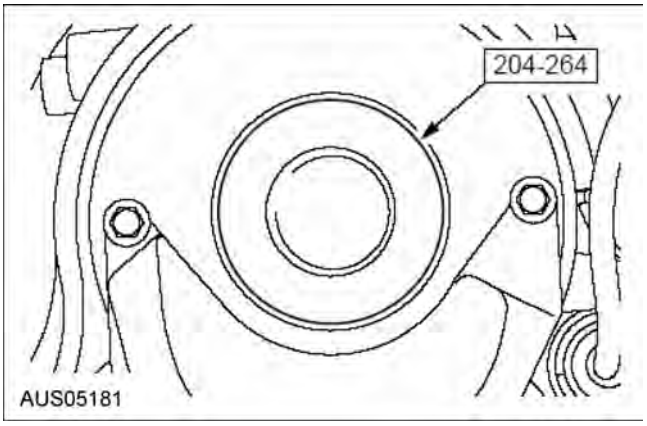
12. Using the special tools, remove the extension housing seal.
    NOTE: Using a suitable metal surface cleaner meeting Ford specification, clean the seal face on the housing before installing the new seal. Clean and inspect the transmission housing seal face.



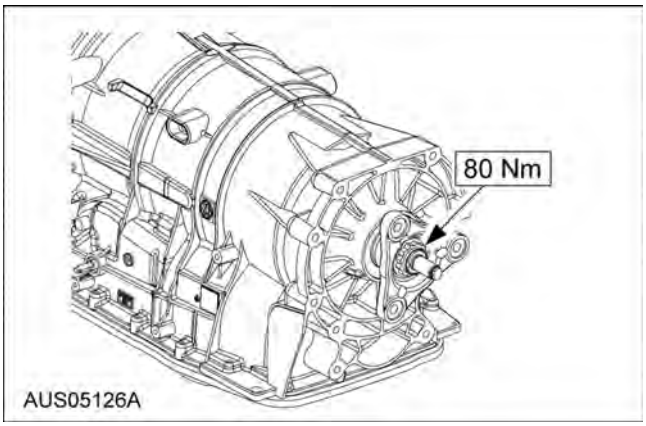


Installation

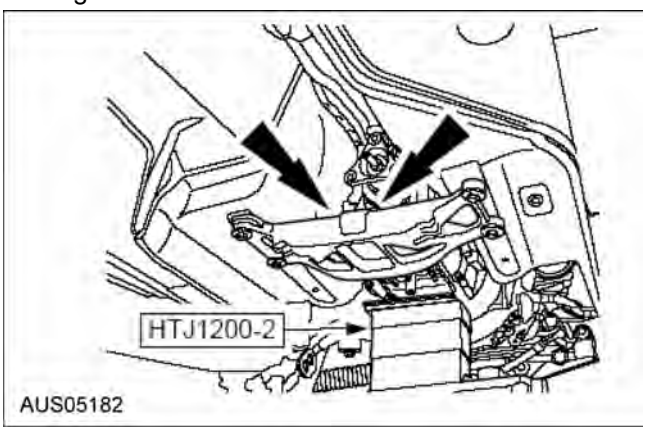
1. Using the special tool, install the extension housing seal.



2. Install the output shaft flange spacing shim.
3. Carefully refit the drive flange, ensuring the new seal is not damaged.
4. Using the special tools install a new output shaft flange retaining nut and tighten to 80Nm. Peen the nut into the slot in the shaft to lock it.

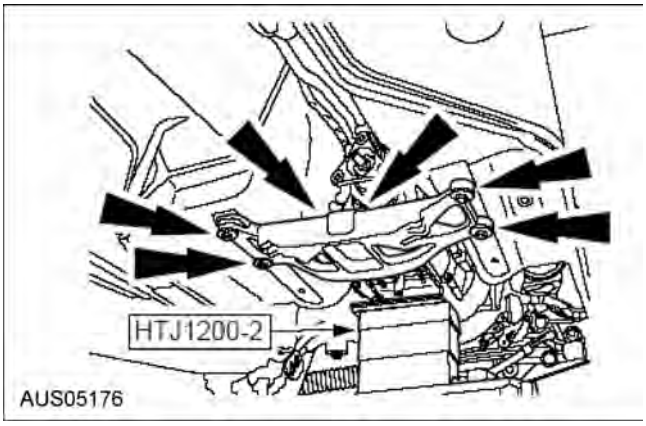


5. Using the special tool, raise the transmission and install the transmission support.
6. Tighten to 25 Nm.



7. Tighten to 48 Nm.

   ⚠ CAUTION: Make sure the front of the driveshaft does not put an excessive load on the centre bearing. Failure to follow this instruction may result in damage to the vehicle.

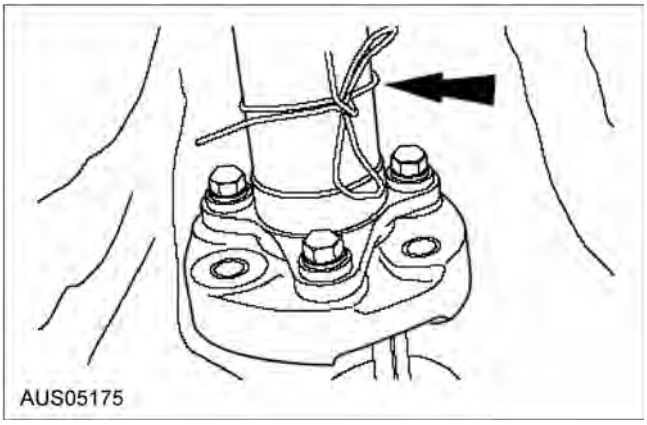


GENERAL PROCEDURES (Continued)

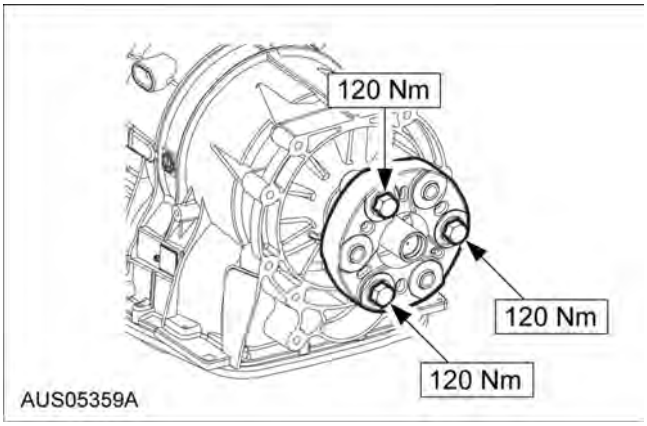
8. Undo the cord and reposition the driveshaft

   CAUTION: Make sure the front of the driveshaft does not put an excessive load on the centre bearing. Failure to follow this instruction may result in damage to the vehicle.

