WORKSHOP MANUAL

UBS AND TF SERIES

TRANSMISSION

AW30-40LE MODEL

(FULLY-AUTOMATIC ELECTRONICALLY CONTROLLED)

SECTION 7

ISUZU

ISUZU
International Service & Parts
Tokyo, Japan

NOTICE

Before using this Workshop Manual to assist you in performing vehicle service and maintenance operations, it is recommended that you carefully read and thoroughly understand the information contained in Section 0A under the headings "GENERAL REPAIR INSTRUCTIONS" and "HOW TO USE THIS MANUAL".

All material contained in this Manual is based on the latest product information available at the time of publication.
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Applicable Model : '02UBS 73 (For General Export)
'02TFS 77 (For Australia)
'02TFR 77 (For Australia and South Africa)
'01TFR 77 (For Thailand)

This manual is applicable to 2001 year model vehicle.

SECTION 7A
AUTOMATIC TRANSMISSION (AW30-40LE)

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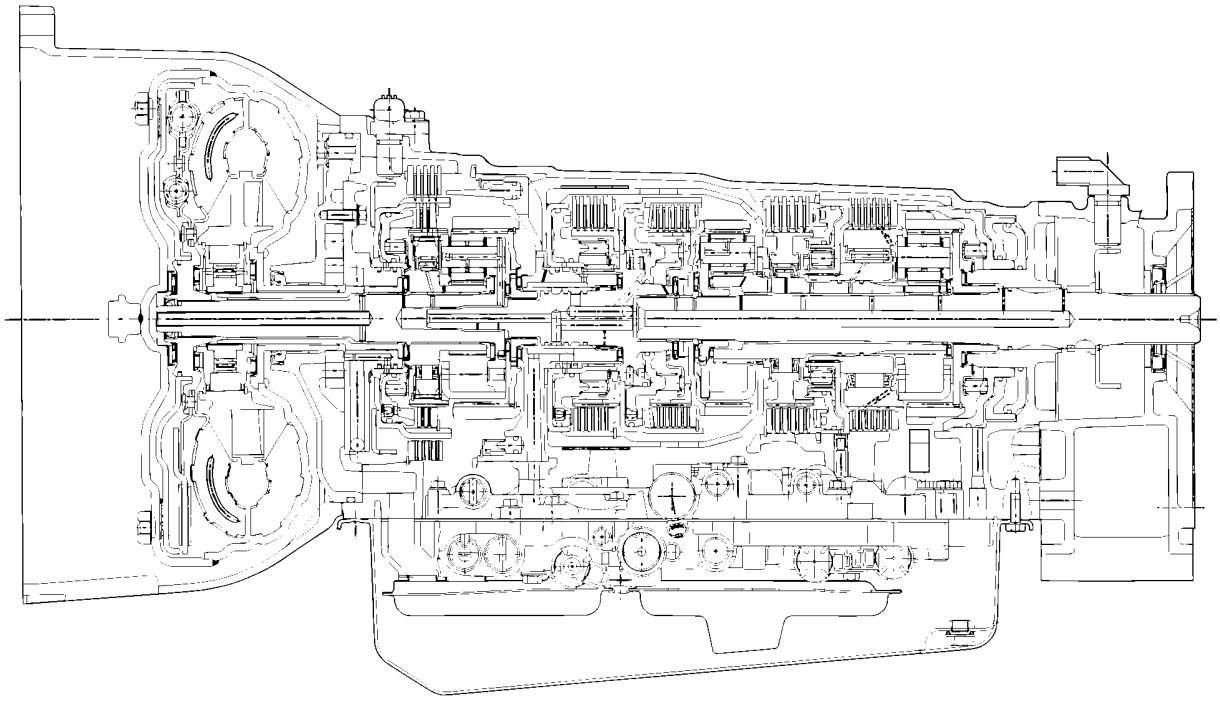
CAUTION:
When fasteners are removed, always reinstall them at a the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used.

Fasteners that are not reused, and those requiring thread locking compound, will be called out. The correct torque values must be used when installing fasteners that require torque. If the above conditions are not followed, parts or system damage could result.

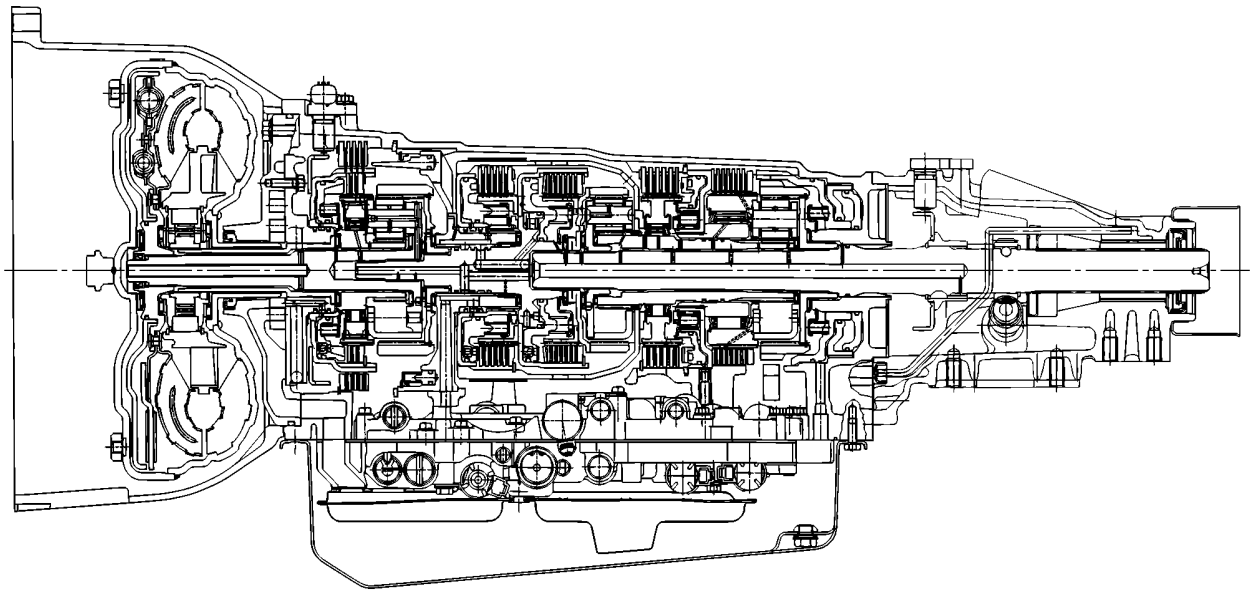
GENERAL DESCRIPTION

CONSTRUCTION

'02 UBS and TFS (4X4)



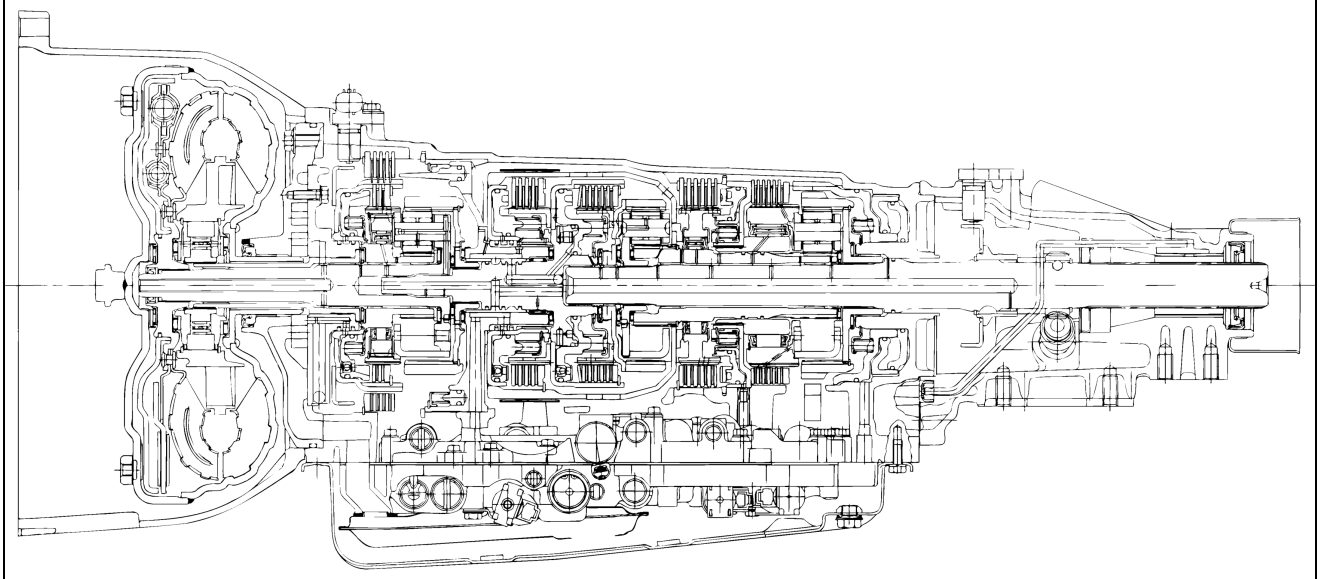
'02 TFR (4X2)



A07RY00001&A07L200001

CONSTRUCTION (Cont'd)

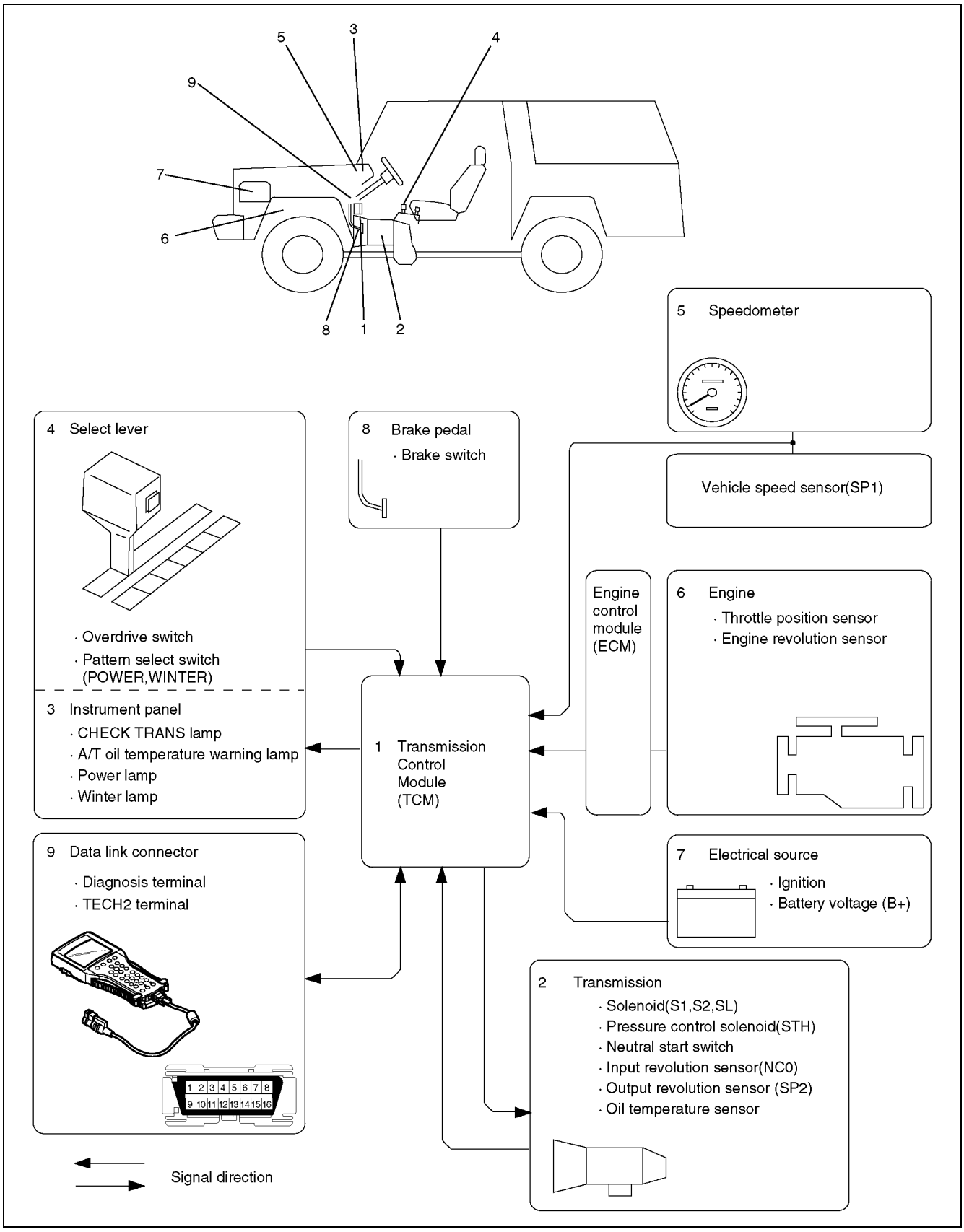
'01 TFR (4×2, For Thailand)



A07L100001

ELECTRONIC CONTROL COMPONENTS

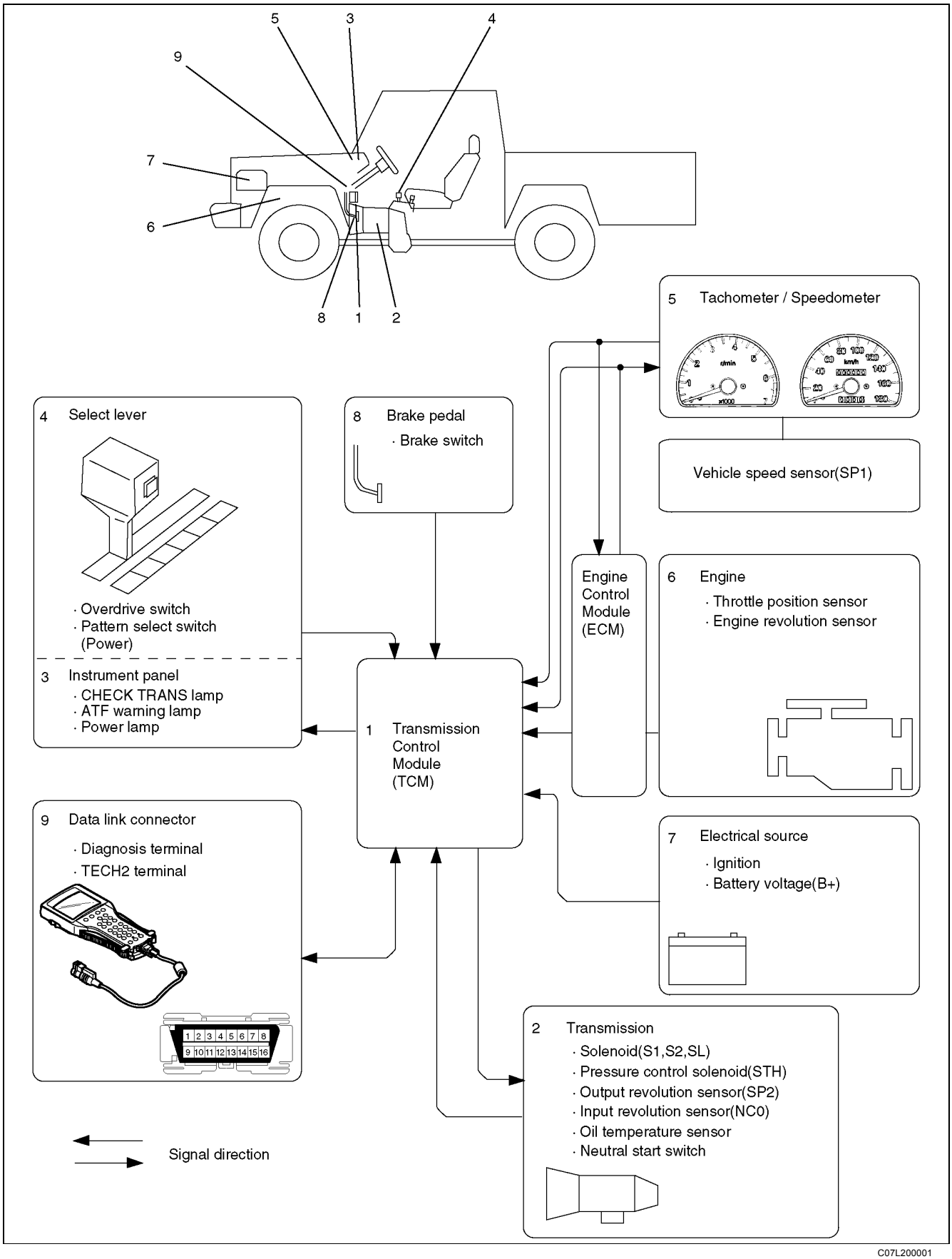
UBS



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ELECTRONIC CONTROL COMPONENTS (Cont'd)

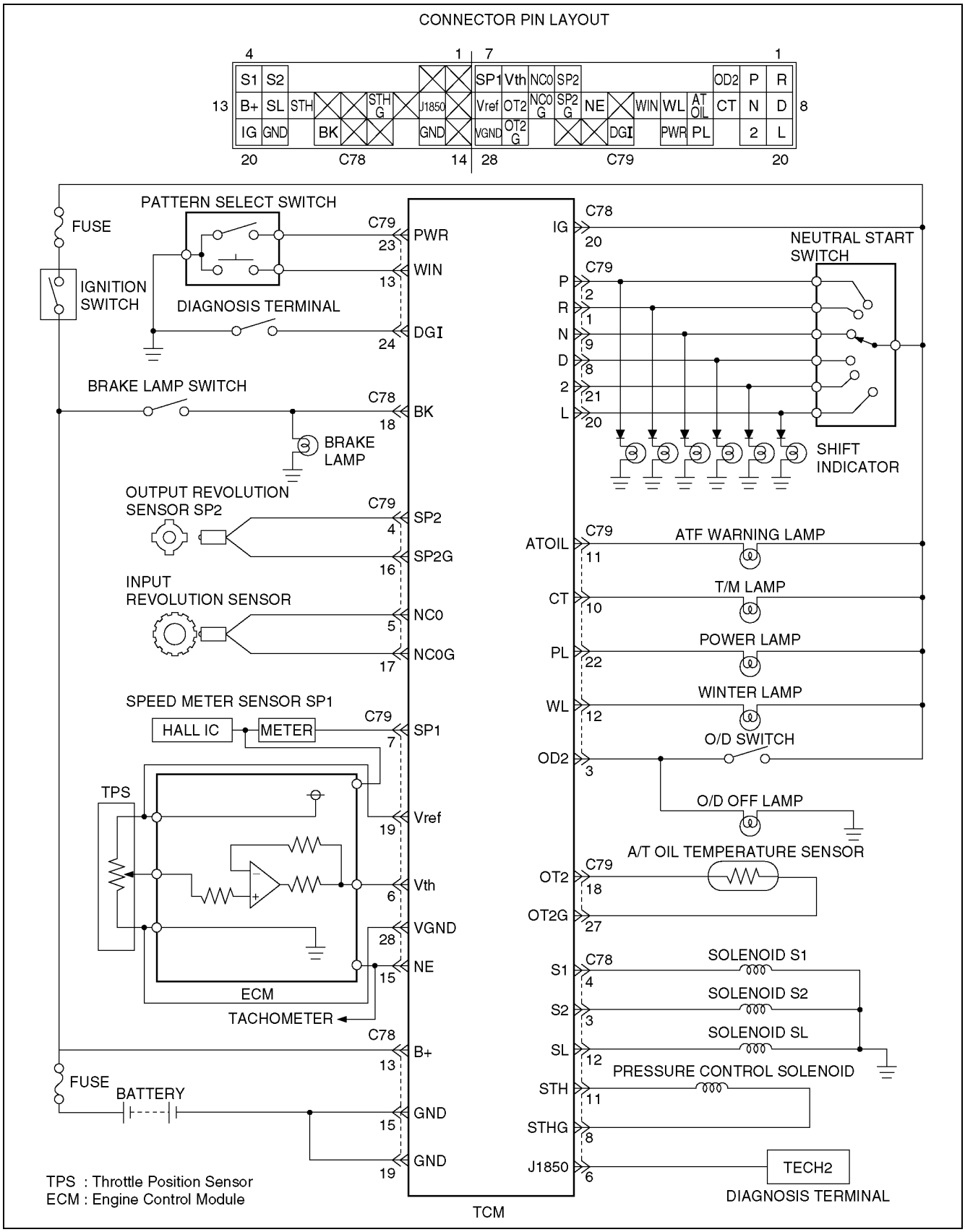
TFR/S



C07L200001

TRANSMISSION CONTROL MODULE (TCM)

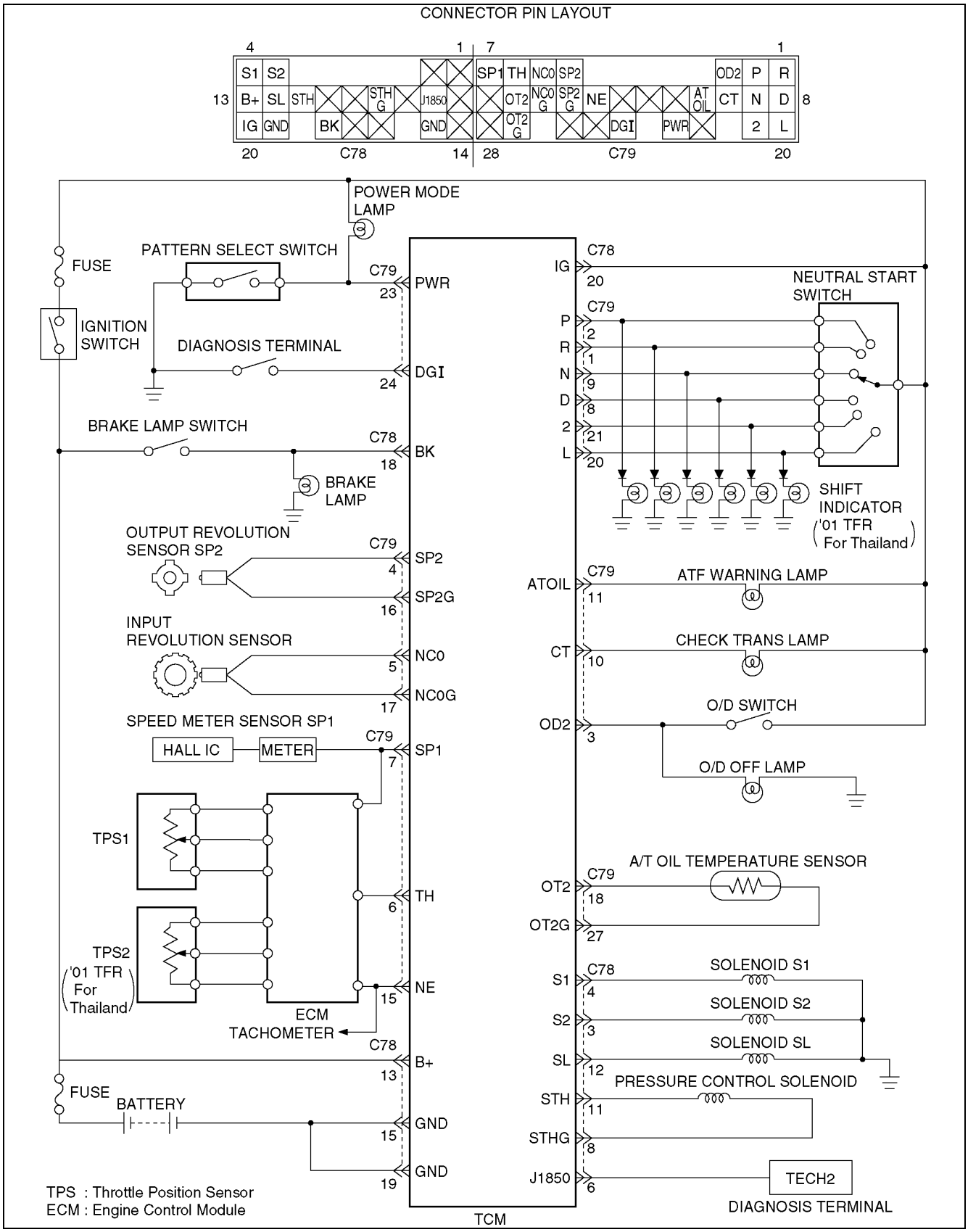
UBS



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TRANSMISSION CONTROL MODULE (TCM) (Cont'd)

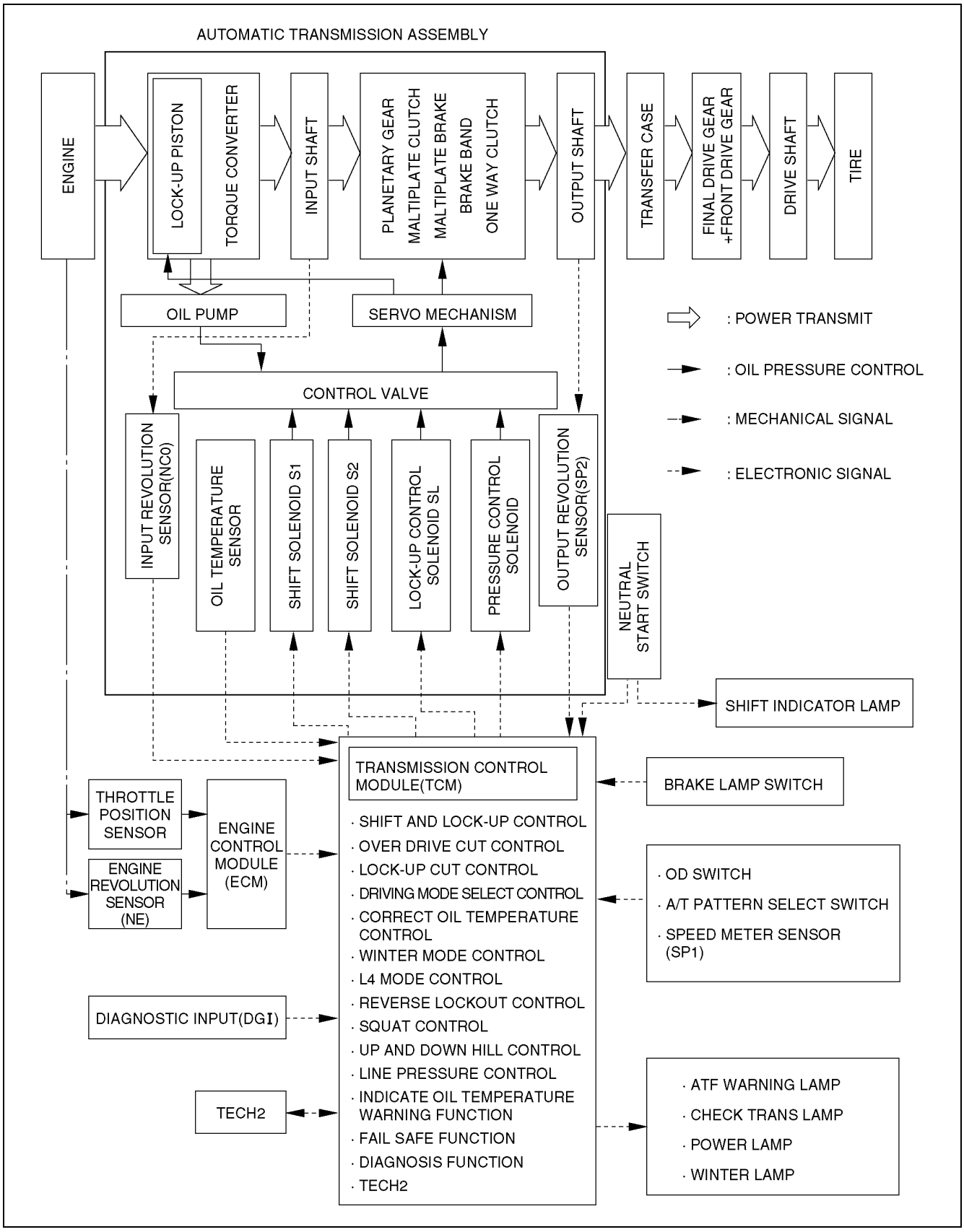
TFR/S



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CONTROL SYSTEM DIAGRAM

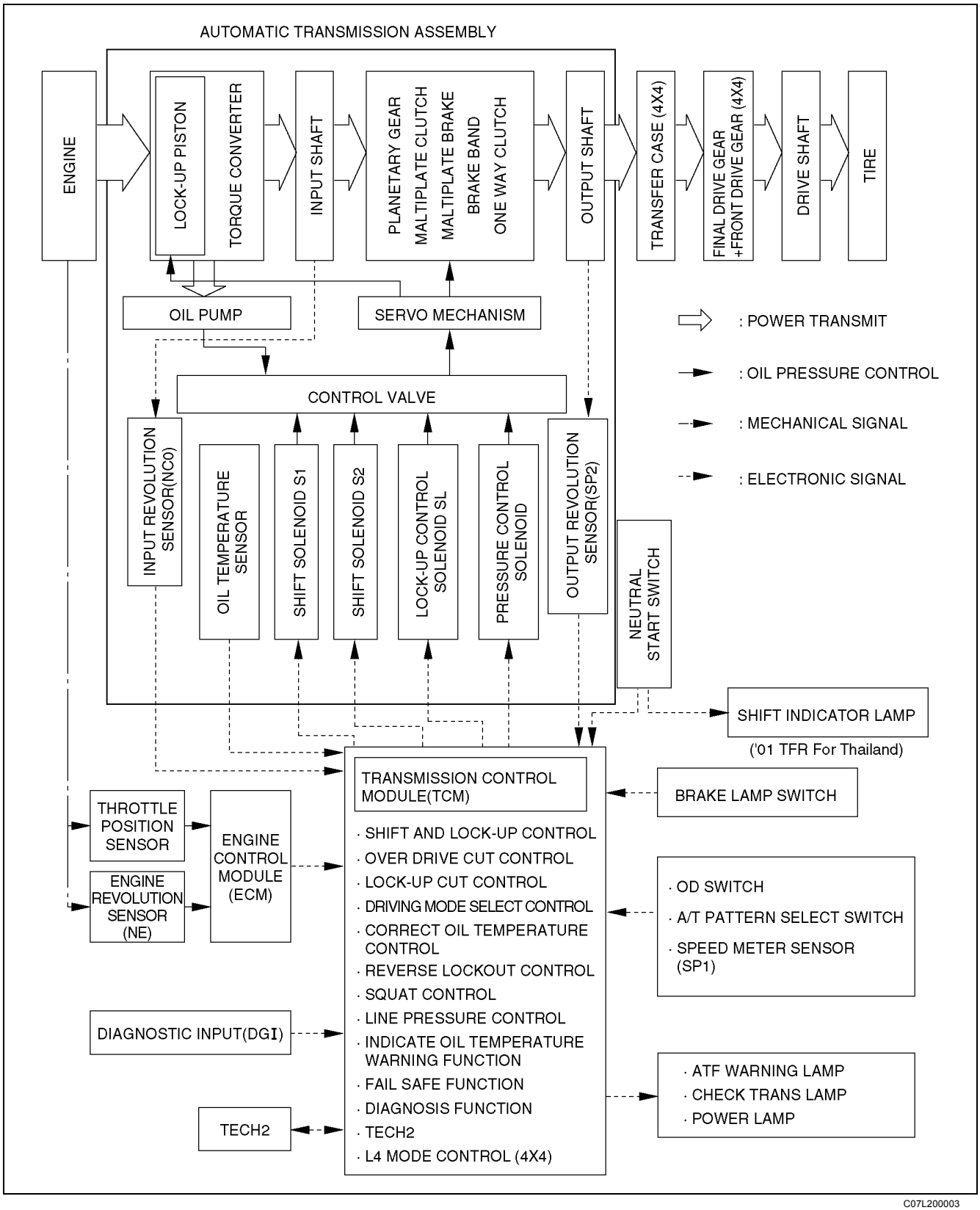
UBS



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CONTROL SYSTEM DIAGRAM (Cont'd)

TFR/S



C07L200003

CONTROL AND FUNCTIONS

Item	Description
Shift and lock-up control	• In D range, speed change point and Lock-up point can be changed by setting pattern selection switch to "POWER", "NORMAL" or "WINTER (UBS)" mode. • Gear shift position in the conditions made up of transmission shift positions (D.2.L) combined with pattern selection switch (POWER, NORMAL, and WINTER) can be controlled in accordance with vehicle speed and the opening of throttle valve.
Overdrive cut control	• If O/D switch is set on in D range (O/D OFF lamp ON), gear shift to O/ D is not effected. • Overdrive is released at O/D switch on and high transmission oil temperature (More than 130°C). However, to prevent engine over revolution • 4→3 shifting at vehicle speed is less than 118 km/h (UBS) or 117 km/h (TF). • 3→4 shifting at vehicle speed is more than 131 km/h (UBS) or 125 km/h (TF) or 120 km/h ('01TFR for Thailand).
Lock-up cut control	• In D range, 2nd (TF), 3rd or O/D lock-up is conducted in "POWER" or "NORMAL" mode. • In 2, L range, lock-up is off in the whole area. • Lock-up is released at brake on or high transmission oil temperature (More than 130°C — UBS and 01'TFR for thailand) . (More than 140°C — TF). • Lock-up is prohibited while driving in coasting condition.
Driving mode select control	• The TCM selects a suitable driving mode from the nine kinds for the variety driving condition. i) Economy mode ii)Power mode iii)Winter mode(UBS) iv)HOT1 mode v)HOT2 mode vi)L4 mode(4×4) vii)Slope mode(UBS) (Up slope 1, Up slope 2 and Down slope mode) • The priority of driving mode: Economy < Power < Slope(UBS) < L4(4×4) < Winter(UBS) < HOT1 < HOT2
Squat control	• When the TCM detects D signal on, the TCM controls 1–3–1 shift by setting a timer, in order to improve the shift feel at N→D.
Line pressure control	• The TCM output current which corresponds to throttle oil pressure to pressure control solenoid based on throttle opening.
Indicate oil temperature warning function	• If the transmission oil temperature sensor senses that transmission oil temperature is greater than 146°C, the TCM turn on A/T OIL TEMP warning lamp. (The warning lamp is turned off, if oil temperature is less than 126°C.)
L4 mode control (4×4)	• The TCM judges whether the transfer is engaged in high or low based on the ratio rpm data from output speed sensor in the transmission and the rpm data from speed meter sensor to select the shift map.
Up and down hill control (UBS)	• The TCM judges up and down hill, and change shift pattern based on throttle opening and acceleration.

CONTROL AND FUNCTIONS (Cont'd)

Item	Description
Correct oil temperature control	• If the temperature exceeds a predetermined value, the TCM selects the high oil temperature shift point for downshifting, thus preventing the oil temperature from rising. (More than 130°C, D range – UBS and '01 TFR for Thailand) (More than 140°C, D range – '02 TF)
Winter mode control (UBS)	• The TCM controls the vehicle start smoothly on low frictional road like snow road by executing this control. Activate condition: When all following conditions are satisfied and winter mode switch ON, winter mode is activated on "D" range. (Winter mode ON is judged at the time of switch release after switch ON condition is 200 ms continuously or more.) 1. Excluding "2", "L" range 2. Vehicle speed is less than 11 km/h 3. Transmission oil temperature is less than 115°C 4. Throttle opening is less than 8% 5. Excluding winter mode Cancel condition: When at least one among the following five conditions is satisfied, the winter mode is canceled. 1. When winter mode switch is pushed again 2. When either "2" or "L" is detected 3. Ignition switch "OFF" 4. Vehicle speed is more than 34 km/h for 1 second or mode continuously 5. Transmission oil temperature is more than 130°C
Fail-safe function	• When trouble occurs to vehicle sensor and each solenoid, TCM automatically exerts fail-safe control not to spoil driveability. • This control is exerted when sensor or actuator is in trouble, while TCM works normally.
Diagnosis function	• If there is an abnormality in vehicle sensors, each solenoid (S1-S3, STH), or throttle position sensor, "CHECK TRANS" lamp is actuated to warn the drive. But when the abnormality items have been restored to normal, the light does not blink. • Faulty parts are memorized in TCM. If self-diagnosis start signal is inputted, "CHECK TRANS" lamp is blinked and results of diagnosis are indicated. A history of faults remains recorded even when IGN switch is off.
TECH 2	• Output of control data in the TCM • Actuator (Solenoid) operation check • Erasure of trouble code

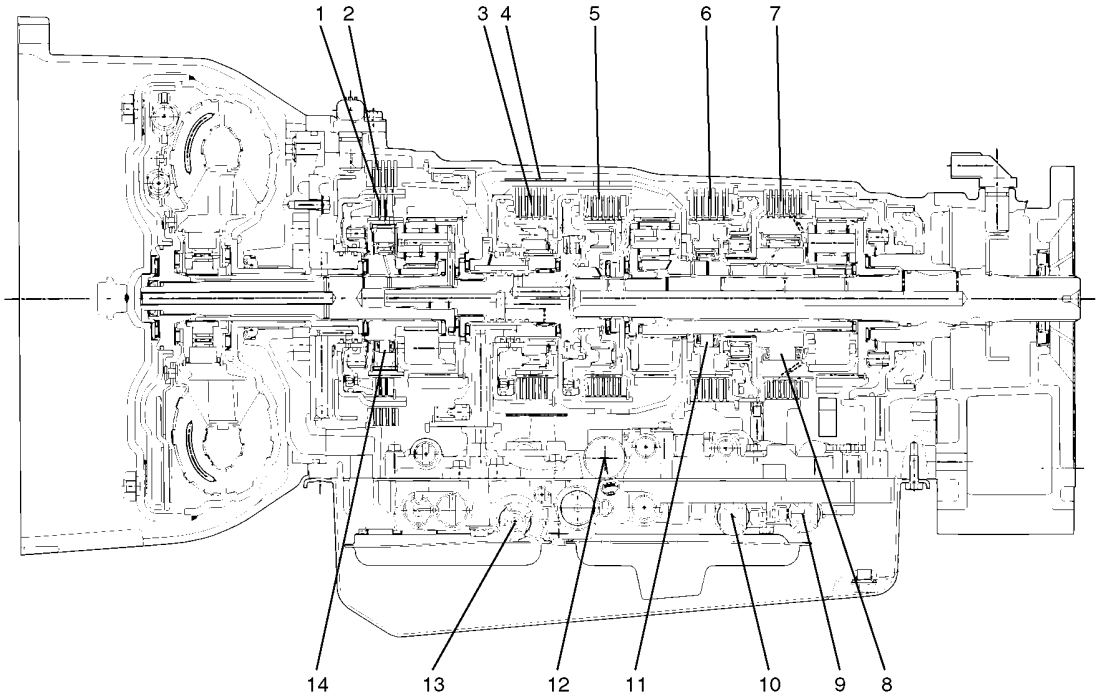
MAJOR INPUT/OUTPUT COMPONENTS

Component		Function
Input	Vehicle speed sensor (Speedometer)	Detects the vehicle speed (Back-up sensor of output revolution sensor).
	Output revolution sensor (Transmission)	Detects the vehicle speed
	Input revolution sensor (Transmission)	Detects the input revolution (O/D direct clutch drum revolution).
	Engine revolution sensor	Detects the engine revolution.
	Throttle position sensor	Detects the throttle opening rate.
	Neutral start switch	Detects the select lever position.
	Pattern select switch	Detects whether the driver has selected "NORMAL", "POWER", or "WINTER" (UBS) mode.
	Overdrive switch	Detects whether the driver has selected O/D.
	Brake lamp switch	Detects whether the driver has pressed the brake pedal or not.
	Oil temperature sensor	Detects the oil temperature.
	Diagnostic start switch	Starts self-diagnosis and displays a code for faulty part if any.
Input/ Output	Data link connector	When connected with Tech2 or tester, can communicate the data for function check, etc.
Output	Shift solenoid S1, S2	Selects shift point and gear position suited to the vehicle running condition on the basis of TCM output.
	Lock-up control solenoid SL	Control the lock-up clutch suited to the vehicle running condition on the basis of TCM output.
	Pressure control solenoid STH	Adjusts throttle pressure by energizing current of linear pressure control solenoid to prevent the shift shock and to obtain shift smoothly.
	"CHECK TRANS" lamp	When trouble has occurred to throttle position sensor, vehicle speed sensor, or solenoid, "CHECK TRANS" lamp is blinked to warn the driver. If also displays the trouble code.
	A/T OIL TEMP warning lamp	Lights when ATF oil temperature rises. (Turned on at greater than 146°C. Turned off at less than 126°C.)
	Power mode lamp	Informs the driver whether the vehicle is in power mode or not.
	Winter mode lamp (UBS)	Informs the driver whether the vehicle is in winter mode or not.
Computer	Transmission Control Module (TCM)	Based on the signals from each switch and sensor, judges necessary shift point and lock-up operation, and send signal to each solenoid.

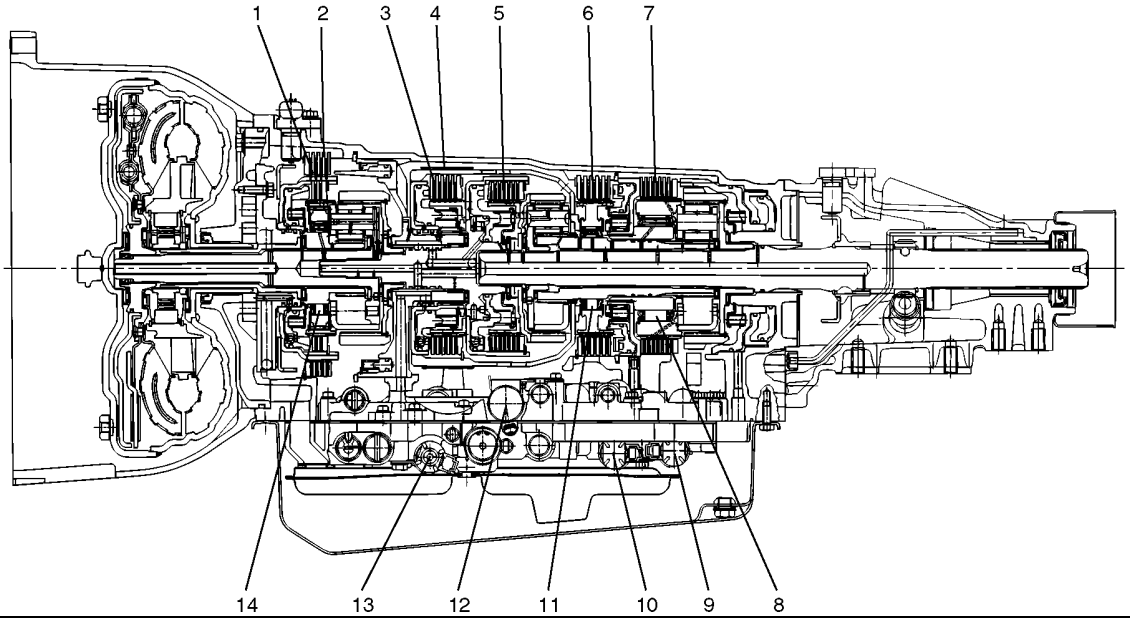
LOCATION OF CLUTCH, BRAKE, ONE-WAY CLUTCH AND SOLENOID

UBS AND TFR/S

4x4

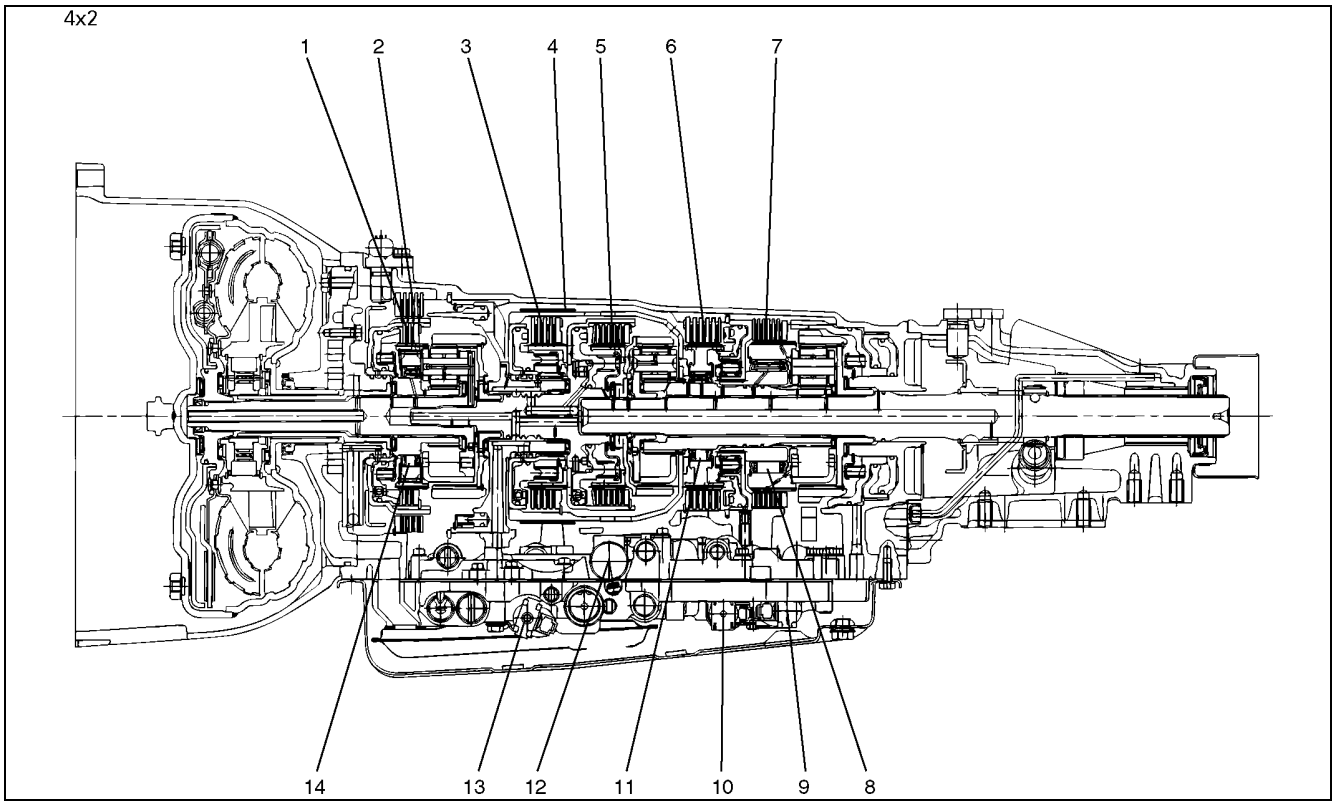


4x2



C07R200022

'**01TFR For Thailand**



Legend

1. Overdrive direct clutch (C-0)
2. Overdrive brake (B-0)
3. Direct clutch (C-2)
4. Second coast brake (B-1)
5. Forward clutch (C-1)
6. Second brake (B-2)
7. First and reverse brake (B-3)
8. One-way clutch (No.2) (F-2)
9. Shift solenoid (S-1)
10. Shift solenoid (S-2)
11. One-way clutch (No.1) (F-1)
12. Pressure control solenoid (STH)
13. Lock-up solenoid (SL)
14. Overdrive one-way clutch (F-0)

OPERATION OF CLUTCH, BRAKE AND ONE-WAY CLUTCH

○ : Operating ⊗ : Free at coast down ◎ : Operating at lock-up

Shift lever position	Gear position	C-0	C-1	C-2	B-0	B-1	B-2	B-3	F-0	F-1	F-2	S-1	S-2	S-3
P	Parking	○										○		
R	Reverse	○		○				○	○			○		
N	Neutral	○										○		
D	1st	○	○						○		⊗	○		
	2nd	○	○				○		○	⊗		○	○	
	3rd	○	○	○			○		○				○	◎
	O/D		○	○	○		○							◎
2	1st	○	○						○		⊗	○		
	2nd	○	○			○	○		○	○		○	○	
	3rd	○	○	○			○		○				○	
L	1st	○	○					○	○		○	○		
	(1*) 2nd	○	○			○	○		○	○		○	○	
	(2*) 3rd	○	○	○			○		○				○	

(1*) Down-shift only in the L range and 2nd gear – no up-shift

(2*) Down-shift only in the L range and 3rd gear – no up-shift

SPEED CHANGE AND LOCK-UP PATTERN

If you select a speed range and a lock-up pattern as shown below by specifying respective positions of transmission shift lever, transfer shift lever and pattern select switch, the transmission control computer controls speed change and lock-up operations based on the specified pattern in accordance with the degree of throttle opening and vehicle speed.

Pattern select sw. position	Transmission shift position			
	D		2	L
	Overdrive switch ON (⊓)	Overdrive switch OFF (⊓)		
NORMAL, POWER	1st⇔[2nd]*⇔[3rd]⇔[O/D]	1st⇔[2nd]*⇔[3rd]←[O/D]	1st⇔2nd⇔(3rd)	1st←(2nd)←(3rd)
WINTER (UBS)	3rd fixing		—	—

[ ]: The lock-up operation is available.

( ): Transmission is shifted at high speed to prevent overrun.

*: TF model

OVERDRIVE AND LOCK-UP OPERATING CONDITIONS

The overdrive and lock-up clutch operate if the following conditions are satisfied.

	Overdrive	Lock-up clutch
Transmission shift position	D range	← (1*)
O/D switch position	ON (凸) (O/D OFF lamp OFF)	—
Brake lamp switch	—	OFF
Throttle opening	—	Except fully closed
Vehicle speed	(UBS) About 49 km/h or more (TFR/S) About 34 km/h or more ('01 TFR) About 32 km/h or more	(UBS) 3rd: About 50 km/h or more O/D: About 65 km/h or more (TFR/S) 2nd: About 35 km/h or more 3rd: About 49 km/h or more O/D: About 59 km/h or more ('01 TFR) 2nd: About 31 km/h or more 3rd: About 46 km/h or more O/D: About 61 km/h or more

(1*): If transmission oil temperature is more than 130°C (UBS and '01TFR) or 140°C (TFR/S), lock-up is inhibit.