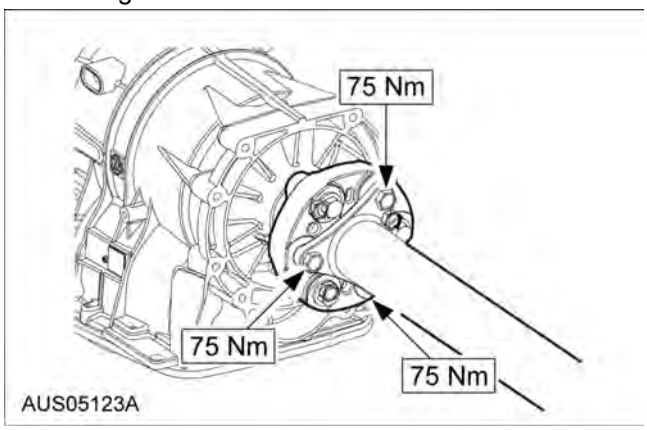
   CAUTION: Make sure all components are installed to the position they were removed from. Failure to follow this instruction may result in damage to the vehicle.



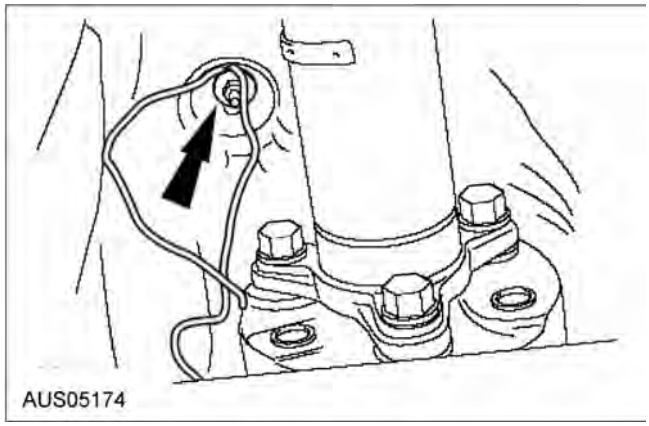
9. Using new bolts, attach the driveshaft to the output flange and torque to 120Nm. Allow thread locker to set.
   If new bolts are not available, coat bolt threads with high strength thread locker (e.g. Loctite 262 or similar) and torque to 120Nm.



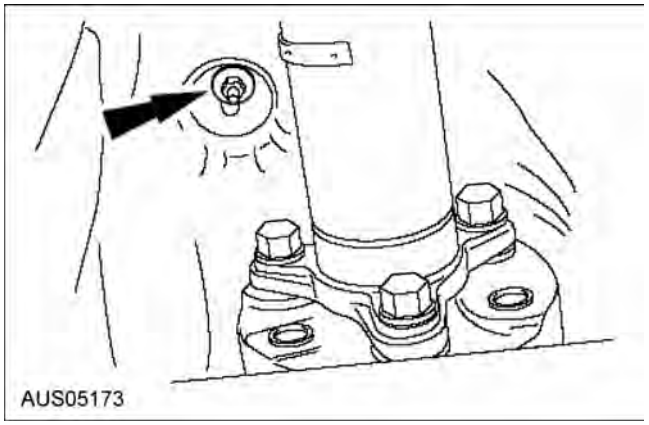
10. Attach the driveshaft to the transmission flange and tighten to 75Nm



11. Loosen the heat shield retaining nut and remove the cord



12. Tighten the retaining nut



13. Carry out a transmission fluid level check. For additional information, refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle, GENERAL PROCEDURES)

GENERAL PROCEDURES (Continued)

Mechatronic plug O-ring seal replacement

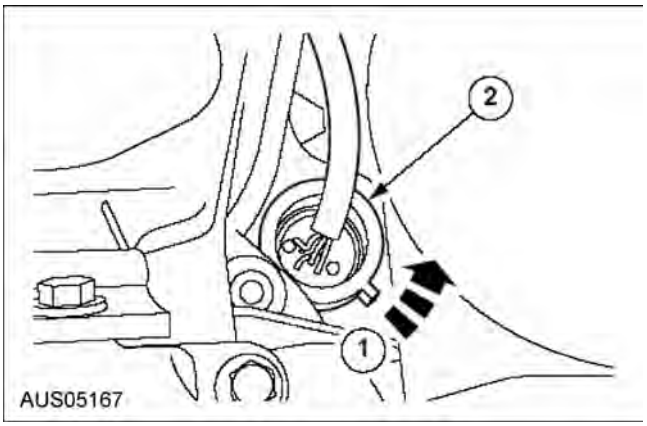
General Equipment

- Anti-Static Wrist Strap

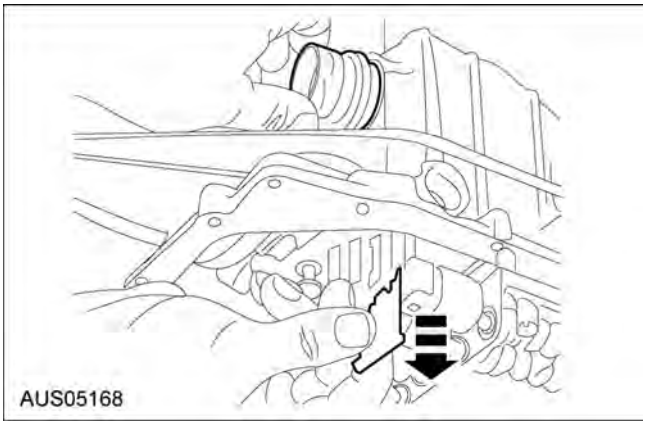
Removal

CAUTION: Make sure the transmission control module (TCM) and main control valve body are protected against electrostatic discharge. Failure to follow this instruction may result in component damage.

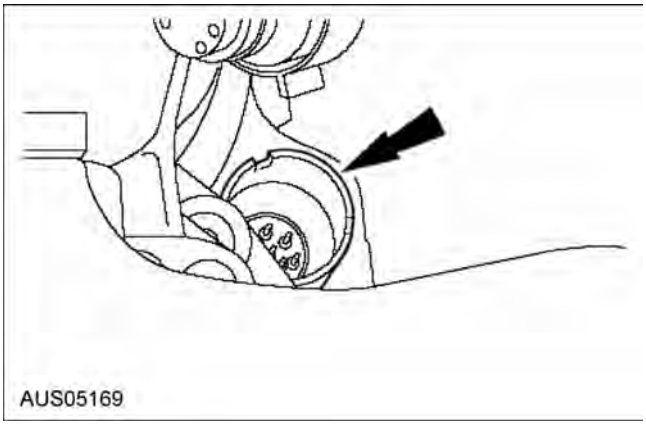
1. Remove the fluid pan, gasket and filter. For additional information, refer to: Fluid Pan, Gasket and Filter (307-01 Automatic Transmission/Transaxle, IN-VEHICLE REPAIR).
2. Disconnect the electrical connector.
    1. Reposition the electrical connector retaining ring.
    2. Disconnect the electrical connector.



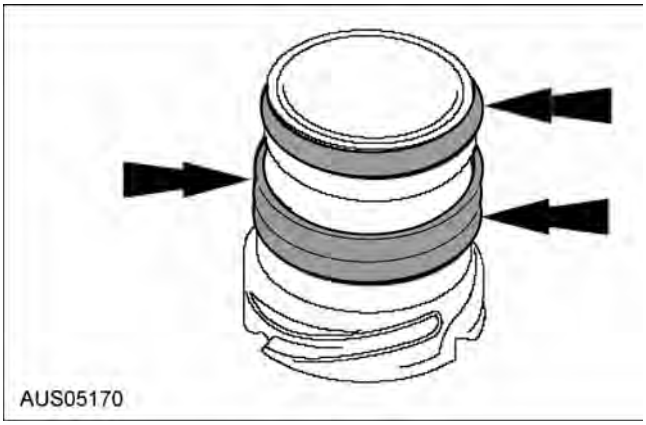
3. Remove the sealing tube locking device



4. Remove the sealing tube



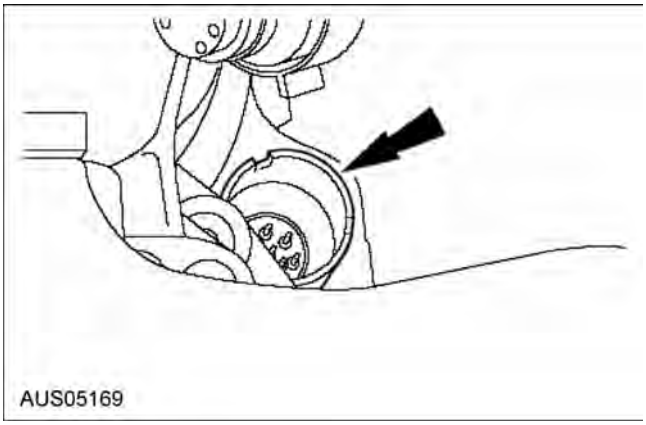
5. Remove and discard the seals



Installation

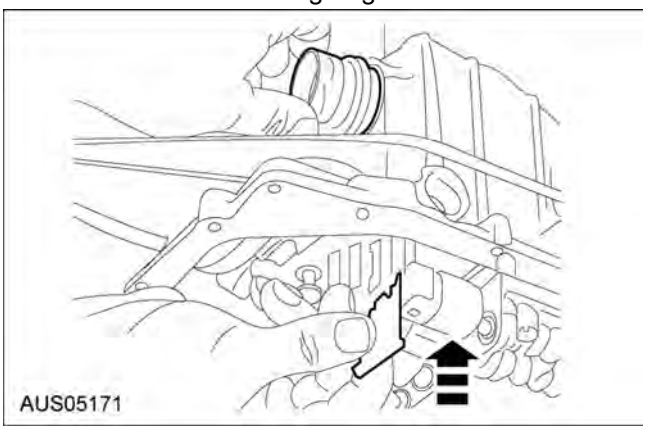
CAUTION: Make sure all suitable safety precautions are taken to protect the transmission control module (TCM) and main control valve body electrical connector pins against electrostatic discharge.

1. Replace the seals on the on the tube.
2. Install the sealing tube.
3. A thin smear of Vaseline© should be used on the seals to aid installation.

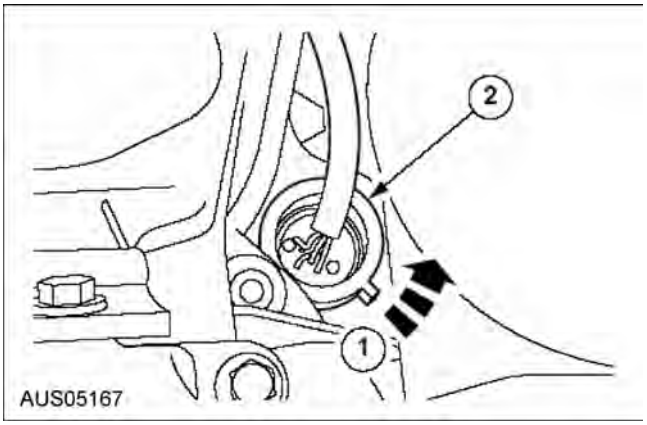


GENERAL PROCEDURES (Continued)

4. Reconnect the electrical connector and relocate the connector retaining ring.



5. Reposition the locking device.

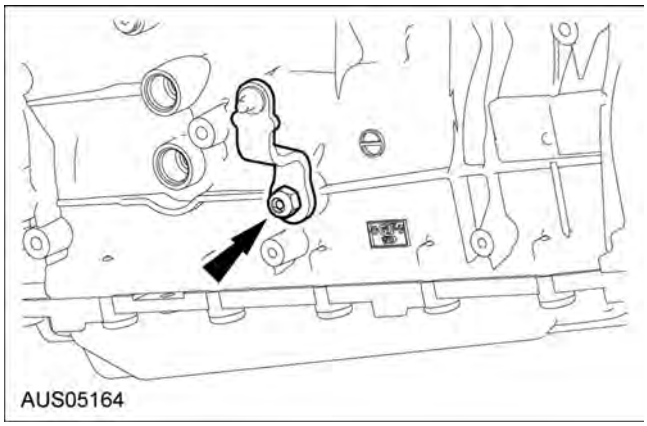


6. Reconnect the wiring loom
7. Install the fluid pan, gasket and filter. For additional information, refer to: Fluid Pan, Gasket and Filter (307-01 Automatic Transmission/Transaxle, IN-VEHICLE REPAIR).
8. Fill the transmission. For additional information, refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission/Transaxle, GENERAL PROCEDURES).