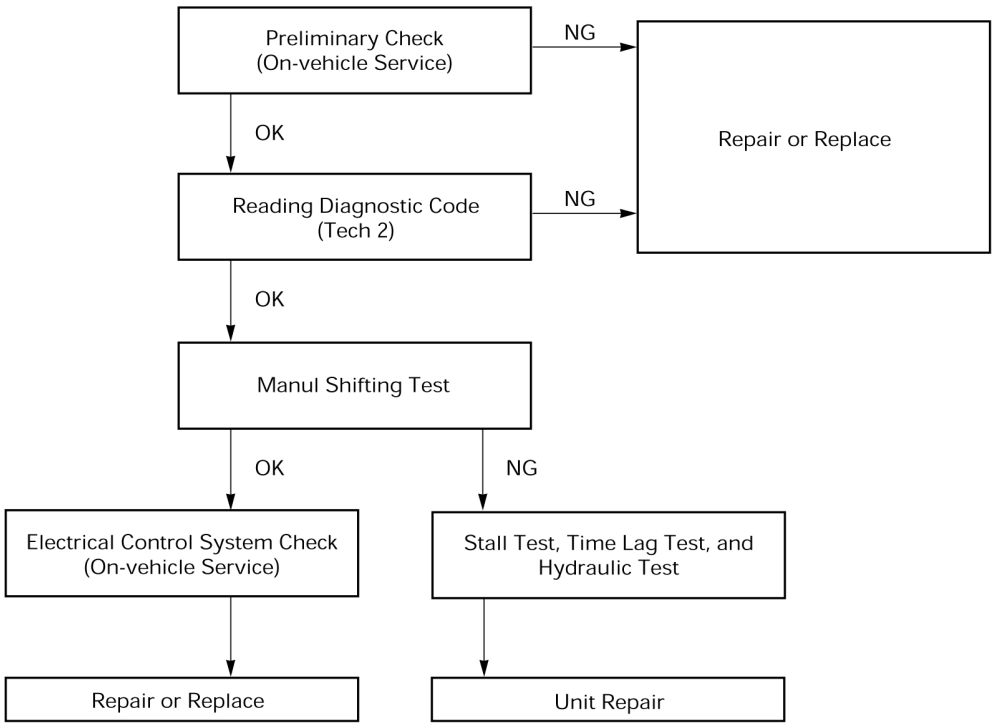
DIAGNOSIS

BASIC TROUBLESHOOTING

AW30-40LE transmission, called Electronic Controlled Transmission (ECT), differs from the Mechanical - Hydraulic control type transmissions. Accordingly, its troubleshooting procedure differs also.

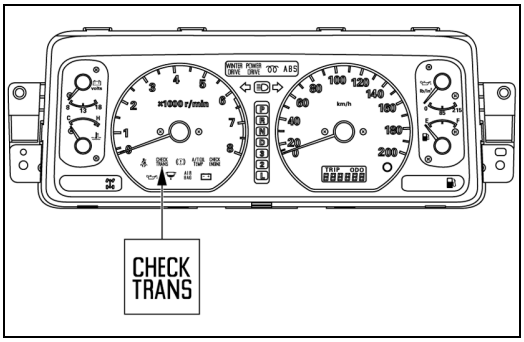
Before troubleshooting an ECT, first determine whether the problem is electrical or mechanical. To do this, just refer to the basic troubleshooting flowchart provided below.

If the cause is already known, using the basic troubleshooting chart below along with the troubleshooting chart should speed the procedure.



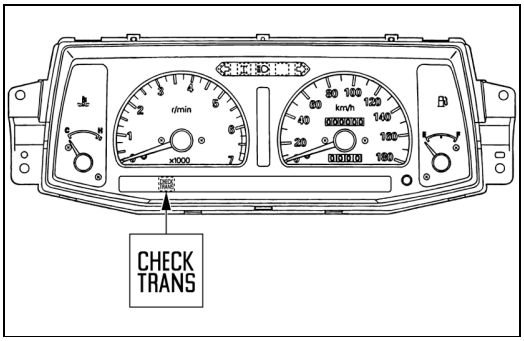
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UBS

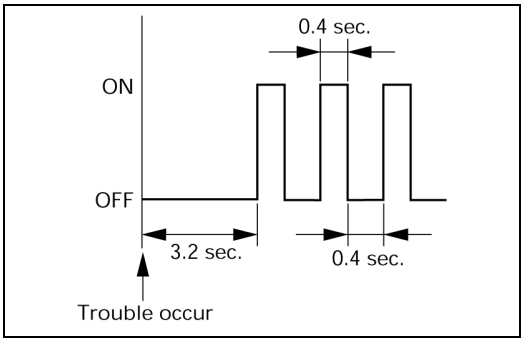


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TFR/S



825R200085



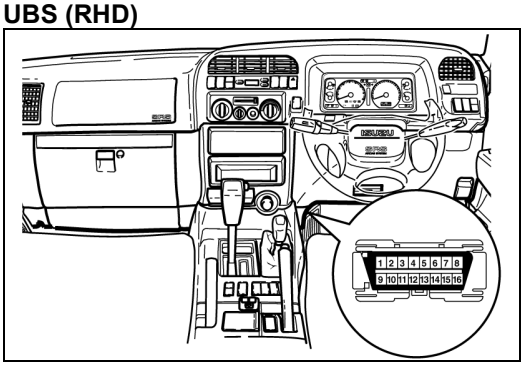
F07LV002

SELF DIAGNOSIS

Warning to the driver

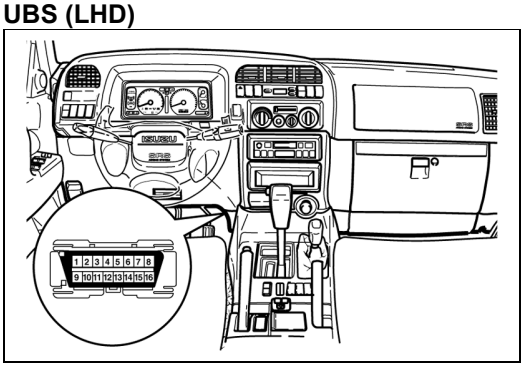
- When trouble has occurred to throttle position sensor, vehicle speed sensor, or solenoid, “CHECK TRANS” lamp is blinked (1.25 Hz) even during driving to warn the driver.
- The trouble is recorded by trouble code is TCM.
- When temporary trouble has been shooted, the “CHECK TRANS” lamp stops blinking. This blinking can be stopped by setting the ignition key off. But the trouble code remains memorized in TCM.

UBS (RHD)



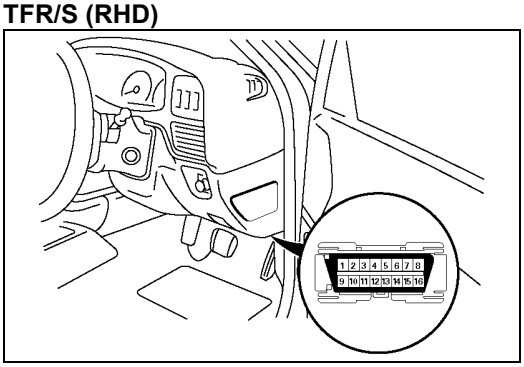
740RY00013

UBS (LHD)



740RY00014

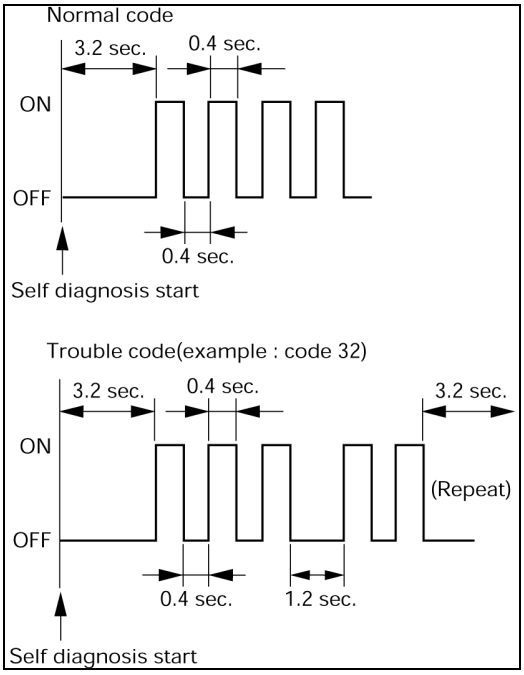
TFR/S (RHD)



826LV002

Self-diagnosis code display

- For quick search for faulty parts, 11 (TF) or 12 (UBS) different items of trouble code are indicated by “CHECK TRANS” lamp blinking.
- The storaged trouble codes can be identified by shorting the terminals No.11 and No.4 or 5 (ground) of diagnosis connector with a lead wire.



Indication Method:

(1) Terminals No.11 and No.4 or 5 (ground) of diagnosis connector are short circuited.

(2) Turn the ignition key to the ON position.

(3) In case there no trouble, normal code is indicated.

(4) In case a plurality of trouble codes have occurred at a time, each code is indicated three times in numerical order.

NOTE:

Power line runs through diagnosis connector.

Be careful shorting with a lead wire, etc.

(The vehicle side of control module may be damaged.)

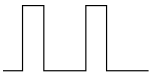
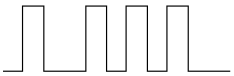
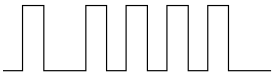
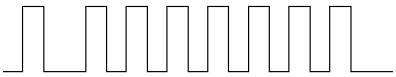
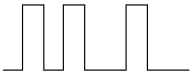
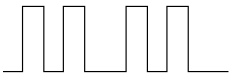
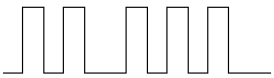
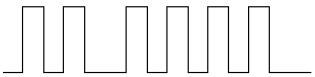
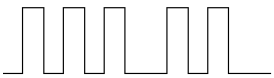
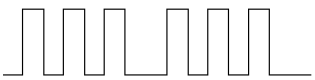
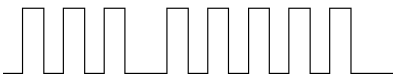
For identification of trouble code, connect Tech 2 to diagnosis connector.

Clear of trouble code memory

1. Clear the trouble code memory using F1: Clear DTC Information for Tech 2.
2. After more than 1 second has elapsed after the ignition key has been turned ON, short between NO.11 and No.4 or 5 (ground) of data link connector. Then, after 1 second, but within 6 seconds, discontinue shorting.

After erasing trouble code, check to see if the normal code is outputted through running test.

Flashing code

Trouble Code (P-Code)	Mode	Diagnostic area and Failure
11 (P0722)		Output revolution sensor failure (SP2)
13 (P0727)		Engine revolution signal failure (NE)
14 (P0717)		Input revolution sensor failure (NC0)
16 (P0710)		Oil temperature sensor failure (OT2)
17 (P0705)		Gear selector failure (PRND2L)
21 (P0120)		Analog throttle signal failure (VTH) (For UBS)
22 (P1120)		PWM throttle signal failure (TH) (For TFR/S)
23 (P1121)		Analog throttle signal failure (VREF, VGND) (For UBS)
24 (P0502)		Speed meter sensor failure (SP1)
31 (P0753)		Solenoid 1 failure (S1)
32 (P0758)		Solenoid 2 failure (S2)
33 (P0743)		Torque converter clutch control lock-up (ON/OFF) solenoid failure (SL)
35 (P0748)		Pressure control solenoid failure (STH)

F07R200014

DIAGNOSIS WITH TECH 2

In this AW30-40LE transmission, troubleshooting can be performed for electrical faults using the Tech 2 scan tool.

If the CHECK TRANS lamp blinks, or if an electrical fault in the transmission may probably exist, check trouble codes using the Tech 2 scan tool.

In the diagnostic procedures described in this manual, first repair the faulty positions indicated by trouble code in the order of numbers and then perform troubleshooting for the faulty positions that are not indicated by trouble code. For correct troubleshooting, it is necessary to first repair the trouble codes of lower-order numbers, then to repair the trouble codes of higher-order numbers in sequence.

How to Use This Manual:

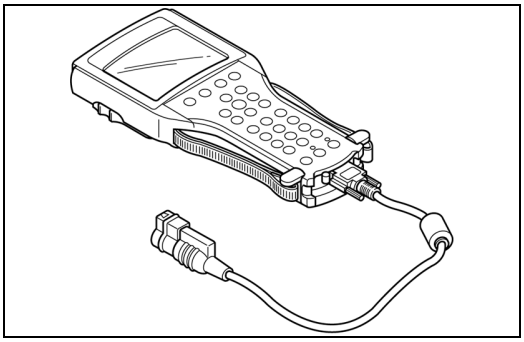
Check trouble codes using the Tech 2 scan tool.

If no codes are set:

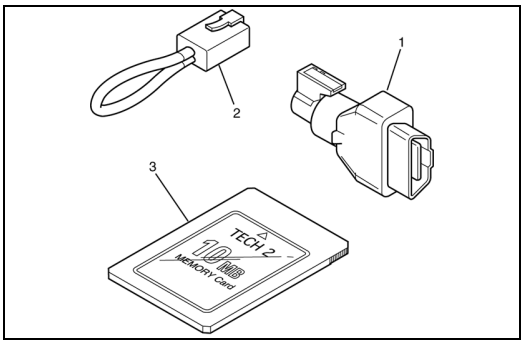
- Refer to Data List and identify the electrical faults that are not indicated by trouble code.

If codes are set:

- Record all the codes displayed by the Tech 2 and check if the codes are intermittent (intermittent faults).
- Clear the codes.
- Drive the vehicle for a test to reproduce the faulty status.
- Check trouble codes again using the Tech 2.
- If no code is displayed by test driving, the fault is intermittent. In this case, refer to the cautions on intermittent conditions.
- If a code is present, refer to “DIAGNOSTIC TROUBLE CODES (DTC) CHECK” for diagnosis.
- Because a code of high-order number may be set for the reason that a code of low-order number has been set after occurrence of a fault, perform repair work starting with a lower-order number is ascending order.

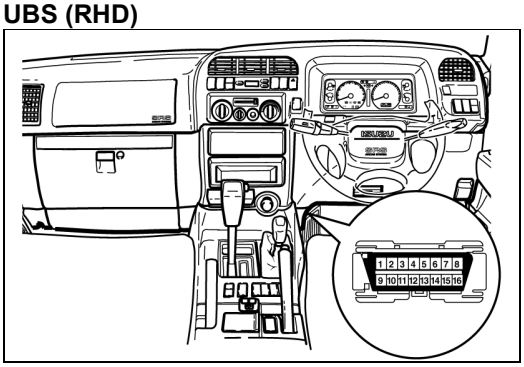


901RW176



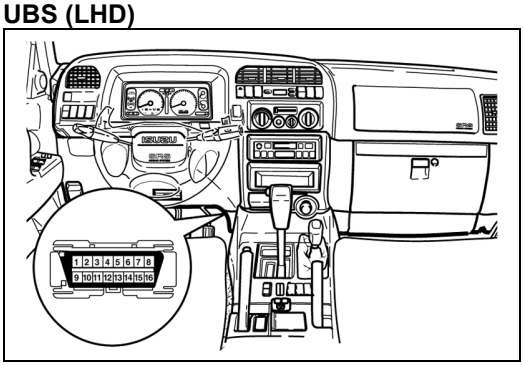
F07RW033

UBS (RHD)



740RY00013

UBS (LHD)



740RY00014

TECH2 CONNECTION

The Tech2 scan tool is used to electrically diagnose the automatic transmission system and to check the system. The Tech2 enhances the diagnosis efficiency though all the troubleshooting can be done without the Tech2.
The Tech2 is a portable, compact, and light tester. When it is connected to the diagnosis connector of the vehicle, you can perform a variety of diagnoses and tests by communicating with the Transmission Control Module (TCM) of the vehicle.

1. Configuration of Tech2
   1. Tech2 scan tool kit (No. 7000086), Tech2 scan tool (No. 7000057) and DLC cable (No. 3000095)
   2. SAE16/19 adapter (No. 3000098) (1), RS232 loop back connector (No. 3000112) (2), and PCMCIA card (No. 3000117) (3)

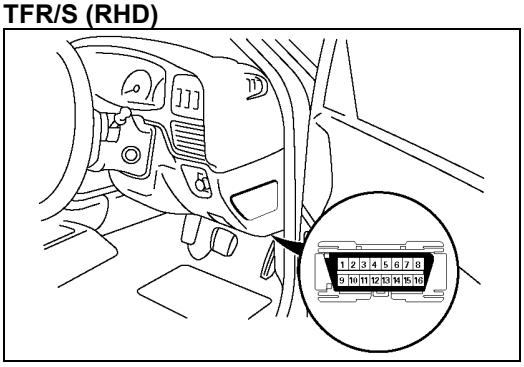
2. Tech2 Connection

- Observe the Tech 2 User Guide.
  1. Check the ignition is OFF.
  2. Insert the ISUZU (model year) system PCMCIA card (1) into the Tech2 (4).
  3. Connect the SAE16/19 adapter (2) to the DLC cable (3).
  4. Connect the DLC cable (3) to the Tech2 (4).
  5. Connect the SAE16/19 adapter (2) to the diagnosis connector of the vehicle.
  6. Turn the ignition of the vehicle ON and press the "PWR" key of the Tech2.
- Check the display of the Tech 2.

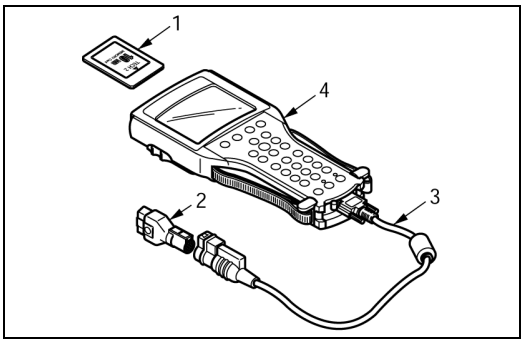
NOTE:

Be sure to check that the power is not supplied to the Tech2 when attaching or removing the PCMCIA card.

TFR/S (RHD)

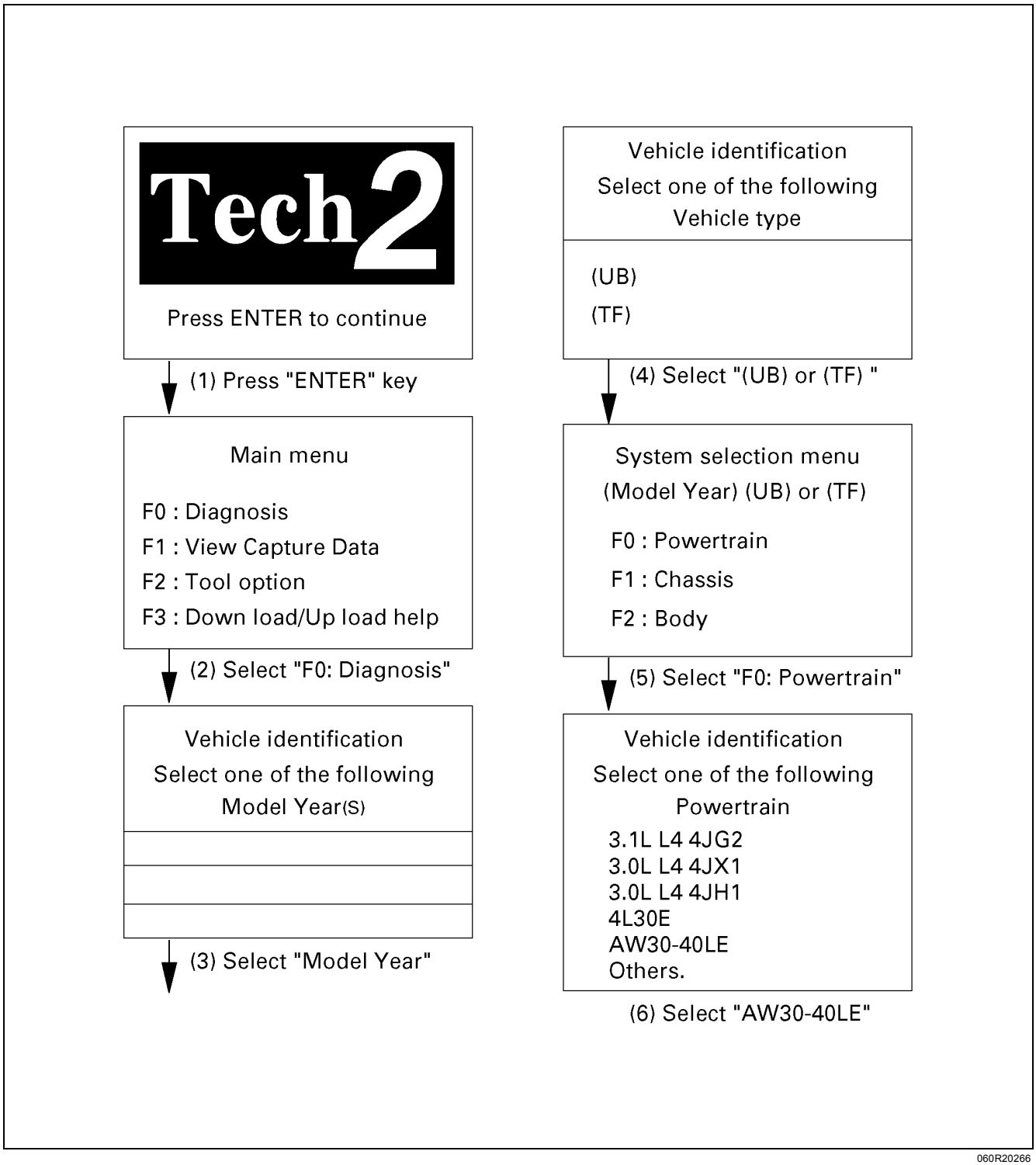


826LV002



901RY00014

TECH2 OPERATING FLOW CHART (START UP)



060R20266

Once the test vehicle has been identified an “Application (Powertrain) Menu" screen appears. Please select the appropriate application.

The following table shows, which functions are used for the available equipment versions.

- F0: Diagnostic Trouble Codes
  - F0: Read DTC Info By Priority
  - F1: Clear DTC Information
  - F2: DTC Information
    - F0: History
    - F1: Last Test Failed
- F1: Data Display
  - F0: Transmission Data
  - F1: TCC Data
- F2: Snapshot
  - F0: Transmission Data
  - F1: TCC Data
- F3: Miscellaneous Tests
  - F0: Lamps
    - F0: Check Light Test
    - F1: Power Lamp Test (For UB) / F1: AT Oil Temperature Lamp Test (For TF)
    - F2: Winter Lamp Test (For UB)
  - F1: Solenoids
    - F0: Solenoid 1-2/3-4 Test
    - F1: Solenoid 2-3 Test
    - F2: TCC Solenoid Test
    - F3: Pressure Control Solenoid (PCS)

Diagnostic Trouble Codes

The purpose of the “Diagnostic Trouble Codes" mode is to display stored TCM trouble codes.

When “Diagnostic Trouble Codes" is selected an “Application Menu" screen appears.

Clear DTC Information

The purpose of the “Clear DTC Information" mode is to command the clearing of stored TCM trouble codes.

When “Clear DTC Information" is selected, a “Clear DTC Information", warning screen appears. This screen informs you that by cleaning DTC's, “all stored DTC information in controller will be erased".

Do you want to clear DTC's (Yes/No).

Press either the Yes or No key when answering.

After clearing codes, confirm system operation by test driving the vehicle.

Allow the vehicle to shift through all four forward gears in a manner which attempts to repeat the failure condition.

NOTE: When the trouble has not been repaired and the trouble code cannot be erased, check the vehicle again.

DTC Information

When “DTC Information" is selected, an “Application Menu" appears with a list of DTC information function keys addressing DTC specifics and their origins.

Function key selections may vary for particular vehicle and/or system.

Data Display

The purpose of the “Data Display" mode is to continuously monitor data parameters.

The current actual values of all important sensors and signals in the system are display through F1 mode.

When “Data Display" is selected an “Application Menu" appears.

See “TRANSMISSION DATA" and “TCC DATA” on next page.

Snapshot

When “Snapshot" is selected an “Application Menu" appears.

When “Transmission Snapshot" application is selected from the “Application Menu", a “Snapshot Menu" appears, displaying several options. “Snapshot" options may vary from one system to another.

“Snapshot" allows a recording of all vehicle parameters. There parameters may then be replayed at a future point in time.

This action allows you to focus on making the condition occur, rather than trying to view all of the data in anticipation of the fault. The snapshot will collect parameter information around a trigger point that you select.

When a snapshot is taken. It is recorded onto the PCMCIA memory card. When the Tech2 is powered down. Snapshots are not lost.

Miscellaneous Tests

The purpose of “Miscellaneous Tests" mode is to check for correct operation of electronic system actuators.

Lamps

You can operate the lamps by pressing the ON and OFF buttons.

Preconditions: P or N position

Solenoid

Solenoid S1(1-2/3-4), S2(2-3) and TCC Solenoid (Torque Converter Clutch)

You can operate the solenoids by pressing the ON and OFF buttons.

Preconditions: P or N position, no vehicle speed, no engine speed

Pressure Control Solenoid (PCS)

You can operate the PC Solenoid by pressing the ON and OFF buttons. ON will command a maximum current of 1000 mA and OFF a minimum of 200 mA.

Preconditions: P or N position, no vehicle speed, engine running

TRANSMISSION DATA

Item	Unit	Engine running at idle
Current Gear		1
Lock Up	L - Up	
Selector Position		Park
AT Output Speed (Automatic Transmission)	RPM	0 RPM
Output Speed (Meter Signal Side)	RPM	0 RPM
AT Input Speed (Automatic Transmission)	RPM	0 RPM
Engine Speed	RPM	695 ~ 745 RPM (UBS)
Vehicle Speed (Output Side)	km/h	0 km/h
Throttle Position	%	0%
Throttle Position Sensor (For UB)	V	0.25 ~ 0.45V
AT Oil Temperature (Automatic Transmission)	°C, °F	70 ~ 80°C (158 ~ 176°F)
Shift Pattern		None
Desired PCS Pressure (Pressure Control Solenoid)	kPa	
PCS Desired Current (Pressure Control Solenoid)	A	
PCS Actual Current (Pressure Control Solenoid)	A	
Overdrive Off Switch	Off, On	
Brake Switch	Open 0V, Closed 12V	Closed 12V
Winter Switch (For UB)	Open, Closed 0V	Open
Power Switch	Open, Closed 0V	Open
Diagnostic Request	Open, Closed	Open
Winter Lamp (For UB)	Inactive 12V, Active 0V	Inactive 12V
Power Lamp (For UB)	Inactive 12V, Active 0V	Inactive 12V
Check Light	Inactive 12V, Active 0V	Inactive 12V
AT Oil Temperature Lamp (Automatic Transmission)	Inactive 12V, Active 0V	Inactive 12V
Solenoid 2-3	Inactive 0V, Active 12V	Inactive 0V
Solenoid 1-2/3-4	Inactive 0V, Active 12V	Active 12V
TCC Solenoid (Torque Converter Clutch)	Inactive 0V, Active 12V	Inactive 0V
Driving Mode		Economy

TCC DATA

Item	Unit	Engine running at idle
Current Gear		1
Lock Up	L - Up	
AT Output Speed (Automatic Transmission)	RPM	0 RPM
Output Speed (Meter Signal Side)	RPM	0 RPM
AT Input Speed (Automatic Transmission)	RPM	0 RPM
Engine Speed	RPM	695 ~ 745 RPM (UBS)
Vehicle Speed (Output Side)	km/h	0 km/h
Throttle Position	%	0%
Gear Ratio	:1	2.804
AT Oil Temperature (Automatic Transmission)	°C, °F	70 ~ 80°C (158 ~ 176°F)
TCC Slip Speed	RPM	695 ~ 745 RPM
TCC Solenoid Pressure Desired	kPa	0 kPa
Desired TCC Solenoid Current	A	0 A
Actual TCC Solenoid Current	A	0 A

INTERMITTENT CONDITIONS

If the Tech2 displays a code as intermittent, or if after a test drive a code does not reappear, the problem is most likely a faulty electrical connection or loose wiring.
Terminals should always be the prime suspect.
Intermittent rarely occur in sophisticated electronic components such as the Transmission Control Module (TCM).
When an intermittent problem is encountered, check suspect circuits for:

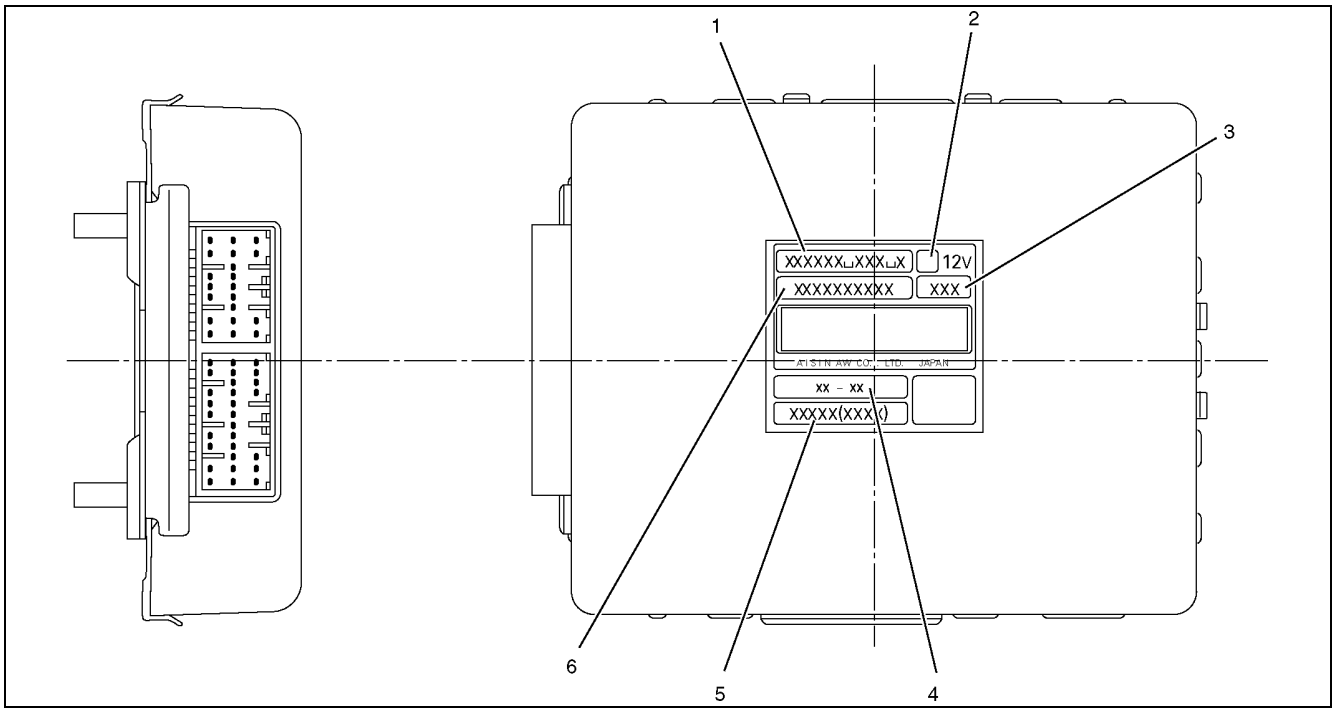
- Poor terminal to wire connection.
- Terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.
- Loose, dirty, or corroded ground connections.

  HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
- Pinched or damaged wires.
- Electro-Magnetic Interference (EMI)

  HINT: Check that all wires are properly routed away from coil, and generator. Also check for improperly installed electrical options, such as lights, 2-way radios, etc.

Use the F2: SNAPSHOT mode of the Tech2 to help isolate the cause of an intermittent fault. The snapshot mode will record information before and after the problem occurs. Set the snapshot to "trigger" on the suspect code (or codes) or, if you notice the reported symptom during test drive, trigger the snapshot manually.
After the snapshot has been triggered, command the Tech2 to play back the flow of data recorded from each of the various sensors. Signs of an intermittent fault in a sensor circuit are a sudden unexplainable jump in data values out of the normal range.

IDENTIFICATION OF TRANSMISSION CONTROL MODULE (TCM)



826R200032

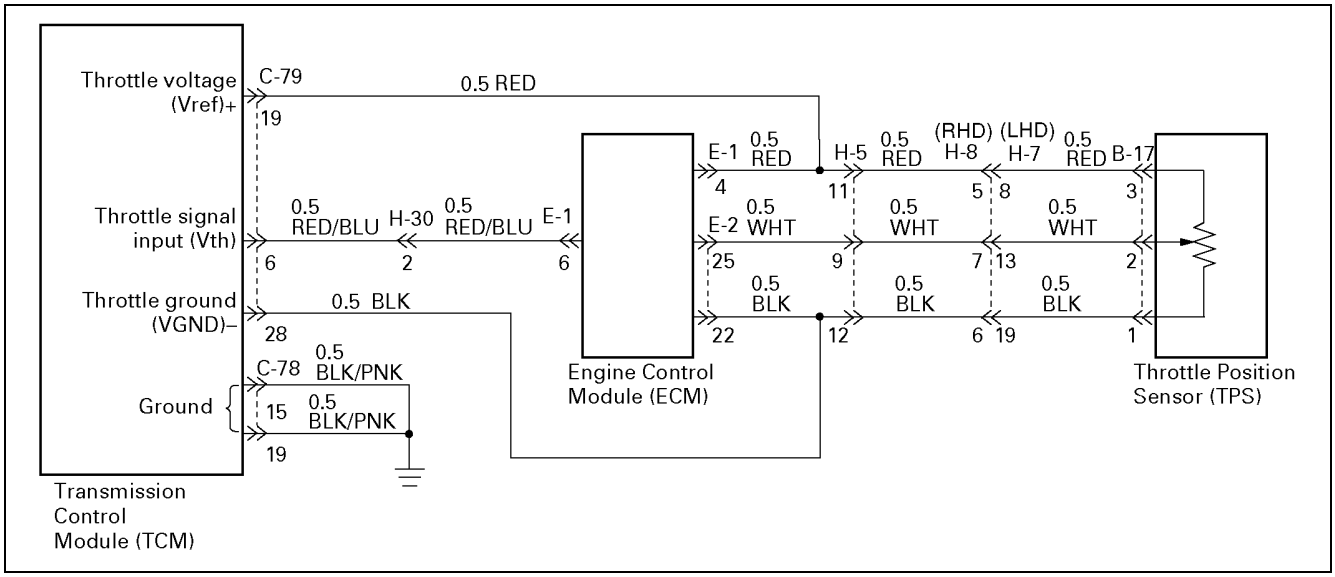
Legend

1. ISUZU Parts No.:
   '02UBS — 8-97230-821-0 (For General Export)
   '02TFS — 8-97303-885-0 (For Australia)
   '02TFR — 8-97303-884-0 (For Australia and South Africa)
   '01TFR — 8-97254-431-0 (For Thailand)
2. Calibration Code
3. Production Date: **XX X**
   - Month-Denotes JAN. to DEC. for A to M (except I).
   - Year-Denotes the last 2 digit of year.
4. Software Version No.: **XX - XX**
   - Calibration Version No.
   - Software Version No.
5. Model Year, Vehicle Model, Engine Type
6. Serial No.

DIAGNOSTIC TROUBLE CODES (DTC) CHECK

DTC NUMBER	FLASHING CODE	DESCRIPTION
P0120	21	ANALOG THROTTLE SIGNAL FAILURE (VTH) (FOR UBS)
P0502	24	SPEED METER SENSOR FAILURE (SP1)
P0705	17	GEAR SELECTOR FAILURE (PRND2L)
P0710	16	OIL TEMPERATURE SENSOR FAILURE (OT2)
P0717	14	INPUT REVOLUTION SENSOR FAILURE (NC0)
P0722	11	OUTPUT REVOLUTION SENSOR FAILURE (SP2)
P0727	13	ENGINE REVOLUTION SIGNAL FAILURE (NE)
P0743	33	TORQUE CONVERTER CLUTCH CONTROL LOCK-UP (ON/OFF) SOLENOID FAILURE (SL)
P0748	35	PRESSURE CONTROL SOLENOID FAILURE (STH)
P0753	31	SOLENOID 1 FAILURE (S1)
P0758	32	SOLENOID 2 FAILURE (S2)
P1120	22	PWM THROTTLE SIGNAL FAILURE(TH) (FOR TFR/S)
P1121	23	ANALOG THROTTLE SIGNAL FAILURE (VREF, VGND) (FOR UBS)

DTC P0120 (FLASHING CODE 21)
ANALOG THROTTLE SIGNAL FAILURE (VTH) (FOR UBS)



D07R200063

Circuit Description:

When the signal of the engine throttle position sensor located on the accelerator pedal is supplied to the TCM, the TCM judges the opening condition of the throttle.

The shift point of the transmission is determined by this opening condition of the throttle.

Fail-safe control:

The TCM controls fail-safe by detecting analog throttle signal (VTH) failure.

Failure detection:

- When the throttle input voltage is detected less than 0.112V or more than 4.417V for 2.0 seconds.

Contents of control:

At failure detection

- Throttle opening for line pressure control ... Throttle opening 100%
- Throttle opening for shift control ... Throttle opening 0%
- Lock-up control inhibit
- Up hill and down hill control inhibit
- Squat control inhibit

At failure decision

Executes following items in addition to above control items at failure detection.

- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure-memory

Conditions of turning "CHECK TRANS" lamp off:

Turns “CHECK TRANS” lamp off when judged 0km/h by output revolution sensor after throttle signal input voltage is detected more than 0.112V and less than 4.717V.

(however, uses 0 km/h judgment by back-up vehicle speed at output revolution failure)

Reversion conditions from fail-safe:

At failure detection

Immediately recovers when the throttle input voltage is detected more than 0.112V and less than 4.717V.

At failure decision

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. Check that the throttle input voltage is 0.25 to 0.45V.
2. At this test, check that as the throttle opens, the voltage goes up and that the voltage reaches 3.74 to 4.56V at the full open status.
6. Check the power supply voltage (4.75 – 5.25V) of the throttle position sensor.

Diagnostic aids:

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

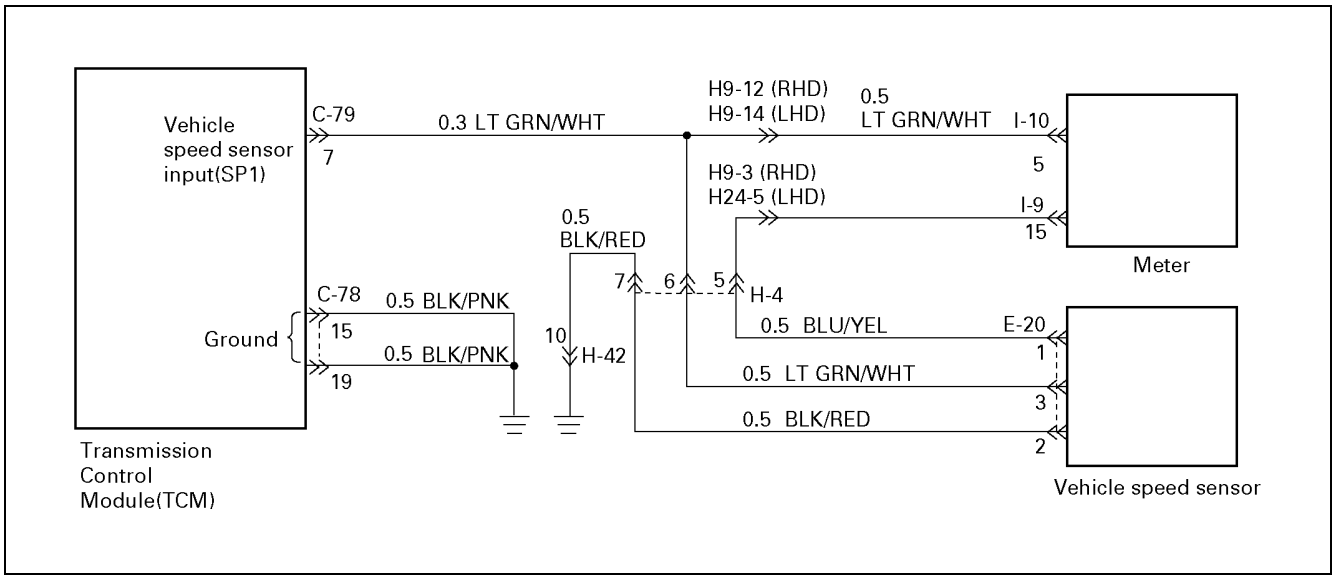
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DTC P0120 (FLASHING CODE 21)
ANALOG THROTTLE SIGNAL FAILURE (VTH) (FOR UBS)

Step	Action	Value(s)	Yes	No
1	1. With the engine “OFF”, turn the ignition “ON”. 2. Connect a voltmeter between the TCM 28 pin connector terminal (6) and ground terminal (28). Is the voltage within the specified valve?	0.25－0.45 V	Go to Step 2	Go to Step 3
2	Open the throttle fully. Is the voltage within the specified value?	3.74－4.56 V	The problem is intermittent. Refer to *“Diagnostic aids”.*	Go to Step 3
3	Connect a voltmeter between the ECM 32 pin connector terminal (E1-6) and (E2-22). Is the voltage within the specified value?	0.25－0.45 V	Go to Step 4	Go to Step 6
4	Open the throttle fully. Is the voltage within the specified value?	3.74－4.56 V	Go to Step 5	Go to Step 6
5	1. Check the wiring harness between the TCM 28 pin connector terminal (6) and ECM 32 pin connector terminal (E1-6). 2. Or TCM is faulty. Was a problem found and corrected?	－	Go to Step 9	－
6	1. Disconnect the TPS 3 pin connecter. 2. Connect a voltmeter between the TPS 3 pin connector terminal (3) and (1). Is the voltage within the specified value?	4.75－5.25 V	Go to Step 7	Go to Step 8
7	Check the TPS connector. If OK, replace the TPS. Is the replacement complete?	－	Go to Step 9	－
8	Check the wiring harness between the TPS and ECM. If OK, replace the ECM. Is the replacement complete?	－	Go to Step 9	－
9	1. After the repair is complete, use the scan tool to select “DTC”, then “clear Info” function. 2. Make a road running test for the vehicle. 3. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	－	Begin the diagnosis again. Go to Step 1	System OK

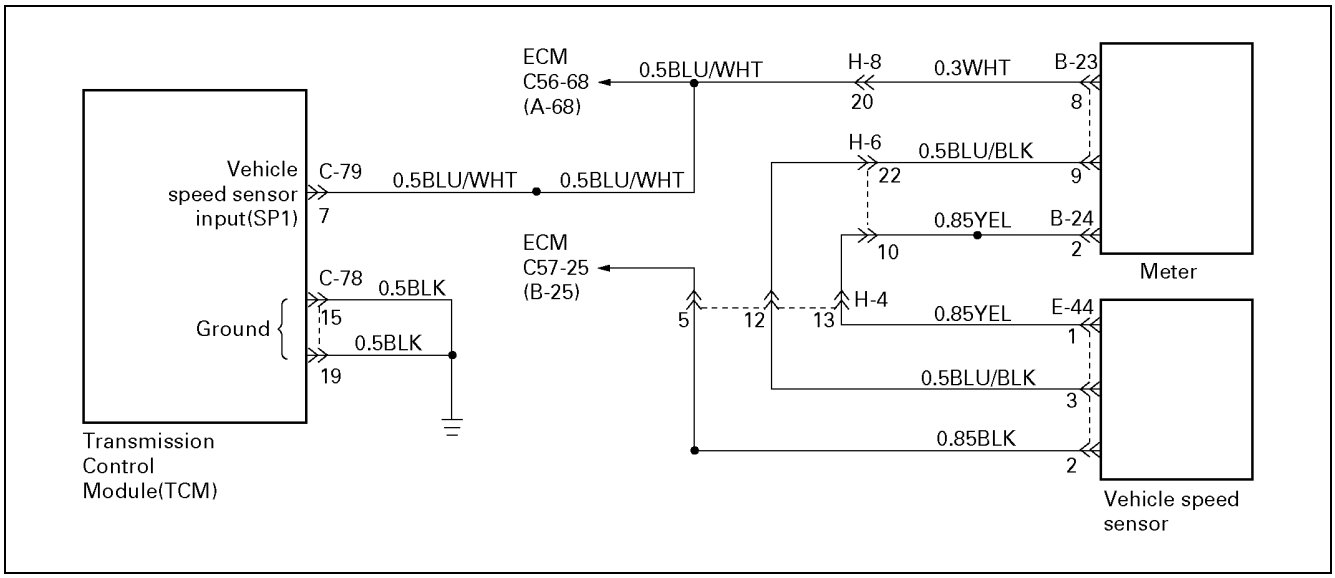
DTC P0502 (FLASHING CODE 24)
SPEED METER SENSOR FAILURE (SP1)

UBS (For General Export)



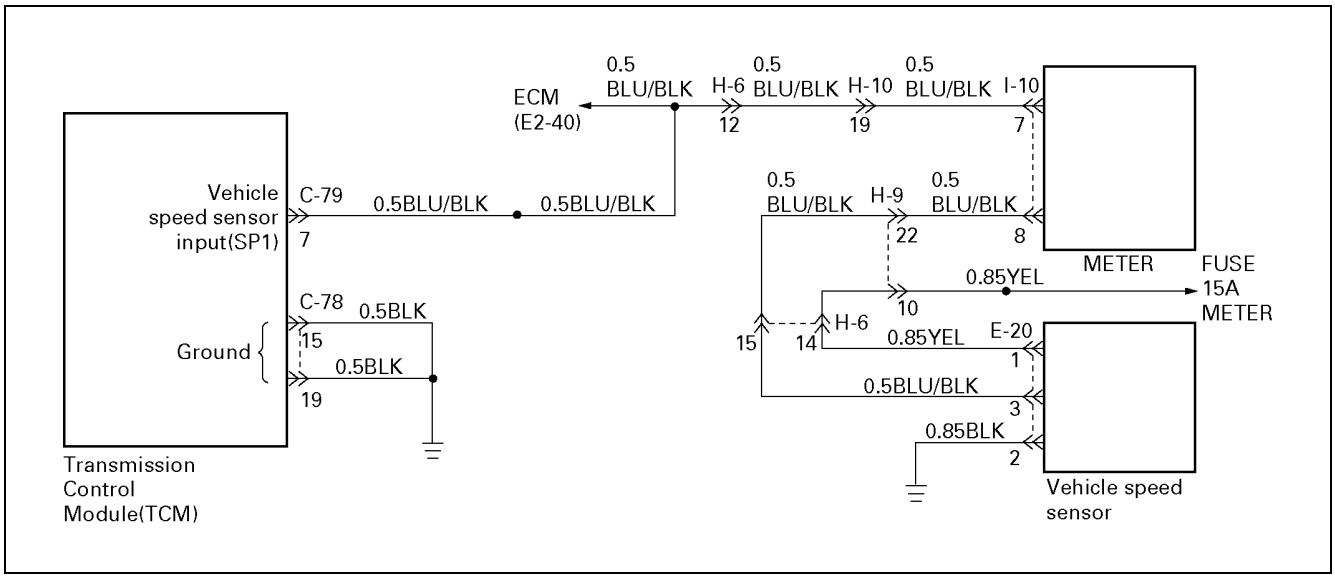
D07R200056

TFR/S (For Australia) and TFR (For South Africa)



D07L200001

'01 TFR (For Thailand)



D07L100004

Circuit description:

Speed information is provided by the speed meter sensor to the meter.

In the meter, the pulses of the speed meter sensor are converted to speed signals (pulses), and these signals are output to the TCM and ECM(TF). The TCM converts these pulse voltages to km/h signals.

Fail-safe control:

The TCM controls fail-safe by detecting speed meter signal failure.

Failure detection:

- When the speed meter signal is not detected from right after ignition turned ON:

  When not even 1 pulse is input in the speed meter signal during the time 100 pulses are input in the output revolution sensor signal.
- When the speed meter signal is not detected, after the speed meter signal is detected more than 1 pulse after ignition turned ON:

  When not even 1 pulse is input in the speed meter signal during the time 27 pulses are input in the output revolution sensor signal.

Contents of control:

At failure detection

- Keeps the condition of transfer (High/Low judgment) just before detection until vehicle speed is 0km/h, and changes shift map to L4 map (3→4 UP None) at vehicle speed is 0km/h. (For UBS)
- Uses high oil temperature map according to shift map priority at correct oil temperature control.
- Up hill and down hill control inhibit. (For UBS)
- Stores the failure information in failure -memory.
- The failure detection of oil temperature sensor inhibit

At failure decision

Executes following items in adition to above control items at failure detection.

- Blinks "CHECK TRANS" lamp

Conditions of turning "CHECK TRANS" lamp off:

Turns "CHECK TRANS" lamp off when judged 0km/h by speed meter sensor after more than 1 pulse are input in the speed meter signal during the time 27 pulses are input in the output revolution sensor.

Reversion conditions from fail-safe:

At failure detection and decision

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

2. The cause of DTC P0502 setting is due to the operation fault of the speed meter.
3. Speed signals are output from the meter. The sensor power supply is given from the TCM.