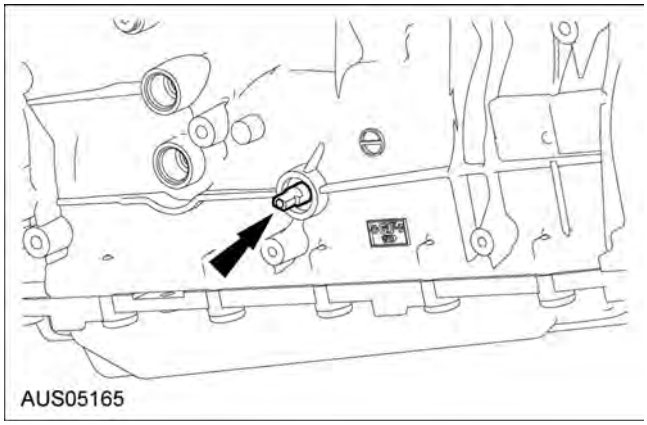
Selector Shaft Seal

Removal

1. Raise and support the vehicle. For additional information, refer to: Lifting (100-02, DESCRIPTION AND OPERATION).
2. The transmission may need to be lowered at the rear to allow clearance between the special tool and transmission tunnel.
3. Place the transmission in the P position
4. Disconnect the selector lever cable
5. Remove the nut and pull off selector lever



6. Place a suitable oil drain container under the shaft
7. Using the special tool remove the selector shaft seal.



8. It is recommended one or two layers of insulating tape are placed over the selector shaft threads to protect the threads and reduce the risk of damage to the new seal when being fitted.
9. Inspect the shaft and seal housing for damage.

Installation

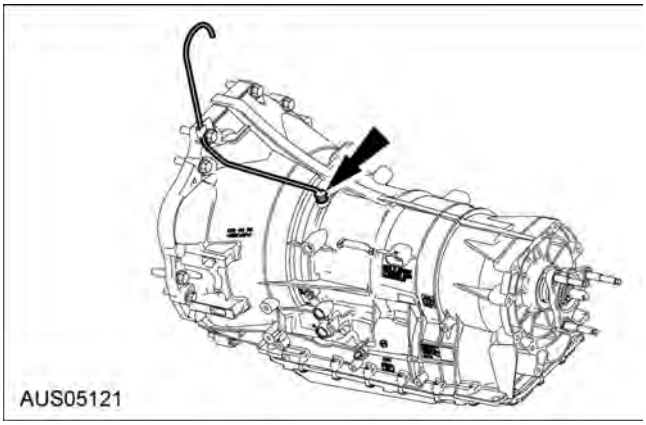
1. Using the special tool install the new seal.
2. A thin smear of petroleum jelly can be used to ease the seal over the shaft
3. Remove the insulating tape and refit the selector lever.
4. Torque the nut to 23Nm
5. Refit and adjust the selector cable
6. Reposition the transmission.
7. Carry out a transmission fluid level check.
8. For additional information, refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle, GENERAL PROCEDURES).

GENERAL PROCEDURES (Continued)

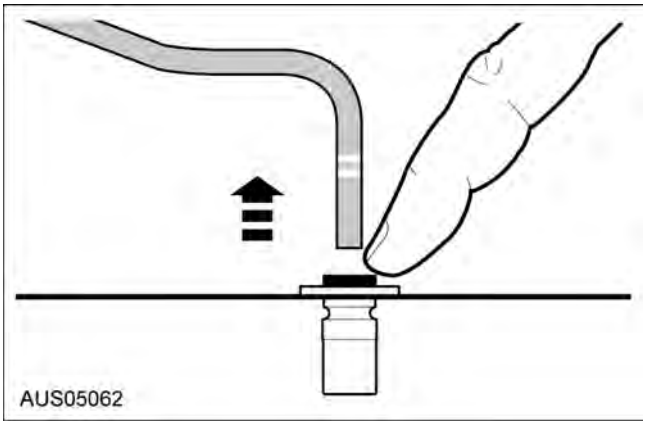
Gearbox Breather Pipe replacement

Removal

1. Raise and support the vehicle. For additional information, refer to: Lifting (100-02, DESCRIPTION AND OPERATION).
2. Unclip the breather pipe

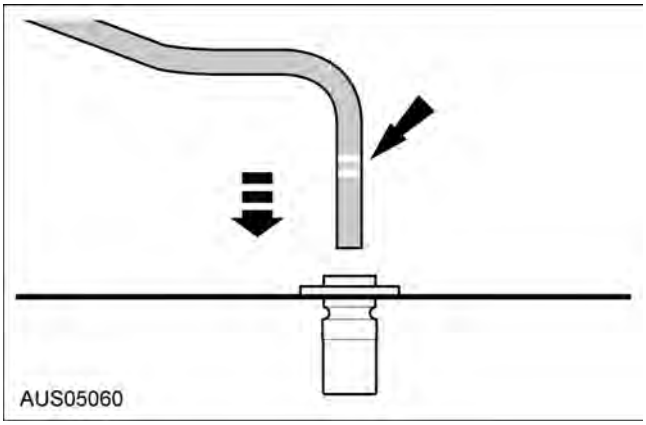


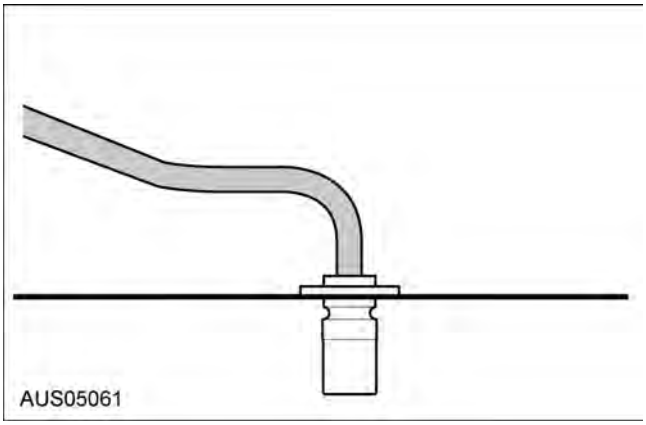
3. To remove the breather pipe press the plastic collar downwards until it contacts the brass ferrule. Gently pull the pipe out



Installation

1. To replace the pipe, push the pipe into the plastic collar until the white ring cannot be seen





2. Reattach pipe to clips
3. Carry out a transmission fluid level check. For additional information, refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle, GENERAL PROCEDURES).