Diagnostic aids:

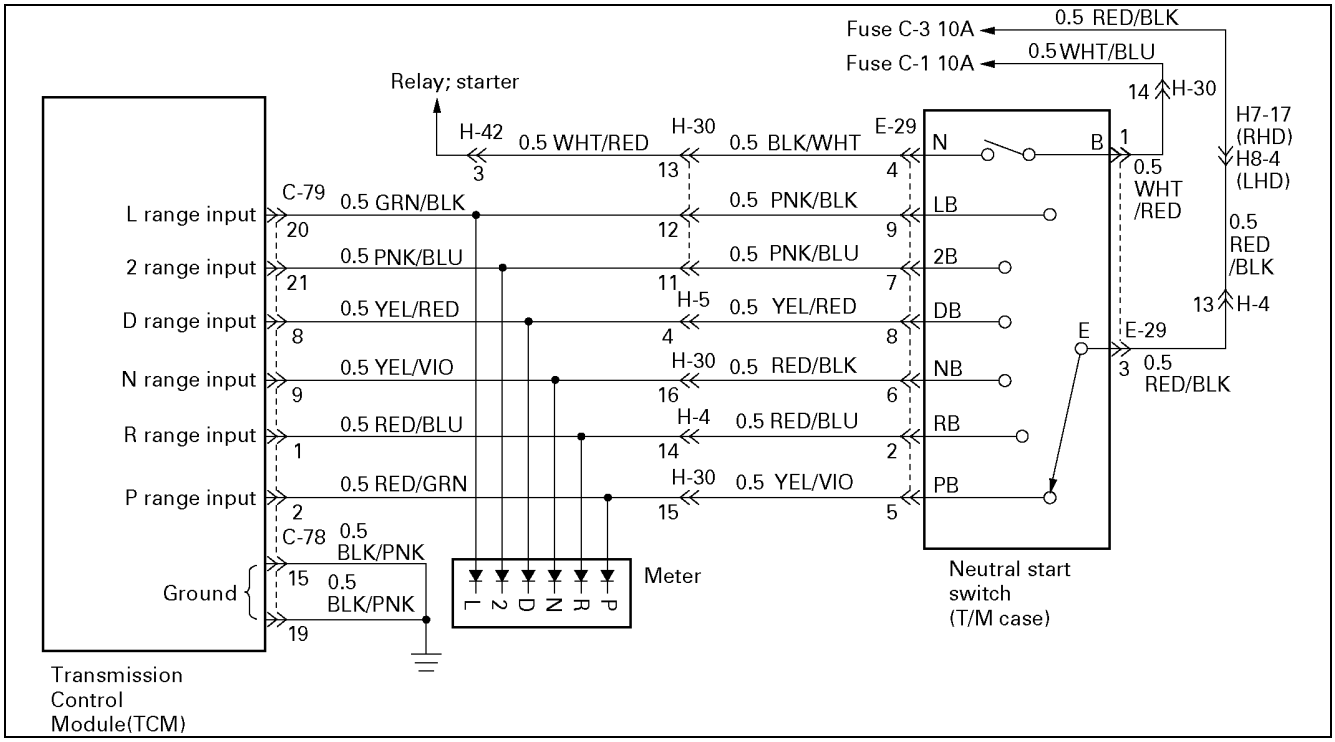
An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P0502 (FLASHING CODE 24)
SPEED METER SENSOR FAILURE (SP1)

Step	Action	Value(s)	Yes	No
1	1. Lift the driving wheels. 2. With the engine idling in gear D range. Is the Tech 2 displayed speed the specified value?	0 km/h	Go to Step 2	DTC P0502 is intermittent. If other DTCs are not stored in memory. Refer to *"Diagnostic aids".*
2	Does the speed meter operate?	—	Go to Step 3	Go to Step 4
3	1. Open the throttle and increase the revolution speed of the driving wheels 2. Measure the voltage between the TCM 28 pin connector terminal (7) and TCM 20 pin connector ground terminal (15 or 19) with a voltmeter. Does the voltage vary intermittently in the specified value?	Less than 1.4 V ⇔ Greater than 9 V (Pulse check) (Vehicle speed 1～2 km/h)	Go to Step 5	Go to Step 6
4	The speed meter or speed meter sensor is faulty. Was a problem found and corrected?	—	Go to Step 7	—
5	The TCM connect is faulty or the TCM is faulty. Was a problem found and corrected?	—	Go to Step 7	—
6	The wiring harness between the speed meter and TCM is open or the speed meter sensor is faulty. Was a problem found and corrected?	—	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make the road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

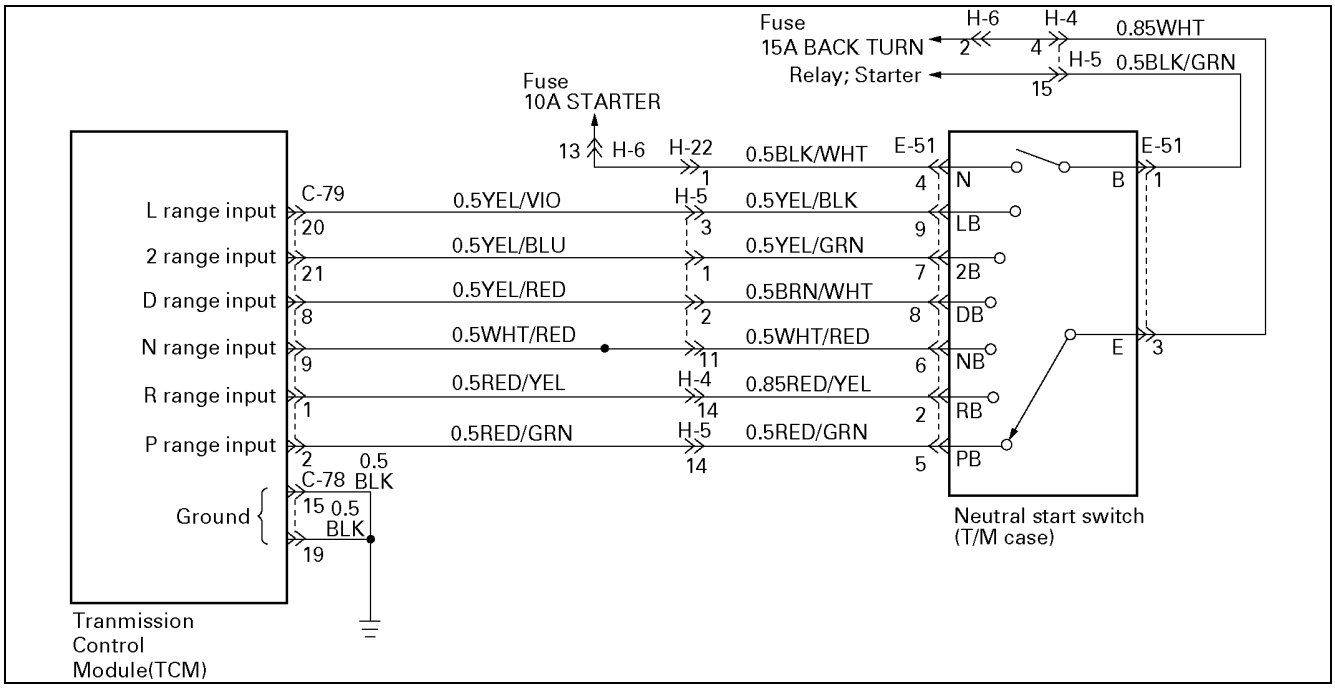
DTC P0705 (FLASHING CODE 17)
GEAR SELECTOR FAILURE (PRND2L)

UBS (For General Export)



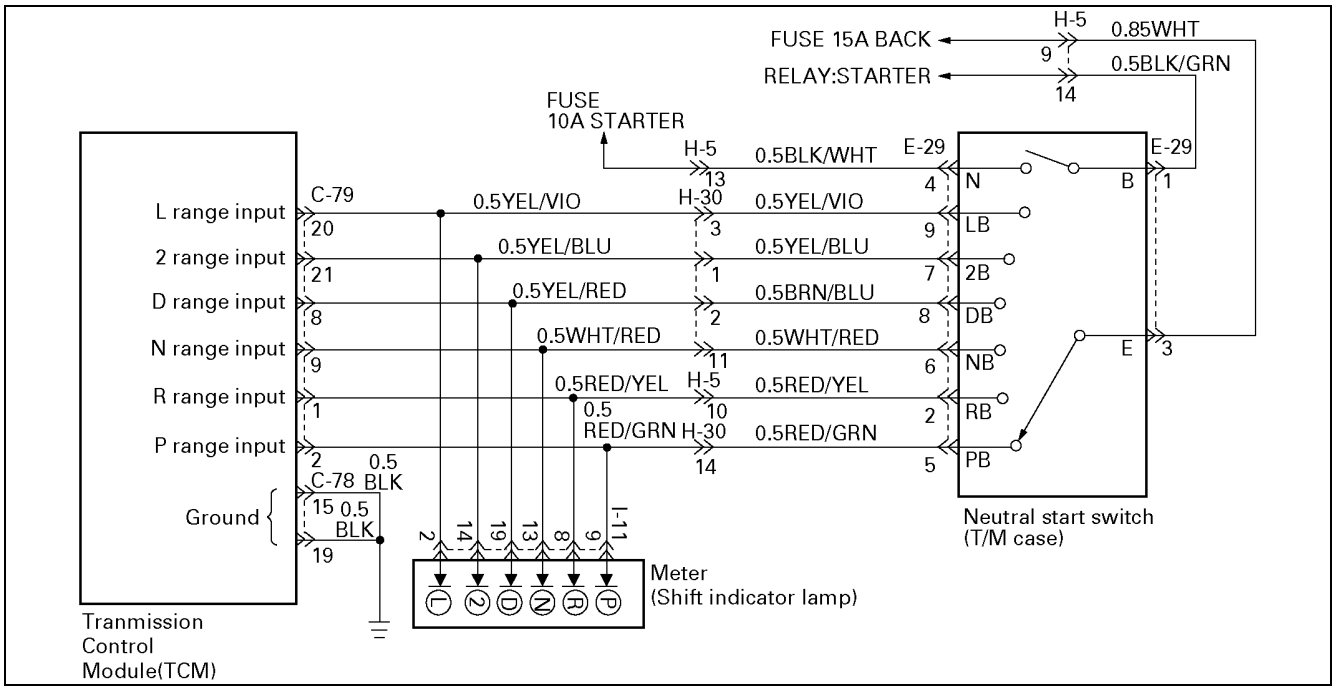
D07R200057

TFR/S (For Australia) and TFR (For South Africa)



D07L200002

'01TFR (For Thailand)



D07L200011

Circuit description:

The neutral start switch gives the signals related to the selector lever position (PRND2L) to the Transmission Control Module (TCM). The neutral start switch turns on when the select lever is shifted to the P, R, N, D, 2 or L range. The neutral start switch, which is connected to the starter switch circuit, is available only when the select lever is in the P or N range

The neutral start switch is connected to the transmission manual shaft and installed in the transmission case.

Fail-safe condition:

The TCM controls fail-safe by detecting selector position switch failure.

Failure detection:

(1) OPEN:

- When all switches are OFF
- When the failure criteria continues for 30 seconds if the vehicle speed which is calculated by output revolution sensor is more than 30 km/h and the engine revolution is more than 1500 rpm.

(2) SHORT:

- When more than two switches are ON at the same time.
- When the failure criteria condition for 10 seconds.

Contents of control:

At failure detection

(1) OPEN: D range judgment

(2) SHORT: Judged by priority D>2>L>R>N>P

- Up hill and down hill control inhibit (For UBS)
- Winter mode inhibit (For UBS)

At failure decision

Excutes following items in addition to above control items at failure detection.

- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure-memory
- Reverse lockout control inhibit

Conditions of turning "CHECK TRANS" off:

Turns "CHECK TRANS" lamp off when only one of all switches is ON.

Reversion conditions from fail-safe:

Turns "CHECK TRANS" lamp off when only one of all switches is ON.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. It is judged whether the input signal received from the neutral start switch by the TCM is proper or not.
5. The power status of the neutral start switch is checked.
6. The continuity between neutral start switch terminals and the continuity of the wire connected to the neutral start switch are checked.

Diagnostic aids:

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P0705 (FLASHING CODE 17)
GEAR SELECTOR FAILURE (PRND2L)

Step	Action	Value(s)	Yes	No
1	1. With the engine "OFF", turn the ignition "ON". 2. Connect a voltmeter to the each terminals of the TCM 28 pin connector and TCM 20 pin connector ground terminal (15 or 19). 3. Measure the voltage shifting the selector lever to very position. (Comparison with table 1) Is the displayed voltage at every position normal?	See table 1	Go to Step 2	Go to Step 3
2	1. Clear the TCM memory. 2. Make a running test. (Greater than 30 seconds). Is DTC P0705 displayed by self-diagnosis?	—	Go to Step 4	The continuity of wiring is temporarily faulty. Refer to “Diagnostic aids”.
3	Is the displayed voltage at every position abnormal?	—	Go to Step 5	Go to Step 6
4	The TCM is faulty or the continuity of wiring is temporarily faulty. Refer to "Diagnostic aids". Was a problem found and corrected?	—	Go to Step 9	—
5	1. Check if there is any breaking in the fuse and wire connected to the 10 pin connector terminal (3) of the neutral start switch. 2. Check the adjusted condition of the neutral start switch. 3. If no fault is found, replace the neutral start switch. Was a problem found and corrected?	—	Go to Step 9	—
6	1. Disconnect the 10 pin connector of the neutral start switch. 2. Make a continuity check between each terminals of the neutral start switch with an ohmmeter. Is the continuity at every position normal?	See table 2	Go to Step 7	Go to Step 8
7	The wiring harness between the TCM and neutral start switch is open or shorted. Was a problem found and corrected?	—	Go to Step 9	—
8	Replace the neutral start switch. Is the replacement complete?	—	Go to Step 9	—
9	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

(Table 1)

TCM 20 pin terminal (-)	TCM 28 pin terminal (+)	Voltage (V)
15 or 19	2	8-16: P range 1 or less: Other than P range
	1	8-16: R range 1 or less: Other than R range
	9	8-16: N range 1 or less: Other than N range
	8	8-16: D range 1 or less: Other than D range
	21	8-16: 2 range 1 or less: Other than 2 range
	20	8-16: L range 1 or less: Other than L range

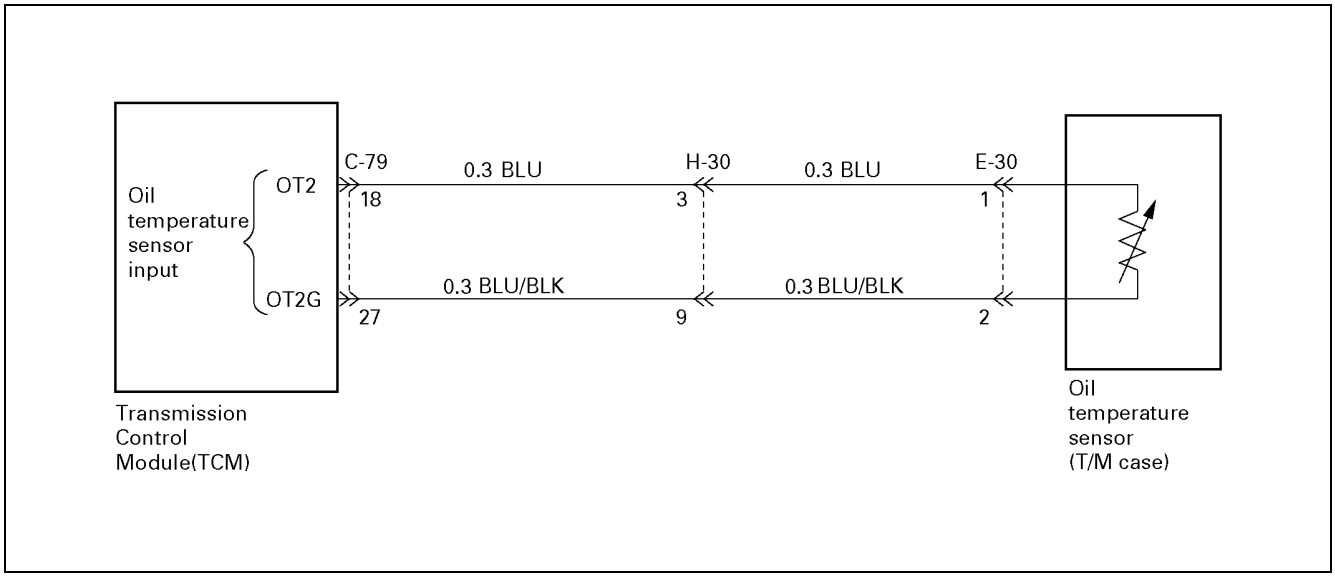
(Table 2)

Terminal / Range	Neutral start switch 10 pin connector								
	1	4	3	5	2	6	8	7	9
P	○—○		○—○						
R			○		○				
N	○—○		○			○			
D			○				○		
2			○					○	
L			○						○

○—○ Continuity

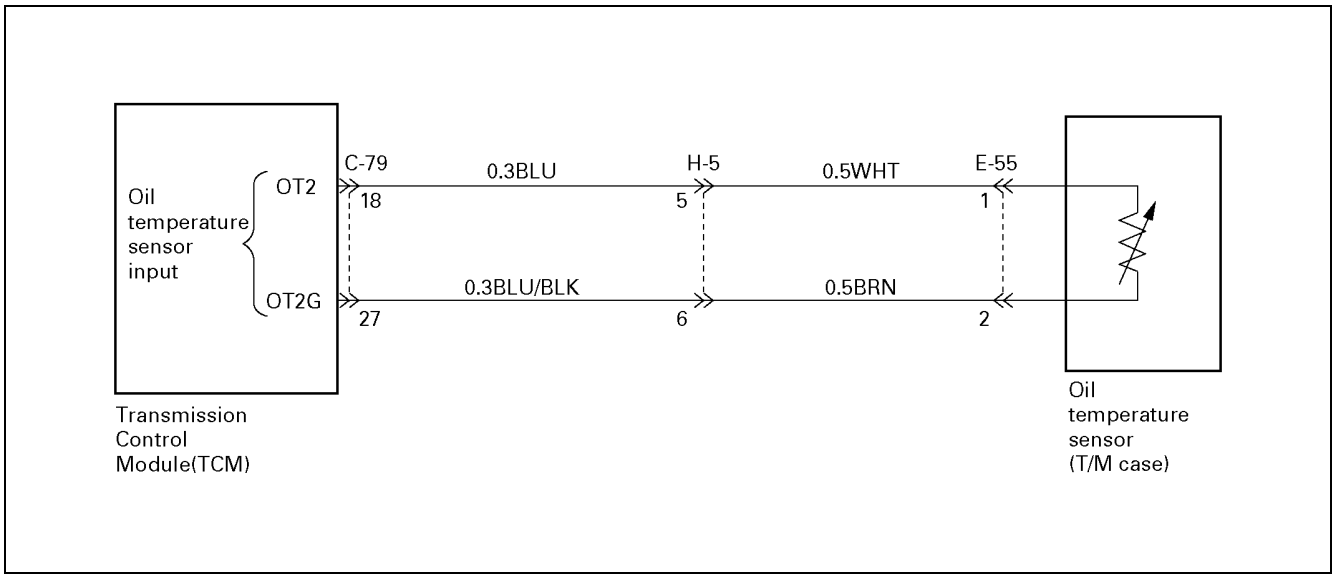
DTC P0710 (FLASHING CODE 16)
OIL TEMPERATURE SENSOR FAILURE (OT2)

UBS (For General Export)



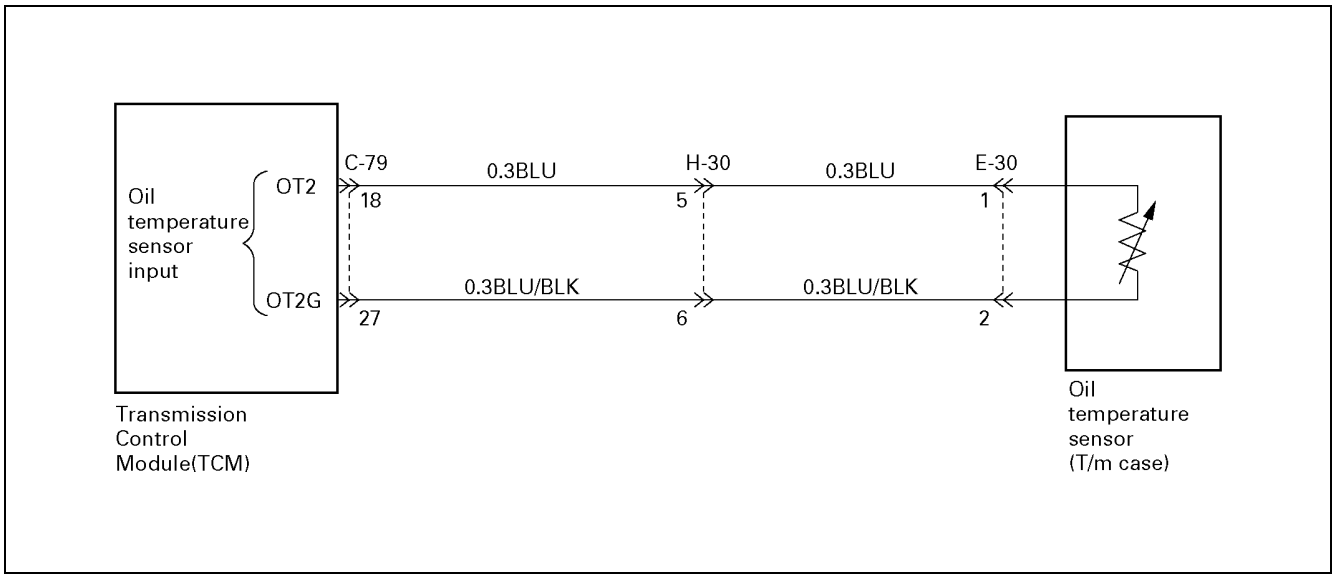
D07R200058

TFR/S (For Australia) and TFR (For South Africa)



D07L200003

'01TFR (For Thailand)



D07L100006

Circuit Description:

The oil temperature sensor is a thermistor sensor that is installed in the transmission case and converts temperature changes into continuous electric signals, then outputs them to the Transmission Control Module (TCM). When the ATF temperature is low, the resistance of the sensor (thermistor) goes up, so that the voltage of the TCM signal becomes high.

As the ATF is gradually warmed, the resistance of the sensor goes down and the voltage becomes low. At the normal operating ATF temperature (80°C/176°F) of the transmission, the voltage of the TCM is about 3.7V.

Fail-safe condition:

The TCM controls fail-safe by detecting oil temperature sensor failure.

Failure detection:

Short detection

- When the A/D value is detected less than 10 (220°C) for 5 minutes continuously while normal judgment is not satisfied from ignition on.

Open detection

- After 15 minites passed when the engine revolution is more than 400 rpm and the selector position switch is selected on R, D, 2, L range.
- When the change of the A/D value from engine start is less than 15 and the minnum A/D value is more than 1000 (-10°C) from engine start.

Contents of control:

At failure detection

- Changes shift map to HOT2 map
- Controls as A/T oil temperature 200°C
- Lock-up control inhibit
- Up hill and down hill control inhibit (For UBS)
- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure-memory

At failure decision

- Same as failure detection.

Conditions of turning "CHECK TRANS" off:

Turns "CHECK TRANS" lamp off when judged 0km/h by output revolution sensor after the normal area of oil temperature 40°C – 150°C is detected for 10 sec continuously.

Reversion conditions from fail-safe:

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. Check that the voltage of the oil temperature sensor varies with ATF temperatures.
3. Check that the resistance of the oil temperature sensor varies with ATF temperatures.

Diagnostic aids:

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P0710 (FLASHING CODE 16)
OIL TEMPERATURE SENSOR FAILURE (OT2)

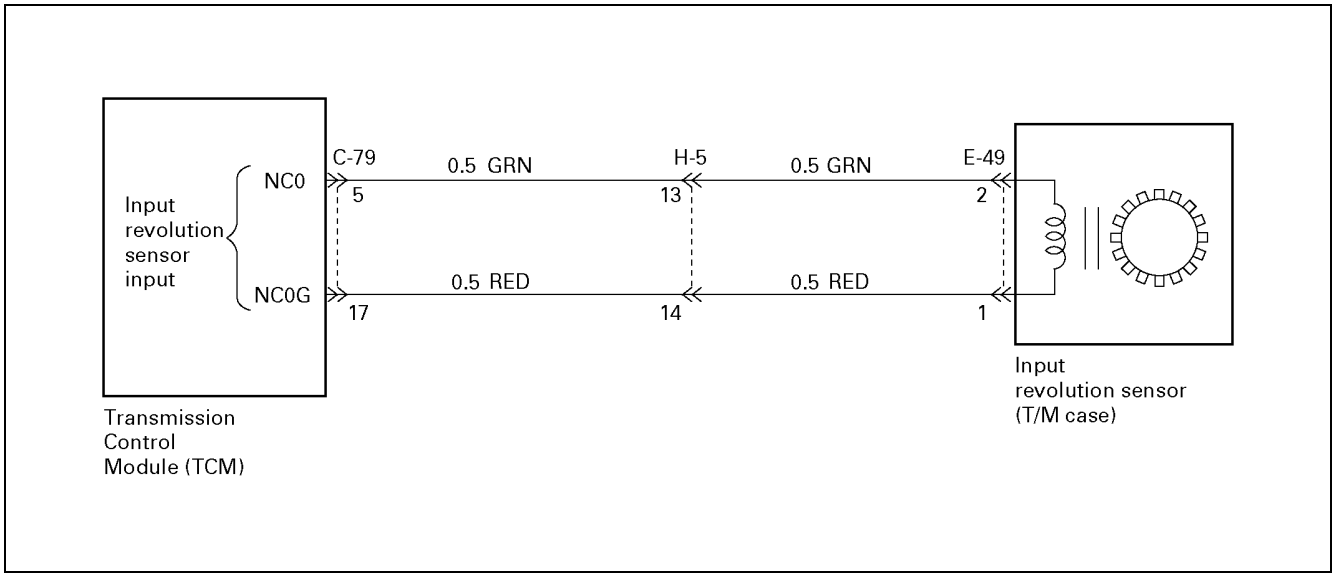
Step	Action	Value(s)	Yes	No
1	1. With the engine "OFF", turn the ignition "ON". 2. Connect a voltmeter between the TCM 28 pin connector terminal (18) and (27). Is the voltage as shown in the table?	See table	Go to Step 2	Go to Step 3
2	1. Replace the TCM with a new one. 2. Make a running test. Is DTC P0710 displayed by self-diagnosis?	—	Go to Step 4	The TCM is faulty. (TCM before replacement) Go to Step 9
3	1. Disconnect the TCM 28 pin connector. 2. Measure the resistance between the TCM 28 pin connecter terminal (18) and (27). Is the resistance as shown in the table?	See table	Go to Step 5	Go to Step 6
4	Check the wiring harness or connector connection between the TCM and oil temperature sensor. Was a problem found and corrected?	—	Go to Step 9	—
5	The TCM is faulty or the continuity of wiring is temporarily faulty. Refer to "Diagnostic aids". Was a problem found and corrected?	—	Go to Step 9	—
6	1. Disconnect the A/T 2 pin connector. 2. Measure the resistance between the A/T 2 pin connector terminal (1) and (2). Is the resistance as shown in the table?	See table	Go to Step 7	Go to Step 8
7	The wiring harness between the TCM and oil temperature sensor connector is ground-shorted. Was a problem found and corrected?	—	Go to Step 9	—
8	Replace the oil temperature sensor. Is the replacement complete?	—	Go to Step 9	—
9	1. After the repair is complete, use the scan tool the select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

(Table)

ATF temperature (°C/°F)	Voltage (V)	Resistance (kΩ)
20/68	Approx. 4.7	0.5 – 30
80/176	Approx. 3.7	

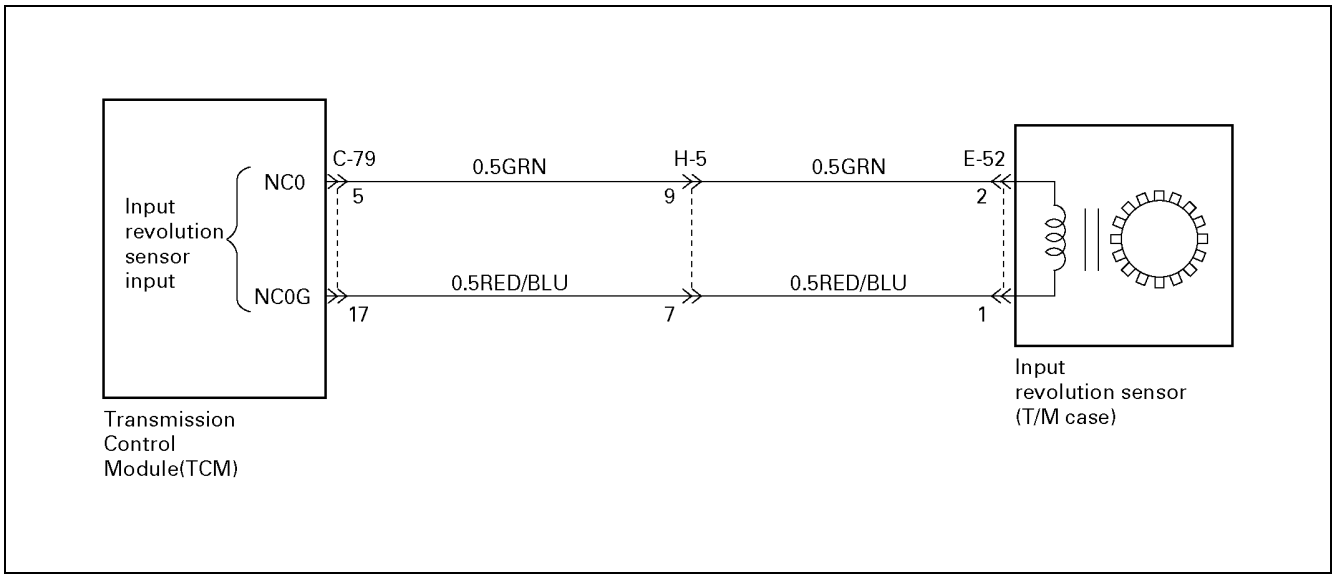
DTC P0717 (FLASHING CODE 14)
INPUT REVOLUTION SENSOR FAILURE (NC0)

UBS (For General Export)



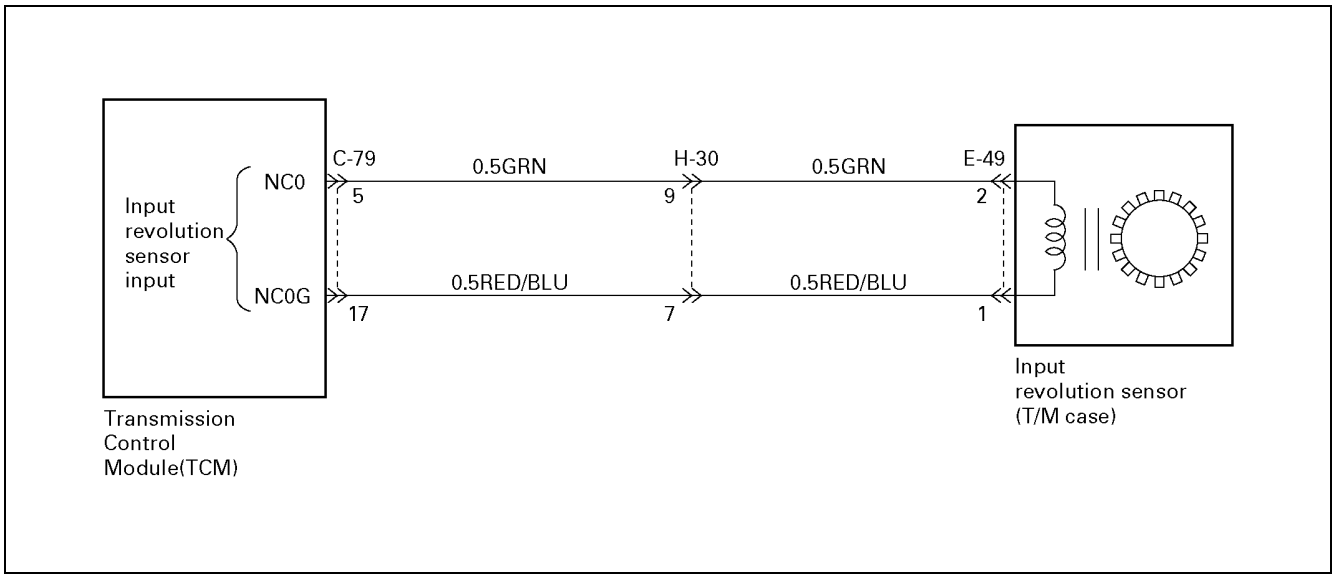
D07R200059

TFR/S (For Australia) and TFR (For South Africa)



D07L200004

'01TFR (For Thailand)



D07L100007

Circuit description:

Input revolution information is provided to TCM by the input revolution sensor. This sensor is located in the transmission case.

The input revolution sensor is an electromagnetic pulse pickup type that generates a speed signal according to the revolution of the transmission OD direct clutch drum.

As a result, the sensor sends a sine wave signal (AC) to the TCM, which converts this sine wave signal (pulse voltage) to a RPM signal.

Fail-safe control:

The TCM controls fail-safe by detecting input revolution sensor failure.

Failure detection:

- When not even 1 pulse is input in the input revolution sensor during the time 4 pulses are input in the output revolution sensor.
- When the failure criteria is continuously 1000 times from the time ignition is turned ON until it is turned OFF.

Prohibits failure detection when at least one among the following conditions is satisfied.

- When D, 2 and L range signal is not fixed.
- When output revolution is less than 775 rpm.
- When the failure detection timer T1 (*1) is less than 25 seconds.
- Solenoid S1, S2, and selector position switch is on failure detection or decision.
- At 4th gear.
- When passed less than 10 seconds after shift command output.

*1: Failure detection inhibit timer T1

Timer starts when D, 2 or L range are detected (fixation signal).

Contents of control:

At failure detection

- Lock-up control inhibit
- Up hill and down hill control inhibit (For UBS)

At failure decision

Executes following items in addition to above control items at failure detection.

- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure-memory

Conditions of turning "CHECK TRANS" off:

At D, 2 or L range and not shifting, turns "CHECK TRANS" lamp off when judged 0km/h by output revolution sensor after more than 1 pulse input in the input revolution sensor and finished vehicle speed calculation during the time 4 pulse are input in the output revolution sensor.

Reversion conditions from fail-safe:

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. When the engine is running, a revolution signal is input from the input revolution sensor to the TCM.
2. At this test, the continuity of circuit wiring and the input revolution sensor is checked.
4. At this test, the continuity of the input revolution sensor is checked.

Diagnostic aids:

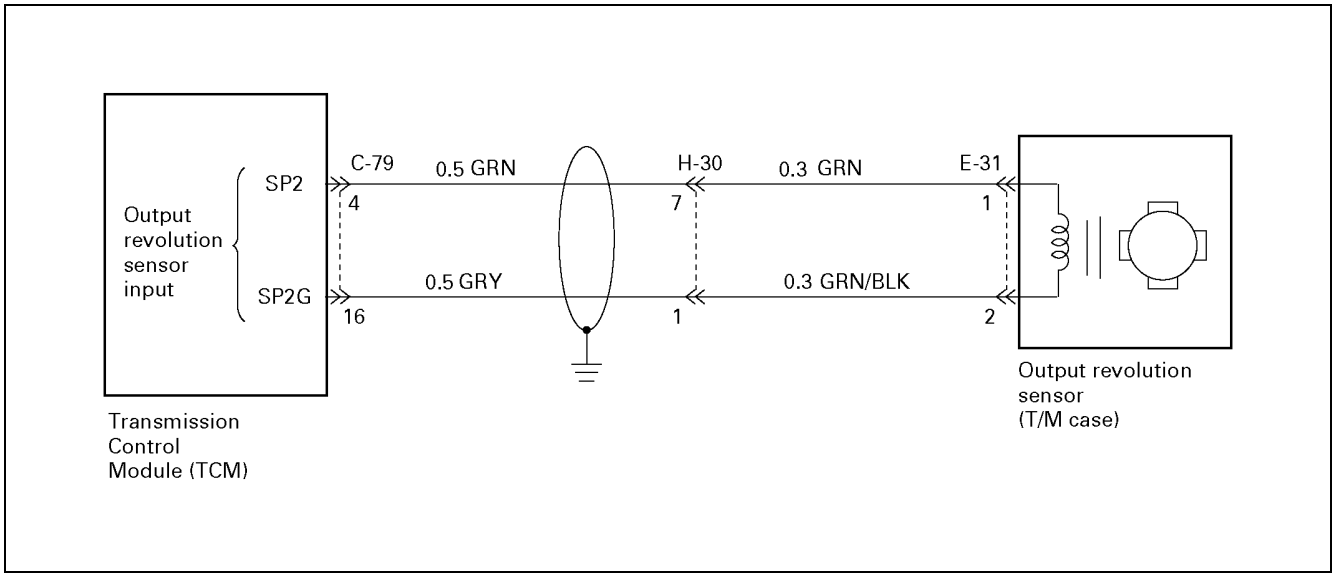
An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P0717 (FLASHING CODE 14)
INPUT REVOLUTION SENSOR FAILURE (NC0)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition "ON" and the engine "ON". 2. With the engine edling, connect a voltmeter between the TCM 28 pin connector terminal (5) and ground terminal (17). Does the voltage rary in the specified value? (The voltage increases in proportion to the speed.)	0-3 V (AC) or more	DTC P0707 is intermittent. If other codes are not stored, refer to "Diagnostic aids".	Go to Step 2
2	1. Turn the ignition "OFF". 2. Disconnect the TCM 28 pin connector. 3. Connect an ohmmeter between the TCM 28 pin connector terminal (5) and (17). Is the resistance within the specified value?	560-680 Ω (at 20°C, 4×4) 387-473 Ω (at 20°C, 4×2)	Go to Step 3	Go to Step 4
3	1. Replace the TCM with a new one. 2. Make a road running test for the vehicle. Is DTC P0717 displayed?	—	Go to Step 5	Go to Step 7
4	1. Disconnect the 2 pin connector of the input revolution sensor. 2. Measure the resistance between each terminals of the input revolution sensor 2 pin connector with an ohmmeter. Is the resistance within the specified value?	560-680 Ω (at 20°C, 4×4) 387-473 Ω (at 20°C, 4×2)	Go to Step 6	Go to Step 5
5	Replace the input revolution sensor. Is the replacement complete?	—	Go to Step 7	—
6	Check the wiring harness between the TCM and input revolution sensor for an open or shorted. Was a problem found and corrected?	—	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Reviews the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

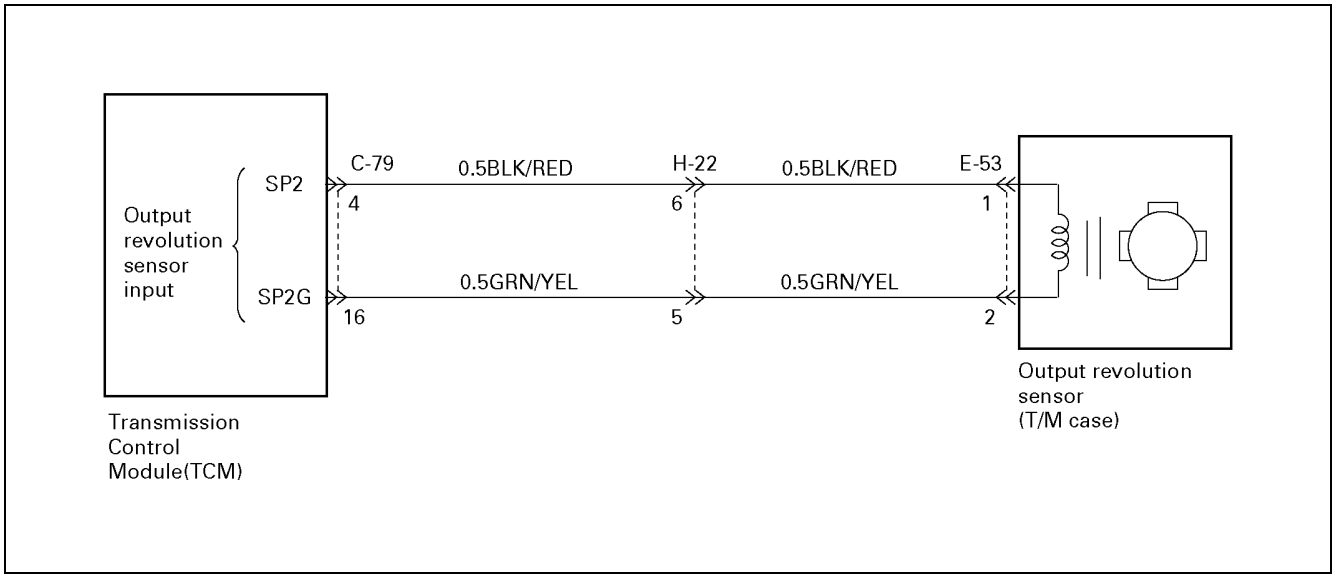
DTC P0722 (FLASHING CODE 11)
OUTPUT REVOLUTION SENSOR FAILURE (SP2)

UBS (For General Export)



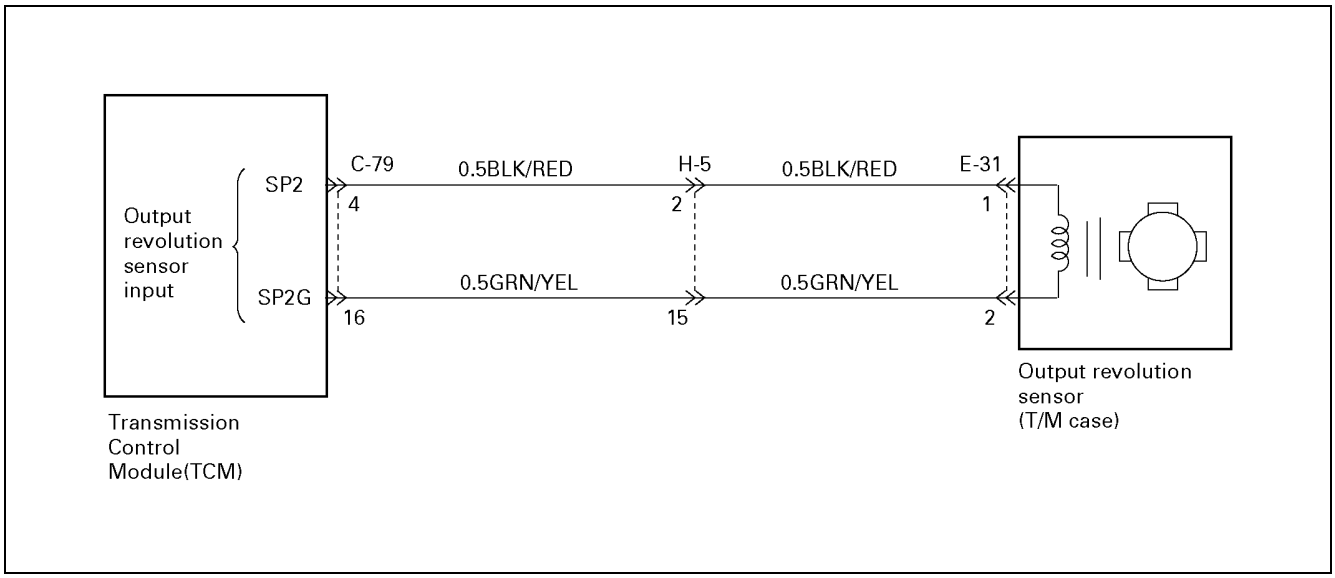
D07R200060

TFR/S (For Australia) and TFR (For South Africa)



D07L200005

'01TFR/S (For Thailand)



D07L100008

Circuit description:

Vehicle speed information is provided to the TCM by the output revolution sensor. This sensor is located in the transmission adapter housing (4×4) or extension housing (4×2). The output revolution sensor is an electromagnetic pulse pickup type that generates a speed signal according to the revolution of the transmission output shaft. As a result, the sensor sends a sine wave signal (AC) to the TCM, which converts this sine wave signal (pulse voltage) to a km/h signal.

Fail-safe control:

The TCM controls fail-safe by detecting output revolution sensor failure.

Failure detection:

- When not even 1 pulse is input in the output revolution sensor during the time 4 pulses are input in the speed meter sensor.
- When the failure criteria is continuously 500 times from the time ignition is turned ON until it is turned OFF.
- Detection inhibit condition:
  When speed meter sensor revolution is less than 80 rpm.

Contents of control:

At failure detection

- Uses the vehicle speed calculated by speed meter sensor for shift control
- Keeps the condition of transfer (High/Low judgment) just before detection until vehicle speed is 0km/h, and changes shift map to L4 map (3→4UP None) at vehicle speed 0km/h. (For UBS)
- Use high oil temperature map according to shift map priority at correct oil temperature control.
- Squat control inhibit
- Up hill and down hill control inhibit (For UBS)
- Reverse lockout control inhibit
- Stores the failure information in failure-memory

At failure decision

Executes following items in addition to above control items at failure detection.

- Blinks "CHECK TRANS" lamp

Conditions of turning "CHECK TRANS" off:

Turns "CHECK TRANS" lamp off when judged 0km/h by speed meter sensor after more than 1 pulse input in the output revolution sensor and finished vehicle speed calculation during the time 4 pulse are input in the speed meter sensor.

Reversion conditions from fail-safe:

Recovers at the same time as the conditions of turning "CHECK TRANS" lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. When the vehicle is running, a speed signal is input from the output revolution sensor to the TCM.
2. At this test, the continuity of circuit wiring and the output revolution sensor is checked.
4. At this test, the continuity of the output revolution sensor is checked.

Diagnostic aids:

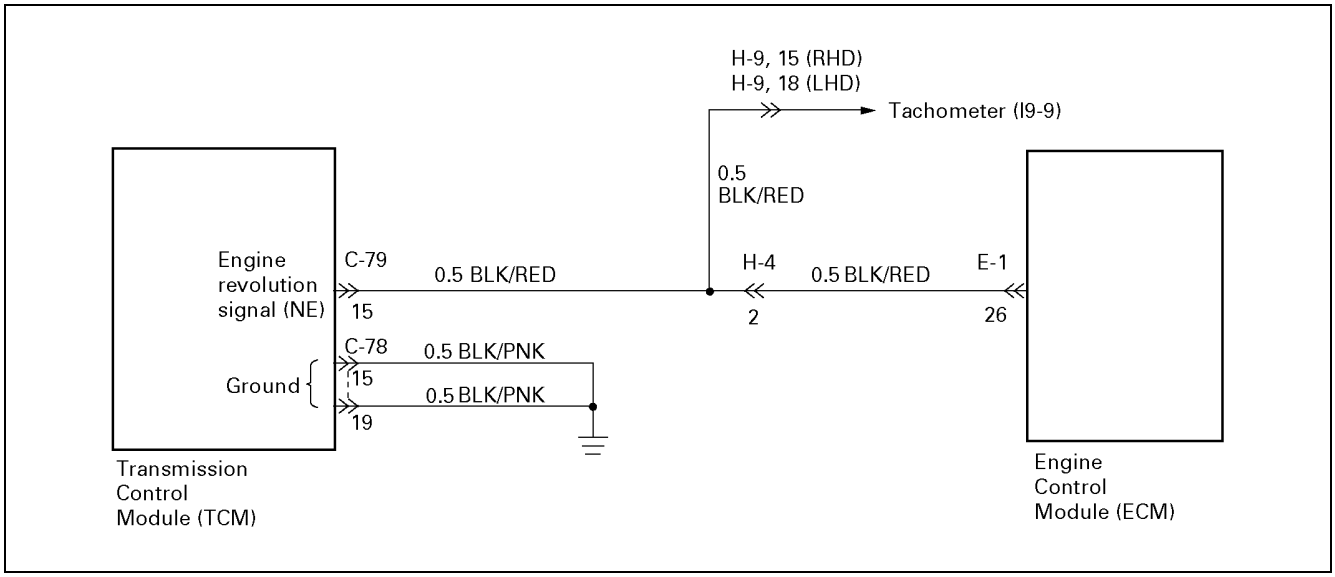
An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P0722 (FLASHING CODE 11)
OUTPUT REVOLUTION SENSOR FAILURE (SP2)

Step	Action	Value(s)	Yes	No
1	1. Lift the driving wheels. 2. With the engine idling in gear, connect a voltmeter between the TCM 28 pin connector terminal (4) and ground terminal (16). Does the voltage vary in the specified value? (The voltage increase in proportion to the speed.)	0-3 V or more	DTC P0722 is intermittent. If other codes are not stored, refer to "Diagnostic aids".	Go to Step 2
2	1. Turn the ignition "OFF". 2. Disconnect the TCM 28 pin connector. 3. Connect an ohmmeter between the TCM 28 pin connector terminal (4) and (16). Is the resistance within the specified value?	560-680Ω (at 20°C)	Go to Step 3	Go to Step 4
3	1. Replace the TCM with a new one. 2. Make a road running test for the vehicle. Is DTC P0722 displayed?	—	Go to Step 5	The TCM is faulty. (TCM before replacement) Go to Step 7
4	1. Disconnect the 2 pin connector of the output revolution sensor. 2. Measure the resistance between each terminals of the 2 pin connector with an ohmmeter. Is the resistance within the specified value?	560-680Ω (at 20°C)	Go to Step 6	Go to Step 5
5	Replace the output revolution sensor. Is the replacement complete?	—	Go to Step 7	—
6	Check the wiring harness between the TCM and output revolution sensor for an open or shorted. Was a problem found and corrected?	—	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

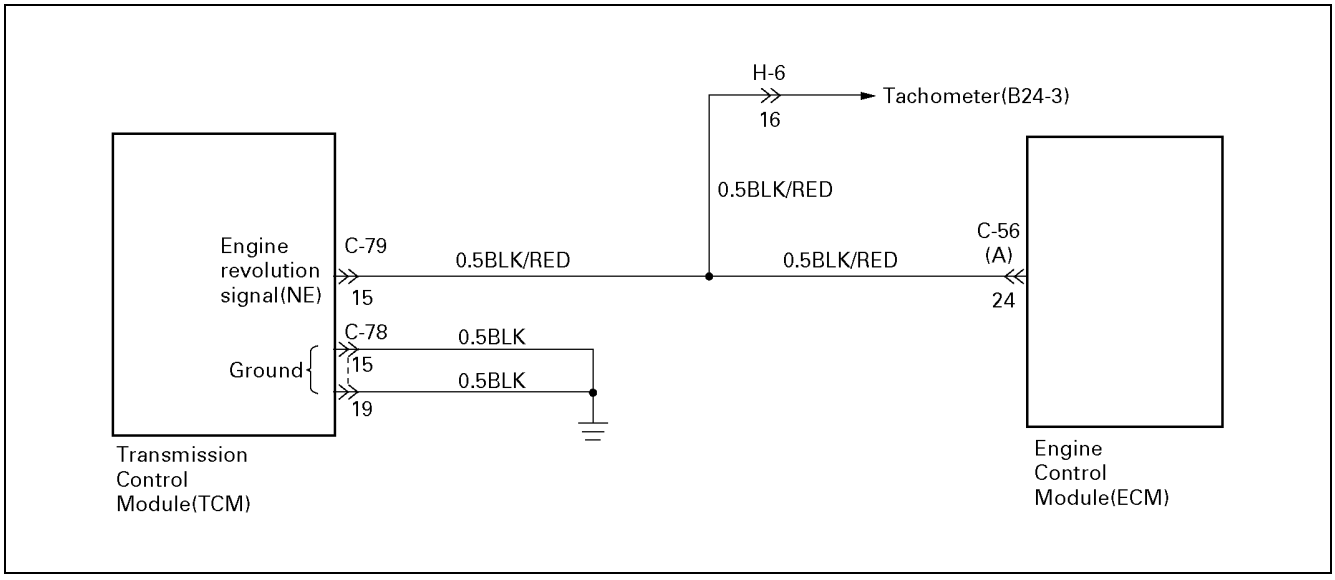
DTC P0727 (FLASHING CODE 13)
ENGINE REVOLUTION SIGNAL FAILURE (NE)

UBS (For General Export)



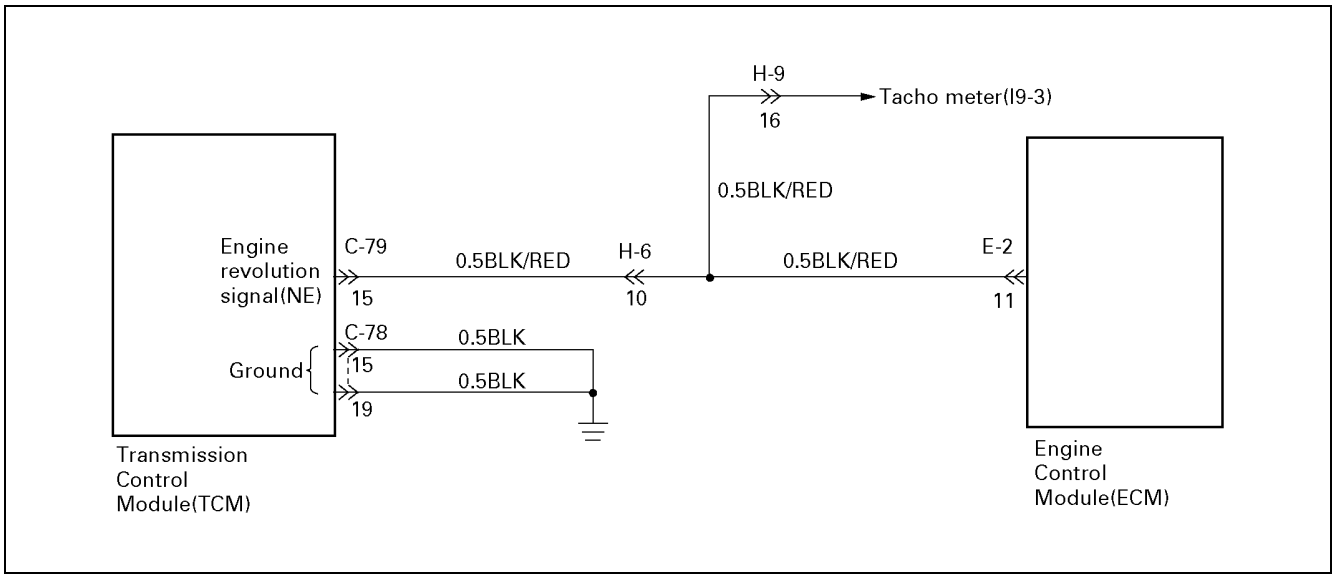
D07R200061

TFR/S (For Australia) and TFR (For South Africa)



D07L200006

'01TFR (For Thailand)



D07L100009

Circuit description:

Engine revolution (rpm) signals are sent from Engine Control Module (ECM) to the Transmission Control Module (TCM).