Mechatronic unit and mechatronic unit seals

Special Tool(s)

 SST418-FS317	**Integrated Diagnostic System (IDS)**

General Equipment

- Anti-Static Wrist Strap

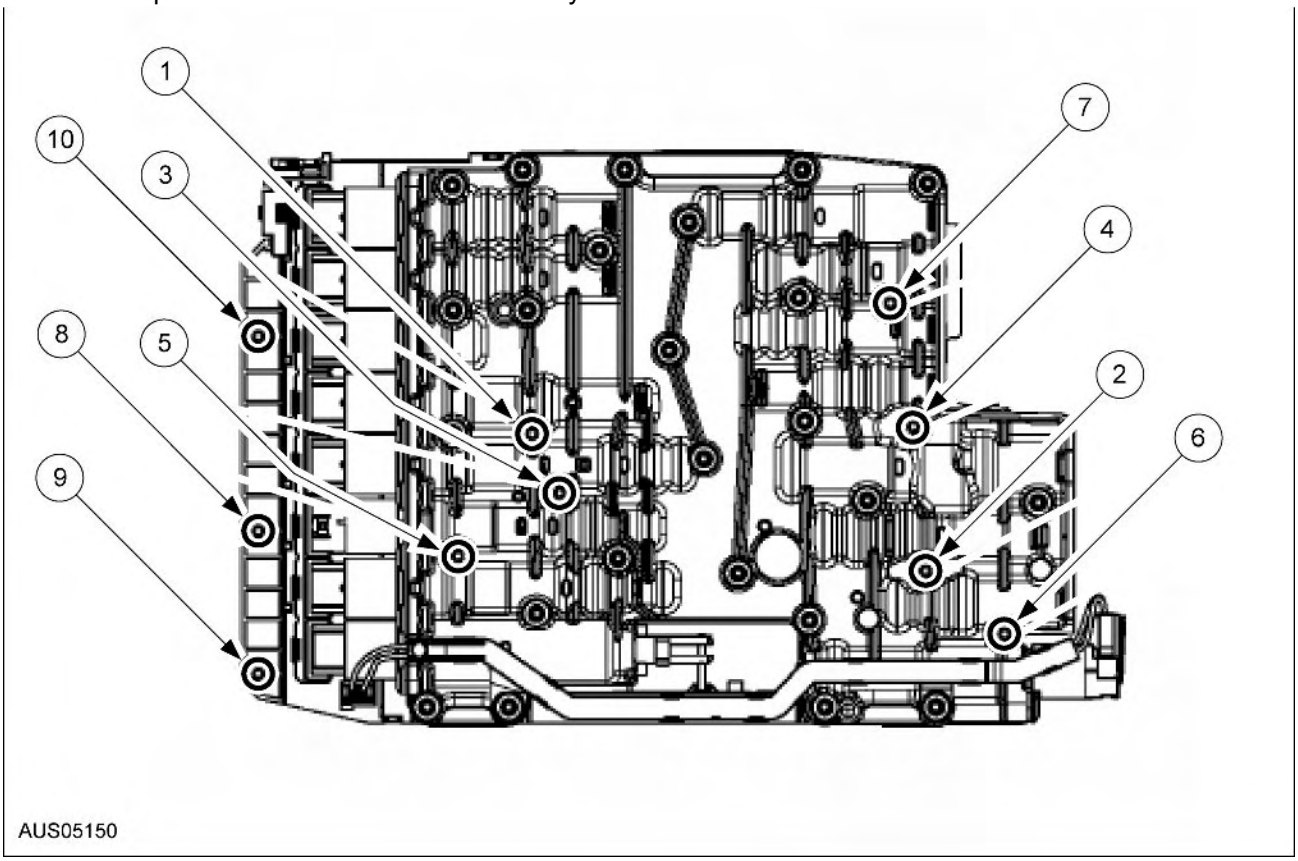
⚠ CAUTION: Make sure the transmission control module (TCM) and main control valve body are protected against electrostatic

GENERAL PROCEDURES (Continued)

discharge. Failure to follow this instruction may result in component damage.

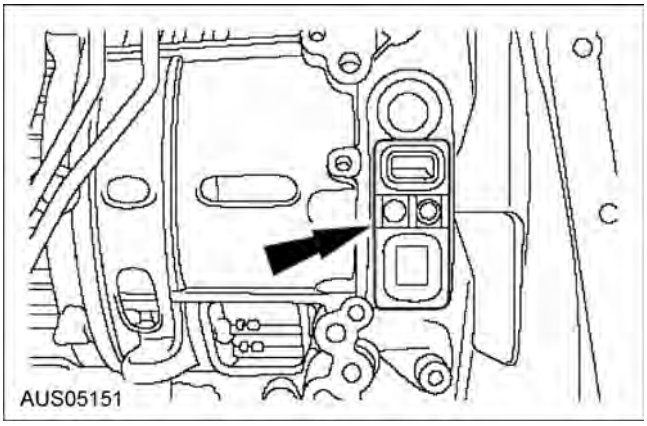
Removal

1. Remove the fluid pan, gasket and filter. For additional information, refer to: Fluid Pan, Gasket and Filter (307-01 Automatic Transmission/Transaxle, IN-VEHICLE REPAIR).
2. Remove Mechatronic connector. For additional information refer to: Mechatronic plug O-ring seal replacement (307-01 Automatic Transmission/Transaxle, IN-VEHICLE REPAIR).
3. Remove the retaining bolts from the main TCM and main control valve body
4. Care should be exercised when removing the valve body retaining bolts, particularly of the gearbox is above ambient air temperature. This is to avoid potential distortion of the valve body.

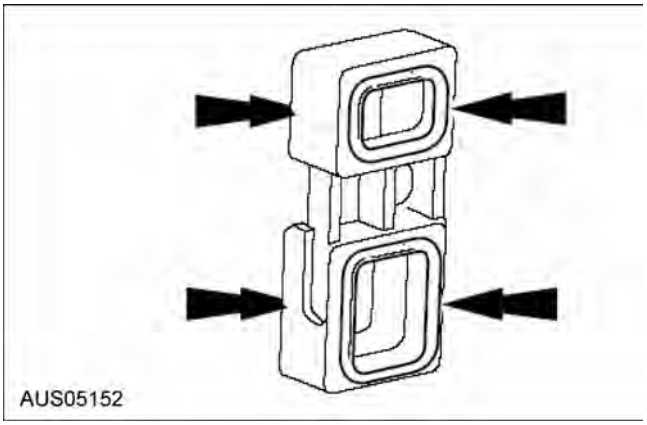


GENERAL PROCEDURES (Continued)