The engine speed sensor is an electromagnetic pulse pickup type that generates signals when the flywheel gear revolves (2 pulses at a single revolution of the flywheel gear).

The TCM converts these sine wave signals into engine revolution (RPM) signals.

Fail-safe control:

The TCM controls fail-safe by detecting engine revolution sensor failure.

Failure detection:

- When input revolution is more than 2000 rpm
- When not even 1 pulse is input in the engine revolution signal during 5 seconds
- Detection inhibit condition: At 4th gear

Contents of control:

At failure detection

- Up hill and down hill control inhibit (For UBS)
- Oil temperature sensor failure detection inhibit
- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure memory.

At failure decision

Same as failure detection

Conditions of turning "CHECK TRANS" lamp off:

Turns "CHECK TRANS" lamp off when judged 0km/h by speed meter sensor after the engine revolution signal pulses are input 250 pulses normally.

(however, uses 0 km/h judgment by back-up vehicle speed at output revolution failure)

Reversion conditions from fail-safe:

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

2. Engine revolution signals are input from the ECM into the TCM.
3. When the engine idling, voltage fluctuates with (AC intermittent) range of less than 1.4V ⇔ 9 ~ 16V.

Diagnostic aids:

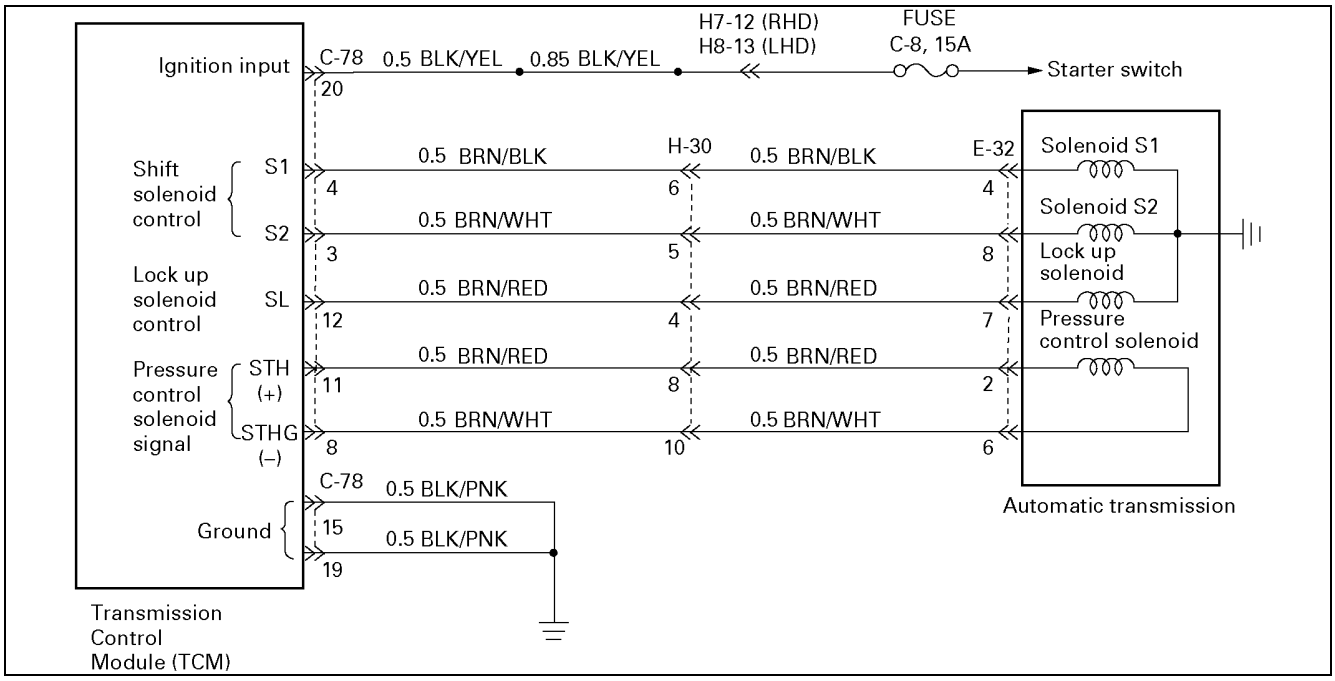
An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P0727 (FLASHING CODE 13)
ENGINE REVOLUTION SIGNAL FAILURE (NE)

Step	Action	Value(s)	Yes	No
1	1. Clear the TCM memory. 2. Turn the ignition "ON" and start the engine. 3. With the engine "OFF", turn the ignition "ON". Is DTC P0727 displayed by self-diagnosis?	—	Go to Step 2	DTC P0727 was temporarily stored into TCM memory. Refer to "Diagnostic aids".
2	1. With the engine "OFF", turn the ignition "ON". 2. Connect a voltmeter to the TCM 28 pin connector terminal (15) and TCM 20 pin connector ground terminal (15 or 19). Is the voltage within the specified value?	9-16V	Go to Step 3	Go to Step 4
3	1. With the ignition "ON" and the engine "ON". 2. Connect a voltmeter between the TCM 28 pin connector terminal (15) and TCM 20 pin connector ground terminal (15 or 19). Does the voltage vary in the specified value at the engine idling?	Less than 1.4-9～16 V (AC intermittently)	Go to Step 5	Go to Step 6
4	Check the wiring harness between the TCM and ECM for breaking or voltage shorted. Was a problem found and corrected?	—	Go to Step 7	—
5	Check the TCM connection. If OK, replace the TCM. Is the replacement complete?	—	Go to Step 7	—
6	Check the wiring harness between the TCM and ECM for ground shorted. If OK, the ECM or the engine revolution sensor is faulty. Was a problem found and corrected?	—	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running, test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

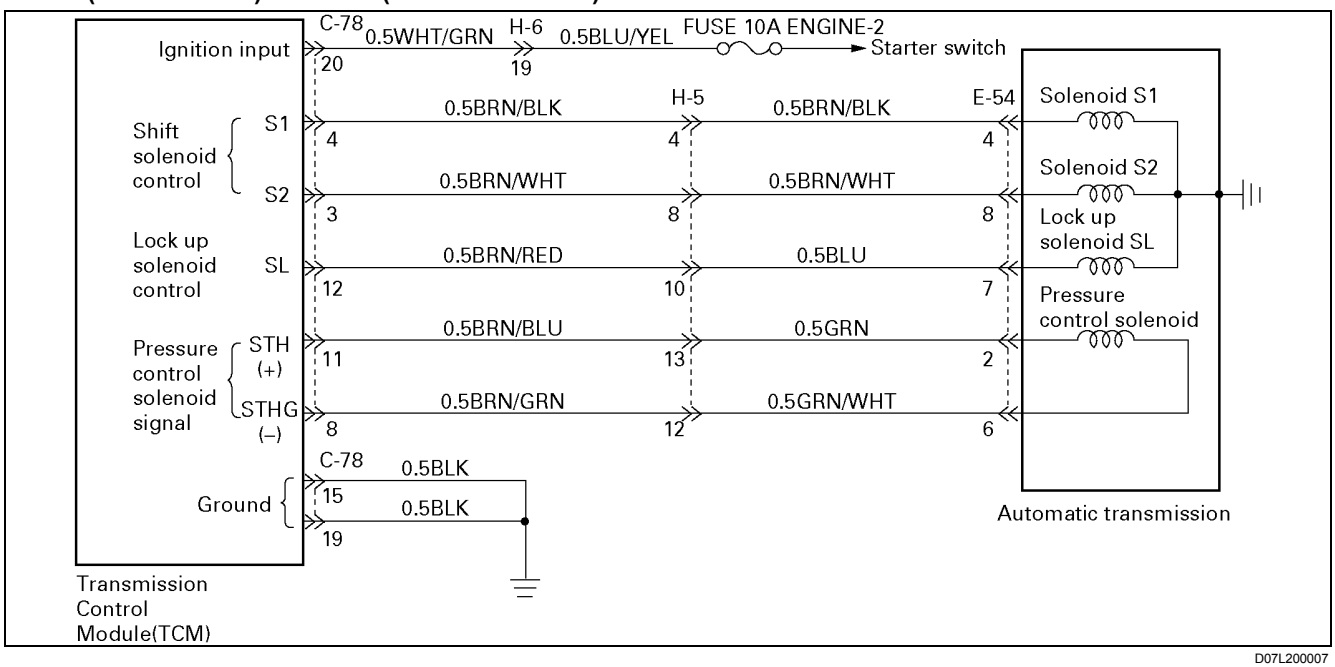
DTC P0743 (FLASHING CODE 33) TORQUE CONVERTER CLUTCH CONTROL LOCK-UP (ON/OFF) SOLENOID FAILURE (SL)

UBS (For General Export)



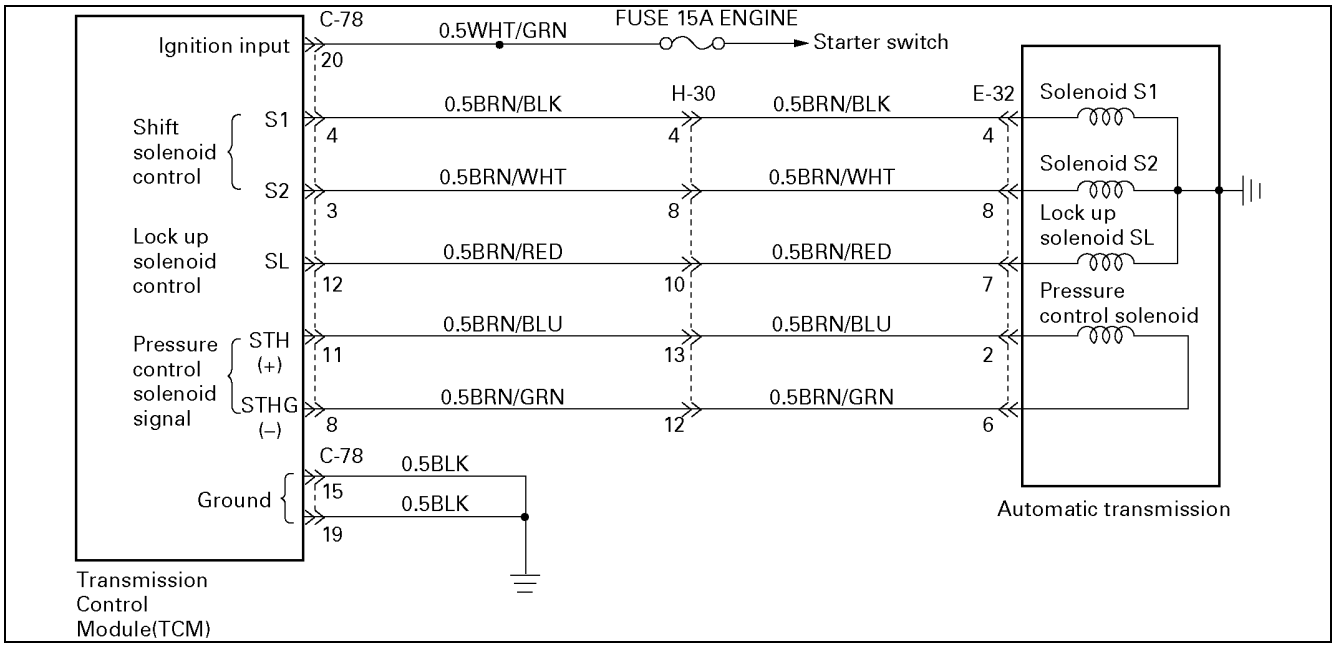
D07R200062

TFR/S (For Australia) and TFR (For South Africa)



D07L200007

'01TFR (For Thailand)



D07L200010

Circuit description:

The lock-up solenoid SL of the torque converter clutch (TCC) controls the lock-up clutch by a signal according to the lock-up range judgement of the TCM when the vehicle runs.

This function can improve the fuel consumption to almost the same extent as the manual transmission. The lock-up solenoid SL is put into B+ by the TCM, so that the solenoid is actuated with the result of lock-up.

Fail-safe control:

The TCM controls fail-safe by detecting SL solenoid failure.

Failure detection:

GND SHORT detection

- When SHORT detection continues for 0.3 sec.
- When SHORT failure detection continues 8 times.

Open detection

- When OPEN detection continues for 0.5 sec.
- When OPEN failure detection continues 8 times.

Contents of control:

At failure detection

- Lock-up control inhibit
- If + B short failure is detected, keeps 1st gear when the vehicle speed calculated by output revolution sensor is less than 10km/h to prevent stall. (Canceled at more than 15km/h)

At failure decision

- Executes following items in addition to above control items at failure detection.
- Stores the failure information in failure-memory.

Conditions of turning "CHECK TRANS" lamp off:

None

Reversion conditions from fail-safe:

When a normal condition is judged by rechecking on the state of lock-up ON/OFF

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. When the key is ON, the voltage between the TCM 20 pin connector terminals (12) and (15 or 19) is 1.0 V or less.
2. When the gear is of the 2nd speed in the D range and the throttle opening is about 50% at a higher speed than about 40km/h, the TCM supplies 8 to 16 V, so that the solenoid is actuated with the result of lock-up.

3.5.7.8. The resistance range of the solenoid is 11 to 15Ω (at 20°C).

Diagnostic aids:

In case of faulty connection, open or shorted circuit. to the TCM 20 pin connector terminal (12), DTC P0743 is displayed. A intermittent failure may be caused by a poor connection, rubbed through wire insulation or a wire broke inside the insulation.

DTC P0743 (FLASHING CODE 33) TORQUE CONVERTER CLUTCH CONTROL LOCK-UP (ON/OFF) SOLENOID FAILURE (SL)

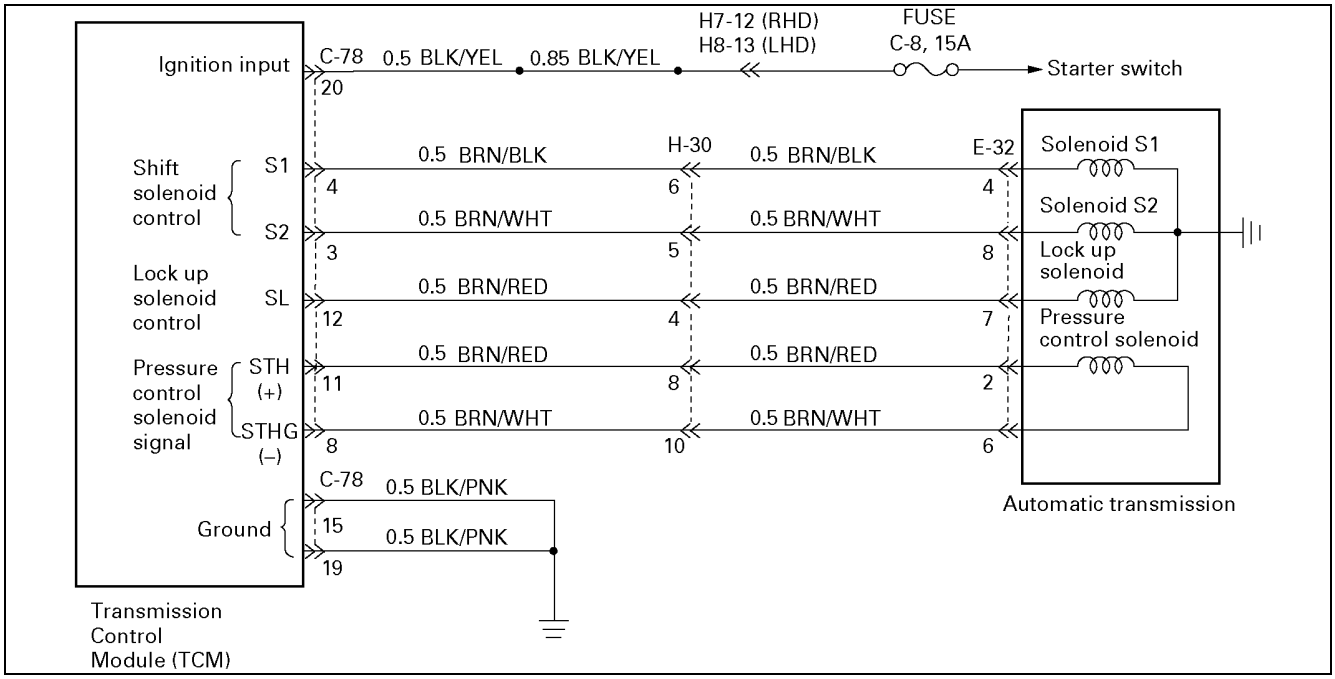
Step	Action	Value(s)	Yes	No
1	1. With the engine "OFF", turn the ignition "ON" after warming up. 2. Connect a voltmeter between the TCM 20 pin connector terminal (12) and ground terminal (15 or 19). Is the voltage less than the specified value?	1 V	Go to Step 2	Go to Step 3
2	1. Lift the driving sheels and support them. 2. At the D range and 2nd speed gear. 3. Make a test at a speed of about 40 km/h or more with 50% or more opening of the throttle. Is the voltage between the TCM 20 pin connector terminal (12) and ground terminal (15 or 19) within the specified value?	8-16V	Go to Step 4	Go to Step 5
3	1. Turn the ignition "OFF". 2. Disconnect the TCM 20 pin connector. 3. Measure the resistance between the terminal (12) and ground. Is the resistance within the specified value?	11-15Ω (at 20℃)	Go to Step 6	Go to Step 7
4	1. Clear the TCM memory. 2. Make a running test. Is DTC P0743 displayed by self-diagnosis?	—	Go to Step 6	The continuity of wiring is intermittent. Refer to "Diagnostic aids".
5	1. Turn the ignition "OFF". 2. Disconnect the TCM 20 pin connector. 3. Measure the TCM 20 pin connector terminal (12) and ground. Is the resistance within the specified value?	11-15Ω (at 20℃)	Go to Step 6	Go to Step 8
6	The TCM is faulty or the continuity of wiring harness is intermittent. Was a problem found and corrected?	—	Go to Step 12	—
7	Disconnect the A/T 8 pin connector. Is the resistance between the lock-up solenoid connector terminal (7) and ground within the specified value?	11-15Ω (at 20℃)	Go to Step 9	Go to Step 10
8	Disconnect the A/T 8 pin connector. Is the resistance between the lock-up solenoid connector terminal (7) and ground within the specified value?	11-15Ω (at 20℃)	Go to Step 11	Go to Step 10
9	Check the wiring harness between the TCM 20 pin connector terminal (12) and A/T 8 pin connector terminal (7) for open. Was a problem found and corrected?	—	Go to Step 12	—

DTC P0743 (FLASHING CODE 33) TORQUE CONVERTER CLUTCH CONTROL LOCK-UP (ON/OFF) SOLENOID FAILURE (SL) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the lock-up solenoid (SL). Is the replacement complete?	—	Go to Step 12	—
11	Check the wiring harness between the TCM 20 pin connector terminal (12) and A/T 8 pin connector terminal (7) for ground shorted. Was a problem found and corrected?	—	Go to Step 12	—
12	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

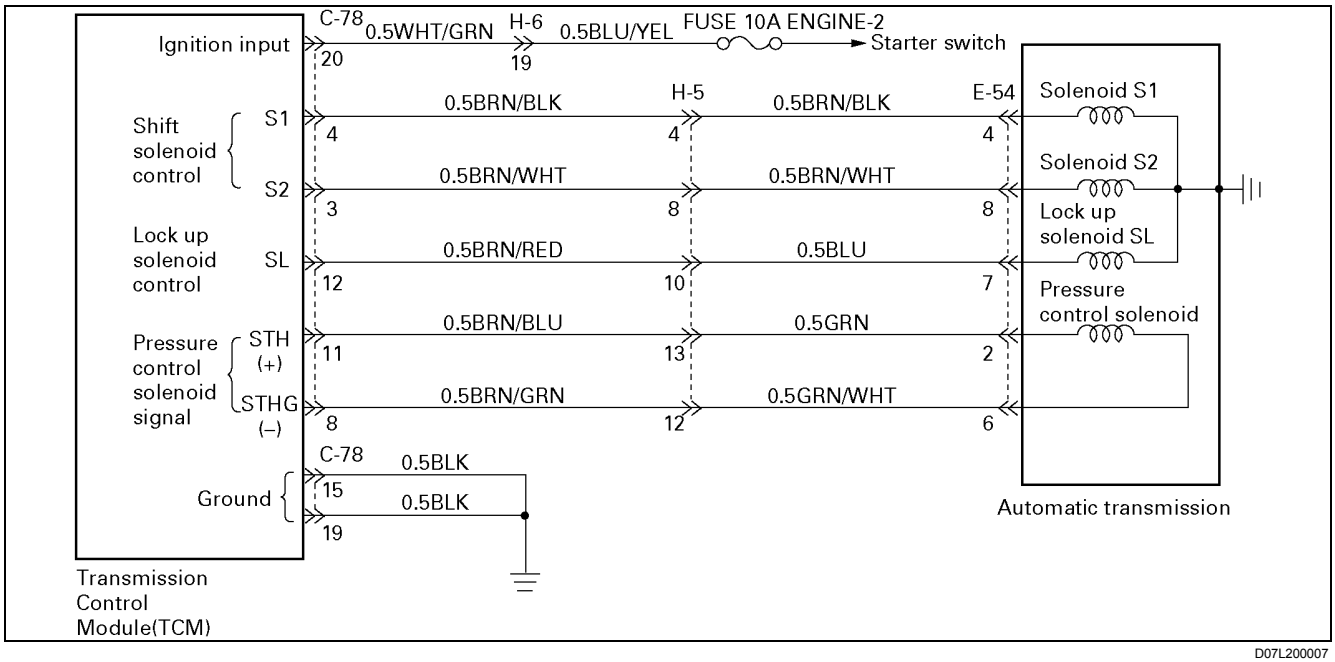
DTC P0748 (FLASHING CODE 35)
PRESSURE CONTROL SOLENOID FAILURE (STH)

UBS (For General Export)



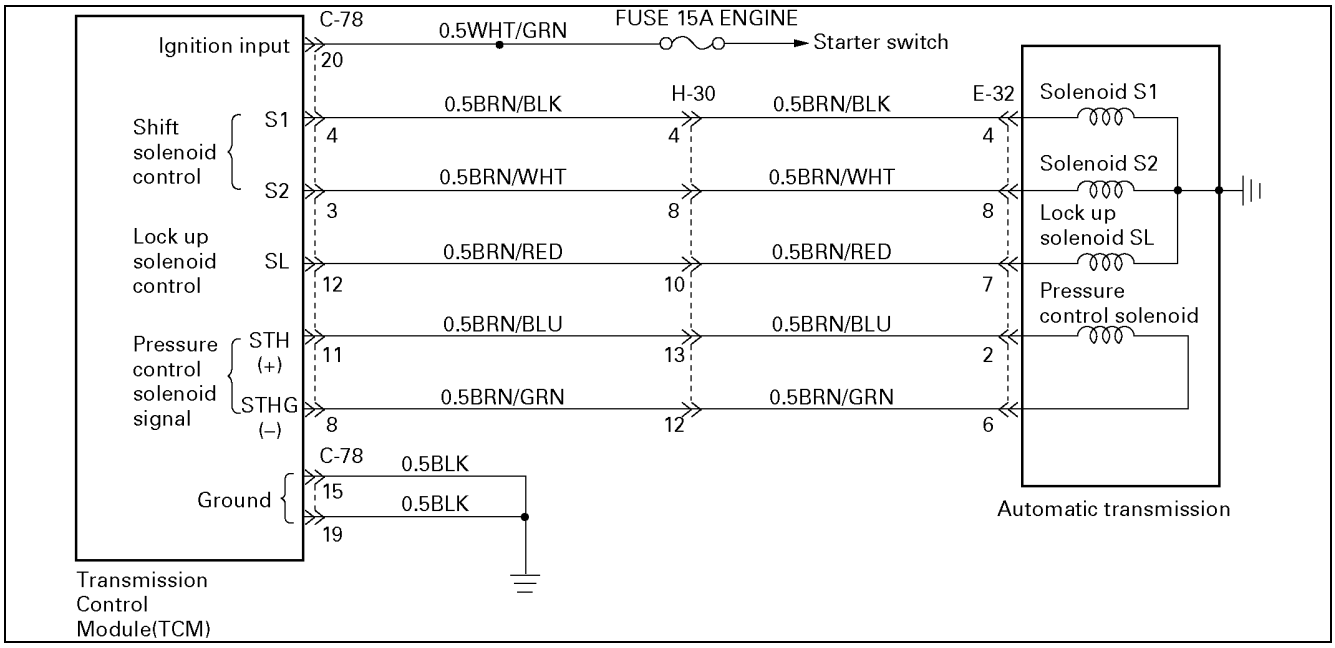
D07R200062

TFR/S (For Australia) and TFR (For South Africa)



D07L200007

'01TFR (For Thailand)



D07L100010

Circuit description:

The pressure control solenoid is a PWM duty control solenoid located in the valve body.

The pressure control solenoid is a TCM-controled device used to regulate transmission throttle pressure by energizing current from the TCM.

Fail-safe control:

The TCM controls fail-safe by detecting pressure control solenoid failure.

Failure detection:

IG short failure

- When the feedback A/D value is more than 1020 for 500 milli-second continuously.
- Detection inhibit condition: Prohibition during 1 second after reversion from open failure, because the possibility of the mis-detection is high.

Open failure (Including GND Short)

- When the feedback A/D value is less than 15 for more than 70 milli-second continuously, judges as faliure, and turns the current of target output off, after 1.5 second passed turns the current of target value to normal. The A/D value is checked, and this operation is repeated during 70 milli-second again.
- When it continues for 12.5 second in total.

Contents of control:

At failure detection

- Lock-up control inhibit
- Up hill and down hill control inhibit (For UBS)
- Squat control inhibit

At failure decision

- Executes following items in addition to above control items at failure detection.
- Turns Solenoid power supply OFF
- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure memory

*Prohibits failure detection of S1, S2, SL, STH, selector position switch, and oil temperature sensor.

Conditions of turning "CHECK TRANS" off:

Turns "CHECK TRANS" lamp off after ignition is turned ON→ OFF→ ON.

Reversion conditions from fail-safe:

At failure detection

When IG short failure···The feedback A/D value is less than 1020 for 1 second continuously.

When open failure···Detection criteria is not satisfied or the feedback A/D value is more than 15 for 1 second continuously.

At failure decision

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. The solenoid resistance is within the range of 5 to 5.6Ω. (at 20°C)
2. This test checks for shorted circuit at the TCM.

Diagnostic aids:

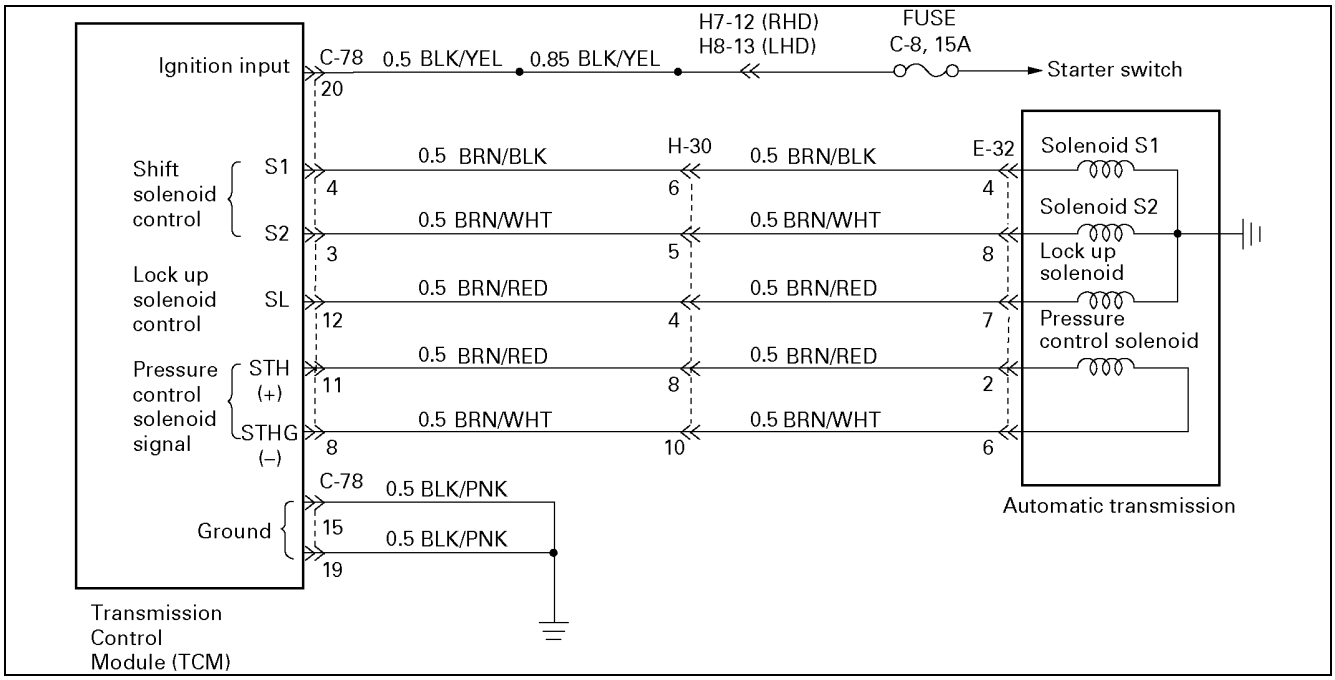
An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P0748 (FLASHING CODE 35)
PRESSURE CONTROL SOLENOID FAILURE (STH)

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition "OFF". 2. Disconnect the TCM 20 pin connector. 3. Connect an ohmmeter between the TCM 20 pin connector terminal (11) and (8). Is the resistance within the specified value?	5-5.6Ω (at 20°C)	Go to Step 2	Go to Step 3
2	1. Connect an ohmmeter between the TCM 20 pin connector terminal (11) and ground terminal (15 or 19). 2. Then, connect between the TCM 20 pin connector terminal (11) and ignition terminal (20). 3. Then, connect TCM 20 pin connector terminal (8) and ground terminal (15 or 19), then between TCM 20 pin connector terminal (8) and ignition terminal (20). Does display a short circuit?	—	Go to Step 4	The problem is intermittent. Refer to "Diagnostic aids".
3	1. Disconnect the A/T 8 pin connector. 2. Connect an ohmmeter between the A/T 8 pin connector terminal (2) and (6). Is the resistance within the specified value?	5-5.6Ω (at 20°C)	Go to Step 5	Go to Step 6
4	Repair the short circuit. Is the repair complete?	—	Go to Step 7	—
5	Repair the wiring harness for open between TCM 20 pin connector and A/T 8 pin connector. Is the repair complete?	—	Go to Step 7	—
6	1. Check the wiring harness for open between A/T 8 pin connector and pressure control solenoid. 2. If OK, replace pressure control solenoid (valve body assembly).	—	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

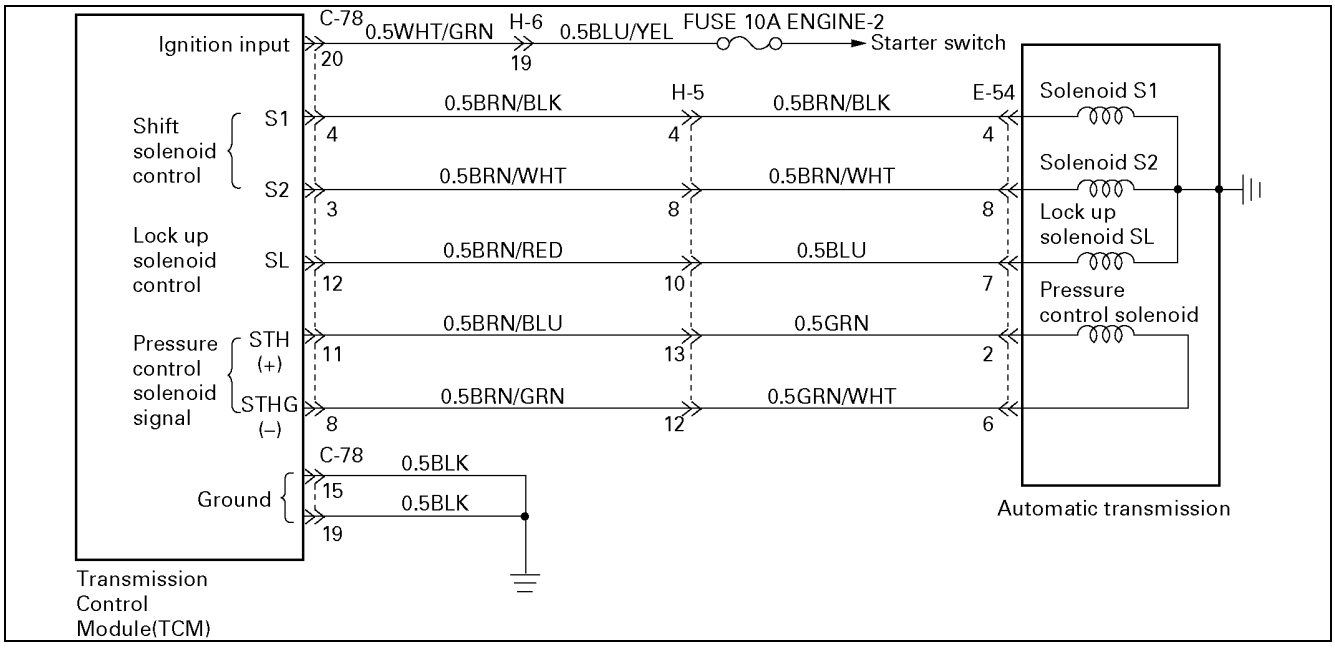
DTC P0753 (FLASHING CODE 31) SOLENOID 1 FAILURE (S1)

UBS (For General Export)



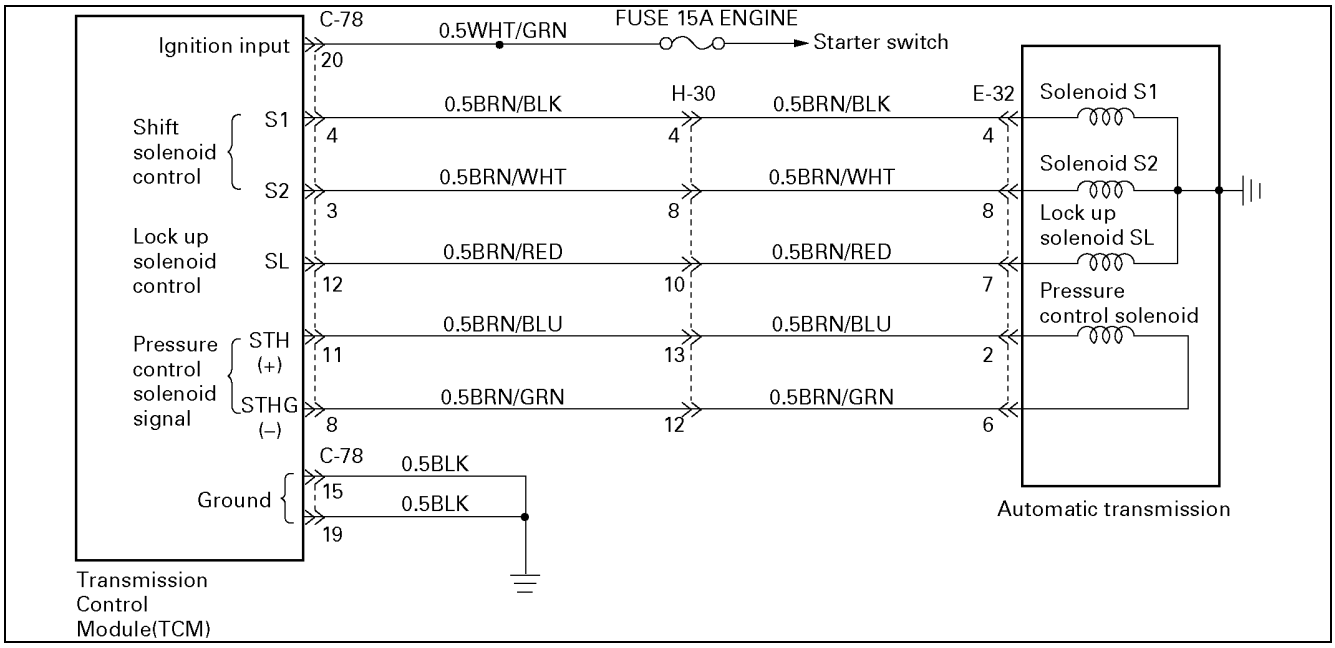
D07R200062

TFR/S (For Australia) and TFR (For South Africa)



D07L200007

'01TFR (For Thailand)



D07L100010

Circuit description:

The shift solenoid S1 changes the hydraulic route with the signals from the TCM according to the vehicle speed and the throttle opening to control shifting. When the solenoid S1 or S2 fails, the hydraulic circuit is mechanically operated as a backup.

Fail-safe control:

The TCM controls fail-safe by detecting S1, S2 shift solenoid failure.

Failure detection:

GND SHORT detection

- When SHORT detection continues for 0.3 sec.
- When SHORT failure detection continues 8 times.

Open detection

- When OPEN detection continues for 0.5 sec.
- When OPEN failure detection continues 8 times.

Contents of control:

At failure detection

- Lock-up control inhibit
- Up hill and down hill control inhibit (For UBS)
- Squat control inhibit

- Changes solenoid output pattern as following figure

The shift theory at shift solenoid failure

Shift lever Position	Normal			S1 failure			S2 filure			S1 and S2 failure		
	Gear	S1	S2	Gear	S1	S2	Gear	S1	S2	Gear	S1	S2
D	1	○	×	3		×→○	1	○		O/D		
	2	○	○			○	O/D	○→×				
	3	×	○			○		×				
	O/D	×	×	O/D		×		×				
2	1	○	×	3		×→○	1	○		3		
	2	○	○			○	O/D	○→×				
	3	×	○			○		×				
L	1	○	×	3		×→○	1	○		3		
	2	○	○			○	O/D	○→×				

At failure decision

Executes following items in addition to above control items at failure detection.

- Turns Solenoid power supply OFF
- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure-memory

*Prohibits failure detection of S1, S2, SL, STH, Selector position switch, and Oil temp. sensor.

Conditions of turning "CHECK TRANS" off:

Turns "CHECK TRANS" lamp off after ignition is turned ON→ OFF→ ON.

Reversion conditions from fail-safe:

At failure detection

When a normal judgment is obtained by rechecking during shifting.

At failure decision

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. With the key "ON", the voltage between the TCM 20 pin connector terminals (4) and (15 or 19) is 8 to 16V.
4. When the driving wheels revolve with the 3rd speed gear, the voltage is 1 V or less.

3.6.8.11. The solenoid resistance is within the range of 11 to 15Ω (at 20°C).

Diagnostic aids:

In case of faulty connection, open or shorted circuit to the TCM 20 pin connector terminal (4), DTC P0753 is displayed. A intermittent failure may be caused by a poor connection, rubbed through wire insulation or a wire broke inside the insulation.

DTC P0753 (FLASHING CODE 31) SOLENOID 1 FAILURE (S1)

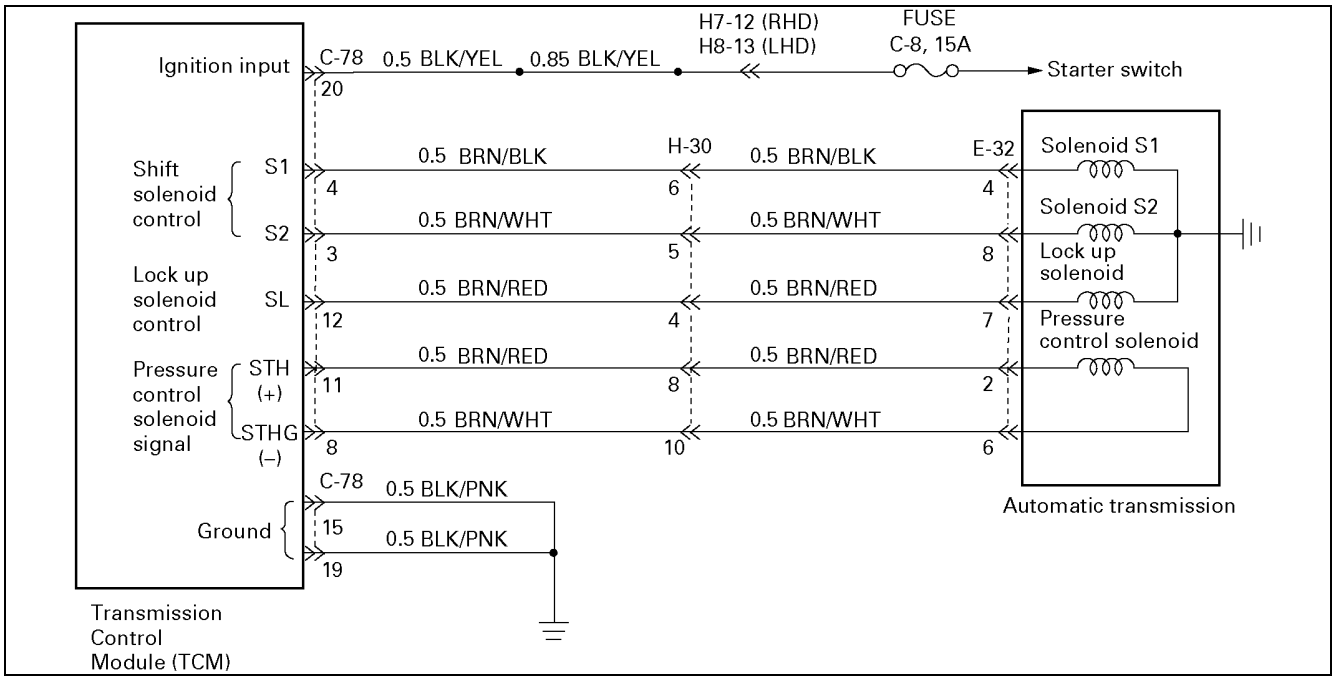
Step	Action	Value(s)	Yes	No
1	1. With the engine "OFF", turn the ignition "ON". 2. Connect a voltmeter between the TCM 20 pin connector terminal (4) and ground terminal (15 or 19). Is the voltage within the specified value?	8-16 V	Go to Step 2	Go to Step 3
2	1. Lift the driving wheels and support them. 2. Turn the ignition "ON", and the engine "ON". Can the speed be changed normally by acceleration is the "NORMAL" mode and the D range?	—	Go to Step 4	Go to Step 8
3	1. Turn the ignition "OFF". 2. Disconnect the TCM 20 pin connector. 3. Measure the resistance between the TCM 20 pin connector terminal (4) and ground. Is the resistance within the specified value?	11-15Ω (at 20°C)	Go to Step 5	Go to Step 6
4	At the 3rd speed gear. Is the voltage between the TCM 20 pin connector terminal (4) and ground terminal (15 or 19) less than the specified value?	1 V	Go to Step 7	Go to Step 8
5	The TCM is faulty or the continuity of wiring harness is intermittent. Was a problem found and corrected?	—	Go to Step 13	—
6	Disconnect the A/T 8 pin connector. Is the resistance between the solenoid S1 connector terminal (4) and ground within the specified value?	11-15Ω (at 20°C)	Go to Step 9	Go to Step 10
7	1. Clear the TCM memory. 2. Make a running test. Is DTC P0753 displayed by self-diagnosis?	—	Go to Step 5	The continuity of wiring is intermittent. Refer to "Diagnostic aids".
8	1. Turn the ignition "OFF". 2. Disconnect the TCM 20 pin connector. 3. Measure the resistance between the TCM 20 pin connector terminal (4) and ground. Is the resistance within the specified value?	11-15Ω (at 20°C)	Go to Step 5	Go to Step 11
9	Check the wiring harness between the TCM 20 pin connector terminal (4) and A/T 8 pin connector terminal (4) for ground shorted. Was a problem found and corrected?	—	Go to Step 13	—
10	Replace the solenoid S1. Is the replacement complete?	—	Go to Step 13	—
11	1. Disconnect the A/T 8 pin connector. 2. Measure the resistance between the A/T 8 pin connector terminal (4) and ground. Is the resistance within the specified value?	11-15Ω (at 20°C)	Go to Step 12	Go to Step 10

DTC P0753 (FLASHING CODE 31) SOLENOID 1 FAILURE (S1) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the wiring harness between the TCM 20 pin connector terminal (4) and A/T 8 pin connector terminal (4) for open. Was a problem found and corrected?	—	Go to Step 13	—
13	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

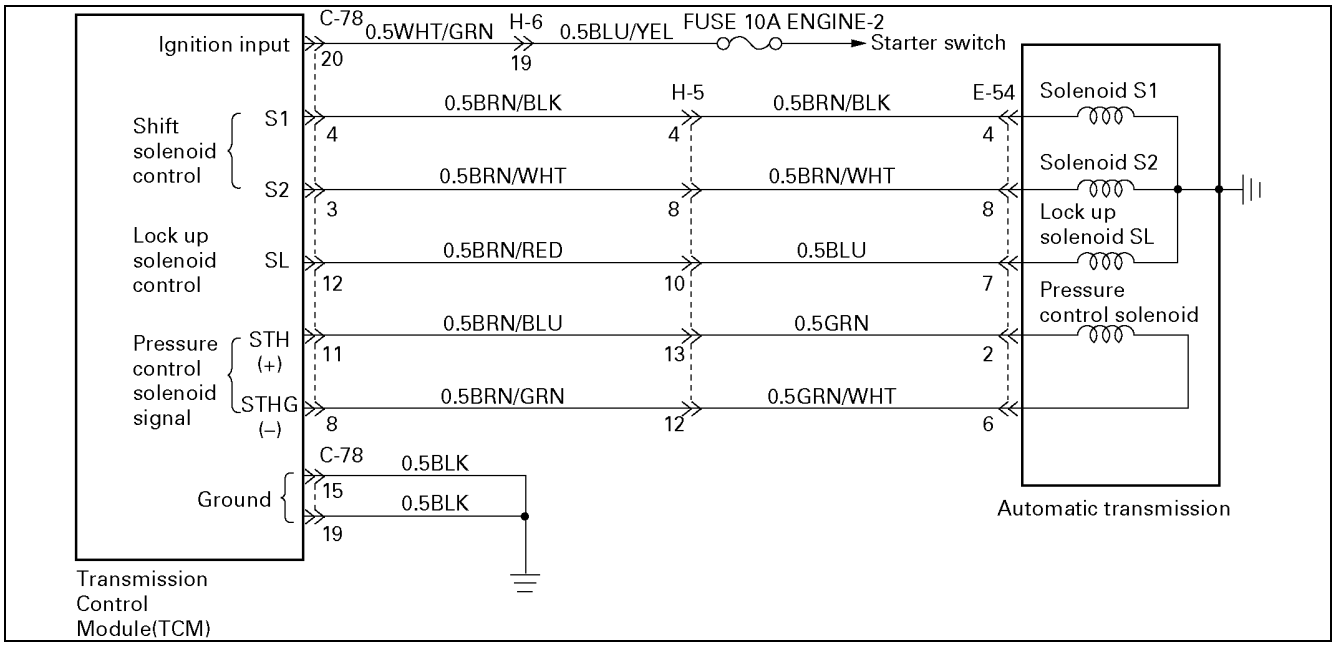
DTC P0758 (FLASHING CODE 32) SOLENOID 2 FAILURE (S2)

UBS (For General Export)



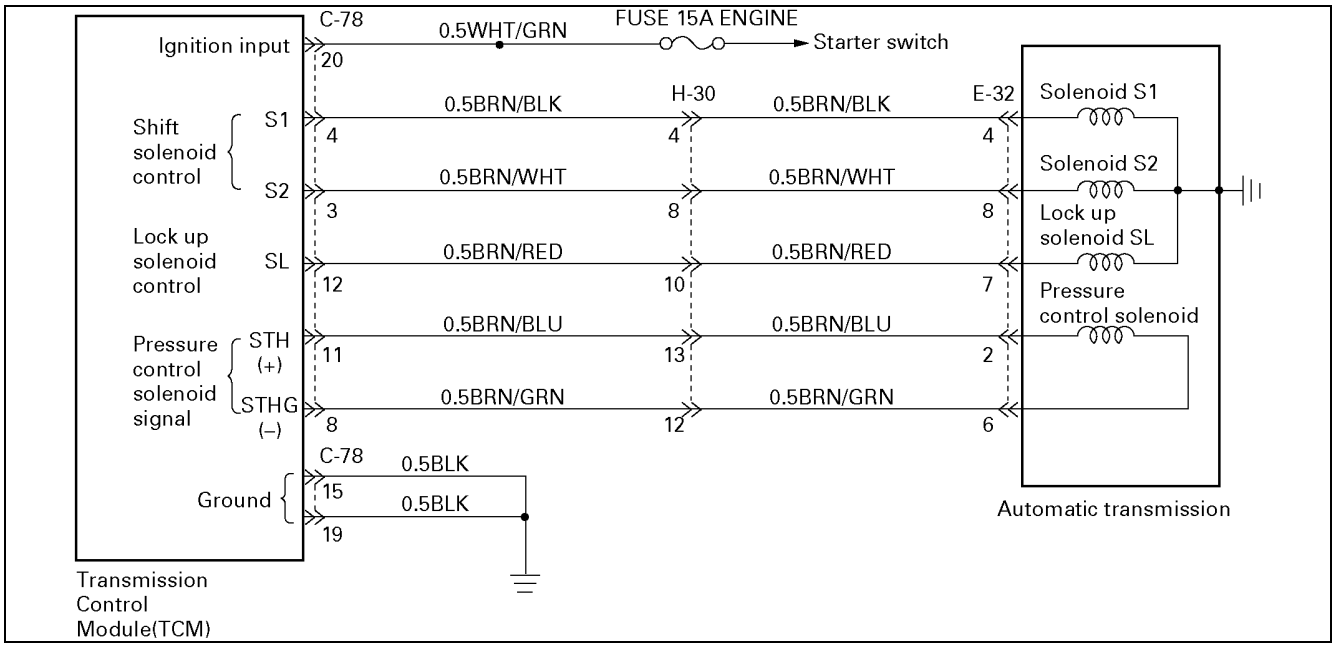
D07R200062

TFR/S (For Australia) and TFR (For South Africa)



D07L200007

'01TFR (For Thailand)



D07L100010

Circuit description:

The solenoid S2 changes the hydraulic route with the signals from the TCM according to the vehicle speed and the throttle opening to control shifting. When the solenoid S1 or S2 fails, the hydraulic circuit is mechanically operated as a backup.

Fail-safe control:

The TCM controls fail-safe by detecting S1, S2 shift solenoid failure.

Failure detection:

GND SHORT detection

- When SHORT detection continues for 0.3 sec.
- When SHORT failure detection continues 8 times.

Open detection

- When OPEN detection continues for 0.5 sec.
- When OPEN failure detection continues 8 times.

Contents of control:

At failure detection

- Lock-up control inhibit
- Up hill and down hill control inhibit (For UBS)
- Squat control inhibit
- Changes solenoid output pattern as "The shift theory at shift solenoid failure". (See DTC P0753)

At failure decision

- Executes following items in addition to above control items at failure detection.
- Turns Solenoid power supply OFF
- Blinks "CHECK TRANS" lamp
- Stores the failure information in failure-memory *Prohibits failure detection of S1, S2, SL, STH, Selector position switch, and Oil temperature sensor.

Conditions of turning "CHECK TRANS" off:

Turns "CHECK TRANS" lamp off after ignition is turned ON→ OFF→ ON.

Reversion conditions from fail-safe:

At failure detection

When a normal judgment is obtained by rechecking during shifting.

At failure decision

Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. With the key "ON", the voltage between the TCM 20 pin connector terminals (3) or (15 or 19) is 1V or less.
4. When the driving wheels revolve with the 2nd speed gear, the voltage is 8 to 16V.

3.6.8.11. The resistance of the solenoid is in the range of 11 to 15Ω (at 20).

Diagnostic aids:

In case of faulty connection, open or shorted circuit to the TCM 20 pin connector terminal (3), DTC P0758 is displayed. A intermittent failure may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

DTC P0758 (FLASHING CODE 32) SOLENOID 2 FAILURE (S2)

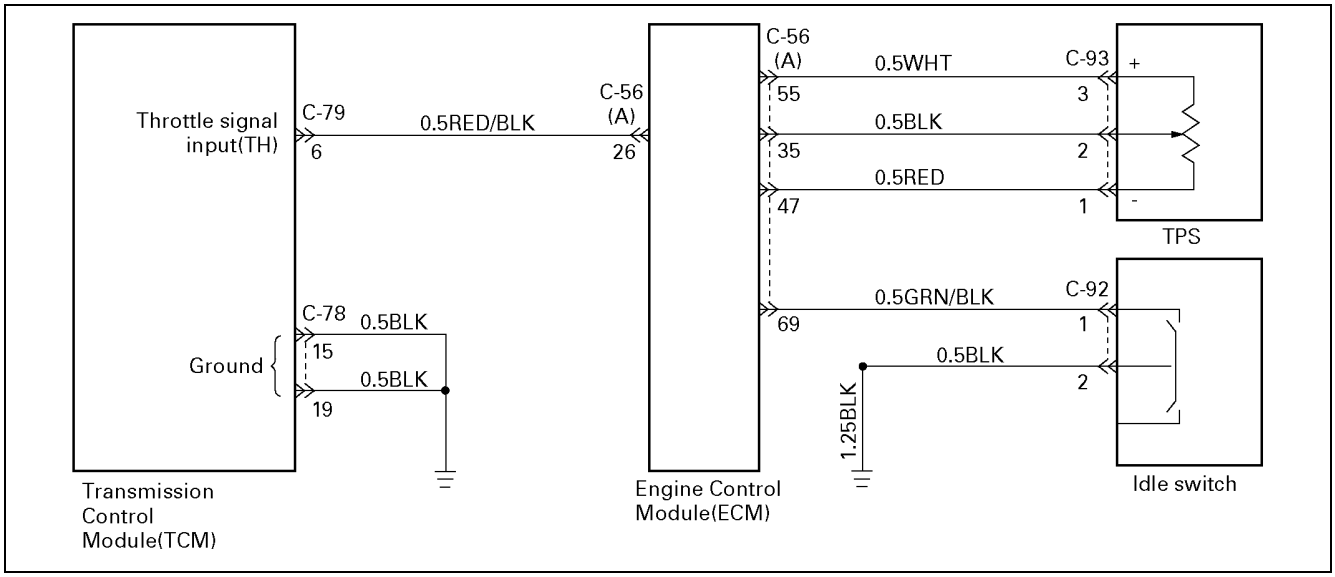
Step	Action	Value(s)	Yes	No
1	1. With the engine "OFF", turn the ignition "ON". 2. Connect a voltmeter between the TCM 20 pin connector terminal (3) and ground terminal (15 or 19). Is the voltage less than the specified value?	1 V	Go to Step 2	Go to Step 3
2	1. Lift the driving wheels and support them. 2. Turn the ignition "ON", and the engine "ON". Can the speed be changed normally by acceleration is the "NORMAL" mode and the D range?	—	Go to Step 4	Go to Step 8
3	1. Turn the ignition "OFF". 2. Disconnect the TCM 20 pin connector. 3. Measure the resistance between the TCM 20 pin connector terminal (3) and ground. Is the resistance within the specified value?	11-15Ω (at 20°C)	Go to Step 5	Go to Step 6
4	At the 2nd speed gear. Is the voltage between the TCM 20 pin connector terminal (3) and ground terminal (15 or 19) within the specified value?	8-16 V	Go to Step 7	Go to Step 8
5	The TCM is faulty or the continuity of wiring harness is intermittent. Was a problem found and corrected?	—	Go to Step 13	—
6	Disconnect the A/T 8 pin connector. Is the resistance between the solenoid S2 connector terminal (3) and ground within the specified value?	11-15Ω (at 20°C)	Go to Step 9	Go to Step 10
7	1. Clear the TCM memory. 2. Make a running test. Is DTC P0758 displayed by self-diagnosis?	—	Go to Step 5	The continuity of wiring is intermittent. Refer to "Diagnostic aids".
8	1. Turn the ignition "OFF". 2. Disconnect the TCM 20 pin connector. 3. Measure the resistance between the TCM 20 pin connector terminal (3) and ground. Is the resistance within the specified value?	11-15Ω (at 20°C)	Go to Step 5	Go to Step 11
9	Check the wiring harness between the TCM 20 pin connector terminal (3) and A/T 8 pin connector terminal (8) for ground shorted. Was a problem found and corrected?	—	Go to Step 13	—
10	Replace the solenoid S2. Is the replacement complete?	—	Go to Step 13	—
11	1. Disconnect the A/T 8 pin connector. 2. Measure the resistance between the A/T 8 pin connector terminal (8) and ground. Is the resistance within the specified value?	11-15Ω (at 20°C)	Go to Step 12	Go to Step 10

DTC P0758 (FLASHING CODE 32) SOLENOID 2 FAILURE (S2) (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the wiring harness between the TCM 20 pin connector terminal (3) and A/T 8 pin connector terminal (8) for open. Was a problem found and corrected?	—	Go to Step 13	—
13	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

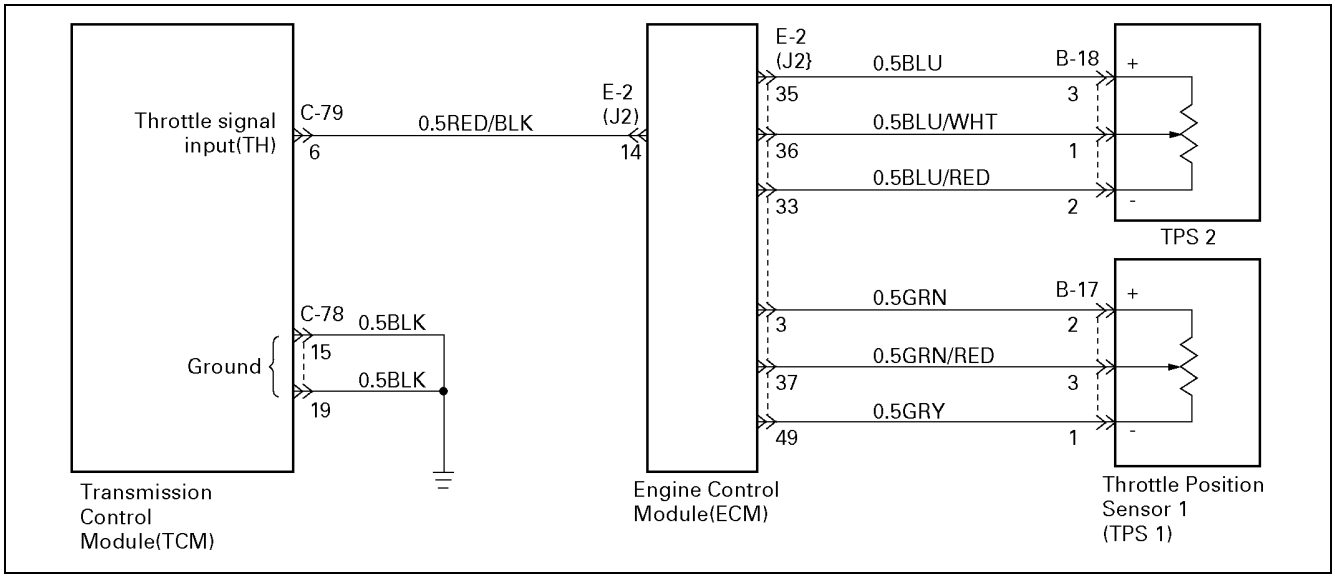
DTC P1120 (FLASHING CODE 22)
PWM THROTTLE SIGNAL FAILURE (TH) (For TFR/S)

TFR/S (For Australia) and TFR (For South Africa)



D07L200008

'01TFR (For Thailand)



D07L100003

Circuit description:

When the PWM signal of the engine throttle position sensor located on the engine manifold ('01TFR, For Thailand) or accelerator pedal assembly (TFR/S) is supplied to the TCM via the ECM, the TCM judges the opening condition of the throttle
The shift point of th transmission is determined by this PWM throttle signal.

Fail-safe control:

The TCM controls fail-safe by detecting PWM throttle signal (TH) failue.

Failure detection:

- When the throttle input duty ratio is detected less than 1% or more than 99% for 2.0 seconds.

Contents of control:

At failure detection

- Throttle opening for line pressure control … Throttle opening 100%
- Throttle opening for shift control … Throttle opening 0%
- Lock-up control inhibit
- Squat control inhibit

At failure detection

- Executes following items in addition to above control items at faulure datection.
- Blinks “CHECK TRANS” lamp
- Stores the failure information in failure-memory

Conditions of turning “CHECK TRANS” lamp off:

Trurns “CHECK TRANS” lamp off when judged 0km/h by output revolution sensor after throttle signal input duty ration is detected more than 1% and less than 99%.

(however, uses 0km/h judgment by back-up vehicle apeed at output rebolution gailure)

Reversion conditions from hail-safe:

At filure detection

- Immediately recovers when the throttle input duty ratio is detected more than 1% and less than 99%.

At filure detection

- Recovers at the same time as the conditions of turning “CHECK TRANS” lamp off are satisfied.

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. Check that the throttle input voltage is 4.4 to 4.6V.
2. At this test, check that as the throttle opens, the voltage goes up and that the voltage reached 0.4 to 0.6V at the full open status.
6. Check the power supplu voltage (4.99-5.01V) of the each throttle position sensors.

Diagnostic aids:

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P1120 (FLASHING CODE 22)
PWM THROTTLE SIGNAL FAILURE (TH) (For TFR/S)

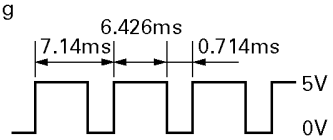
Step	Action	Value(s)	Yes	No
1	1. Connect a analog voltmeter between the TCM 28 pin connector terminal (6) and TCM 20 pin connector terminal (15 or 19). 2. Turn the ignition "ON". Is the voltage within the specified value?	4.4-4.6 V *	Go to Step 2	Go to Step 3
2	Open the throttle fully. Is the voltage within the specified value?	0.4-0.6 V *	The problem is intermittent. Refer to "Diagnostic aids".	Go to Step 3
3	1. Turn the ignition "ON". 2. Measure the voltage between the ECM 81 pin connector terminal (26) and ground terminal (47) (TFR/S), or ECM 32 pin connector terminal (14) and ground terminal (33 or 49) ('01 TFR, for Thailand). Is the voltage within the specified value?	4.4-4.6 V *	Go to Step 4	Go to Step 6
4	Open the throttle fully. Is the voltage within the specified value?	0.4-0.6 V *	Go to Step 5	Go to Step 6
5	Check the wiring harness between the TCM 28 pin connector terminal (6) and ECM 81 pin connector terminal (26) (TFR/S), or ECM 32 pin connector terminal (14) ('01 TFR, for Thailand). Or TCM is faulty. Was a problem found and corrected?	—	Go to Step 9	—
6	1. Disconnect the TPS connector. 2. Connect a voltmeter between the TPS connector terminal (C93-3) and (C93-1) (TFR/S), or TPS connector terminal (B17-2) and (B17-1), or (B18-3) and (B18-2) ('01 TFR, for Thailand). Is the voltage within the specified value?	4.99-5.01 V	Go to Step 7	Go to Step 8
7	Check the TPS connectors. If OK, replace the TPS. Is the replacement complete?	—	Go to Step 9	—
8	Check the wiring harness between the TPS and ECM. If OK, replace the ECM. Is the replacement complete?	—	Go to Step 9	—

DTC P1120 (FLASHING CODE 22)
PWM THROTTLE SIGNAL FAILURE (TH) (For TFR/S) (Cont'd)

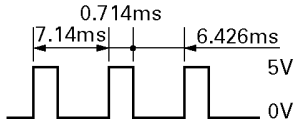
Step	Action	Value(s)	Yes	No
9	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin the diagnosis again. Go to Step 1	System OK

*Reference (Oscilloscope waveform)
(TFR/S)

At idling

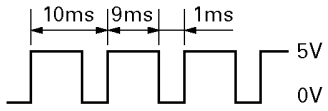


At WOT

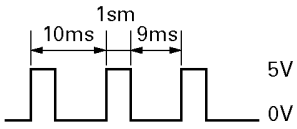


('01 TFR, for Thailand)

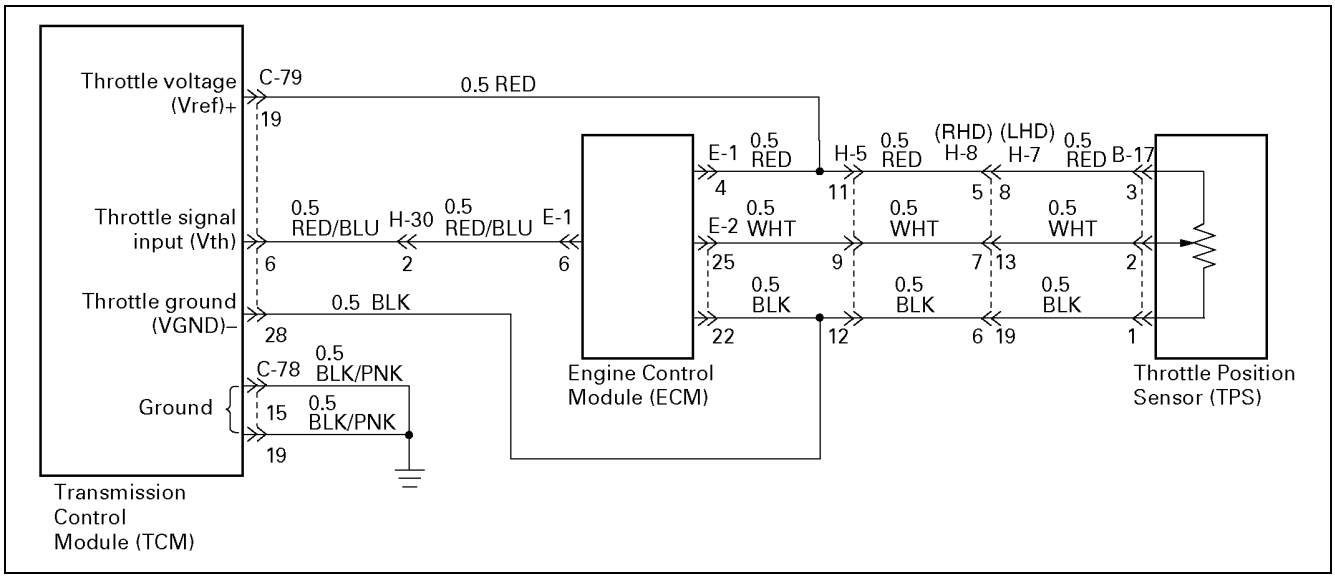
At idling



At WOT



DTC P1121 (FLASHING CODE 23)
ANALOG THROTTLE SIGNAL FAILURE (VREF, VGND)(For UBS)



D07R200063

Circuit description:

When the signal of the engine throttle position sensor located on the accelerator pedal is supplied to the transmission TCM, the TCM judges the opening condition of the throttle.

The shift point of the transmission is determined by this opening condition of the throttle.

Fail-safe control:

The TCM controls fail-safe by detecting analog throttle signal (VREF, VGND) failure.

Failure detection:

- When the Vref input voltage is detected more than 5.55V or less than 4.45V.
- When the Vgnd input voltage is detected more than 0.40V or less than -0.40V.
- When the failure criteria is continuously for 1.0 sec.

Contents of control:

At failure detection

- Judges throttle opening of linear sensor (Vth) as Vref:5V, Vgnd:0V
- Throttle learning control inhibit
- Up hill and down hill control inhibit

At failure decision

Executes following items in addition to above control items at failure detection.

- Stores the failure information in failure-memory

Conditions of turning “CHECK TRANS” lamp off:

None

Reversion conditions from fail-safe:

At failure detection

When the Vref input voltage is detected less than 5.55 V and more than 4.45 V.

When the Vgnd input voltage is detected less than 0.40 V and more than -0.40 V.

At failure decision

- Recovers when judged 0km/h by output revolution sensor after the Vref input voltage is detected less than 5.55V and more than 4.45V.
  (however, uses 0 km/h judgment by back-up vehicle speed at output revolution failure)
- Recovers when judged 0km/h by output revolution sensor after the Vgnd input voltage is detected less than 0.40V and more than -0.40V.
  (however, uses 0 km/h judgment by back-up vehicle speed at output revolution failure)

Test description:

The following numbers correspond to the step numbers on the diagnostic chart.

1. Check the power supply voltage (4.75-5.25V) of throttle position sensor.

Diagnostic aids:

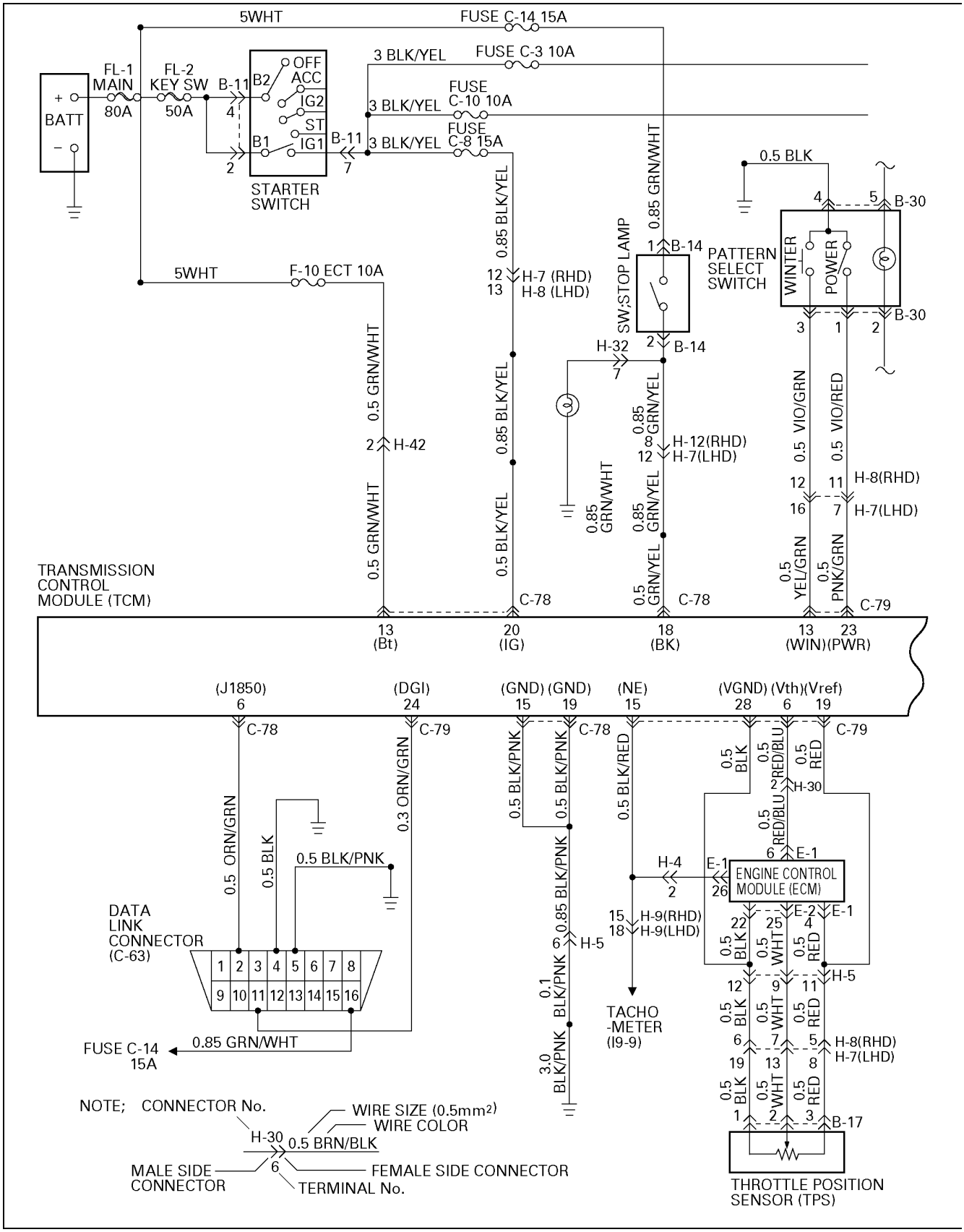
An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Inspect related harness connector for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection and damaged harness.

DTC P1121 (FLASHING CODE 23)
ANALOG THROTTLE SIGNAL FAILURE (VREF, VGND)(For UBS)

Step	Action	Value(s)	Yes	No
1	1. With the engine "OFF", turn the ignition "ON". 2. Connect a voltmeter between the TCM 28 pin connector terminal (19) and (28). Is the voltage within the specified value?	4.75-5.25 V	The problem is intermittent. Refer to "Diagnostic aids".	Go to Step 2
2	Connect a voltmeter between the ECM 32 pin connector terminal (E1-4) and (E2-22). Is the voltage within the specified value?	4.75-5.25 V	Go to Step 3	Go to Step 4
3	Check the wiring harness between the TCM and ECM. Was a problem found and corrected?	—	Go to Step 5	—
4	Check the ECM 32 pin connectors. If OK, replace the ECM. Is the replacement complete?	—	Go to Step 5	—
5	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function. 2. Make a road running test for the vehicle. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	—	Begin in the diagnosis again. Go to Step 1	System OK

WIRING DIAGRAM

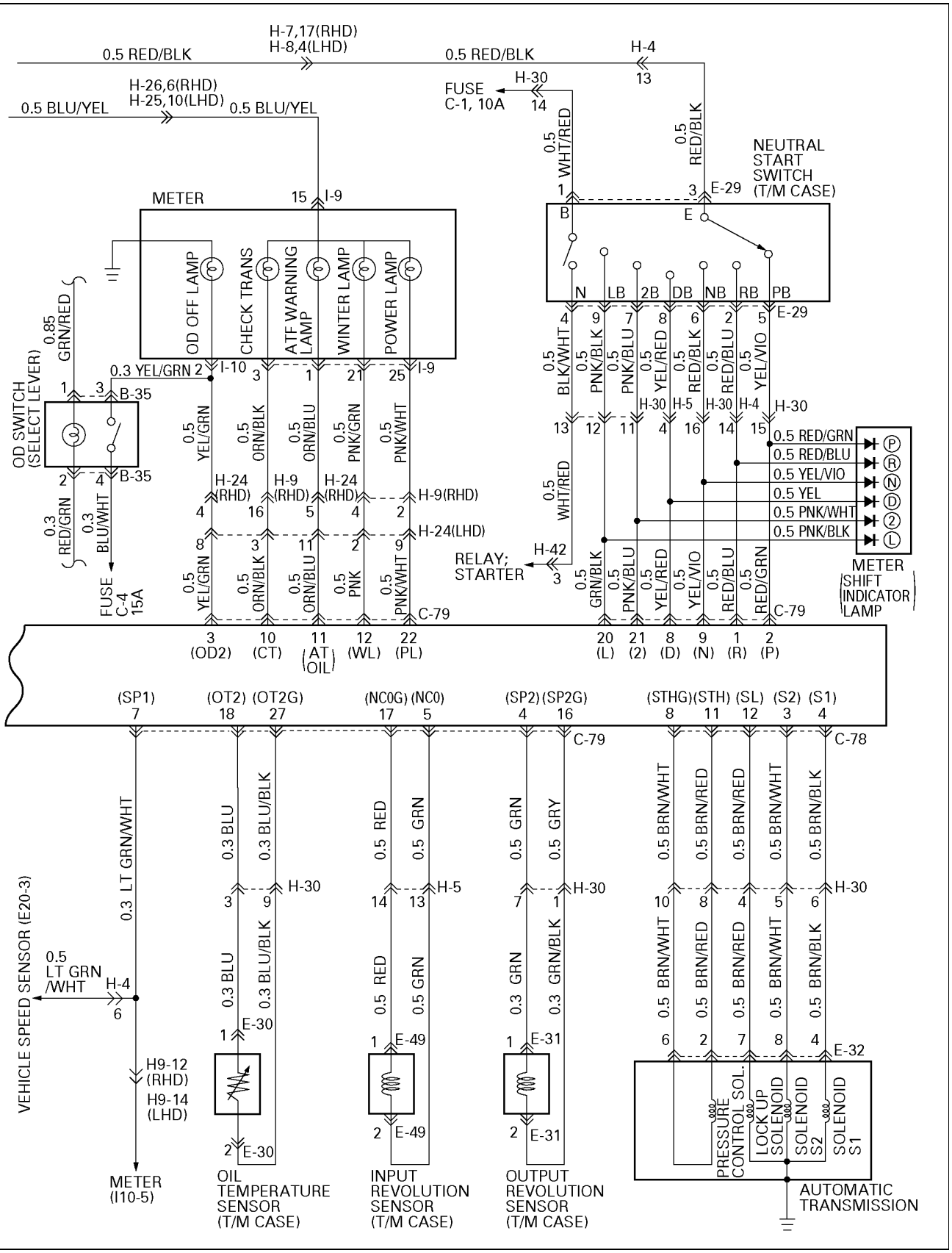
UBS (For General Export)



D07R200064

WIRING DIAGRAM (Cont'd)

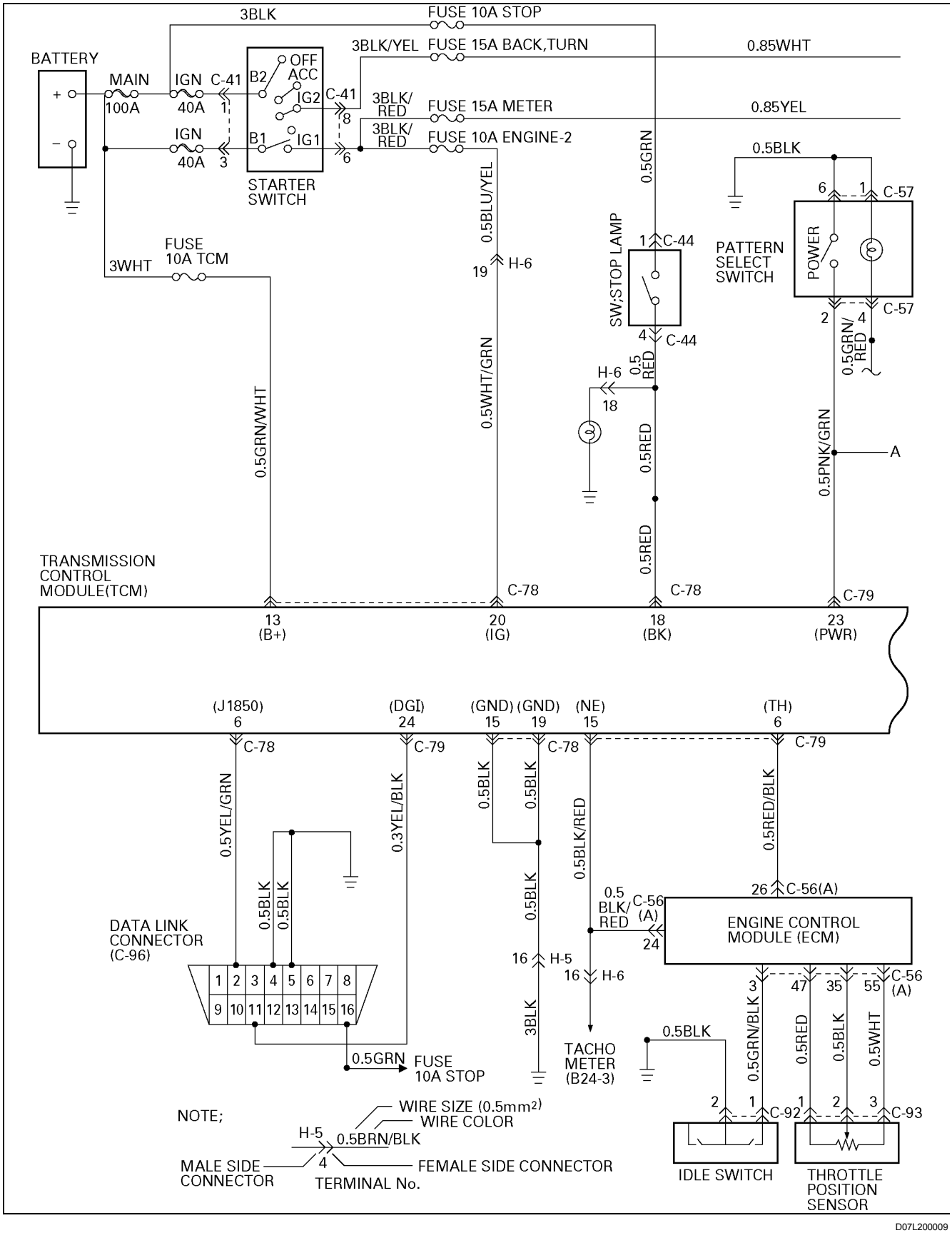
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D07R200065

WIRING DIAGRAM (Cont'd)

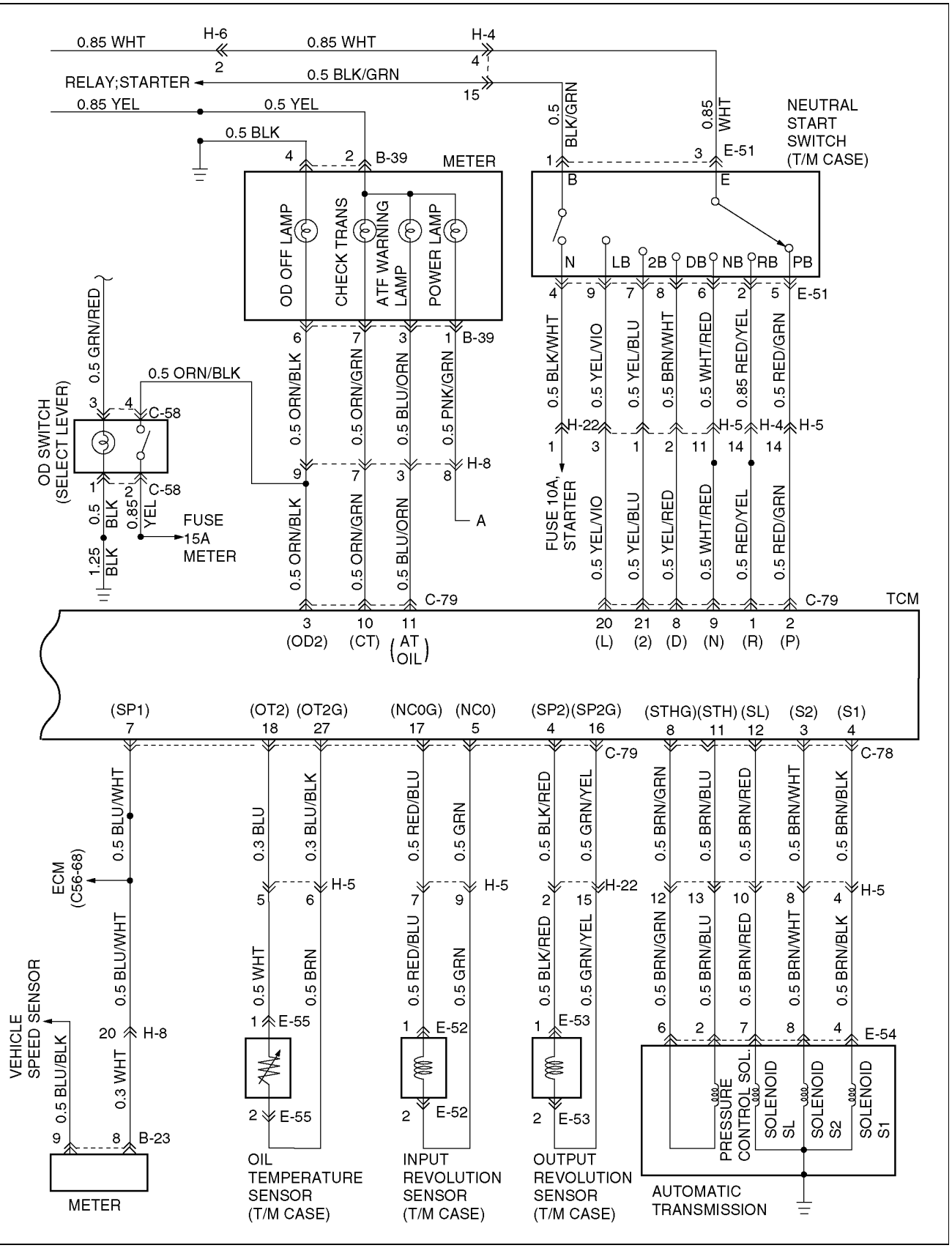
TFR/S (For Australia) and TFR (For South Africa)



D07L200009

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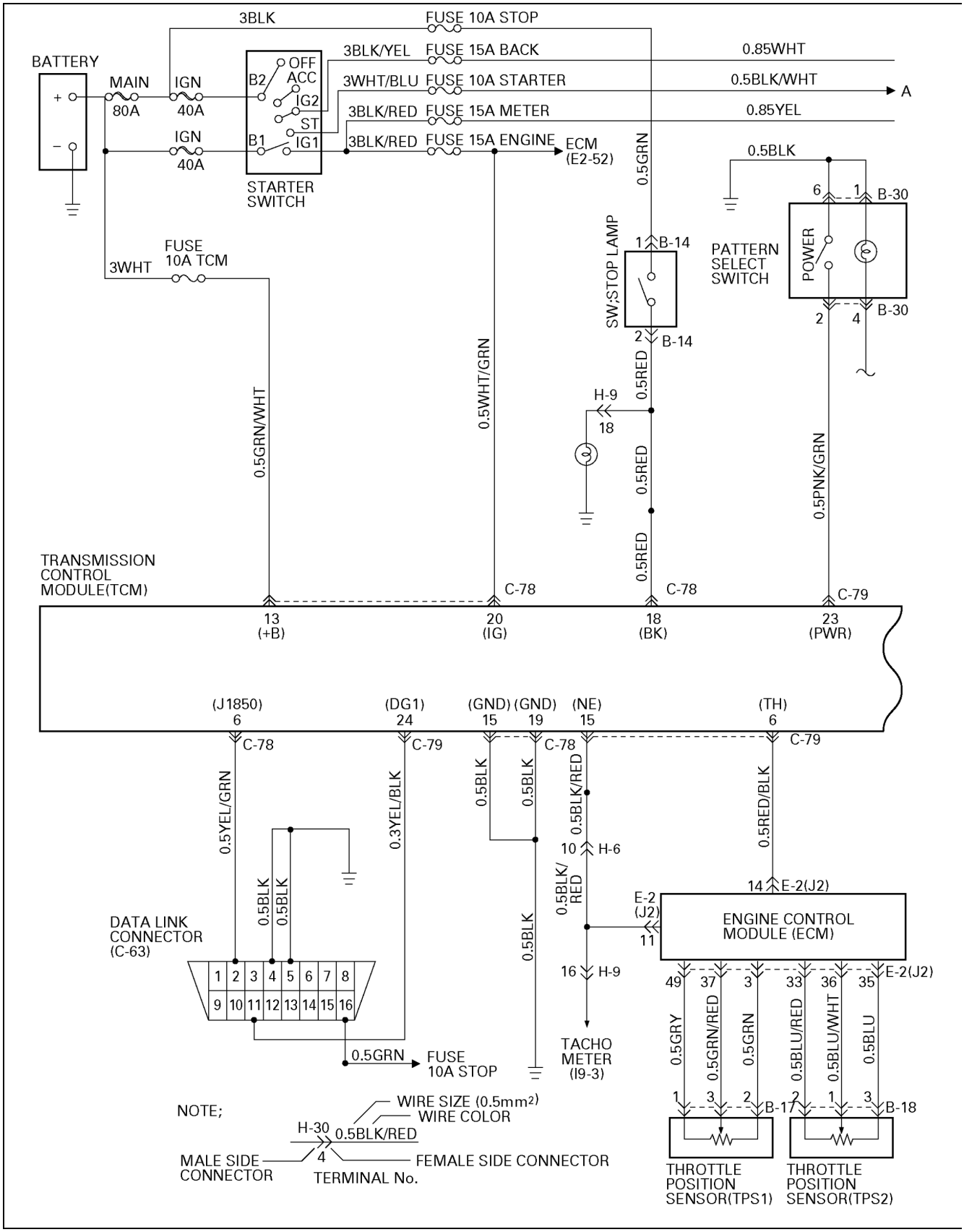
TFR/S (For Australia) and TFR (For South Africa)



D07L200010

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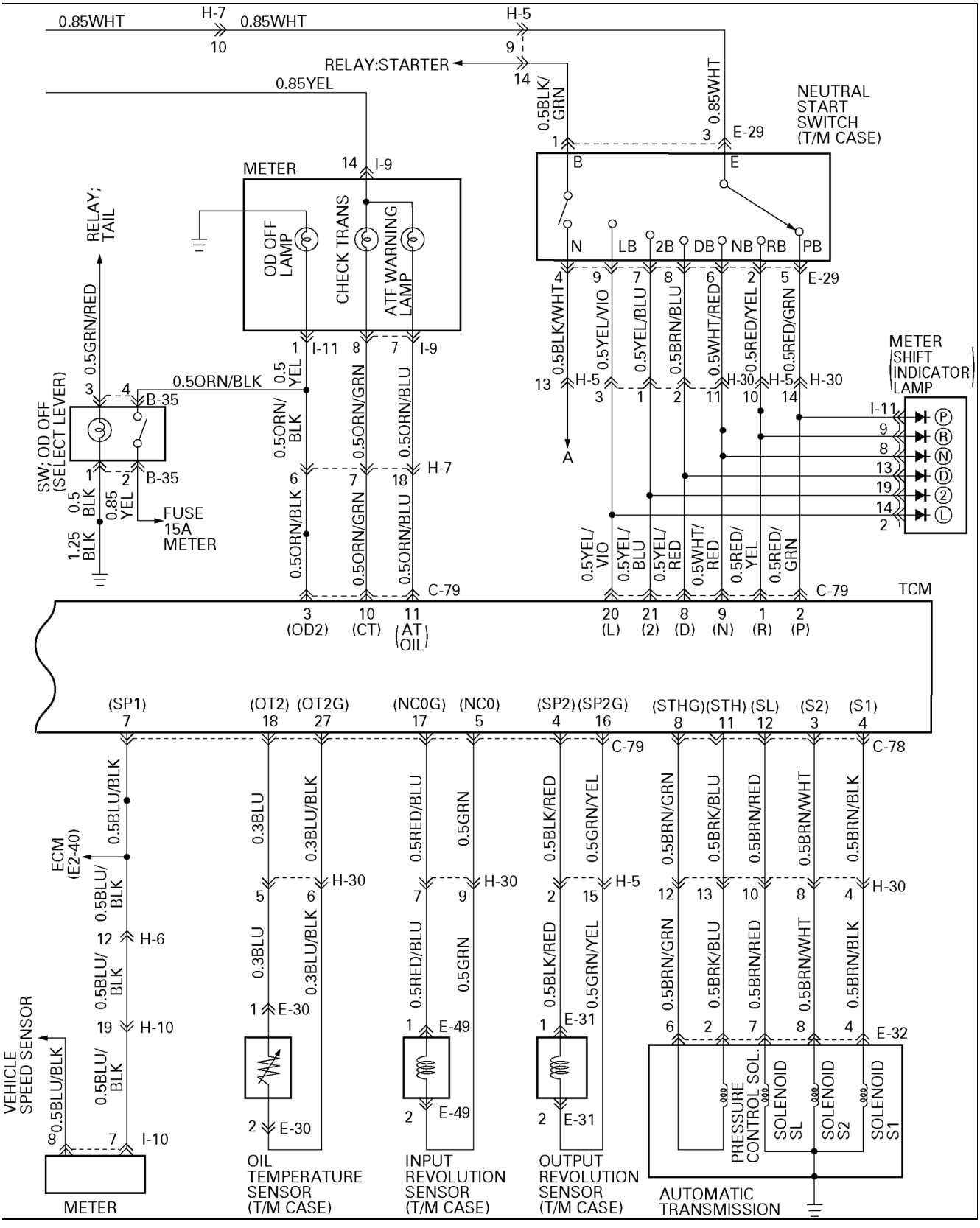
'01 TFR (For Thailand)



D07L200012

WIRING DIAGRAM (Cont'd)

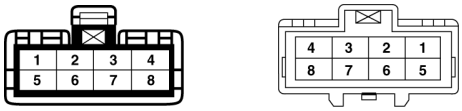
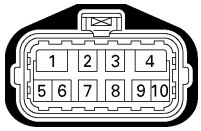
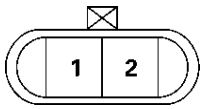
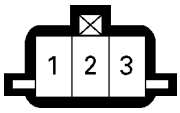
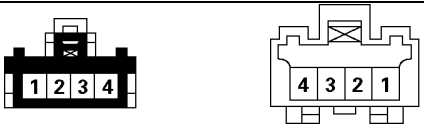
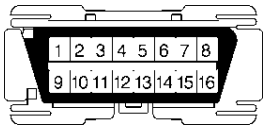
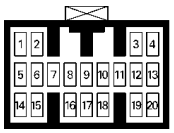
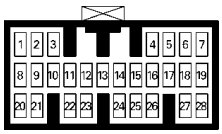
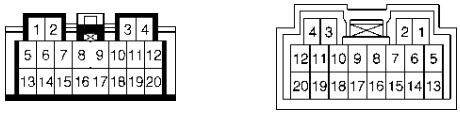
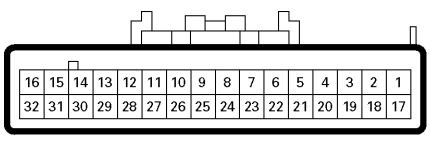
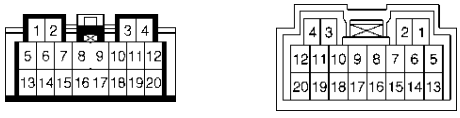
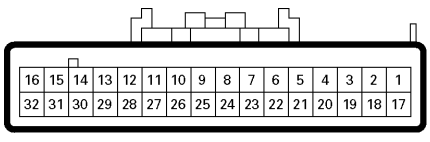
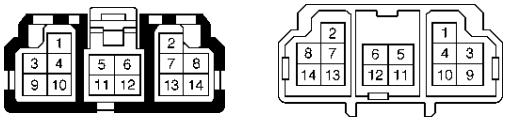
'01 TFR (For Thailand)



D07L200013

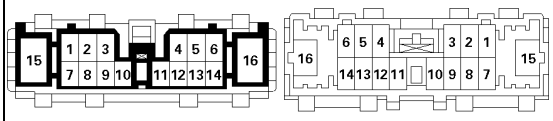
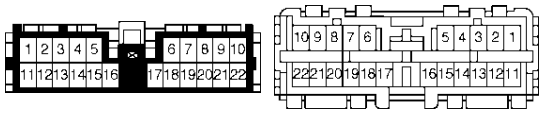
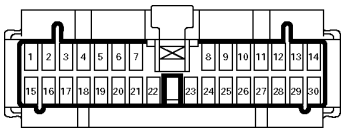
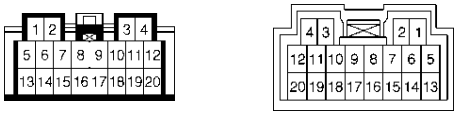
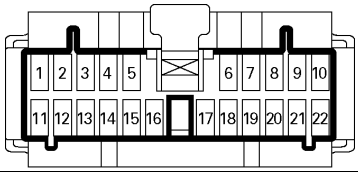
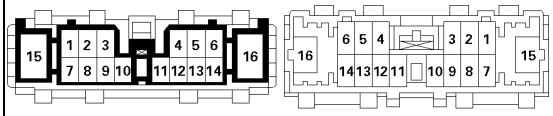
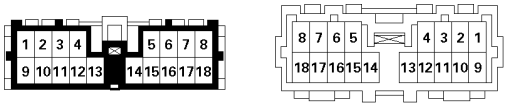
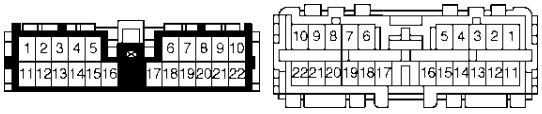
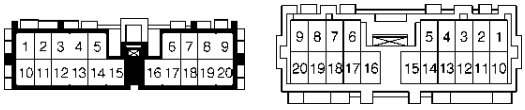
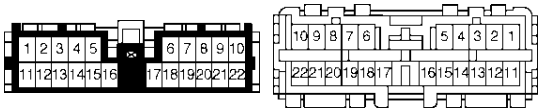
CONNECTOR LIST

UBS (For General Export)

No.	Connector face	No.	Connector face
B-11	 (WHITE)	E-29	
B-14	 (BLACK)	E-30	
B-17		E-31	
B-30	 (WHITE)	E-32	
B-35	 (WHITE)	E-49	
C-63		H-4	 (BLACK)
C-78		H-5	 (GREEN)
C-79		H-7 (RHD)	
E-1		H-7 (LHD)	
E-2		H-8 (RHD)	

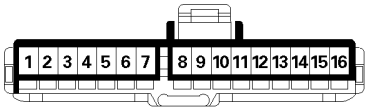
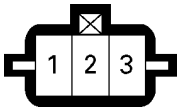
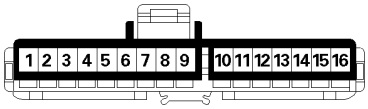
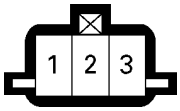
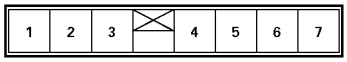
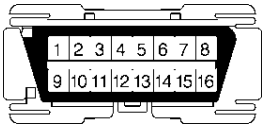
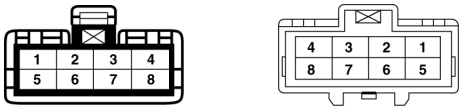
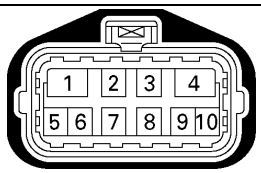
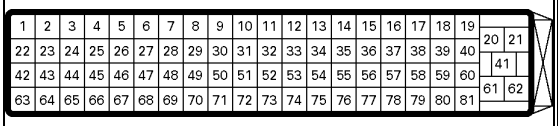
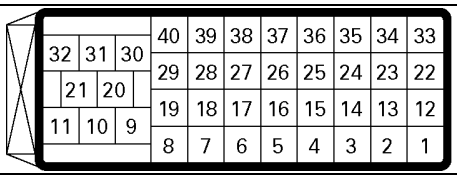
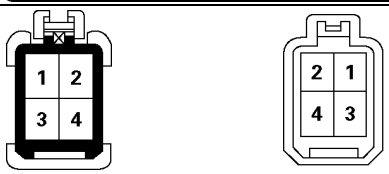
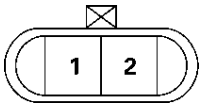
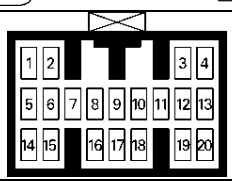
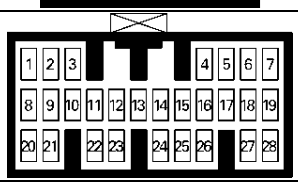
CONNECTOR LIST (Cont'd)

UBS (For General Export)

No.	Connector face	No.	Connector face
H-8 (LHD)		H-42	 (BLACK)
H-9 (RHD)		I-9	
H-9 (LHD)		I-10	
H-12 (RHD)			
H-24 (RHD)			
H-24 (LHD)			
H-25 (LHD)			
H-26 (RHD)			
H-30	 (NATURAL)		
H-32	 (BLACK)		

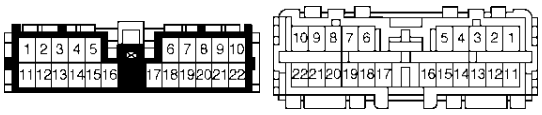
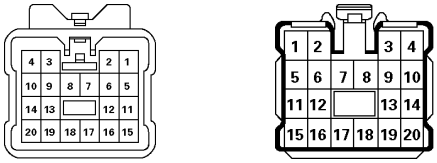
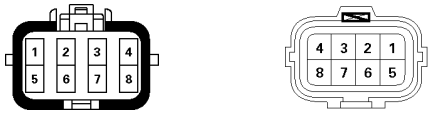
CONNECTOR LIST (Cont'd)

TFR/S (For Australia) and TFR (For South Africa)

No.	Connector face	No.	Connector face
B-23		C-92	
B-24		C-93	
B-39		C-96	
C-41		E-51	
C-44		E-52	
C-56		E-53	
C-57		E-54	
C-58		E-55	
C-78		H-4	 (BLACK)
C-79		H-5	 (BLACK)

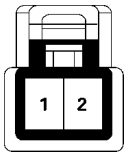
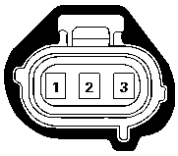
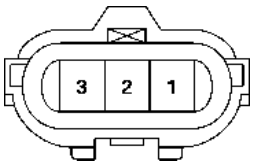
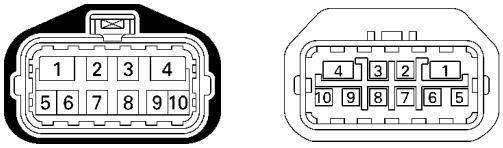
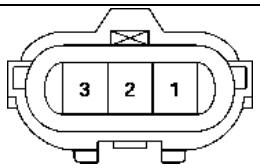
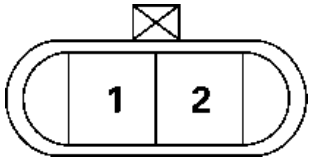
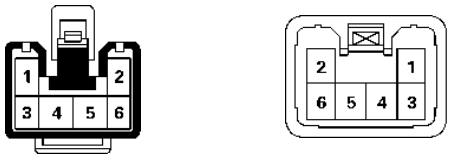
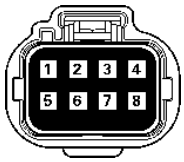
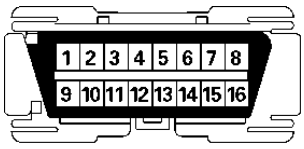
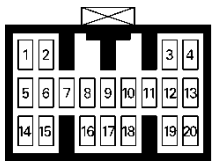
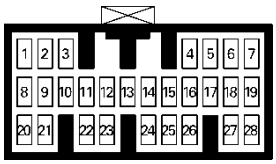
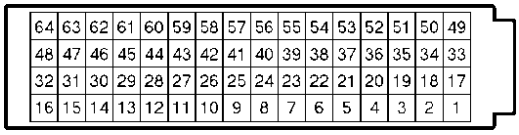
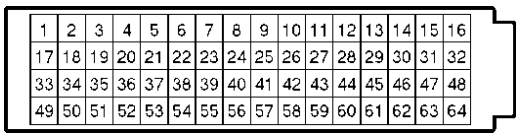
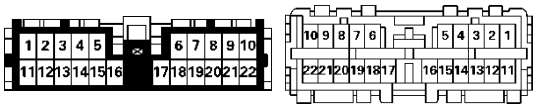
CONNECTOR LIST (Cont'd)

TFR/S (For Australia) and TFR (For South Africa)

No.	Connector face	No.	Connector face
H-6	 (WHITE)		
H-8			
H-22	 (GRAY)		

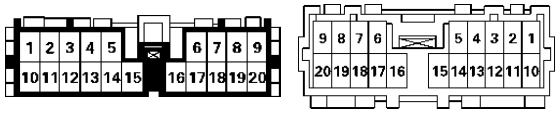
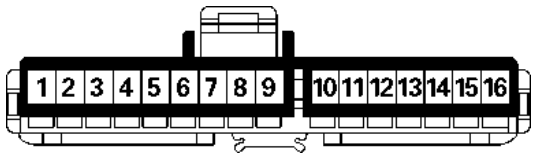
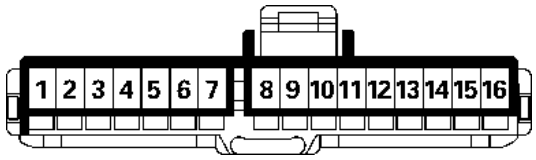
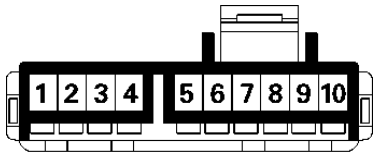
CONNECTOR LIST (Cont'd)

'01 TFR (For Thailand)

No.	Connector face	No.	Connector face
B-14		E-20	
B-17		E-29	
B-18		E-30	
B-30		E-31	
B-35		E-32	
C-63		E-49	
C-78		H-5	 (GRAY)
C-79		H-6	 (BLUE)
E-1		H-7	
E-2		H-9	

CONNECTOR LIST (Cont'd)

'01 TFR (For Thailand)

No.	Connector face	No.	Connector face
H-10			
H-30	 (BLACK)		
I-9			
I-10			
I-11			

TROUBLESHOOTING CHART

Number are arranged in order of probability.