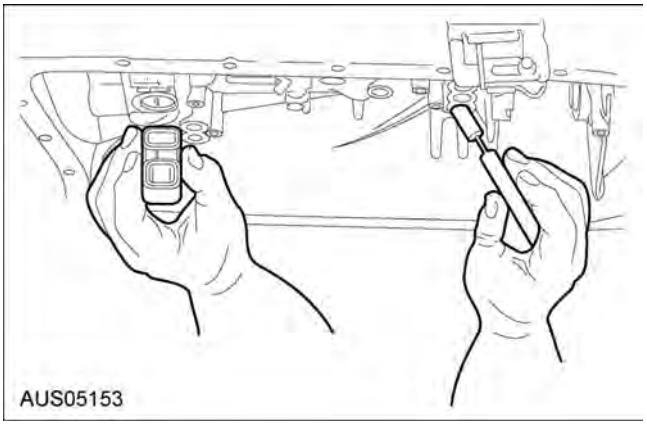
5. Remove the TCM and main control valve body sealing block



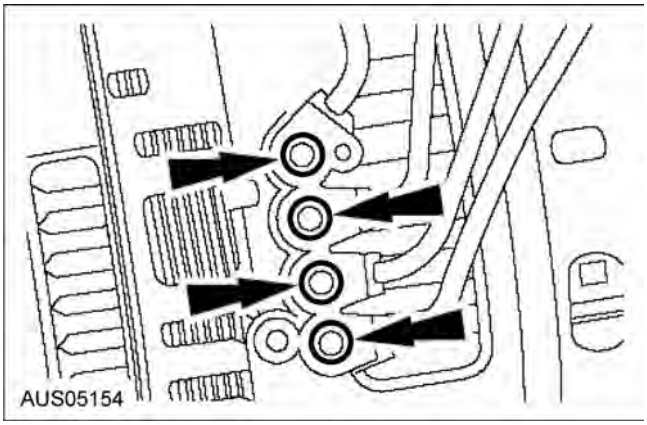
6. Remove and discard the mating block seals



7. Remove the 4 sealing sleeves from the transmission housing



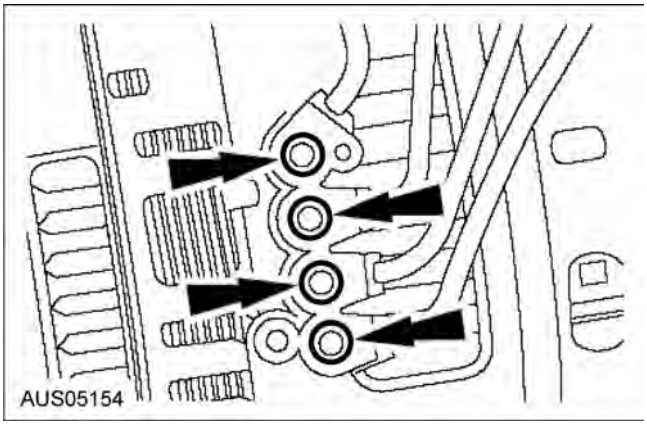
8. Sealing sleeve locations



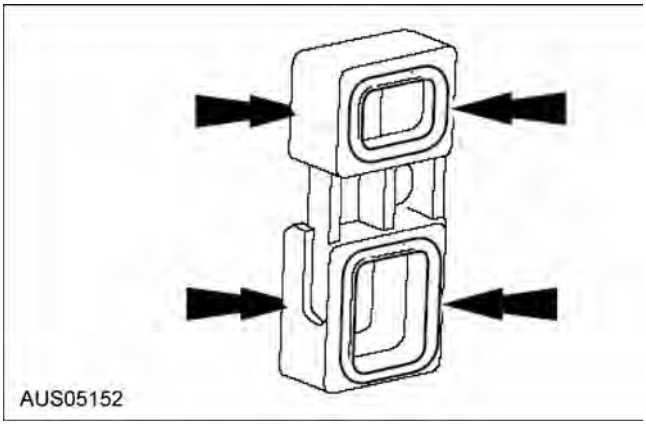
Installation

⚠ CAUTION: Make sure the transmission control module (TCM) and main control valve body are protected against electrostatic discharge. Failure to follow this instruction may result in component damage.

1. Install new transmission housing seals

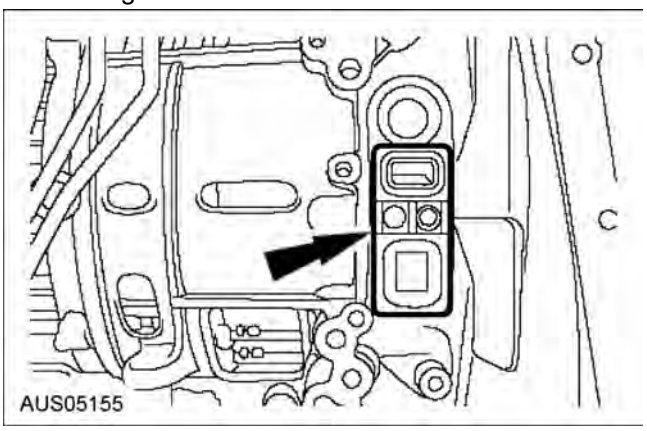


2. Install new valve body sealing block seals

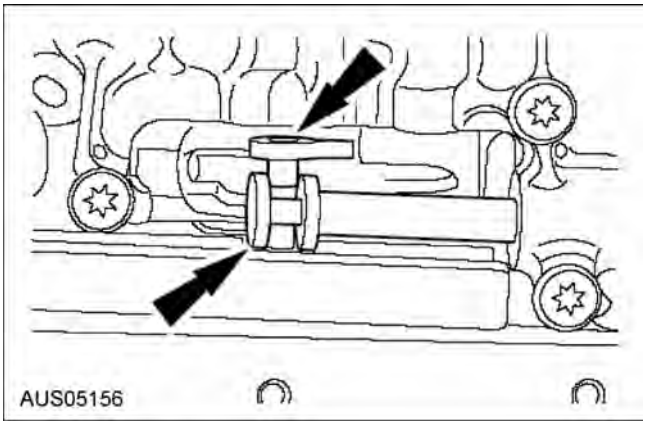


GENERAL PROCEDURES (Continued)