Parform inspections starting with number one and working up.

ON-VEHICLE TROUBLESHOOTING

No	Symptom	Inspection item	ENG			Chassis		Electrical system																	A/T (External)					ATF		A\T			
			Engine tuning	Drive plate	Engine and automatic transmission mounting	Exhaust system resonance	Drive train and body interference	Suspension looseness	Throttle position sensor circuit	Shift solenoid No. 1 circuit	Shift solenoid No. 2 circuit	Lock-up solenoid circuit	Pressure control solenoid circuit	Input speed sensor circuit	SP2 sensor circuit (Output speed sensor)	SP1 sensor circuit (Speedometer sensor)	Neutral start switch circuit (Operation and adjustment)	Oil temperature sensor circuit	Pattern select switch circuit	Overdrive switch circuit	Brake switch circuit	Wire harness connectors	Tachometer	ECM	TCM internal circuits	Select lever linkage (Operation and adjustment)	Breather (Bending)	Cooler pipes (Bending and/or clogging)	Cooler pipe installation	Cooler pipe resonance	Automatic transmission fluid level (Too much or too little)	Water in fluid/Wrong fluid	Oil seals	Gaskets	O-rings	A/T interior * Refer to unit troubleshooting
1	No vehicle movement	No forward movement		5																							4			1	2				6
		No reverse movement		7						4					5										3		6			2	2				8
2	Slippage	Slip to front							3				4																						5
		Slip to rear							3				4																						5
3	Long garage shift time lag	N→D											3					4							5							2			5
		N→R											3												4							2			4
4	No engine start																2																		
5	Engine stop	N→D or N→R	1																																
		Speed reduction	1												3		2							5											
6	No shift	1→2, 2→1							1		4				3		2							5											
		2→3, 3→2							1	4					3		2							5											
		3→4, 4→3							3		6				4	2	5			1				7							8				
		Lock-up does not operate							1			4			3		2				5			6							7				
		Poor engine braking in 2nd gear															2								1						3				
		Poor engine braking in 1st gear															2								1						3				
		No kick-down							1	4	3				2									5											

ON-VEHICLE TROUBLESHOOTING (Cont'd)

No	Symptom	Inspection item	ENG				Chassis		Electrical system																	A/T (External)				ATF		A/T			
			Engine tuning	Drive plate	Engine and automatic transmission mounting	Exhaust system resonance	Drive train and body interference	Suspension looseness	Throttle position sensor circuit	Shift solenoid No. 1 circuit	Shift solenoid No. 2 circuit	Lock-up solenoid circuit	Pressure control solenoid circuit	Input speed sensor circuit	SP2 sensor circuit (Output speed sensor)	SP1 sensor circuit (Speedometer sensor)	Neutral start switch circuit (Operation and adjustment)	Oil temperature sensor circuit	Pattern select switch circuit	Overdrive switch circuit	Brake switch circuit	Wire harness connectors	Tachometer	ECM	TCM internal circuits	Select lever linkage (Operation and adjustment)	Breather (Bending)	Cooler pipes (Bending and/or clogging)	Cooler pipe installation	Cooler pipe resonance	Automatic transmission fluid level (Too much or too little)	Water in fluid/Wrong fluid	Oil seals	Gaskets	O-rings	A/T interior * Refer to unit troubleshooting
7	Shift point failure	Shift point too high							1						5	4	3	6	2					7											
		Shift point too low							1						5	4	3		2					6											
8	Shift lever too stiff or too loose																			1															
9	Poor fuel economy											3						5	4	2					6					1					
10	Pattern select switch not working																	2	1					3											
11	Oil leakage	Breather																							5		3	4			1	2			
		Engine and transmission housing mating surfaces		1																					4									3	
		Transmission case and engine housing mating																															1		
		Oil pan																							2								1		
		Manual shift oil seal																														1			
		O-rings (Union elbow and transmission wires																																1	
		Cooler pipe installation																										3	1	2					

ON-VEHICLE TROUBLESHOOTING (Cont'd)

No	Symptom	Inspection item	ENG: Engine tuning	ENG: Drive plate	ENG: Engine and automatic transmission mounting	ENG: Exhaust system resonance	Chassis: Drive train and body interference	Chassis: Suspension looseness	Electrical system: Throttle position sensor circuit	Electrical system: Shift solenoid No. 1 circuit	Electrical system: Shift solenoid No. 2 circuit	Electrical system: Lock-up solenoid circuit	Electrical system: Pressure control solenoid circuit	Electrical system: Input speed sensor circuit	Electrical system: SP2 sensor circuit (Output speed sensor)	Electrical system: SP1 sensor circuit (Speedometer sensor)	Electrical system: Neutral start switch circuit (Operation and adjustment)	Electrical system: Oil temperature sensor circuit	Electrical system: Pattern select switch circuit	Electrical system: Overdrive switch circuit	Electrical system: Brake switch circuit	Electrical system: Wire harness connectors	Electrical system: Tachometer	Electrical system: ECM	Electrical system: TCM internal circuits	A/T (External): Select lever linkage (Operation and adjustment)	A/T (External): Breather (Bending)	A/T (External): Cooler pipes (Bending and/or clogging)	A/T (External): Cooler pipe installation	A/T (External): Cooler pipe resonance	ATF: Automatic transmission fluid level (Too much or too little)	ATF: Water in fluid/Wrong fluid	A/T: Oil seals	A/T: Gaskets	A/T: O-rings	A/T: A/T interior * Refer to unit troubleshooting
12	Jolt when gears are changed	N→D			3				5				6					7							8						1	2				9
		N→R			3				5				6												7	4					1	2				8
		1→2	9		3				4				5	6	7										8						1	2				10
		2→3	9		3				4				5	6	7										8						1	2				10
		3→4	9		3				4				5	6	7										8						1	2				10
		Coast-down (Including vehicle stop)			2			4	5				6	7	8										9							1				10
		Kick-down			2			3	4				5	6	7										8							1				9
		Lock-up (ON/OFF)			2				3				4												5							1				6
		Accelerator ON/OFF (No gear change)	5		1				2			3													4											
13	Excessive vibration	Running	3	7	6	4	5																													8
14	Abnormal noise	Idling	3																											2						4
		Garage shift			1																															
		Running	2		1	1	1																							1						3
		Gear change	2		1	1	1																													3
		Accelerator ON/OFF (No gear change)	2		1	1	1																													

ON-VEHICLE TROUBLESHOOTING (Cont'd)

No	Inspection item / Symptom	DTC (FLASHING CODE) P0120 (21) (UBS)	P0502 (24)	P0705 (17)	P0710 (16)	P0717 (14)	P0722 (11)	P0727 (13)	P0743 (33)	P0748 (35)	P0753 (31)	P0758 (32)	P1120 (22) (TF)	P1121 (23) (UBS)
15	A/T: A/T interior * Refer to unit troubleshooting													
	A/T: O-rings													
	A/T: Gaskets													
	A/T: Oil seals													
	ATF: Water in fluid/Wrong fluid													
	ATF: Automatic transmission fluid level (Too much or too little)													
	A/T (External): Cooler pipe resonance													
	A/T (External): Cooler pipe installation													
	A/T (External): Cooler pipes (Bending and/or clogging)													
	A/T (External): Breather (Bending)													
	A/T (External): Select lever linkage (Operation and adjustment)													
	Electrical system: TCM internal circuits	3	2	2	2	2	2	2	2	2	2	2	3	3
	Electrical system: ECM	1						1					1	
	Electrical system: Tachometer							1						
	Electrical system: Wire harness connectors	2	1	1	1	1	1	1	1	1	1	1	2	2
	Electrical system: Brake switch circuit													
	Electrical system: Overdrive switch circuit													
	Electrical system: Pattern select switch circuit													
	Electrical system: Oil temperature sensor circuit				1									
	Electrical system: Neutral start switch circuit (Operation and adjustment)			1										
	Electrical system: SP1 sensor circuit (Speedometer sensor)		1											1
	Electrical system: SP2 sensor circuit (Output speed sensor)						1							
	Electrical system: Input speed sensor circuit					1								
	Electrical system: Pressure control solenoid circuit									1				
	Electrical system: Lock-up solenoid circuit								1					
	Electrical system: Shift solenoid No. 2 circuit											1		
	Electrical system: Shift solenoid No. 1 circuit										1			
	Electrical system: Throttle position sensor circuit	2											2	2
	Chassis: Suspension looseness													
	Chassis: Drive train and body interference													
	ENG: Exhaust system resonance													
	ENG: Engine and automatic transmission mounting													
	ENG: Drive plate													
	ENG: Engine tuning													

UNIT TROUBLESHOOTING

Symptom / Inspection item			T/C		Oil pump	Oil strainer	Transmission case	Shift lever No. 1 (Stick)	Shift lever No. 2 (Stick)	Lock-up solenoid (Stick)	Pressure controller solenoid (Stick)	Valve body (Internal)	Accumulator (C0, C2, B0, and B2)	Clutch			Brake				One-way clutch			Overdrive front and rear planetary gears	Bearing races	Detent spring
			Internal problem	External problem										Overdrive direct clutch (C0)	Forward clutch (C1)	Direct clutch (C2)	Overdrive brake (B0)	2nd coast brake (B1)	2nd brake (B2)	1st and reverse brake (B3)	Overdrive one-way clutch (F0)	One-way clutch No. 1 (F1)	One-way clutch No. 2 (F2)			
1	No vehicle movement	No forward movement	7		3	1					2	8			4								5	6		
		No reverse movement	6		3	1					2	7				4				5						
2	Slippage	Slip to front	7		3	1					2	8			4								5	6		
		Slip to rear	6		3	1					2	7				4				5						
3	Long garage shift time lag	N→D			2						1	5			3								4			
		N→R			2						1	5				3				4						
4	Engine stop	N→D or N→R	2							1		3														
		Speed reduction								1		2														
5	No shift	1→2							1			4							2			3				
		2→3						1				3				2										
		3→4							1			3					2									
		4→3							1			4		2			3				2					
		3→2						1				4				2						3				
		2→1							1			5							2			3	4			
		Lock-up does not operate	2							1		3														
		Poor engine braking in 2nd gear										2						1								
		Poor engine braking in 1st gear										2							1							
6	Shift lever too stiff or too loose																									1

UNIT TROUBLESHOOTING (Cont'd)

		Inspection item / Symptom		Detent spring	Bearing races	Overdrive front and rear planetary gears	One-way clutch: One-way clutch No. 2 (F2)	One-way clutch: One-way clutch No. 1 (F1)	One-way clutch: Overdrive one-way clutch (F0)	Brake: 1st and reverse brake (B3)	Brake: 2nd brake (B2)	Brake: 2nd coast brake (B1)	Brake: Overdrive brake (B0)	Clutch: Direct clutch (C2)	Clutch: Forward clutch (C1)	Clutch: Overdrive direct clutch (C0)	Accumulator (C0, C2, B0, and B2)	Valve body (Internal)	Pressure controller solenoid (Stick)	Lock-up solenoid (Stick)	Shift lever No. 2 (Stick)	Shift lever No. 1 (Stick)	Transmission case	Oil strainer	Oil pump	T/C: External problem	T/C: Internal problem
7		Poor fuel economy																3		1						2
8	Oil leakage		Breather															1								
			Engine and transmission housing mating surfaces																					2	1	
			Oil pan																				1			
9	Jolt when gears are changed		N→D												2			3	1							
			N→R											3			2	4	1							
			1→2								3						2	4	1							
			2→3											3			2	4	1							
			3→4										3				2	4	1							
			Coast-down														2	3	1							
			Kick-down														2	3	1							
			Lock-up															2	1	1						
10	Excessive vibration		Running															3					1			2
11	Abnormal noise		Idling		3																		1	2		4
			Garage shift												1	2										
			Running		4	3												6					1	2		5
			Gear change							7	6	4	2	3	5	1										

MANUAL SHIFTING TEST

NOTE:

With this test, it can be determined whether the trouble lies within the electrical circuit or is a mechanical problem in the transmission.

1. Disconnect TCM connector

With the engine OFF, disconnect the TCM connector.

2. Inspect manual driving operation

Check that the shift and gear positions correspond with the table.

If the “L”, “2” and “D” range gear positions are difficult to distinguish, do perform the following road test.

While driving, shift through the “L”, “2” and “D” renges. Check that the gear change corresponds to the gear position.

If any abnormality is found in the above test, do perform the stall, time lag or gear change tests.

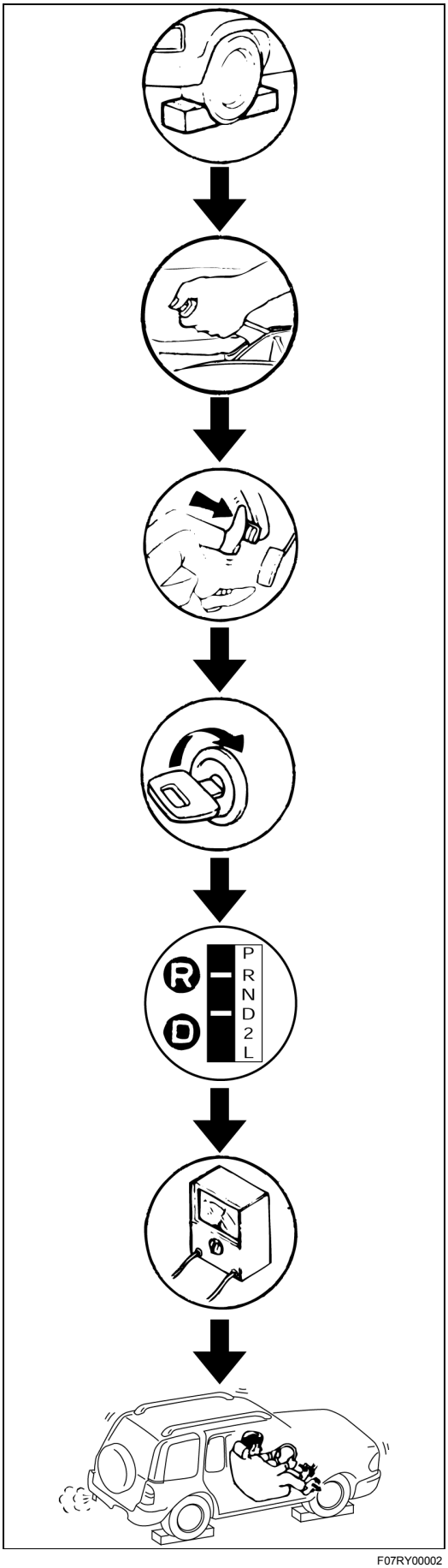
Position	Transmission		
Shift	"D" range	"2" range	"L" range
Gear	OD	3rd	3rd

Transmission	
"R" range	"P" range
Reverse	Pawl Lock

F07RY00024

3. Connect TCM connector

With the engine off, connect the TCM connector.



F07RY00002

STALL TEST

The object of this test is to check the overall performance of the transmission and engine by measuring the maximum engine speeds at the “D” and “R” ranges.

NOTE:

(1) Perform the test at normal operation fluid temperature (50 – 80°C or 122-176 °F).

(2) Do not continuously run this test longer than 5 seconds.

MEASURE STALL SPEED

1. Chock the four wheels.
2. Mount an engine tachometer.
3. Fully apply the parking brake.
4. Step down strongly on the brake pedal with your left foot.
5. Start the engine.
6. Turn off the A/C.
7. Shift into the “D” range. Step all the way down on the accelerator pedal with your right foot. Quickly read the highest engine rpm.

   Stall speed: 2450±150 rpm (UBS)

   : 2270±150 rpm (TFR/S)

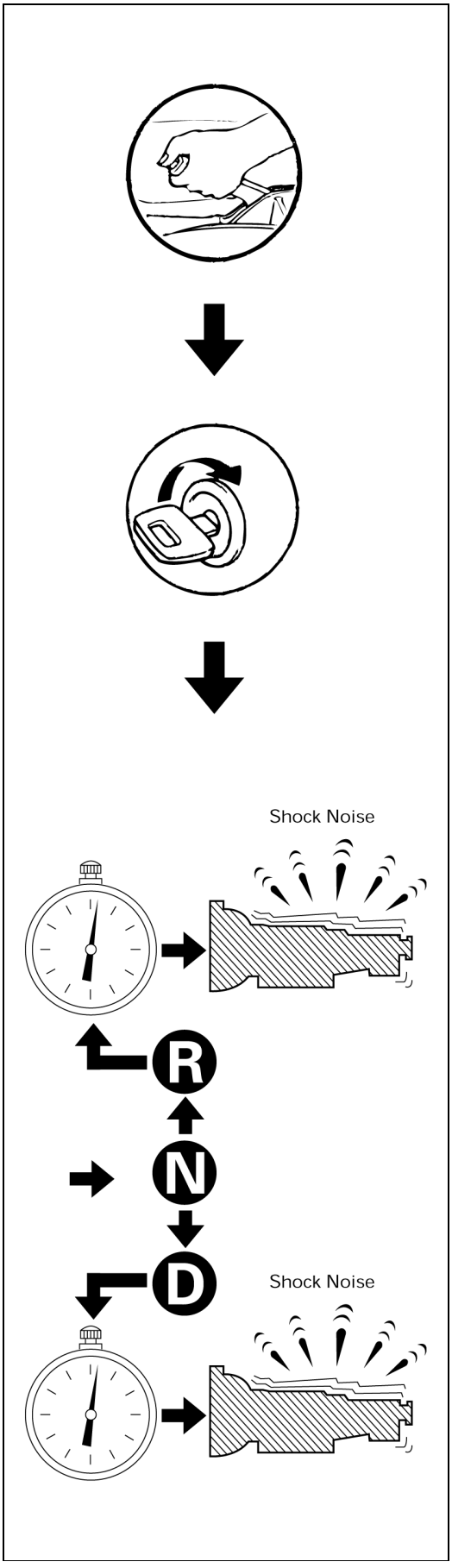
   : 2415±150 rpm (’01 TFR)
8. Perform the same test in the “R” range.

EVALUATION

1. If the engine speed is the same for both ranges but lower than the specified value:
   - Engine output is insufficient.
   - Stator one-way clutch is not operating properly.

   NOTE:

   If more than 600 rpm below the specified value, the torque converter could be faulty.
2. If the stall speed is “D” range is higher than specified:
   - Line pressure too low
   - Forward clutch slipping
   - No.2 one-way clutch not operating properly
3. If the stall speed in “R” range is higher than specified:
   - Line pressure too low
   - Direct clutch slipping
   - No.3 brake slipping
4. If the stall speed in the “R” and “D” ranges are higher than specified:
   - Line pressure too low
   - Improper fluid level



F07RY00003

TIME LAG TEST

If the shift lever is shifted while the engine is idling, there will be a certain time elapse or lag before the shock can be felt. This is used for checking the condition of the forward clutch, direct clutch, No.3 brake, and No.2 one-way clutch.

NOTE:

(1) Perform the test at normal operation fluid temperature (50 – 80°C or 122 – 176°F)

(2) Be sure to allow one minute interval between tests.

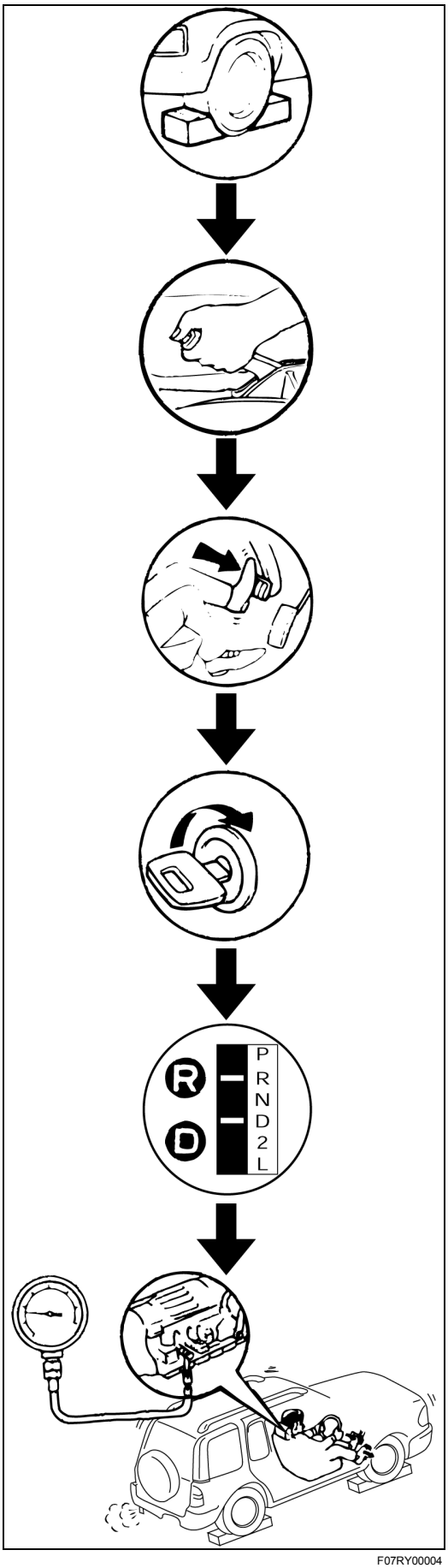
(3) Make three measurements and take the average value.

MEASURE TIME LAG

1. Fully apply the parking brake.
2. Start the engine.
   Check idling speed (A/C OFF).
3. Shift the shift lever from "N" to "D" range. Using a stop watch, measure the time it takes from sihfting the lever until the shock is felt.
   Time lag: Less than 0.7 seconds
4. In same manner, measure the time lag for "N" → "R".
   Time lag: Less than 1.2 seconds

EVALUATION

1. If "N" → "D" time lag is longer than specified:
   - Line pressure too low
   - Forward clutch malfunction
   - No.2 one-way clutch not operating properly
2. If "N" → "R" time lag is longer than specified:
   - Line pressure too low
   - Direct clutch malfunction
   - No.3 brake malfunction
3. If both time lag is longer than specified:
   - Line pressure too low



F07RY00004

HYDRAULIC TEST

PREPARATION

1. Warm up the transmission fluid.
2. Remove the transmission case test plug and mount the hydraulic pressure gauge.

   Oil pressure gauge: 5-8840-0093-0

NOTE:

Perform the test at normal operation fluid temperature (50 – 80°C or 122 – 176°F).

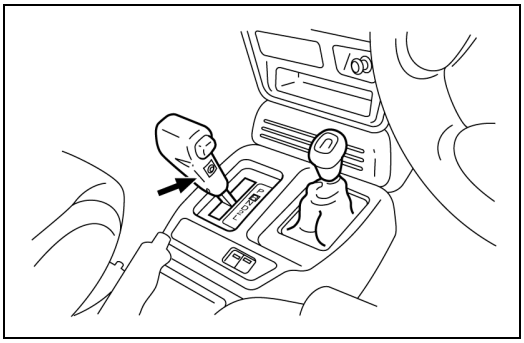
MEASURE LINE PRESSURE

1. Fully apply the parking brake and chock the four wheels.
2. Start the engine and check idling rpm.
3. Shift into “D” range, step down strongly on the brake pedal with your left foot and, while manipulating the accelerator pedal with the right foot, measure the line pressures at the engine speeds specified in the table.
4. In the same manner, perform the test in “R” range.

Engine speed	Line pressure kPa (kg/cm^2/psi)	
	“D” range	“R” range
Idling	358 – 417 (3.6 – 4.3/ 51 – 61)	588 – 686 (6.0 – 7.0/ 85 – 100)
Stall	1,176 – 1,323 (12.0 – 13.5/ 171 – 192)	1,607 – 1,940 (16.4 – 19.8/ 233 – 282)

EVALUATION

1. If the measured values at all ranges are higher than specified:
   - Pressure control solenoid defective
   - Primary regulator valve defective
2. If the measured values at all ranges are lower than specified:
   - Primary regulator valve defective
   - Oil pump defective
   - Pressure control solenoid defective
3. If pressure is low in “D” range only:
   - “D” range circuit fluid leakage
4. If pressure is low in “R” range only:
   - “R” range circuit fluid leakage



255RT004

ROAD TEST

NOTE:

Perform the test at normal operation fluid temperature (50 – 80°C or 122 – 176°F).

"D" RANGE TEST IN "NORMAL", AND "POWER" PATTERN RANGES

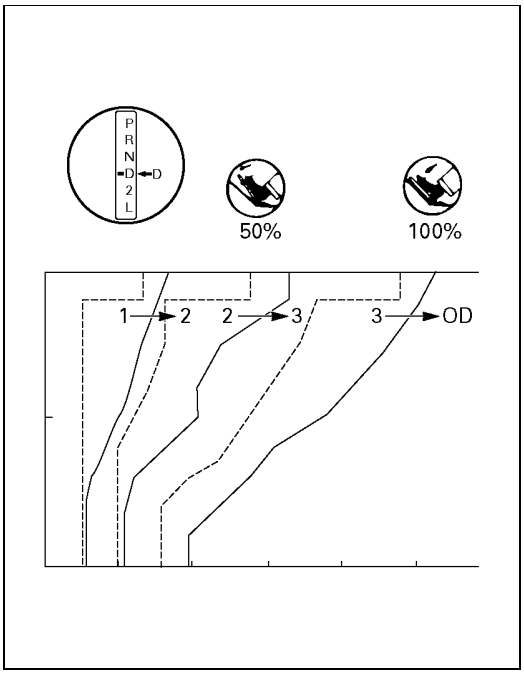
Shift into the "D" range and hold the accelerator pedal constant at the 50% and 100% throttle valve opening positions.

Push in one of the pattern selector buttons and check the following:

1. 1-2, 2-3, 3-OD and lock-up, up-shifts should take place, and shift points should conform to those shown in the automatic shift diagram.

NOTE:

Drive the vehicle on level ground.



F07R200019

EVALUATION

(1) If there is no 1→2 up-shift:
- Solenoid S2 is stuck
- 1-2 shift valve is stuck

(2) If there is no 2→3 up-shift:
- Solenoid S1 is stuck
- 2-3 shift valve is stuck

(3) If there is no 3→OD up-shift (throttle valve opening 1/2):
- Solenoid S2 is stuck
- 3-OD shift valve is stuck

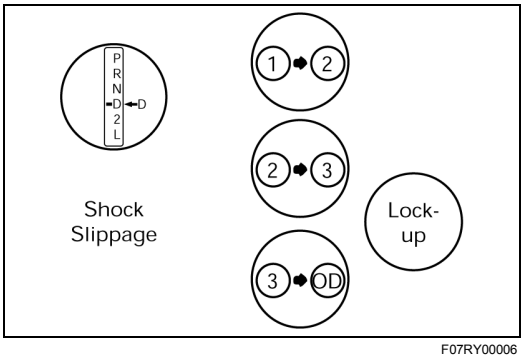
(4) If the shift point is defective:

Refer to "TROUBLESHOOTING CHART" in this section.

(5) If the lock-up is defective:

Refer to "TROUBLESHOOTING CHART" in this section.

2. In the same manner, check the shock and slip at the 1→2, 2→3 and 3→OD up-shifts.

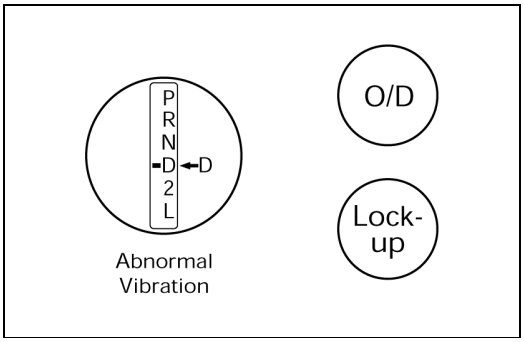


F07RY00006

EVALUATION

If the shock is excessive:

Refer to "TROUBLESHOOTING CHART" in this section.

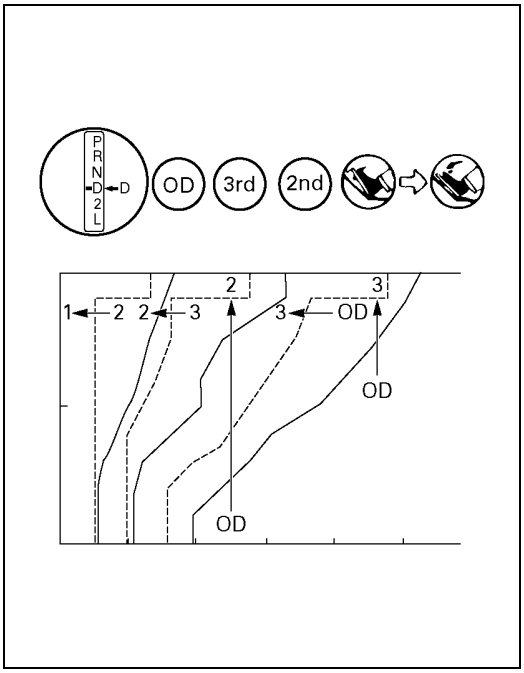


F07RY00007

3. Run at “D” range lock-up or OD gear and check for abnormal noise and vibration.

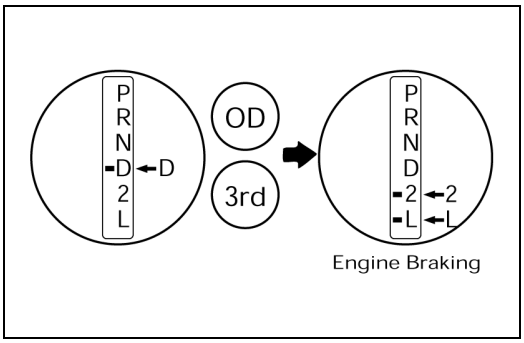
NOTE:

The check for the cause of abnormal noise and vibration must be made with extreme care as it could also be due to loss of balance in the propeller shaft, differential, the torque converter, etc. or insufficient bending, rigidity, etc. in the power train.



F07R200020

4. While running in “D” range, 2nd, 3rd gears and OD, check to see that the possible kick-down vehicle speed limits for 2→1, 3→1, 3→2, OD→3 and OD→2 kick-downs conform to those indicated on the automatic shift diagram.
5. Check for abnormal shock and slip at kick-down.
6. While running in “D” range, OD gear or “lock-up”, shift to “2” and “L” ranges and check the engine braking effect at each of these ranges.
7. Also check to see that downshift is made from 3→2 or from OD to 3 and then to 2 immediately and that 2→1 downshift point is within the limits shown in the diagram when tested by releasing the accelerator pedal and shifting into position of “L” while driving in the third gear or in overdrive.

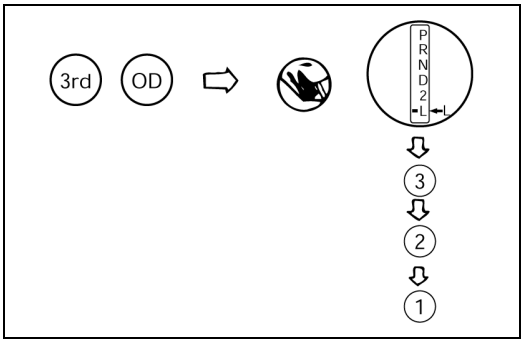


F07RY00009

EVALUATION

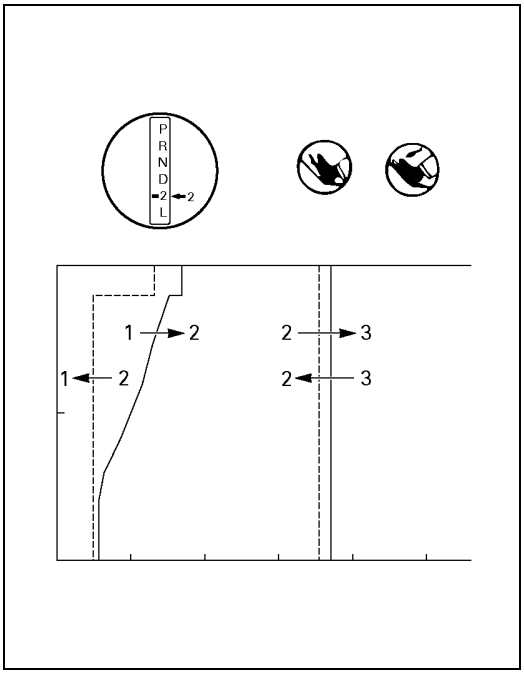
(1) If there is no engine braking effect in the “2” range:
- Second coast (No.1) brake is defective.

(2) If there is no engine braking effect in the “L” range:
- First and reverse (No.3) brake is defective.



F07RY00010

(3) Also check to see that downshift is made from 3→2 or from OD to 3 and then to 2 immediately and that 2→1 downshift point is within the limits shown in the diagram when tested by releasing the accelerator pedal and shifting into “L” position while driving in the third gear or in overdrive.



F07R200021

"2" RANGE TEST

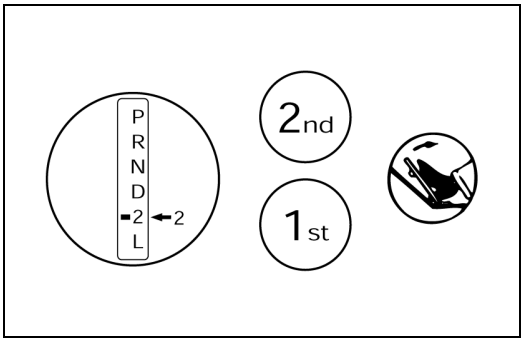
Shift into "2" range and, while driving with the accelerator pedal held constantly at the specified point (throttle valve opening 50% and 100%), push in one of the pattern selectors (only for 4×4) and check on the following points.

1. At each of the above throttle openings, check to see that the 1→2 up-shift takes place and that the shift points conform to those shown on the automatic shift diagram.

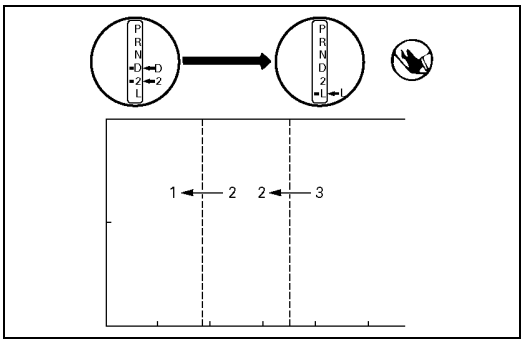
NOTE:

There is no OD and no lock-up in the "2" range.

2. While running in the "2" range and 2nd gear, release the accelerator pedal and check the engine's braking effect.
3. Check for 2→1 down-shift and abnormal noise at acceleration and deceleration, and for shock at upshift and down-shift.



F07RY00012

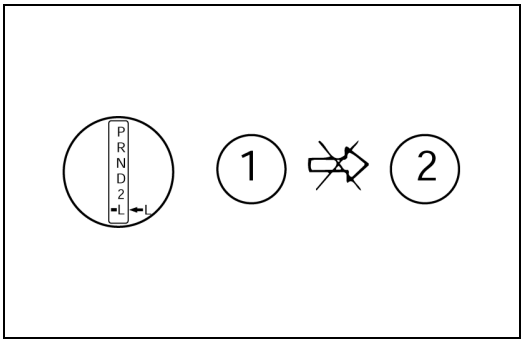


F07R200018

"L" RANGE TEST

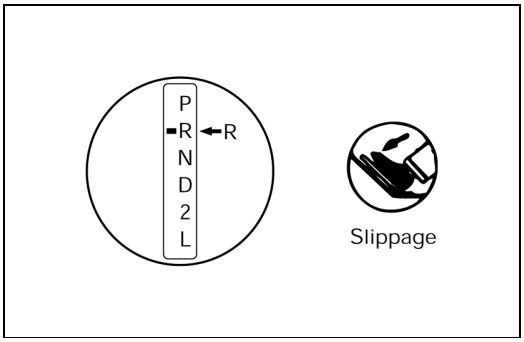
1. While running above 80 km/h (50 mph) in the "D" range, release your foot from the accelerator pedal and shift into the "L" range.

   Then check to see that the 2→1 down-shift occurs at the specified point shown on the automatic shift diagram.



F07RY00014

2. While running in the "L" range, check to see that there is no up-shift to 2nd gear.
3. While running in the "L" range, release the accelerator pedal and check the engine braking effect.
4. Check for abnormal noise during acceleration and deceleration.



F07RY00015

"R" RANGE TEST

Shift into the "R" range and, while starting at full throttle, check for slipping.

"P" RANGE TEST

Stop the vehicle on a grade (more than 9%) and after shifting into the "P" range, release the parking brake.

Then check to see that the parking lock pawl holds the vehicle in place.

SHIFT POINT CHART AND LOCK-UP POINT CHART

SHIFT POINT CHART (UBS)

(H2, H4)
(REAR AXLE RATIO: 4.300)
(RADIUS OF TIRE: 0.363m)

"NORMAL" mode

Up shift **km/h**

Range	Throttle Opening	1→2	2→3	3→4
D	Fully opened	39 – 45	78 – 84	128 – 134
	Half throttle	22 – 28	48 – 54	89 – 95
2	Fully opened	39 – 45	89 – 95	—
	Half throttle	22 – 28	89 – 95	—

Down shift **km/h**

Range	Throttle Opening	1←2	2←3	3←4
D	Fully opened	30 – 36	65 – 71	115 – 121
	Half throttle	9 – 15	27 – 33	64 – 70
	Fully closed	9 – 15	22 – 28	37 – 43
2	Fully opened	30 – 36	85 – 91	—
	Half throttle	9 – 15	85 – 91	—
	Fully closed	9 – 15	85 – 91	—
L	Fully opened	43 – 49	85 – 91	—
	Half throttle	43 – 49	85 – 91	—
	Fully closed	43 – 49	85 – 91	—

"POWER" mode

Up shift **km/h**

Range	Throttle Opening	1→2	2→3	3→4
D	Fully opened	39 – 45	78 – 84	128 – 134
	Half throttle	29 – 35	58 – 64	89 – 95
2	Fully opened	39 – 45	89 – 95	—
	Half throttle	22 – 28	89 – 95	—

Down shift **km/h**

Range	Throttle Opening	1←2	2←3	3←4
D	Fully opened	30 – 36	65 – 71	115 – 121
	Half throttle	11 – 17	45 – 51	74 – 80
	Fully closed	9 – 15	22 – 28	37 – 43
2	Fully opened	30 – 36	85 – 91	—
	Half throttle	9 – 15	85 – 91	—
	Fully closed	9 – 15	85 – 91	—
L	Fully opened	43 – 49	85 – 91	—
	Half throttle	43 – 49	85 – 91	—
	Fully closed	43 – 49	85 – 91	—

LOCK-UP POINT CHART (UBS)

(H2, H4)
(REAR AXLE RATIO: 4.300)
(RADIUS OF TIRE: 0.363m)

km/h

Range	A/T Mode	Throttle Opening: 20 %			
		Lock-up ON		Lock-up OFF	
		3rd	4th	3rd	4th
D	NORMAL	47 – 53	62 – 68	45 – 51	62 – 68
	POWER	47 – 53	66 – 72	45 – 51	62 – 68

SHIFT POINT CHART AND LOCK-UP POINT CHART (Cont'd)

SHIFT POINT CHART (TFR/S)

(H2, H4)
(REAR AXLE RATIO: 4.555)
(RADIUS OF TIRE: 0.348m)

"NORMAL" mode

Up shift **km/h**

Range	Throttle Opening	1→2	2→3	3→4
D	Fully opened	34 – 40	71 – 77	112 – 118
	Half throttle	24 – 30	44 – 50	75 – 81
2	Fully opened	34 – 40	76 – 82	—
	Half throttle	28 – 34	76 – 82	—

Down shift **km/h**

Range	Throttle Opening	1←2	2←3	3←4
D	Fully opened	26 – 32	57 – 63	97 – 103
	Half throttle	9 – 15	27 – 33	49 – 55
	Fully closed	5 – 11	13 – 19	26 – 32
2	Fully opened	26 – 32	74 – 80	—
	Half throttle	17 – 23	74 – 80	—
	Fully closed	5 – 11	74 – 80	—
L	Fully opened	38 – 44	74 – 80	—
	Half throttle	38 – 44	74 – 80	—
	Fully closed	38 – 44	74 – 80	—

"POWER" mode

Up shift **km/h**

Range	Throttle Opening	1→2	2→3	3→4
D	Fully opened	34 – 40	71 – 77	112 – 118
	Half throttle	28 – 34	52 – 58	79 – 85
2	Fully opened	34 – 40	76 – 82	—
	Half throttle	28 – 34	76 – 82	—

Down shift **km/h**

Range	Throttle Opening	1←2	2←3	3←4
D	Fully opened	26 – 32	57 – 63	97 – 103
	Half throttle	17 – 23	42 – 48	66 – 72
	Fully closed	5 – 11	13 – 19	26 – 32
2	Fully opened	26 – 32	74 – 80	—
	Half throttle	17 – 23	74 – 80	—
	Fully closed	5 – 11	74 – 80	—
L	Fully opened	38 – 44	74 – 80	—
	Half throttle	38 – 44	74 – 80	—
	Fully closed	38 – 44	74 – 80	—

LOCK-UP POINT CHART (TFR/S)

(H2, H4)
(REAR AXLE RATIO: 4.555)
(RADIUS OF TIRE: 0.348m)

km/h

Range	A/T Mode	Throttle Opening: 20 %					
		Lock-up ON			Lock-up OFF		
		2nd	3rd	4th	2nd	3rd	4th
D	NORMAL	32 – 38	46 – 52	56 – 62	26 – 32	42 – 48	54 – 60
	POWER	32 – 38	46 – 52	56 – 62	26 – 32	42 – 48	54 – 60

SHIFT POINT CHART AND LOCK-UP POINT CHART (Cont'd)

SHIFT POINT CHART ('01 TFR For Thailand)

(REAR AXLE RATIO: 4.300)
(RADIUS OF TIRE: 0.321m)

"NORMAL" mode

Up shift **km/h**

Range	Throttle Opening	1→2	2→3	3→4
D	Fully opened	30 – 36	67 – 73	105 – 111
	Half throttle	15 – 21	45 – 51	70 – 76
2	Fully opened	30 – 36	76 – 82	—
	Half throttle	22 – 28	76 – 82	—

Down shift **km/h**

Range	Throttle Opening	1←2	2←3	3←4
D	Fully opened	23 – 29	45 – 51	90 – 96
	Half throttle	9 – 15	31 – 37	47 – 53
	Fully closed	6 – 12	13 – 19	27 – 33
2	Fully opened	24 – 30	73 – 79	—
	Half throttle	13 – 19	73 – 79	—
	Fully closed	6 – 12	73 – 79	—
L	Fully opened	47 – 53	73 – 79	—
	Half throttle	47 – 53	73 – 79	—
	Fully closed	47 – 53	73 – 79	—

"POWER" mode

Up shift **km/h**

Range	Throttle Opening	1→2	2→3	3→4
D	Fully opened	30 – 36	67 – 73	105 – 111
	Half throttle	22 – 28	51 – 57	80 – 86
2	Fully opened	30 – 36	76 – 82	—
	Half throttle	22 – 28	76 – 82	—

Down shift **km/h**

Range	Throttle Opening	1←2	2←3	3←4
D	Fully opened	24 – 30	49 – 55	93 – 99
	Half throttle	13 – 19	39 – 45	67 – 73
	Fully closed	6 – 12	13 – 19	27 – 33
2	Fully opened	24 – 30	73 – 79	—
	Half throttle	13 – 19	73 – 79	—
	Fully closed	6 – 12	73 – 79	—
L	Fully opened	47 – 53	73 – 79	—
	Half throttle	47 – 53	73 – 79	—
	Fully closed	47 – 53	73 – 79	—

LOCK-UP POINT CHART ('01 TFR For Thailand)

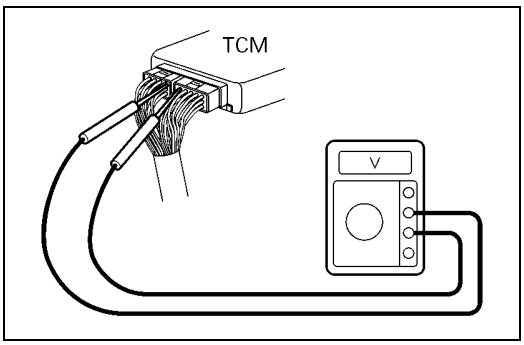
(REAR AXLE RATIO: 4.300)
(RADIUS OF TIRE: 0.321m)

km/h

Range	A/T Mode	Throttle Opening: 20 %					
		Lock-up ON			Lock-up OFF		
		2nd	3rd	4th	2nd	3rd	4th
D	NORMAL	28 – 34	43 – 49	58 – 64	25 – 31	40 – 46	55 – 61
	POWER	28 – 34	43 – 49	56 – 64	25 – 31	40 – 46	55 – 61

TCM VOLTAGE CHECK

TCM voltage check is done to check for transmission and transmission control module (TCM) problems which cannot be detected by self-diagnosis.
Additionally, it serves as a back-up check for self-diagnosis.
Measure the voltage drop and make a continuity test for each of the sensors, solenoids, and switches.
If the voltage is within the specified range and continuity exists, that particular area of the TCM and automatic transmission assembly is normal.
If voltage deviation or lack of continuity is discovered, disconnect the applicable parts and check each of them individually.
This will allow you to determine the trouble location (TCM, automatic transmission unit, or another area of the vehicle).



826RY00017

Inspection Tool

Use a circuit tester to measure voltage and circuit continuity.
Insert the test probes from the connector wiring side. TCM terminals are extremely small.
Wrap a piece of thin wire around the probe of tester.
This will make measurement easier.
NOTE:
TCM is located in the behind instrument panel of the driver's compartment.

TCM Voltage Check Procedure

1. Remove the TCM.
2. Turn the ignition switch on. Do not start the engine.
3. Measure the voltage at the terminal.

   Refer the following table for the specified voltage ranges.