3. Install the TCM and main control valve body sealing block



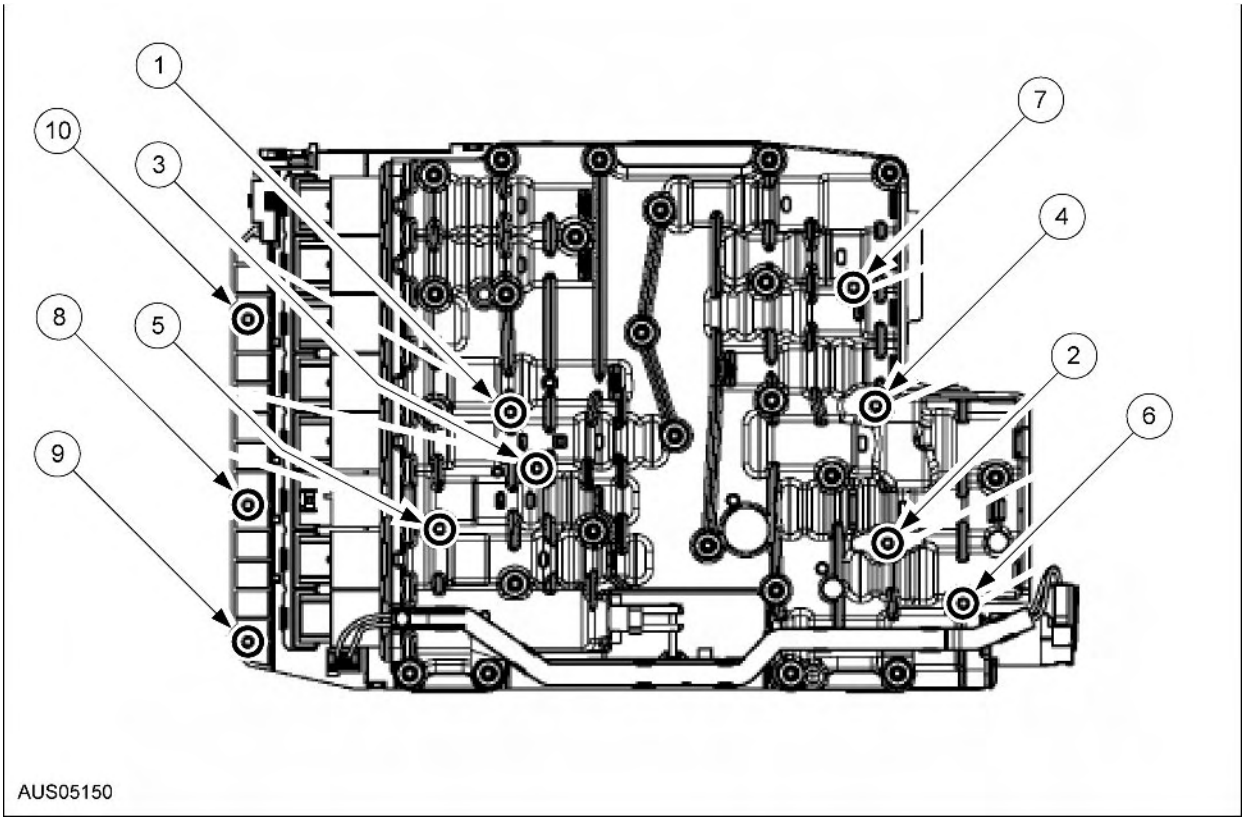
4. Align the transmission selector shaft to the TCM and main control valve body.



5. Install the TCM and main control valve body retaining bolts.

GENERAL PROCEDURES (Continued)

6. Tighten the bolts evenly to 8 Nm in the order shown.

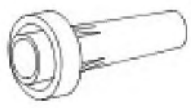
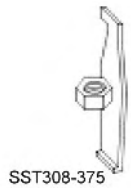
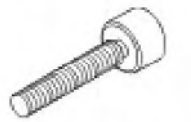
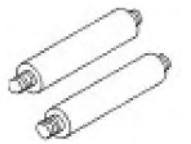


7. Refit the sealing tube - For additional information refer to: Mechatronic plug O-ring seal replacement (307-01 Automatic Transmission/Transaxle, IN-VEHICLE REPAIR).
8. Replace the oil pan - For additional information, refer to: Fluid Pan, Gasket and Filter (307-01 Automatic Transmission/Transaxle, IN-VEHICLE REPAIR).
9. Replenish the transmission fluid - For additional information, refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission/Transaxle, GENERAL PROCEDURES).

GENERAL PROCEDURES (Continued)

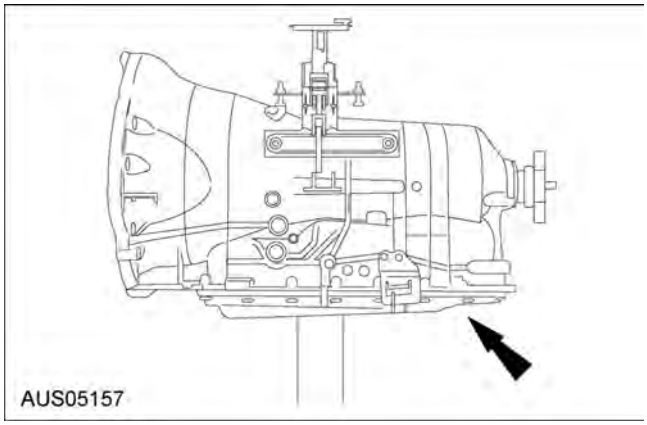
Renew the torque converter and shaft sealing ring on the oil pump

Special Tool(s)

 SST 308-246	**Front seal installer (308-246)**
 SST308-375	**Seal Remover Input and Output (308-375)**
 SST100-012	**Slide Hammer (100-012)**
 SST100-012-01	**Slide Hammer Adaptor (100-012-01)**
 SST307-139	**Torque Converter Handles (307-139)**

Removal

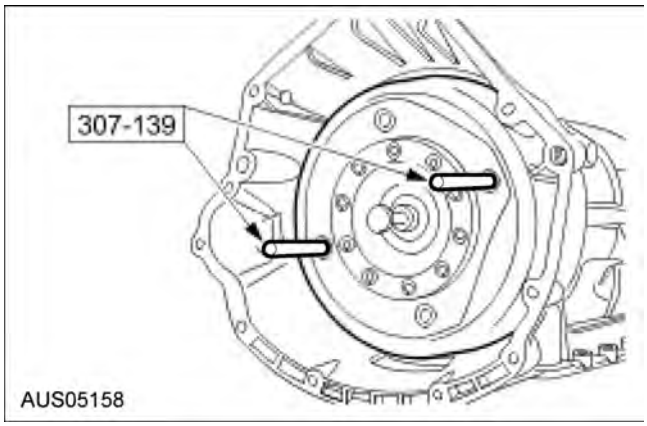
1. Remove the transmission - For further information refer to section - 307-01 - Removal and Installation.
2. Mount the transmission securely on a stand using the appropriate brackets.