TCM STANDARD VOLTAGE

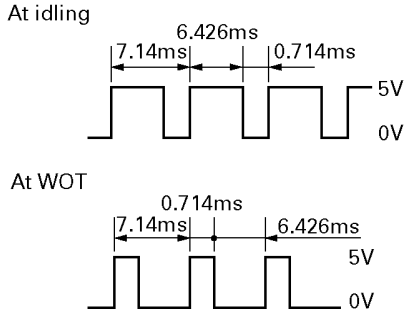
Check circuit	Terminal		Measuring condition	Voltage (V)
	+	–		
Throttle position sensor (UBS)	C79-6	C79-28	Throttle fully closed (Idling)	0.25 ~ 0.45
			Throttle fully opened (WOT)	3.47 ~ 4.56
	C79-19	C79-28	Key switch ON	4.75 ~ 5.25
Throttle position sensor (TFR/S)	C79-6	C78-15 or –19	Throttle fully closed (Idling) (*1)	4.4 ~ 4.6
			Throttle fully opened (WOT) (*1)	0.4 ~ 0.6
Output revolution sensor	C79-4	C79-16	Engine idling in gear	0 ~ 3
Input revolution sensor	C79-5	C79-17	Engine idling	0 ~ 3
Speed meter sensor	C79-7	C78-15 or –19	Vehicle speed 1 ~ 2 km/h (Pulse check)	Less than 1.4 ⇔ Greater than 9
Brake switch	C78-18	C78-15 or –19	Depress brake	7 ~ 16
			Release brake	Less than 1
O/D switch	C79-3	C78-15 or –19	O/D switch position ON (⊔) (O/D OFF lamp OFF)	Less than 1
			O/D switch position OFF (⊓) (O/D OFF lamp ON)	7 ~ 16
Neutral start switch (P)	C79-2	C78-15 or –19	Selector “P” range	7 ~ 16
			Selector all ranges except “P”	Less than 1
Neutral start switch ®	C79-1	C78-15 or –19	Selector “R” range	7 ~ 16
			Selector all ranges except “R”	Less than 1
Neutral start switch (N)	C79-9	C78-15 or –19	Selector “N” range	7 ~ 16
			Selector all ranges except “N”	Less than 1
Neutral start switch (D)	C79-8	C78-15 or –19	Selector “D” range	7 ~ 16
			Selector all ranges except “D”	Less than 1
Neutral start switch (2)	C79-21	C78-15 or –19	Selector “2” range	7 ~ 16
			Selector all ranges except “2”	Less than 1
Neutral start switch (L)	C79-20	C78-15 or -19	Selector “L” range	7 ~ 16
			Selector all ranges except “L”	Less than 1
Engine revolution signal	C79-15	C78-15 or -19	Engine idling	Less than 1.4 ⇔ 9 ~ 16
Diagnosis terminal	C79-24	C78-15 or -19	Self-diagnosis ON	0 ~ 1.5
Power pattern switch	C79-23	C78-15 or -19	Power pattern switch OFF (NORMAL)	8 ~ 16
			Power pattern switch ON (POWER)	Less than 1.4
Winter select switch	C79-13	C78-15 or -19	Switch OFF	8 ~ 16
			Switch ON	Less than 1.4
Electrical source (Battery)	C78-13	C78-15 or -19	—	9 ~ 16

TCM STANDARD VOLTAGE (Cont'd)

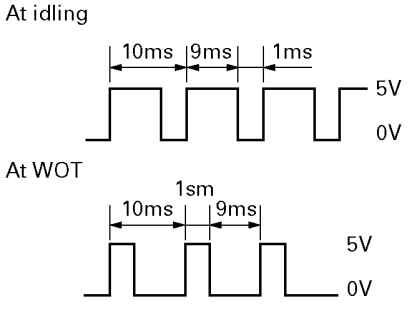
Check circuit	Terminal		Measuring condition	Voltage (V)
	+	–		
Electrical source (Ignition)	C78-20	C78-15 or -19	Key switch ON	9 ~ 16
Oil temperature warning lamp	C79-11	C78-15 or -19	Oil temperature warning lamp ON	Less than 1
			Oil temperature warning lamp OFF	8 ~ 16
"CHECK TRANS lamp"	C79-10	C78-15 or -19	"CHECK TRANS" lamp ON	Less than 1
			"CHECK TRANS" lamp OFF	8 ~ 16
Power lamp (UBS)	C79-22	C78-15 or -19	Power lamp ON	Less than 1
			Power lamp OFF	8 ~ 16
Winter lamp (UBS)	C79-12	C78-15 or -19	Winter lamp ON	Less than 1
			Winter lamp OFF	8 ~ 16
Solenoid S1	C78-4	C78-15 or -19	OFF (3rd or O/D)	Less than 1
			ON (1st or 2nd)	8 ~ 16
Solenoid S2	C78-3	C78-15 or -19	OFF (1st or O/D)	Less than 1
			ON (2nd or 3rd)	8 ~ 16
Lock up solenoid SL	C78-12	C78-15 or -19	OFF (Lock up OFF)	Less than 1
			ON (Lock up ON)	8 ~ 16
Pressure control solenoid	C78-11	C78-8	At throttle pressure changing	Less than 1 ⇔ 8-16
Oil temperature sensor	C79-18	C79-27	ATF temperature 20°	4.70
			ATF temperature 80°C	3.65
Tech 2 diagnosis terminal (J1850)	C78-6	C78-15 or -19	On diagnosis communication	0-1.5 ⇔ 6.25-8.0
Throttle position sensor (ground) (UBS)	C79-19	C78-15 or -19	Key switch ON	-0.1 ~ 0.1

*1: Reference (Oscilloscope waveform)

(TFR/S)

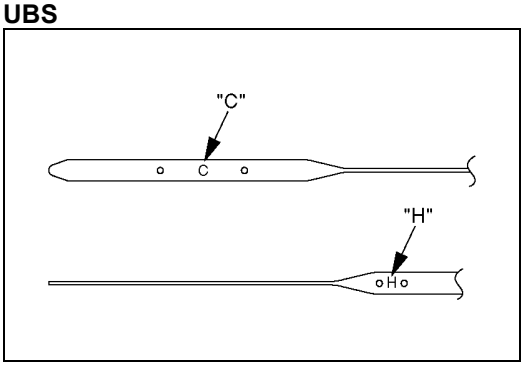


('01 TFR for Thailand)



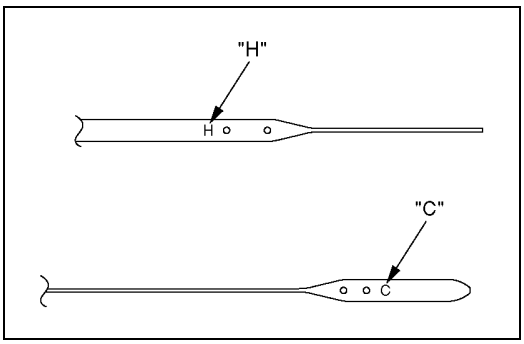
ON-VEHICLE SERVICE

UBS



242R200004

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242R200005

TRANSIMISSION FLUID LEVEL AND CONDITION

Park vehicle on level ground and set parking brake.
With the engine idling, move the shift lever through all positions from "P" to "L", then return to position "P".
Check to see If the level of fluid comes to "HOT" range of about 80°C (176°F) on the dipstick gauge.
If the level of fluid is too low, replenish to bring it to maximum level in "HOT" range.

Inspection of fluid condition

If the ATF is black or smells burnt, replace it.

ATF REPLACEMENT

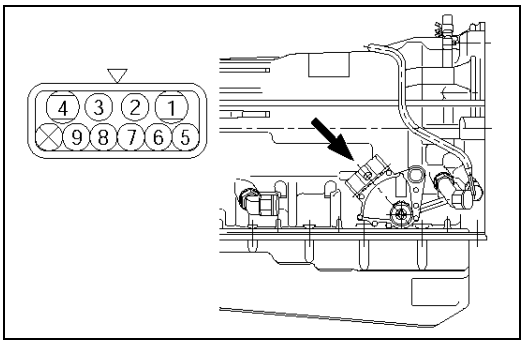
NOTE:
Do not overfill.

1. Remove the drain plug from oil pan and drain the fluid.
2. Reinstall the drain plug securely.
   Torque: 19 N·m (1.9 kg·m/14 lb·ft)
3. With the engine OFF, add new fluid through the filler tube.

Drain and refill	5.2 liter (UBS and TFR/S)
	4.5 liter ('01 TFR)
Dry fill	8.7 liter (UBS and TFR/S)
	8 liter ('01 TFR)
Fluid	BESCO ATF III

4. Start the engine and shift the selector into all position from "P" through "L", and then shift into "P".
5. With the engine idling, check the fluid level. Add fluid up to the "COLD" level on the dipstick.
6. The ATF level must be checked again for correct level with the "HOT" level.

NOTE:
To prevent fluid leaks, the drain plug gasket must be replaced each time this plug is removed.



249RY00010

NEUTRAL START SWITCH INSPECTION

Inspection

With a circuit tester, make a continuity test on the neutral start switch with the moving piece set in each position.

Terminal Position	1	4	3	5	2	6	8	7	9
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
L			○						○

○—○ Continuity

Removal

Preparation:

Disconnect negative (-) battery cable.

1. Remove rear sound cover (UBS).
2. Remove the rear side ATF cooler pipe from the transmission elbow.
3. Disconnect neutral start switch connector.
4. Unstake the lock washer, and then remove the shaft nut.
5. Remove the neutral start switch.

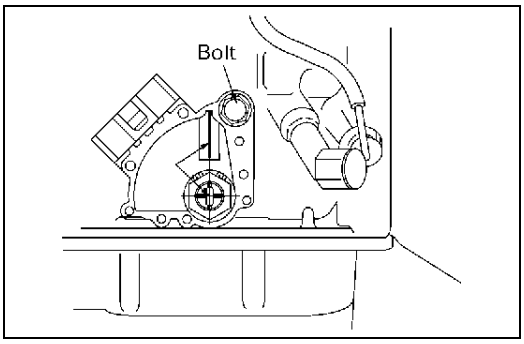
Installation

To install, follow the removal steps in the reverse order, noting the following points;

Torque:

Nut – 7 N·m (0.7 kg·m/61 lb·in)

Bolt – 13 N·m (1.3 kg·m/113 lb·in)

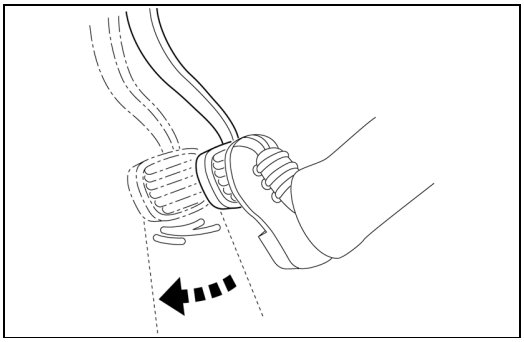


249RY00008

Adjustment

1. Loosen the neutral start switch bolt and set the shift selector to the “N” range.
2. Align the groove and neutral basic line.
3. Hold in position and tighten the bolt.

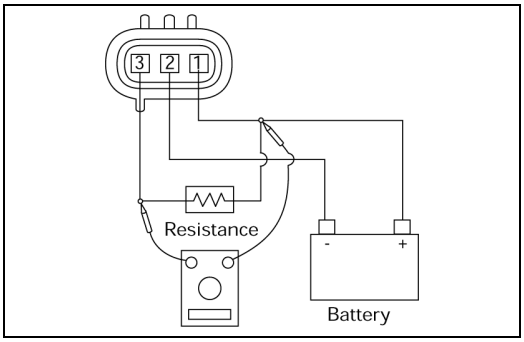
Torque: 13 N·m (1.3 kg·m/113 lb·in)



310RW020

BRAKE SIGNAL INSPECTION

Check that the brake light comes on when the brake pedal is depressed.



F07RY00017

VEHICLE SPEED SENSOR INSPECTION

1. Connect the vehicle speed sensor connector terminal (1) to the battery (+) terminal and terminal (2) to the battery (-) terminal.
2. Connect a resistance of 1.3k ohm to 5k ohm (1.4W or more) between terminals (1) and (3).

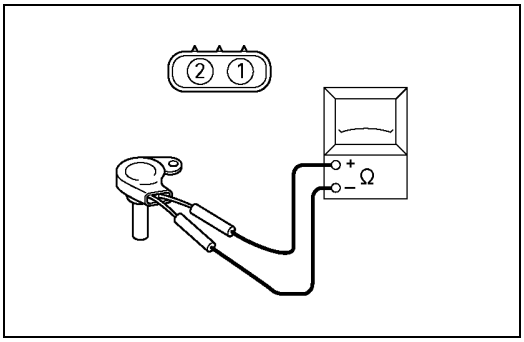
   NOTE:

   Be extremely careful not to connect the battery (+) terminal to the terminal (3).

   This may damage the vehicle speed sensor.
3. Rotate the shaft of the vehicle speed sensor slowly and measure the voltage at both ends with a digital tester.

   The voltage, with one rotation of shaft, fluctuates four times in the following range: 10 to 14V ⇔ 2V or less.

   Replace the sensor when the result of inspection is found abnormal.



F07RY00018

INPUT AND OUTPUT REVOLUTION SENSOR INSPECTION

1. Disconnect the input and output revolution sensor connector.
2. Use an ohmmeter to measure the resistance between terminals 1 and 2.

   Standard resistance

   Input revolution sensor: 387 – 473 Ω (at 20℃, 4×2)

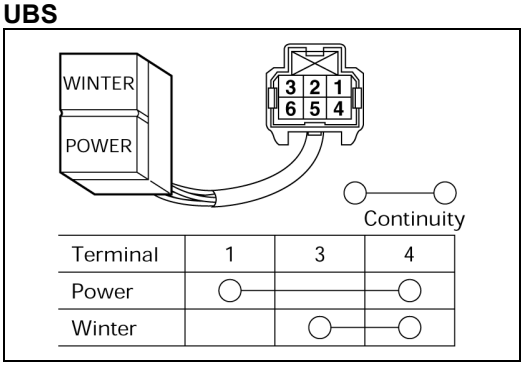
   560 – 680 Ω (at 20℃, 4×4)

   Output revolution sensor: 560 – 680 Ω (at 20℃)

PATTERN SELECT SWITCH INSPECTION

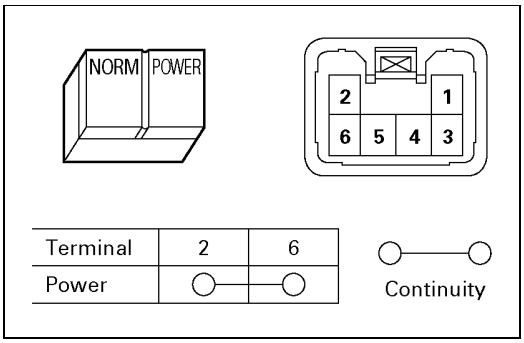
Inspect that there is continuity between each terminals.

UBS



F07RY00019

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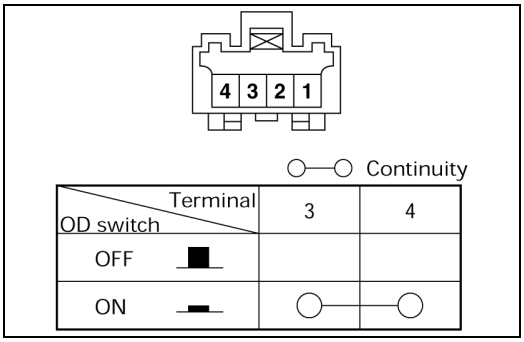


F07L100005

OVERDRIVE SWITCH INSPECTION

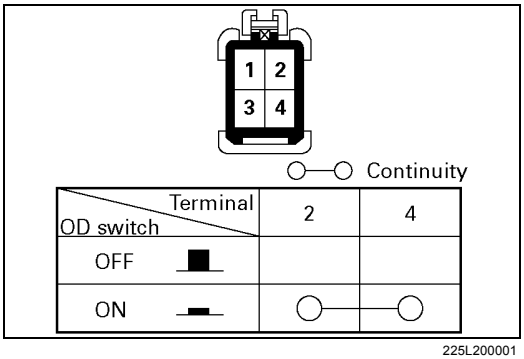
Inspect that there is continuity between each terminals.

UBS

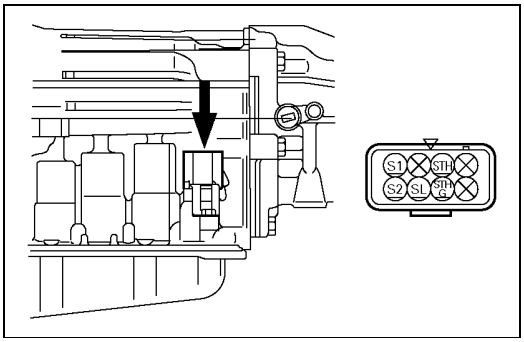


225R200003

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225L200001



220L100001

SOLENOID INSPECTION

1. Resistance check
   - Using an ohmmeter, check the resistance between each terminals (S1/S2/SL) and body.

     Solenoid S1, S2 and lock-up solenoid resistance:

     11 – 15 Ω (at 20°C)

     (Reference) 12 – 16 Ω (at 40°C)
   - Using an ohmmeter, check the resistance between each terminals (STH) and (STHG).

     Pressure control solenoid resistance:

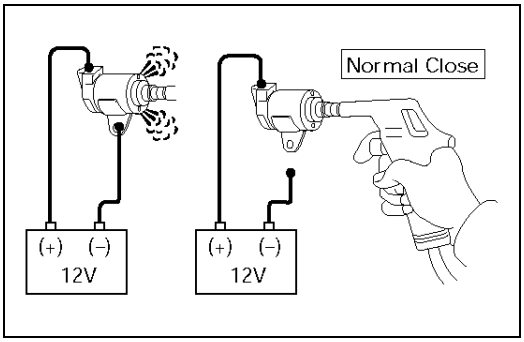
     5 – 5.6 Ω (at 20°C)

     (Reference) 5.4 – 6.1 Ω (at 40°C)

     NOTE:

     If the pressure control solenoid resistance is not within specification, replace the valve body assembly.
2. Operation check

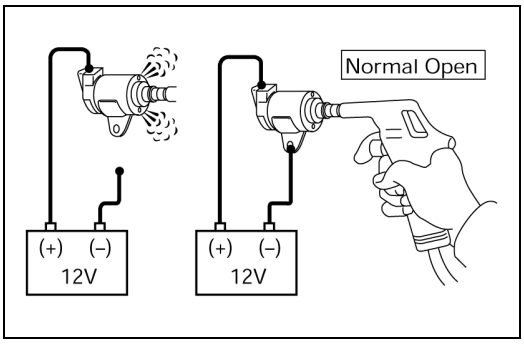
   Check the solenoid operation by blowing into an oil hole as shown in the figure.



244RX00001

Solenoid S1 and S2 (Normal close type)

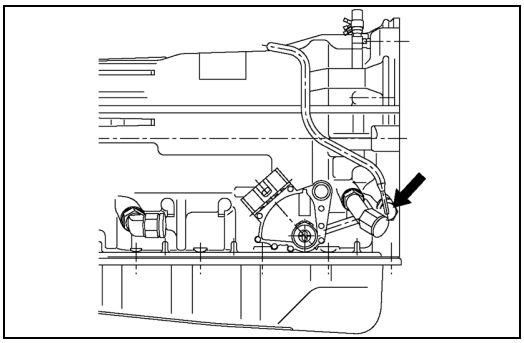
When battery terminal is disconnected	No air leaks
When battery terminal is connected	Air passes through



244RY00005

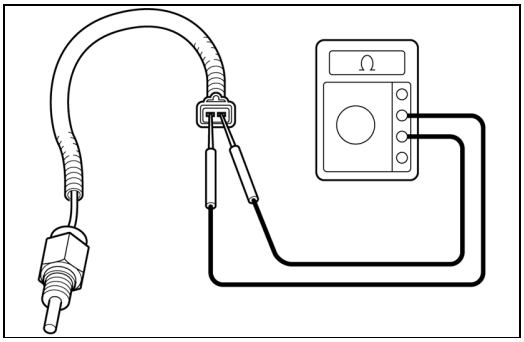
Lock-up solenoid S3 (Normal open type)

When battery terminal is disconnected	Air passes through
When battery terminal is connected	No air leaks


249L100001

ATF TEMPERATURE SENSOR INSPECTION

1. Disconnect the front side ATF cooler pipe from the elbow and remove the elbow.
2. Remove the ATF temperature sensor from the transmission case.
3. Place the ATF temperature sensor in a container of ATF.



242RW013

4. Measure the resistance between each terminals.
   Resistance: 0.5 – 30 kΩ (at 0℃ - 120℃)
5. If either of the measured values exceeds the specified, replace the ATF temperature sensor.
   Torque: 15 N·m (1.5 kg·m/11 lb·ft)

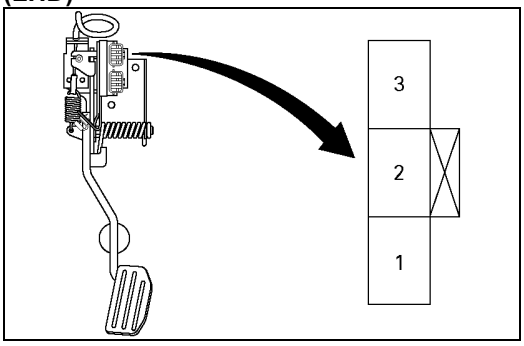
THROTTLE POSITION SENSOR INSPECTION (UBS and TFR/S)

1. Turn the starter switch to the “ON” position.
2. Measure the voltage between throttle position sensor connector terminals 2 (output) and 1 (ground).

NOTE:

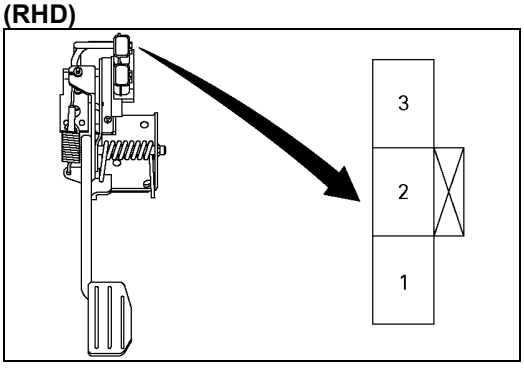
- **Do not remove the sensor connector.**
- **Make sure that power source (4.75 – 5.25V) is measured between terminals 1 and 3 before measurement at step 2.**
  Standard voltage:
  Idling — 0.25 – 0.45V
  WOT — 3.74 – 4.56V

(LHD)

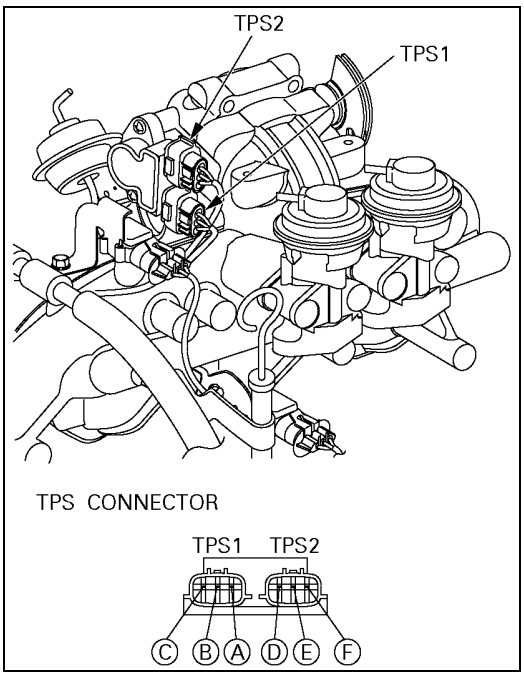


101R200007

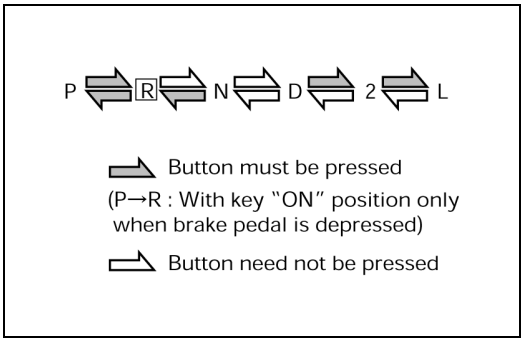
(RHD)



101L200001



035L100001



256RY00001

THROTTLE POSITION SENSOR INSPECTION ('01 TFR)

1. Turn the starter switch to the "ON" position.
2. Measure the voltage between TPS1 connector terminals (A) (output) and (C) (ground), and TPS2 connector terminals (D) (output) and (E) (ground).

NOTE:

- **Do not remove the sensor connector.**
- **Make sure that power source (5.0±0.01V) is measured between TPS1 connector terminals (B) and (C), and TPS2 connector terminals (F) and (E) before measurement at step 2.**

Standard voltage:

	TPS1	TPS2
Idling	0.55－0.65 V	0.2－0.4 V
WOT	3.1－3.3 V	1.5－1.6 V

SELECTOR LEVER

Inspection

1. Make sure that when the selector lever is shifted from "P" to "L", a "clicking" can be felt at each shift position. Make sure that the gear corresponds to that of the position plate indicator.
2. Check to see if the selector lever can be shifted as shown.

REMOVAL

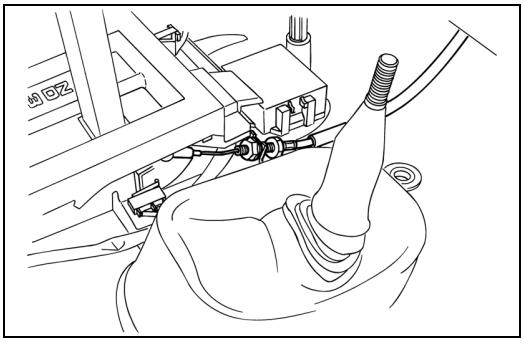
Preparation:

Disconnect negative (-) battery cable.

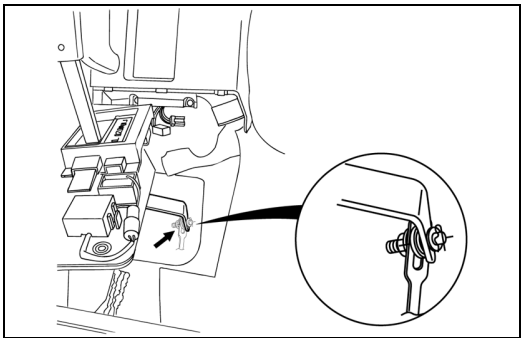
1. Transfer Control Lever Knob (4×4)
2. Front Console

   Disconnect wiring harness connectors.
3. Selector Lever Assembly
   1. Disconnect shift lock cable from the selector lever assembly side (UBS).
   2. Disconnect wiring harness connectors.

UBS

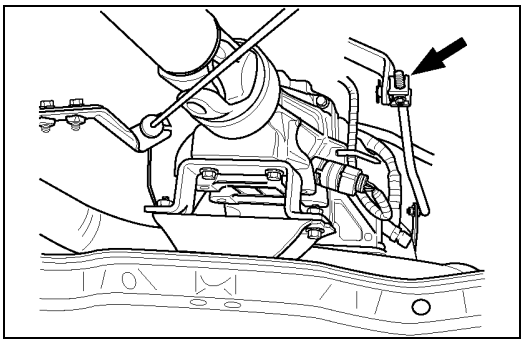


256RW012

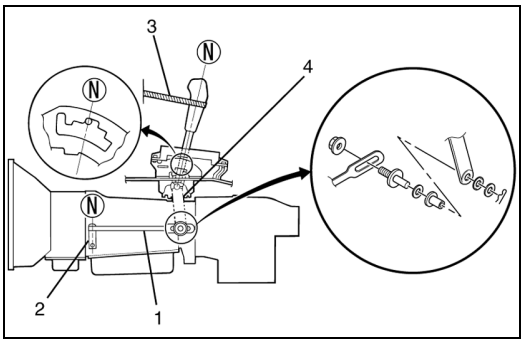


256RW013

'01 TFR

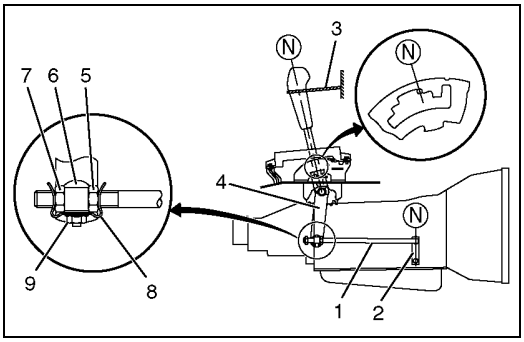


220L200001



256RW014

'01 TFR



256L200001

3. Disconnect shift control rod from the selector lever assembly side.

INSTALLATION

To install, follow the removal steps in the reverse order, noting the following points;

Adjustment of select lever and control rod

1. Place the vehicle on a level surface.

   NOTE:

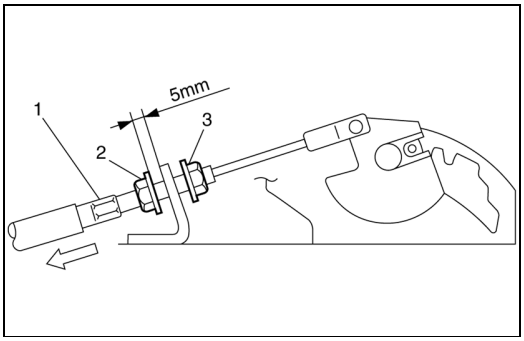
   If the vehicle is not on a level surface, the shift select cable set position will vary with the movement of the engine. To prevent possible misadjustment of the cable, the vehicle must be placed on a level surface.
2. Install the shift control rod (1) to the transfmission select lever (2), and then place the lever in the "N" position.
3. Set select lever in the "N" position.
4. Push selector lever forward and secure it (using a rubber band (3), etc.) so that pin comes into contact with the wall of detent plate.
5. Install the shift control rod (1) to the selector lever arm (4).

   Nut torque: 27 N·m (2.8 kg·m/20 lb·ft)

   NOTE:

   Do not apply oil to threaded portions.

6. ('01 TFR)
   a. Turn nut (5) until it butts against boss (6).
   b. Tighten nut (7) to lock boss while keeping nut (5) stationary with a tool.
      Nut torque: 27 N·m (2.8 kg·m/20 lb·ft)
   c. Attach clip (8) and fix it with nut (9).
      Nut torque: 7 N·m (70 kg·cm/61 lb·in)
7. After adjustment, operate select lever on a trial basis to makes sure of its smooth operation and no abnormal indication in each position.



256RW015

Adjustment of shift lock cable (UBS)

1. Set ignition key in "LOCK" position and selector lever in "P" position.
2. Adjust cable screw cap on selector lever side to provide a gap (slack for cable) of 1-2mm between rod on steering lock side and stopper

   Adjust cap as follows:
   a. Pull screw cap (1) in arrow direction to put off slack of inner cable.
   b. With cable kept as (a), adjust gap between nut (2) and bracket to 5mm (0.2in).
   c. Lock inner cable by turning nut (3) while holding nut (2) in place.

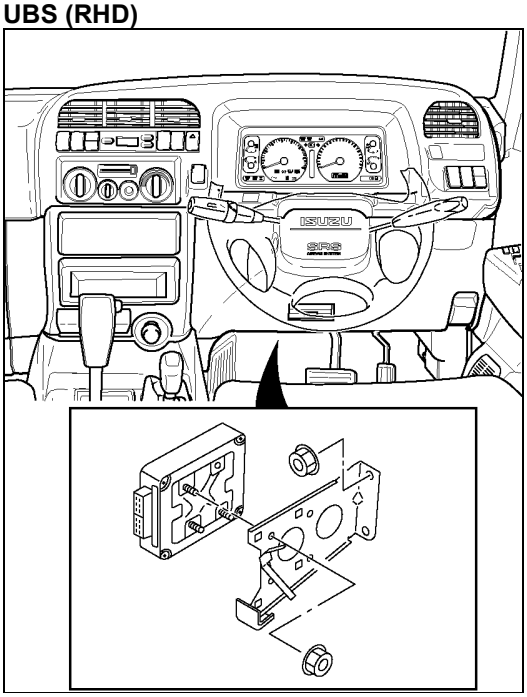
      Lock nut torque: 3.7 N·m (38 kg·cm/33 lb·in)

      NOTE:

      Clean the rod threads and do not apply oil to the threaded portions.
3. Make sure of proper operation of shift lock through checks as follows:
   a. Selector lever shall not be moved out of "P" position with ingition key in "Lock" position.
   b. Selector lever can be moved out of "P" position with ignition key in "ON" position only when brake pedal is depressed.
   c. Ignition key can be turned to "LOCK" position only when selector lever is in "P" position (key can be pulled out).

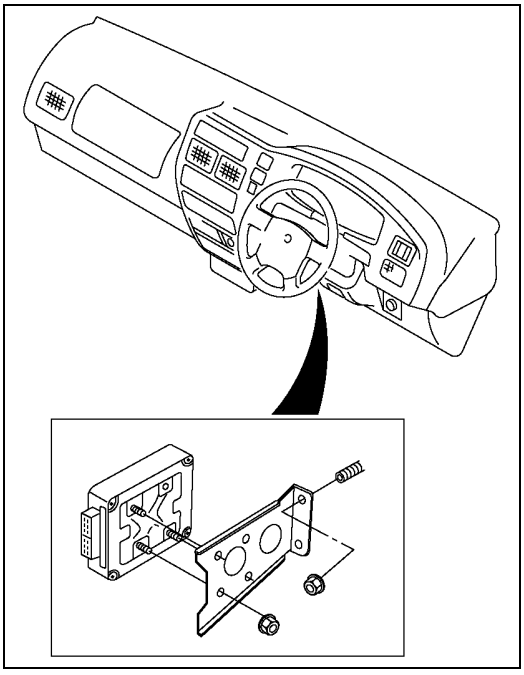
      If (a) and (c) fail, readjust cable. If (b) fails, readjust connector wiring and brake pedal switch.

UBS (RHD)



826R200033

TF



826L100002

TRANSMISSION CONTROL MODULE (TCM)

REMOVAL

Preparation:

Disconnect negative (-) battery cable.

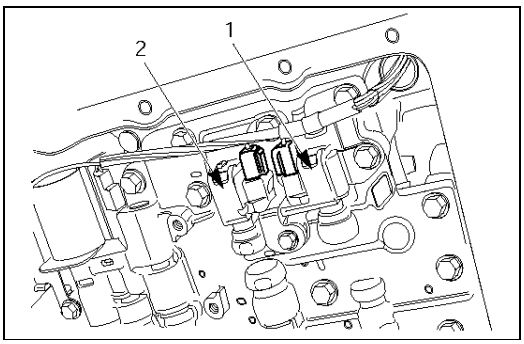
1. Disconnect the TCM harness connectors.
2. Remove fixing nuts (3 pieces) and TCM from the bracket.

   NOTE:

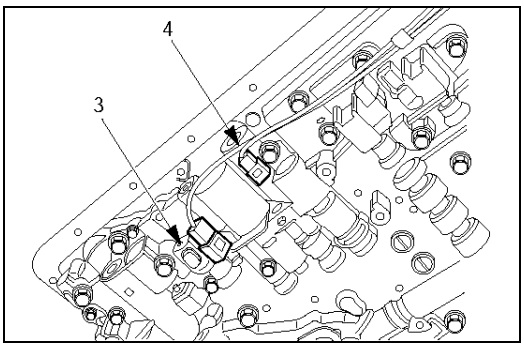
   The TCM is fitted under instrument panel of the driver's compartment by means of two stud bolts.

INSTALLATION

To install, follow the removal steps in reverse order.



249RY00011



249RY00012

SHIFT SOLENOID AND LOCK-UP SOLENOID

REMOVAL

Preparation:

- Disconnect negative (-) battery cable.
- Remove the rear sound cover. (UBS)
- Drain the fluid.

  Refer to "*ATF REPLACEMENT*" in this section.

1. Remove the nineteen bolts and oil pan.
2. Remove the oil strainer assembly.
3. Disconnect the solenoid wiring connectors from the shift solenoid S1(1), S2(2) and lock-up solenoid (3).
4. Remove each retaining bolts and solenoids.

INSTALLATION

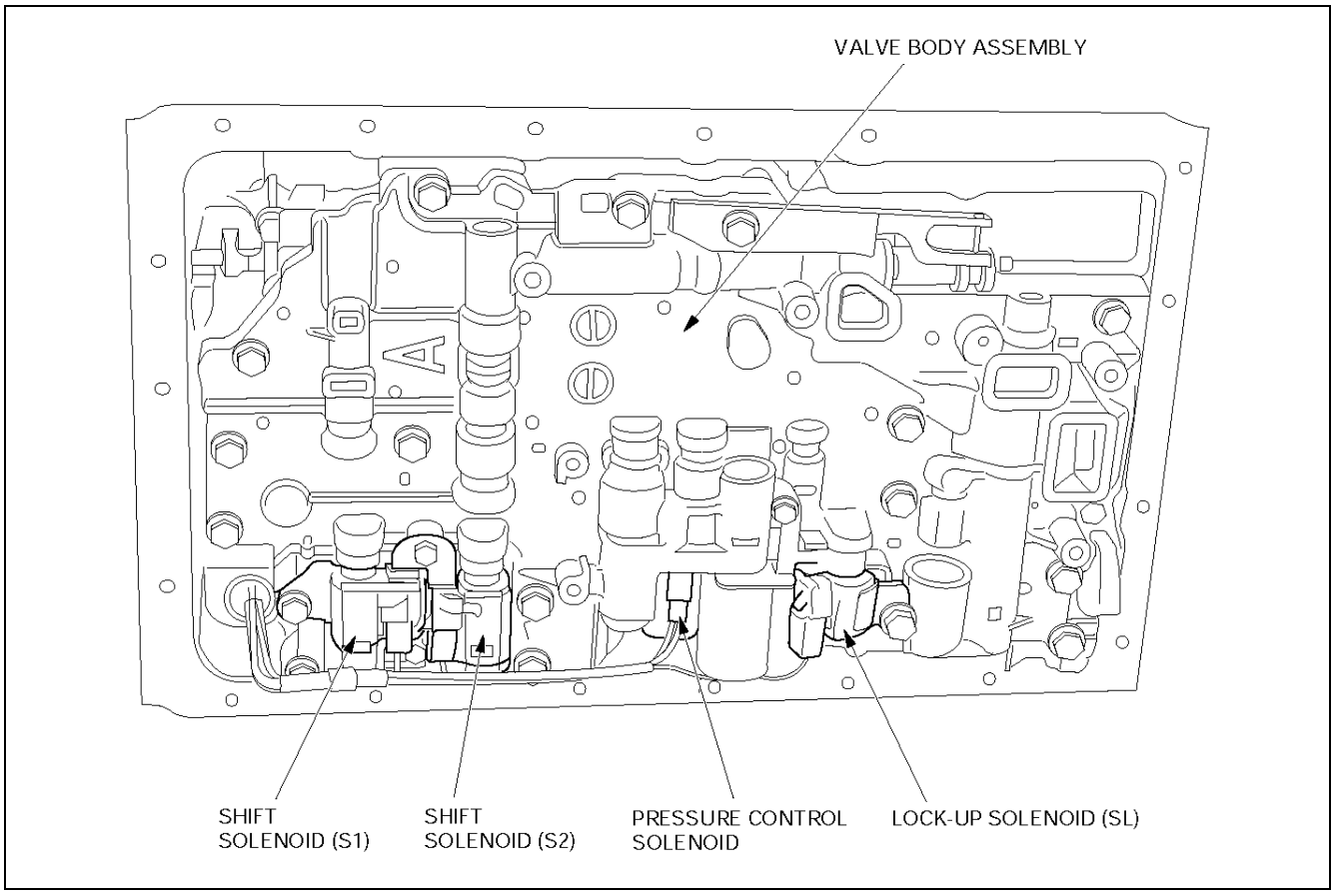
To install, follow the removal steps in reverse order noting the following point;

Torque:

Solenoid S1, S2 bolt — 6.4 N·m (0.65 kg·m/57 lb·in)

Lock-up solenoid bolt — 10 N·m (1.0 kg·m/87 lb·in)

VALVE BODY ASSEMBLY AND PRESSERE CONTOROL SOLENOID



244RY00009

REMOVAL

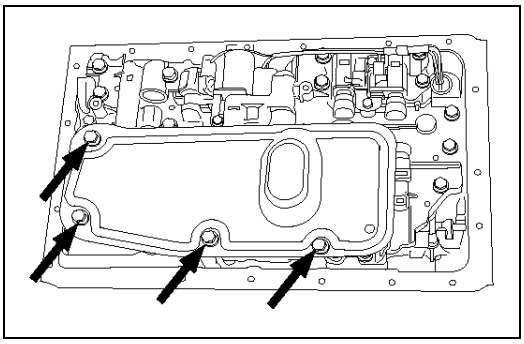
Preparation:

- Disconnect negative (-) battery cable.
- Remove the rear sound cover. (UBS)
- Drain the fluid.

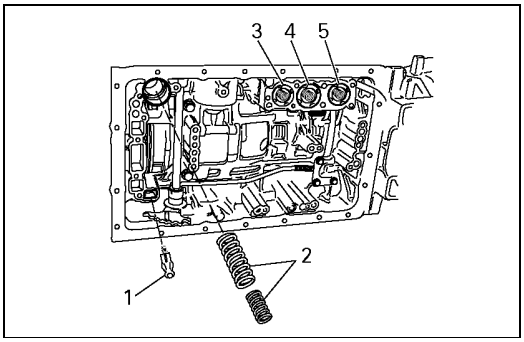
  Refer to "*ATF REPLACEMENT*" in this section.

1. Remove the nineteen bolts and oil pan.
2. Remove the oil strainer assembly.
3. Disconnect the solenoid wiring connectors from the solenoids.
4. Remove the twenty bolts from the valve body.
5. Remove the valve body assembly and pressure control solenoid.
   - When removing valve body assembly from the transmission case, loosen the solenoid clamp bolt and remove the pressure control solenoid from the upper valve body assembly.

     Also disconnect the harness connector from the pressure control solenoid.



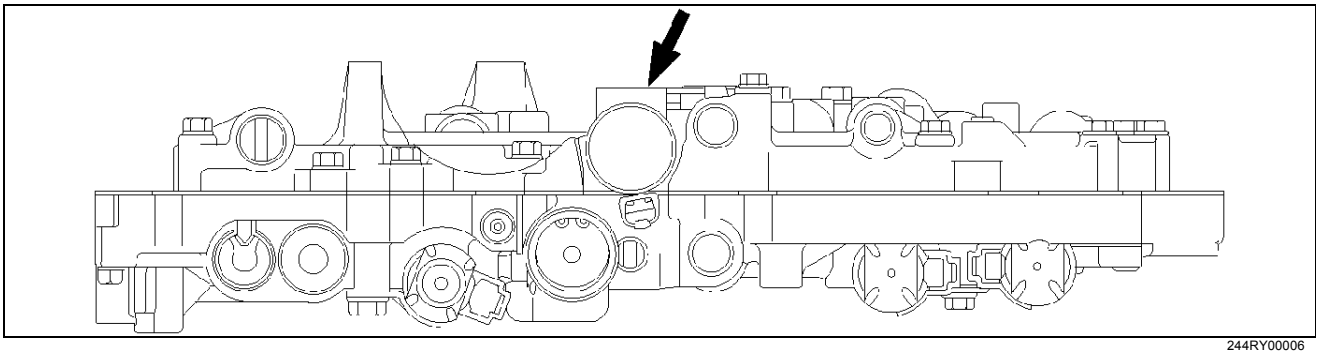
244RY00003



244RY00018

NOTE:

1. **Two or more persons are required for removal and installation of the valve body assembly and pressure control solenoid.**
2. **The check valve assembly (1) and the C0 accumulator piston springs (2) will fall from the transmission case during removal of valve body assembly.**
   Protect these parts from damage.
   The B0 (3), C2 (4), and B2 (5) accumulator piston and springs may also fall free and must be protected.

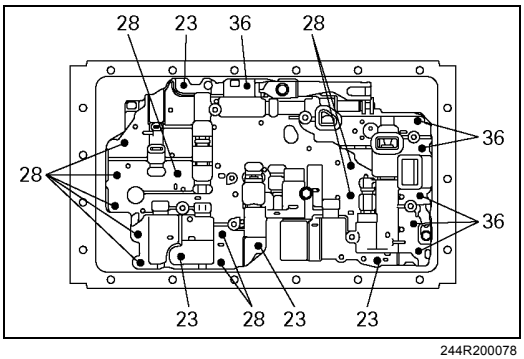

244RY00006

INSTALLATION

To install, follow the removal steps in reverse order noting the following point;

1. Reinstall the parts removed with the valve body assembly to their assigned positions in the transmission case (check valve assembly, C0 accumulator pistons, etc). Install the valve body assembly to the transmission case.

   Refer to "*REASSEMBLY OF MAJOR COMPONENTS (2)*."



244R200078

2. Solenoid clamp bolt

   Torque : 6.4 N·m (0.65 kg·m/57 lb·in)

3. Valve body fixing bolts

   Each bolt location and length (mm) is indicated in the figure.

   Torque : 10 N·m (1.0 kg·m/87 lb·in)

4. Oil strainer fixing bolts

   Torque : 10 N·m (1.0 kg·m/87 lb·in)

5. Oil pan fixing bolts

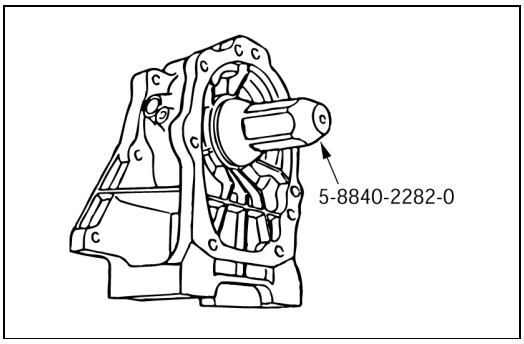
   Torque : 7.4 N·m (0.75 kg·m/65 lb·in)

REAR OIL SEAL (ADAPTER HOUSING, 4×4)

REMOVAL

1. Remove the front and rear propeller shaft assembly form the transfer case.
2. Remove the transfer case assembly from the transmission case.

   Refer to Section 4 “DRIVELINE/AXLE”.
3. Using a screwdriver, remove the rear oil seal.



240RY00003

INSTALLATION

1. Apply ATF to a new rear oil seal lip.
2. Using oil seal installer, install the rear oil seal to the adapter housing.

   Oil seal installer : 5-8840-2282-0
3. Install the transfer case assembly.
4. Install the front and rear propeller shaft assembly.

   Torque:

   Flange bolt : 63 N·m (6.4 kg·m/46 lb·ft)

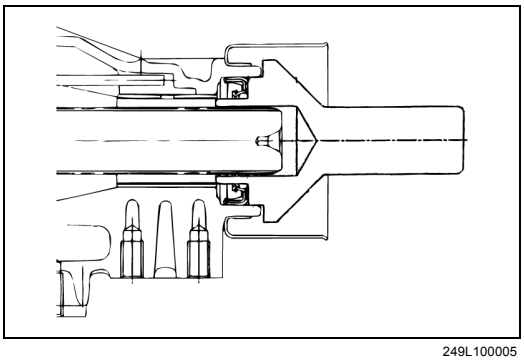
   Center bearing retainer bolt

   : 69 N·m (7.0 kg·m/51 lb·ft)

REAR OIL SEAL (EXTENSION HOUSING, 4×2)

REMOVAL

1. Remove the rear propeller shaft assembly.
2. Using a screwdriver, remove the rear oil seal.


249L100005

INSTALLATION

1. Apply ATF to a new rear oil seal lip.
2. Using oil seal installer, install the rear oil seal to the extension housing.

   Oil seal installer : 5-8840-2702-0
3. Install the rear propeller shaft.

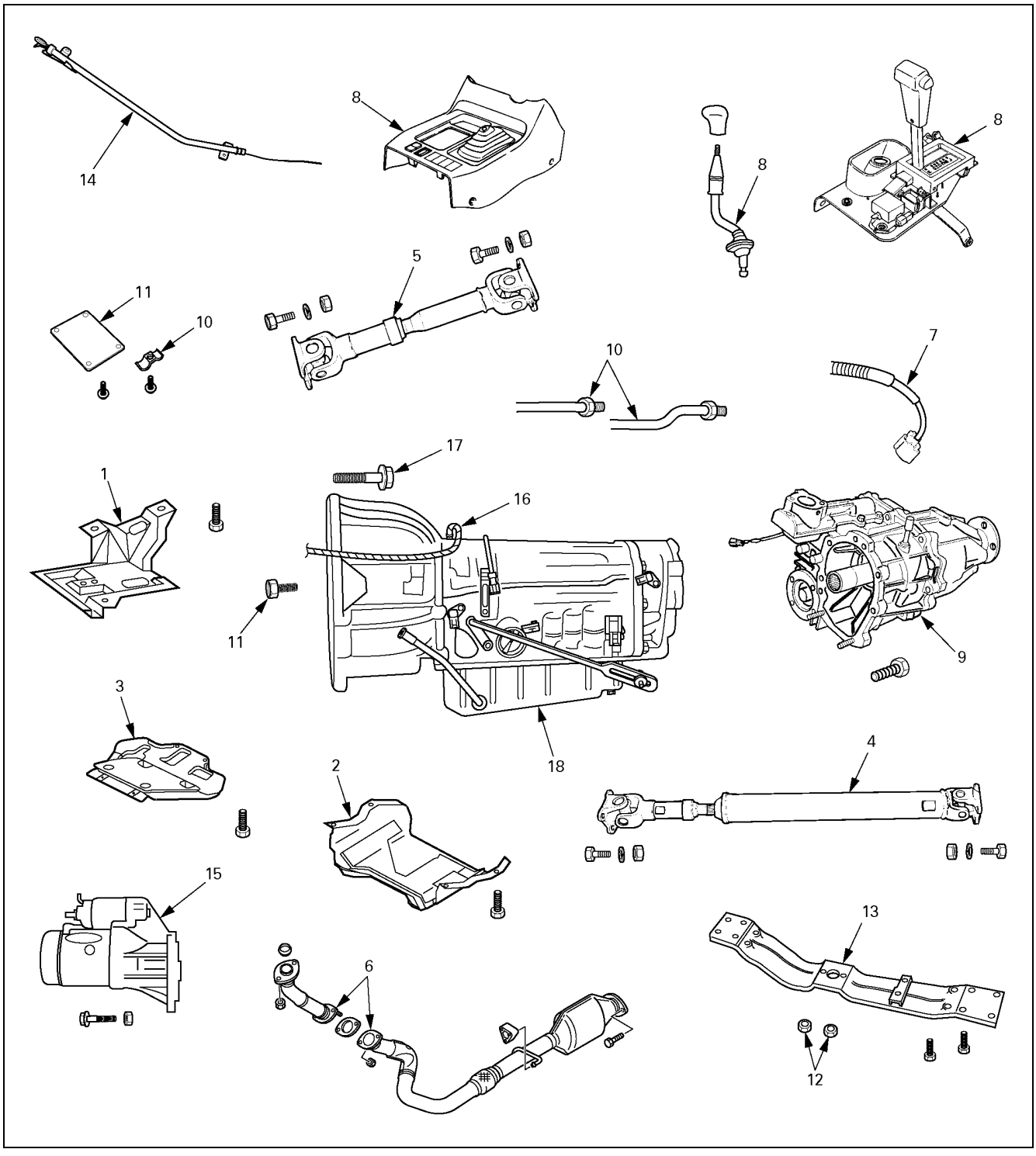
   Torque:

   Flange bolt : 63 N·m (6.4 kg·m/46 lb·in)

   Center bearing retainer bolt

   : 69 N·m (7.0 kg·m/51 lb·ft)

TRANSMISSION REMOVAL AND INSTALLATION (UBS)



240R200031

Removal Steps

1. Transfer protector
2. Rear sound cover
3. Front sound cover
4. Rear propeller shaft
5. Front propeller shaft
6. Exhaust pipe
7. Harness connector
8. Front console, selector lever assembly, and transfer control lever
9. Transfer case assembly
10. ATF cooler pipe and clamp
11. Under cover and flex plate-torque converter bolt
12. Rear mounting nut
13. 3rd crossmember
14. Oil level gauge and tube
15. Starter
16. Breather hose
17. Engine-transmission bolt
18. Transmission assembly

Installation Steps

To install, follow the removal steps in reverse order.

REMOVAL

Preparation:

- Remove engine hood.
- Disconnect negative (-) battery cable.

1. Transfer protector

2. Rear sound cover

3. Front sound cover

4. Rear propeller shaft

5. Front propeller shaft

NOTE:

Apply alignment marks on the flange at both front and rear sides.