3. Drain the transmission fluid into a suitable container

   ⚠ WARNING: Do not let the torque converter drop out of the transmission. Failure to follow this instruction may result in personal injury.

   ⚠ WARNING: Oil may leak from the converter and/or transmission when the torque converter is removed
4. Using the two converter pull-out handles remove the converter bracket and carefully pull out the converter to avoid damage to the torque converter bearings and oil pump seal.

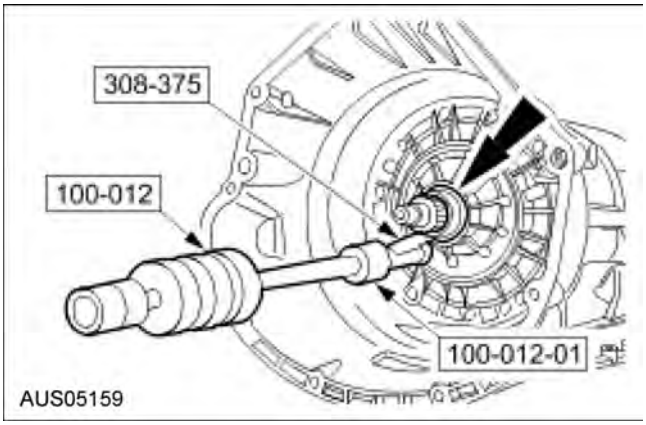


Transmission oil pump seal replacement.

5. With the torque converter removed, using the special tool carefully remove the oil pump shaft seal.

   ⚠ CAUTION: Ensure the transmission housing seal face is not damaged when removing the torque converter seal. Failure to follow this instruction may result in damage to the vehicle.

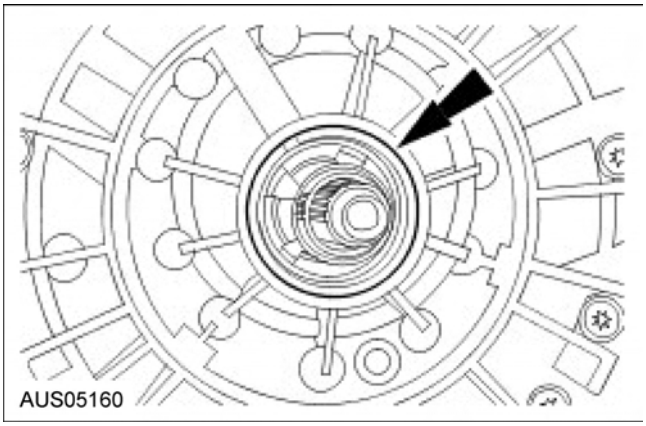
GENERAL PROCEDURES (Continued)



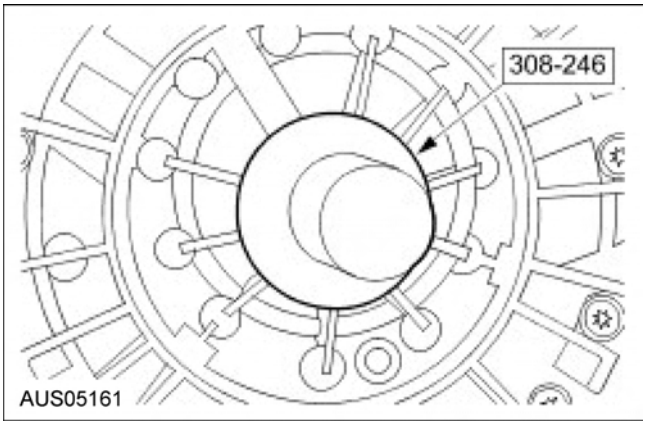
6. Clean the seal location in the pump housing using a Ford approved cleaning material.
7. Check the condition of the housing.

Installation

1. Ensure the seal housing is clean and there is no evidence of damage.



2. Using the special tool fit the new seal.



Refit the Torque Converter

NOTE: Although the operating principle is the same there are three variations of torque converter used

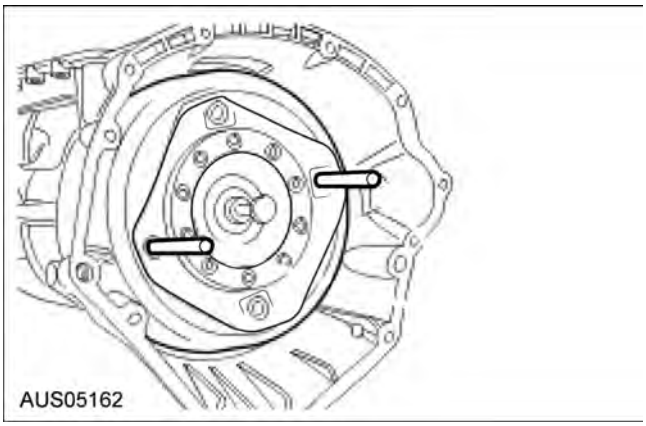
- I6 260mm rated at 278Nm @ 2000 rpm
- I6 Turbo 280mm rated at 297Nm @ 2000 rpm
- V8 - 4 valve 280mm rated at 297Nm @ 2000 rpm

It is vitally important that in the event of torque converter replacement they are replaced "like-for-like". In the event an incorrectly rated torque converter is fitted it will seriously affect gearbox performance.

3. Using the special tools 5x56 000 090, carefully fit the torque converter avoiding damage to the oil pump seal and bearings.
4. The torque converter spigot and the inner lip of the seal can be lightly lubricated with new transmission fluid to aid the shaft sliding through the seal
   NOTE: The torque converter must be fully engaged in the oil pump drive gear.

   ⚠ WARNING: Failure to fully engage the torque converter to the oil pump drive gear will result in extensive engine and transmission damage.

   NOTE: when the transmission is fitted in position and correctly mated to the engine, there should be some lateral movement between the torque converter and flywheel prior to bolting them together.



5. Install the transmission assembly.
6. Replenish the transmission fluid.
7. For additional information refer to - Transmission Fluid Drain and Refill. (307-01a Automatic Transmission/Transaxle, GENERAL PROCEDURES).
8. Check and adjust the transmission fluid level as required.
9. For additional information, refer to: Transmission Fluid Level Check (307-01a Automatic Transmission/Transaxle, GENERAL PROCEDURES).