6. Exhaust pipe

- Remove the 2nd front exhaust pipe from the 1st front exhaust pipe and exhaust silencer.

7. Harness connector

- Disconnect the engine harness connectors from the transmission side.

8. Front console, selector lever assembly, and transfer control lever

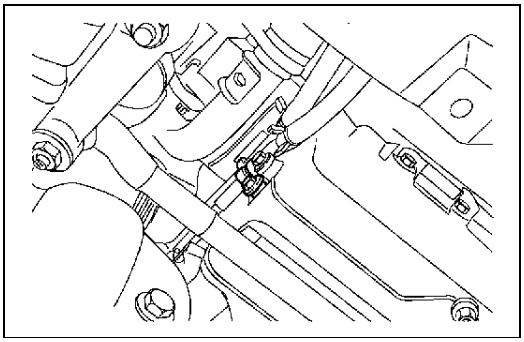
- Disconnect the transfer control lever knob.
- Remove the front console.
- Disconnect the harness connector.
- Remove the transfer control lever.
- Remove the selector lever assembly.
- Disconnect the shift control rod from the selector lever assembly.

9. Transfer case assembly

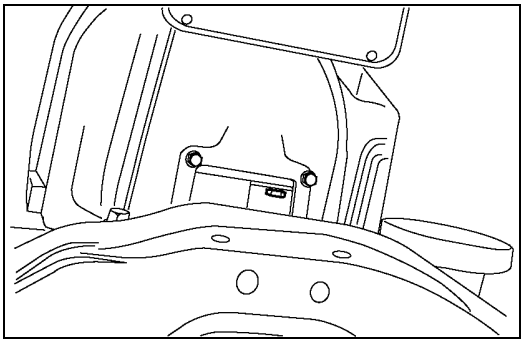
- Disconnect the breather hose from the transfer case.
- Remove the transfer case assembly from the transmission.

10. ATF cooler pipe and clamp

- Disconnect two ATF cooler pipes from A/T side.
- Remove oil pipe clamp from torque converter housing side.
- Loosen oil pipe clamp bolt at engine mount side.



253RY00001



240RY00026

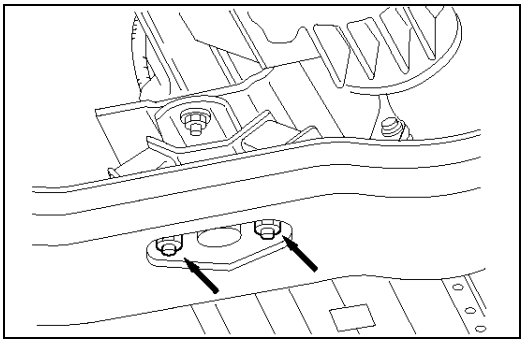
11. Under cover and flex plate-torque converter bolt

- Remove the under cover.
- Turn the crankshaft to gain access to each bolt.

  Remove the six torque coverter fixing bolts.

NOTE:

New fixing bolts should be replaced for reassembly.



022RY00001

12. Rear mounting nut

- Support transmission with a jack.
- Remove two rear mounting nuts from the 3rd crossmember.

13. 3rd crossmember

14. Oil level gauge and tube

15. Starter

- Remove the mounting bolts, and pull the starter toward the front of the vehicle.

  Lay the starter alongside the engine.

16. Breather hose

17. Engine-transmission bolt

- Remove engine-transmission fixing bolts.
- Disconnect the breather hose from the breather hose 2 way.

18. Transmission assembly

NOTE:

Keep the oil pan positioned down.

Be careful not to let the torque converter slide out.

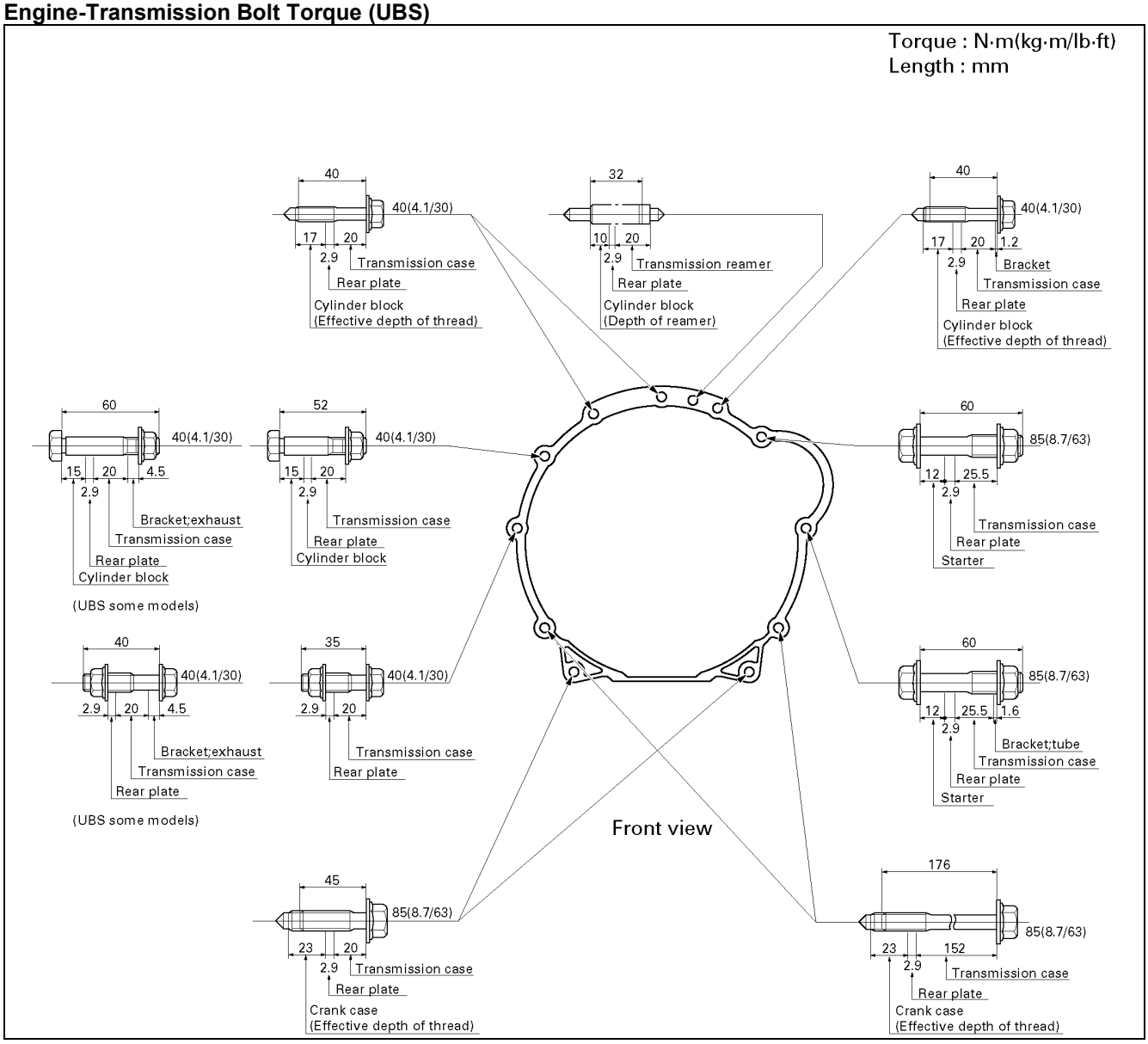
INSTALLATION

To install, follow the removal steps in reverse order, noting the following point;

1. Torque

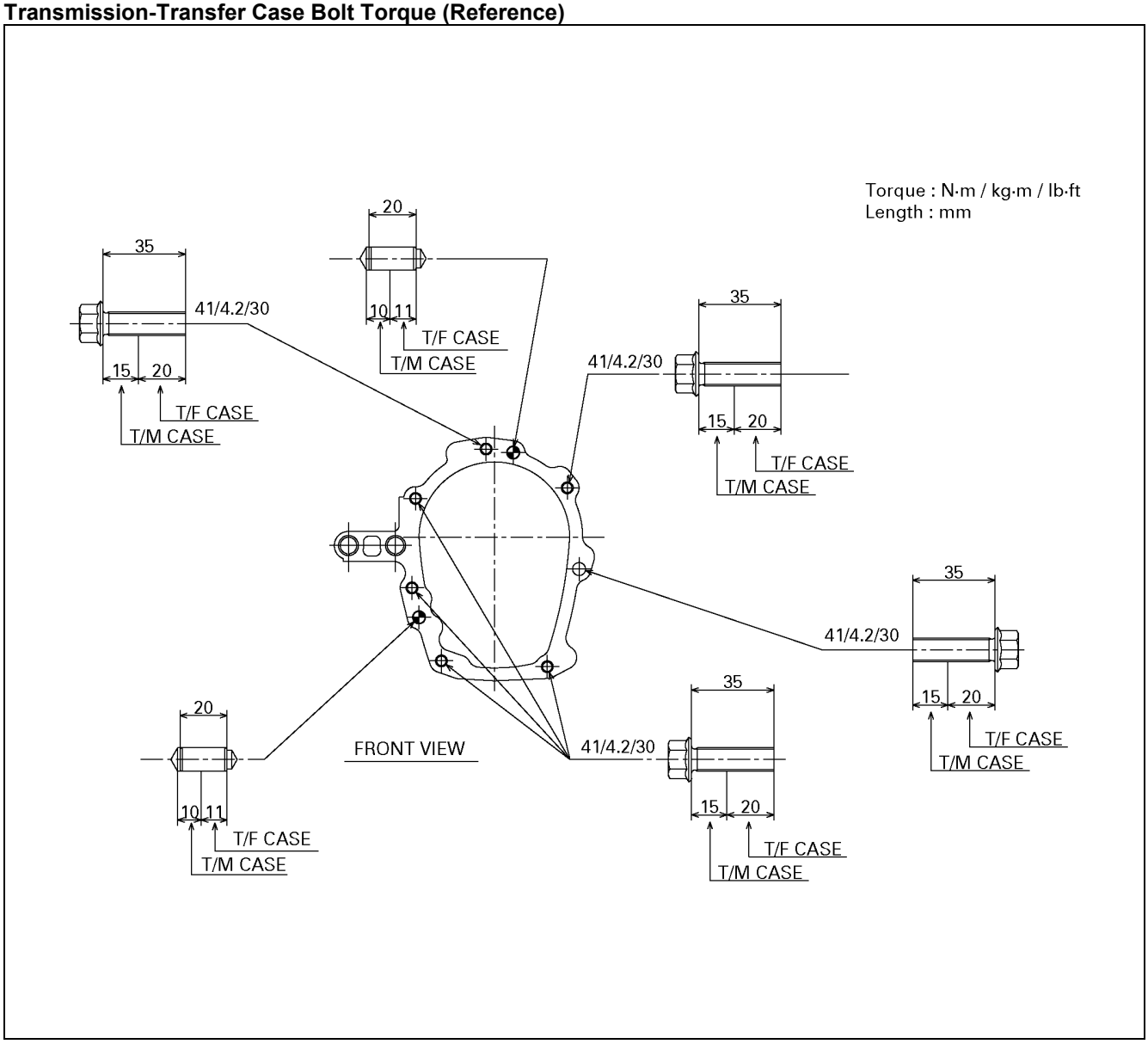
Rear mounting to 3rd crossmember	50 N·m (5.1 kg·m/37 lb·ft)
Torque converter bolt	29 N·m (3.0 kg·m/22 lb·ft)
ATF cooler pipe to transmission	44 N·m (4.5 kg·m/33 lb·ft)
Exhaust pipe flange to flange	43 N·m (4.4 kg·m/32 lb·ft)
3rd crossmember to flame	76 N·m (7.8 kg·m/56 lb·ft)
Front propeller shaft bolt	63 N·m (6.4 kg·m/46 lb·ft)
Rear propeller shaft bolt	63 N·m (6.4 kg·m/46 lb·ft)
Under cover bolt	6 N·m (0.6 kg·m/52 lb·in)
Transfer protector	37 N·m (3.8 kg·m/27 lb·ft)

Engine-Transmission Bolt Torque (UBS)



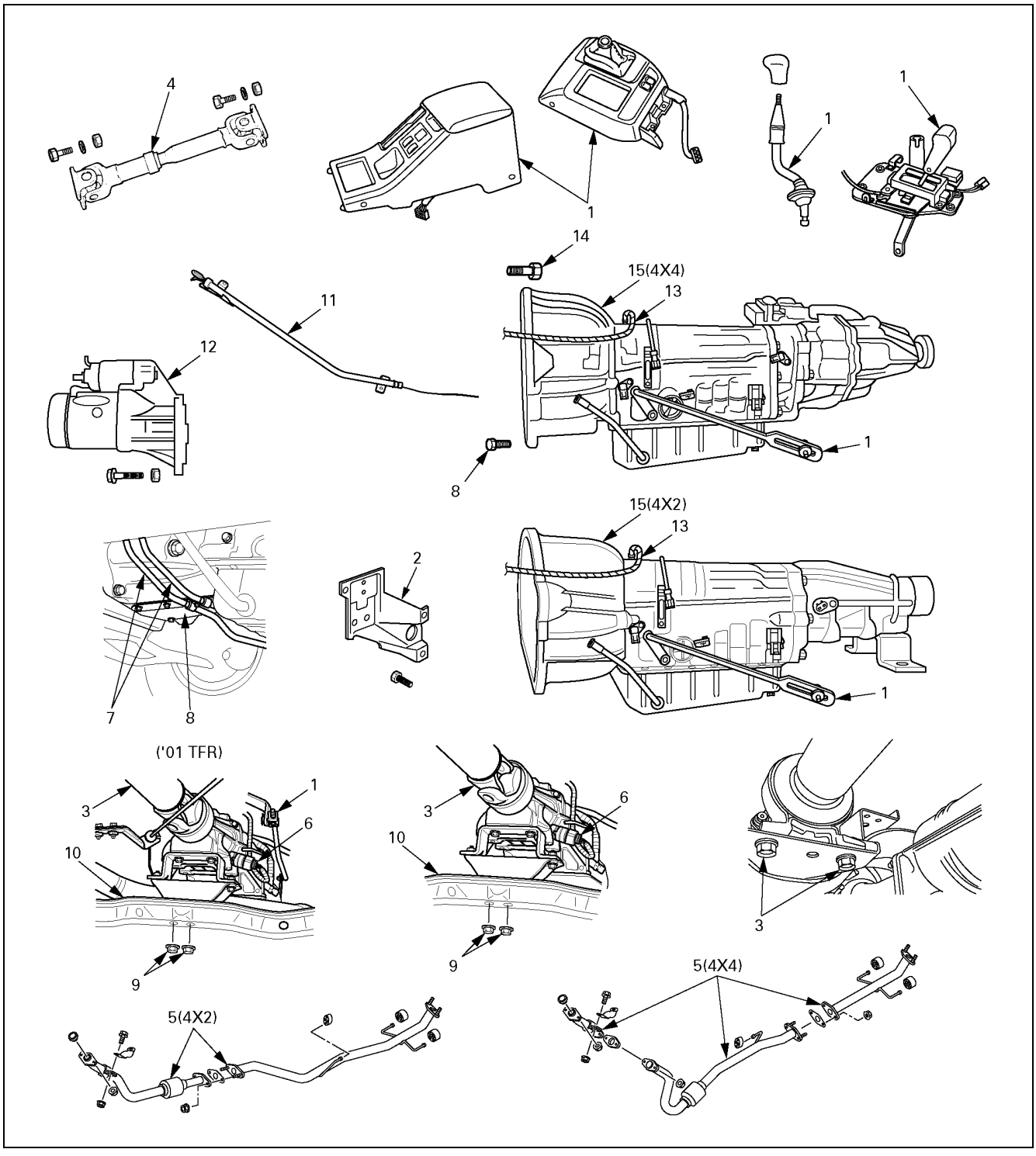
225R200006

Transmission-Transfer Case Bolt Torque (Reference)



260RY00001

TRANSMISSION REMOVAL AND INSTALLATION (TFR/S)



240L200001

Removal Steps

1. Center console, rear console, select lever assembly, and transfer control lever (4×4)
2. Transfer protector (4×4)
3. Rear propeller shaft
4. Front propeller shaft (4×4)
5. Exhaust pipe
6. Harness connector
7. ATF cooler pipe and clamp
8. Under cover and flex plate-torque converter bolt
9. Rear mounting nut
10. 3rd crossmember
11. Oil level gauge and tube
12. Starter
13. Breather hose
14. Engine – transmission bolt
15. Transmission assembly

Installaiton Steps

To install, follow the removal steps in reverse order.

REMOVAL

Preparation:

- Remove engine hood.
- Disconnect negative (-) battery cable.

1. Center console, rear console, select lever assembly, and transfer control lever (4×4)

- Disconnect the control rod from the select lever assembly.

2. Transfer protector (4×4)

3. Rear propeller shaft

Disconnect the center bearing bracket, and remove rear propeller shaft.

4. Front propeller shaft (4×4)

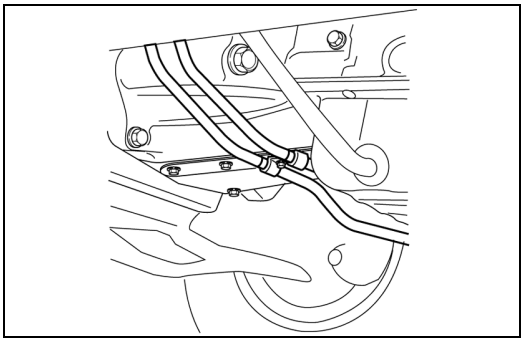
5. Exhaust pipe

6. Harness connector

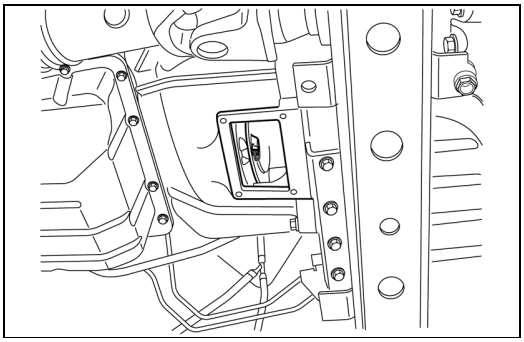
Disconnect the engine harness connectors from the transmission side.

7. ATF cooler pipe and clamp

- Disconnect two ATF cooler pipes from A/T side.
- Remove oil pipe clamp from the under cover and torque converter housing side.



253LV001



240RW037

8. Under cover and flex plate-torque converter bolt

- Remove the under cover.
- Turn the crankshaft to gain access to each bolt. Remove the six torque converter fixing bolts.

NOTE:

New fixing bolts should be replaced for reassembly.

9. Rear mounting nut

- Support transmission with a jack.
- Remove two rear mounting nuts from the 3rd crossmember.
- If necessary, remove the rear mounting from the transmission.

10. 3rd crossmember

11. Oil level gauge and tube

12. Starter

- Remove the mounting bolts, and pull the starter toward the front of the vehicle.

  Lay the starter alongside the engine.

13. Breather hose

14. Engine-transmission bolt

- Remove engine-transmission fixing bolts.

15. Transmission assembly

- If necessary, remove the transfer case from the transmission assembly. (4×4)

  Refer to Section 4 “DRIVE LINE/AXLE” for removal and installation.

NOTE:

Keep the oil pan positioned down.

Be careful not to let the torque converter slide out.

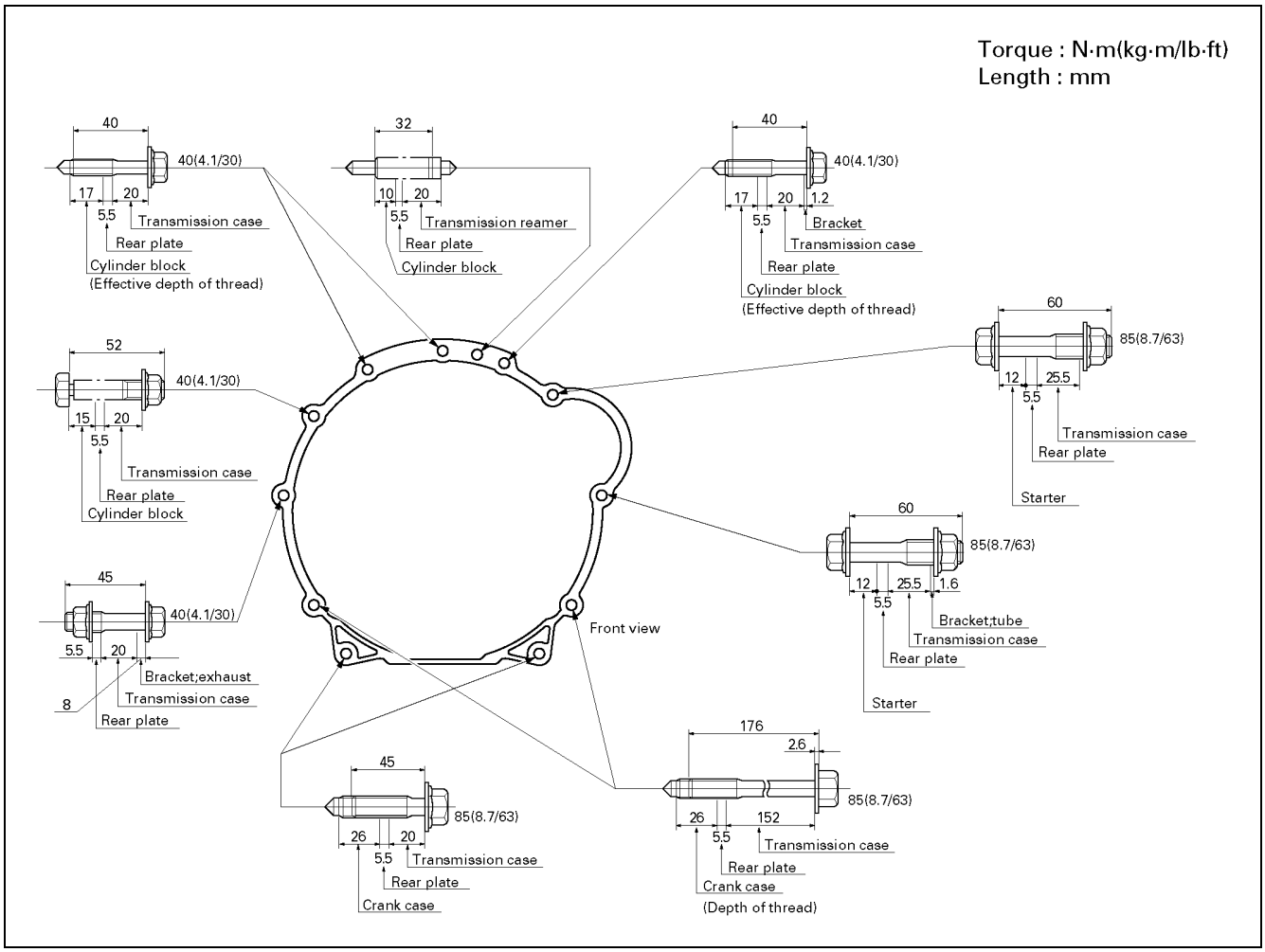
INSTALLATION

To install, follow the removal steps in the reverse order, noting the following points;

1. Torque

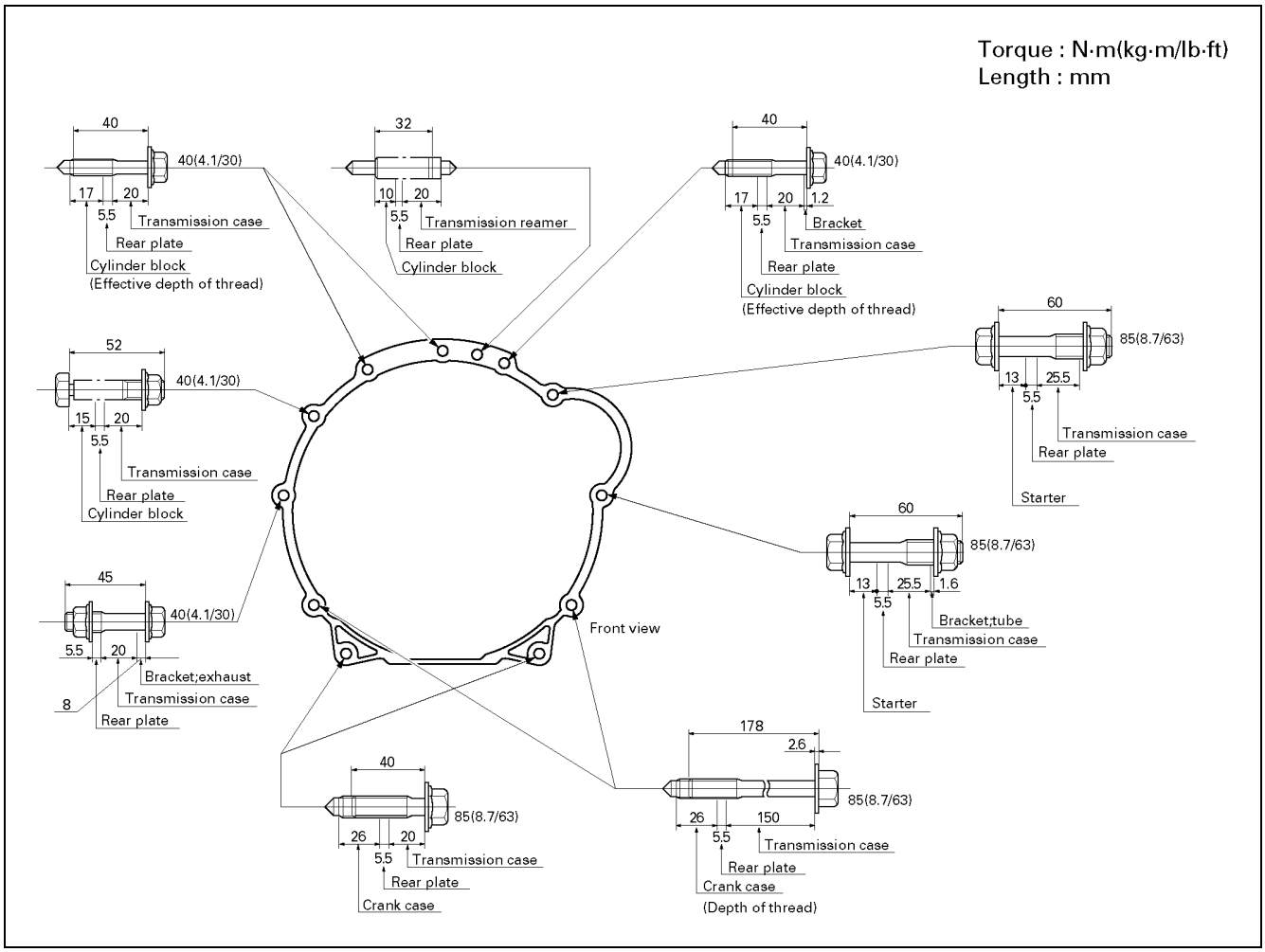
Rear mounting to crossmember	41 N·m (4.2 kg·m/30 lb·ft)
Rear mounting to transmission	41 N·m (4.2 kg·m/30 lb·ft)
Torque converter bolt	29 N·m (3.0 kg·m/22 lb·ft)
ATF cooler pipe to elbow	44 N·m (4.5 kg·m/33 lb·ft)
Exhaust pipe flange to flange	43 N·m (4.4 kg·m/32 lb·ft)
Exhaust pipe to exhaust manifold	67 N·m (6.8 kg·m/4.9 lb·ft)
Rear propeller shaft bolt	63 N·m (6.4 kg·m/46 lb·ft)
Center bearing retainer bolt	69 N·m (7.0 kg·m/51 lb·ft)
Front propeller shaft bolt	63 N·m (6.4 kg·m/46 lb·ft)
3rd crossmember bolt	76 N·m (7.8 kg·m/56 lb·ft)
Under cover bolt	6 N·m (0.6 kg·m/52 lb·in)

Engine – Transmission Bolt Torque ('02 TFR/S)



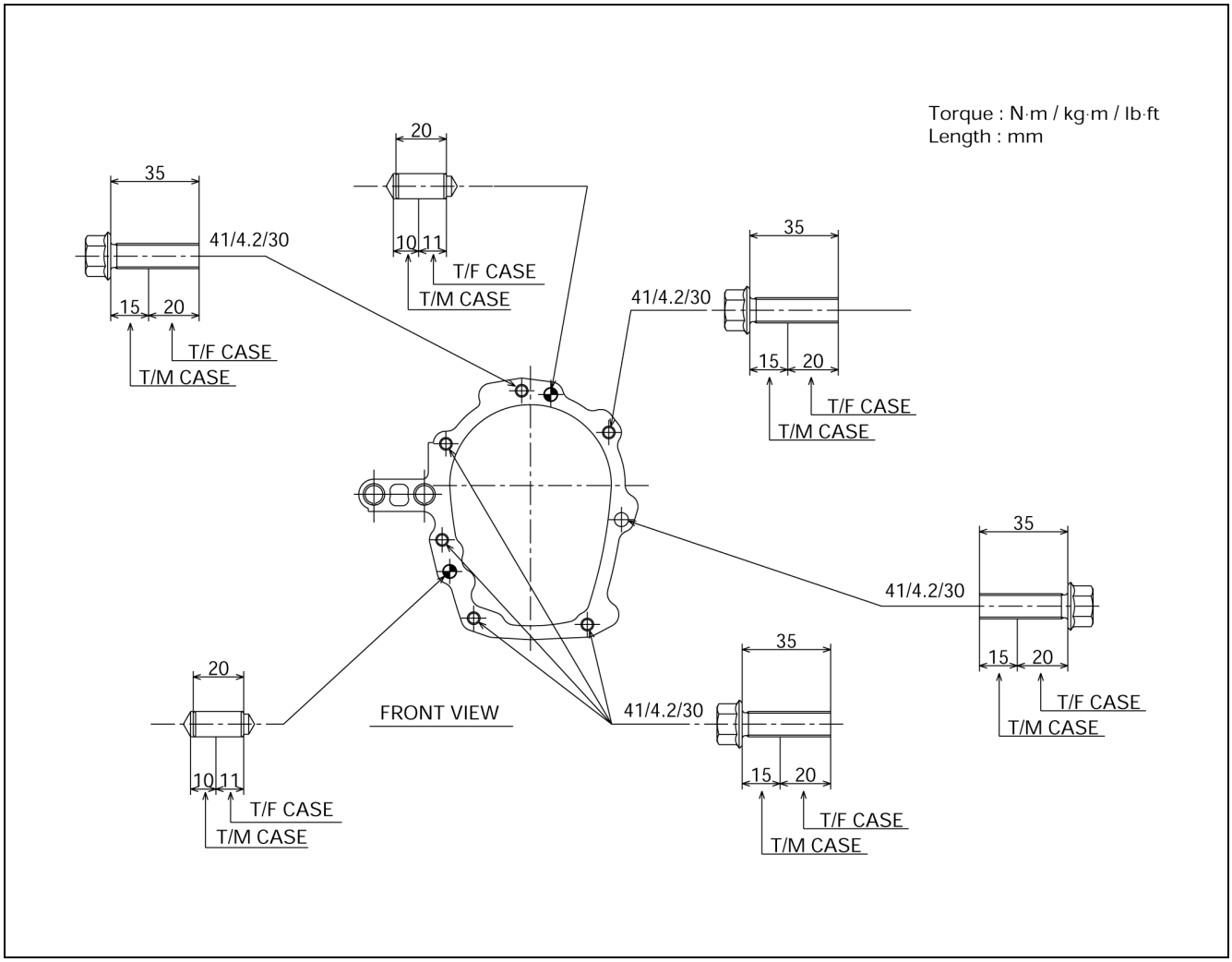
E07R200019

Engine – Transmission Bolt Torque ('01 TFR)



E07L200003

Transmission-Transfer Case Bolt Torque (Reference)



260RY00001

UNIT REPAIR

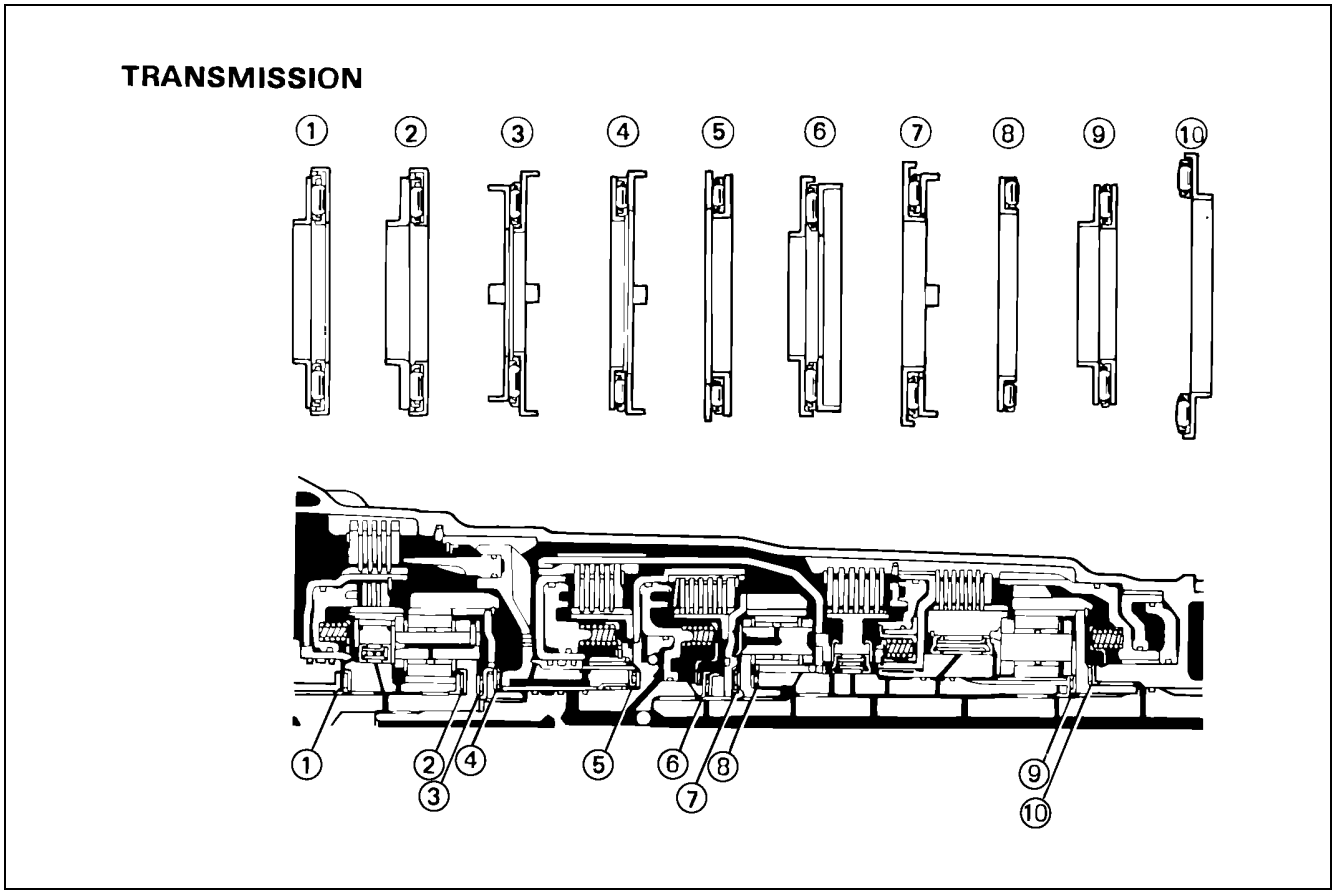
MAJOR COMPONENTS

Disassembly, inspection and reassembly of each component group is indicated in the following chapter. Before reassembly, make sure, again, that all component groups are assembled correctly.

If something wrong is found in a certain component group during assembly, inspect and repair this group immediately.

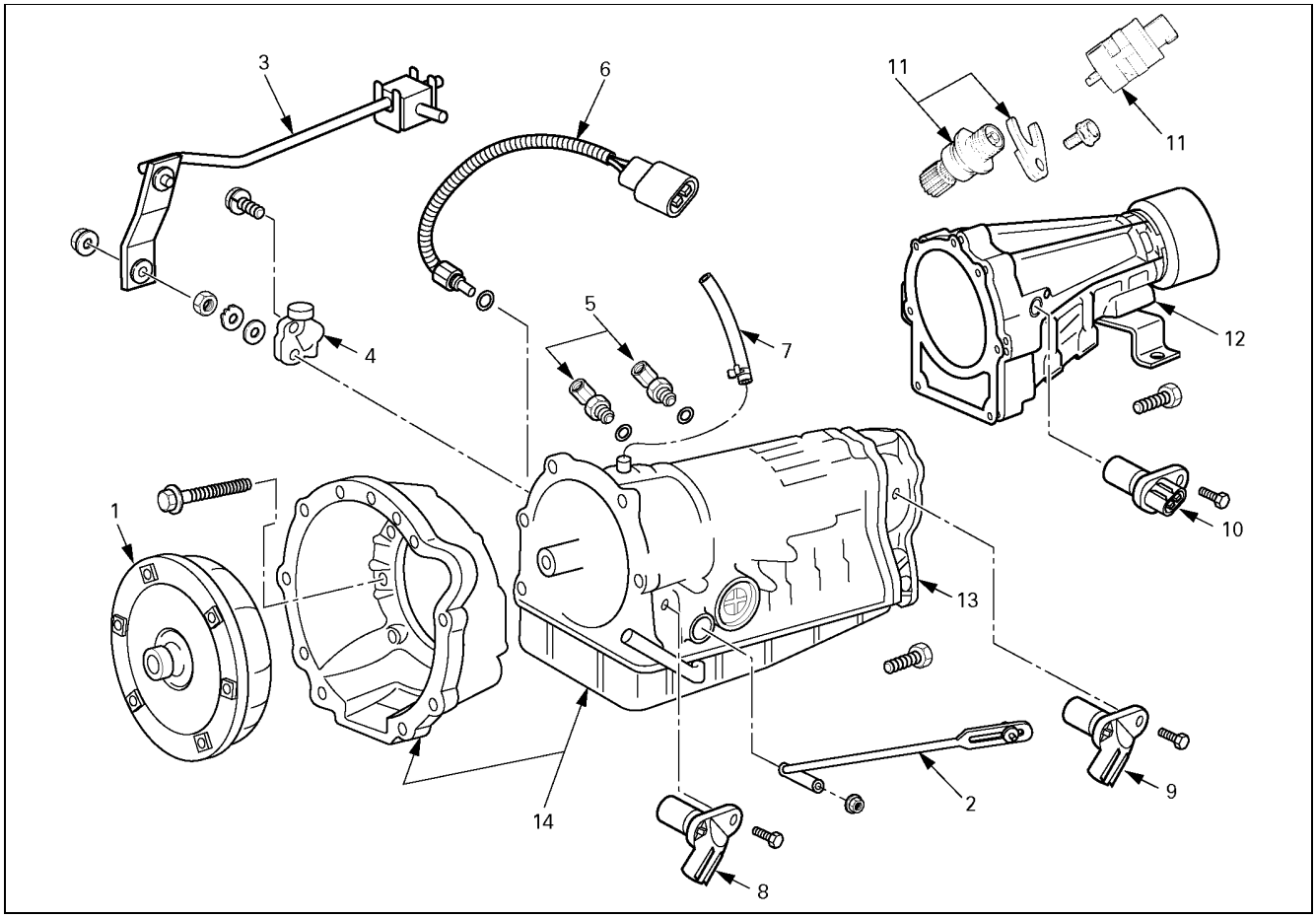
GENERAL ASSEMBLY NOTES:

1. The automatic transmission is composed of highly precision-finished parts, necessitating careful inspection before assembly because even a small nick could cause fluid leakage or affect performance.
2. Before assembling new clutch discs and brake bands, soak them in automatic transmission fluid for at least thirty minutes.
3. Apply automatic transmission fluid on the sliding or rotating surfaces of parts before assembly.
4. Use petroleum jelly to keep small parts in their palces.
5. Do not use adhesive cements on gaskets and similar parts.
6. When assembling the transmission, be sure to use new gaskets and O-rings.
7. Dry all parts with compressed air – never use shop rags.
8. Be sure to install the thrust bearings and races in the correct direction and position.



240RY00022

DISASSEMBLY OF MAJOR COMPONENTS (1)



240R200036

Disassembly steps

1. Torque converter
2. Transmission control rod and select lever (UBS and TFR/S)
3. Transmission control rod and select lever ('01 TFR)
4. Neutral start switch
5. Elbow
6. Oil temperature sensor
7. Breather hose
8. Input revolution sensor
9. Output revolution sensor (4×4)
10. Output revolution sensor (4×2)
11. Speedometer sensor, speedometer driven gear and plate (4 × 2)
12. Extension housing (4 × 2)
13. Adapter housing (4 × 4)
14. Transmission assembly

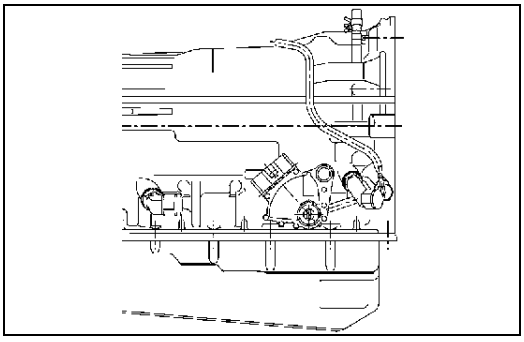
Disassembly steps

1. **Torque converter**
2. **Transmission control rod and select lever (UBS and TFR/S)**
3. **Transmission control rod and select lever ('01 TFR)**
4. **Neutral start switch**

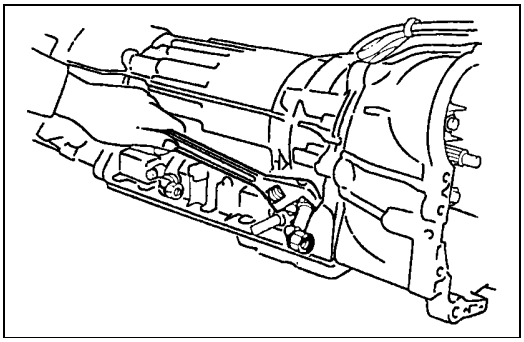
   Unstake the lock washer.

   Remove the nut and bolts, and then remove the neutral start switch.

   Remove the lock washer and grommet.



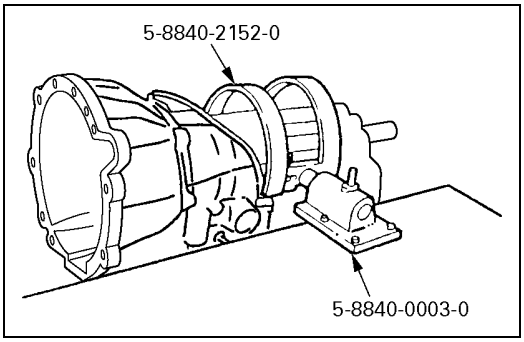
249RW003



240RY00001

5. **Elbow**

   Remove two elbows from transmission case.
6. **Oil temperature sensor**
7. **Breather hose**
8. **Input revolution sensor**
9. **Output revolution sensor (4×4)**
10. **Output revolution sensor (4×2)**
11. **Speedometer sensor, speedometer driven gear and plate (4 × 2)**
12. **Extension housing (4 × 2)**
13. **Adapter housing (4 × 4)**



240R200021

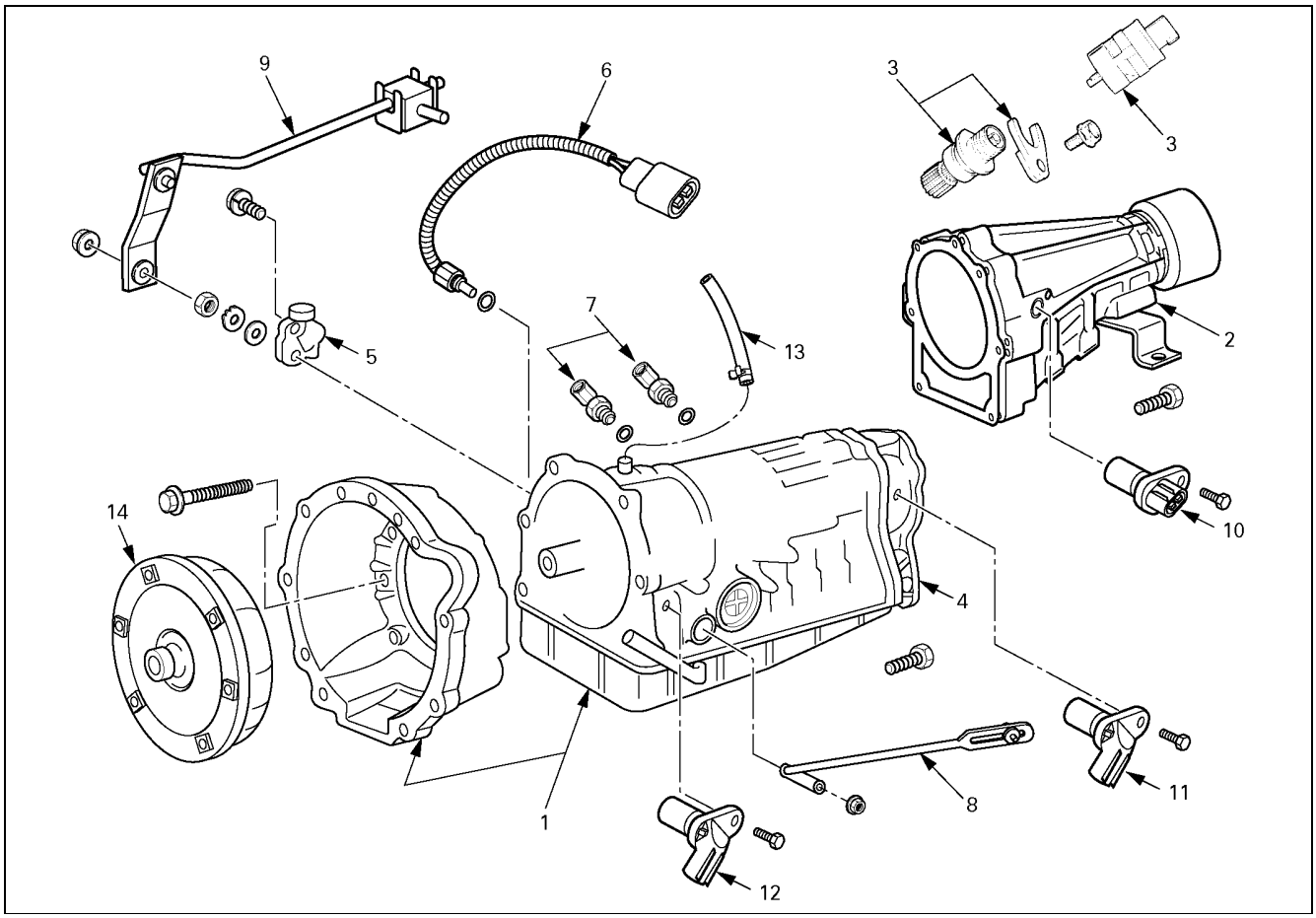
14. **Transmission assembly**

    Install special tool to the transmission unit.

    Holding fixture: 5-8840-2152-0 (J-37227)

    Holding fixture base: 5-8840-0003-0 (J-3289-20)

REASSEMBLY OF MAJOR COMPONENTS (1)



240R200035

Reassembly steps

1. Transmission assembly
2. Extension housing (4×2)
3. Speedometer driven gear, plate, and speedometer sensor (4×2)
4. Adapter housing (4×4)
5. Neutral start switch
6. Oil temperature sensor
7. Elbow
8. Transmission control rod and select lever (UBS and TFR/S)
9. Transmission control rod and select lever ('01 TFR)
10. Output revolution sensor (4×2)
11. Output revolution sensor (4×4)
12. Input revolution sensor
13. Breather hose
14. Torque converter

Reassembly steps

1. Transmission assembly

2. Extension housing (4×2)

Install a new gasket and the extension housing to the transmission case.

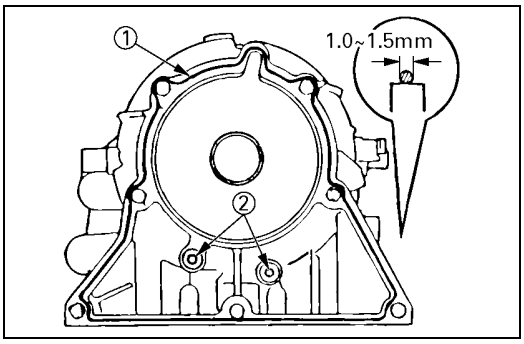
Torque: 36 N·m (3.7 kg·m/27 lb·ft)

3. Speedometer driven gear, plate, and speedometer sensor (4×2)

Torque:

Plate bolt – 15 N·m (1.5 kg·m/11 lb·ft)

Speedometer sensor – 25 N·m (2.5 kg·m/18 lb·ft)



241RY00020

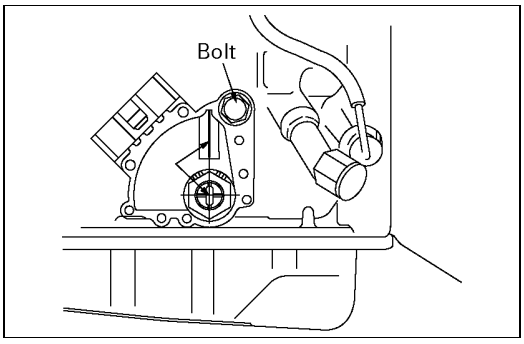
4. Adapter housing (4×4)

Remove any gasket material on the contacting surfaces of the adapter housing and transmission case.

Apply liquid gasket (TB1281-B or its equivalent) (1) and install the apply gaskets (2) to the adapter housing as shown in the figure.

Install the adapter housing to the transmission case.

Torque: 34 N·m (3.5 kg·m/25 lb·ft)



249L100003

5. Neutral start switch

Using the transmission select lever, fully turn the manual valve lever shaft back and return two notches.

It is now in neutral.

Insert the neutral start switch onto the manual valve lever shaft and temporarily tighten the adjusting bolt.

Install the lock washer and nut.

Torque: 7 N·m (0.7 kg·m/61 lb·in)

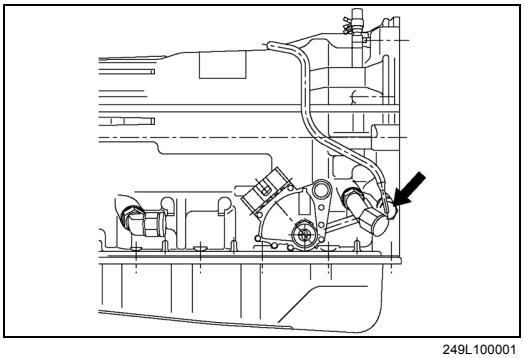
Align the neutral standard line and the switch groove and tighten the adjusting bolt.

Torque: 13 N·m (1.3 kg·m/113 lb·in)

Bend the tabs of the lock washer.

NOTE:

Bend at least two of the lock washer tabs.



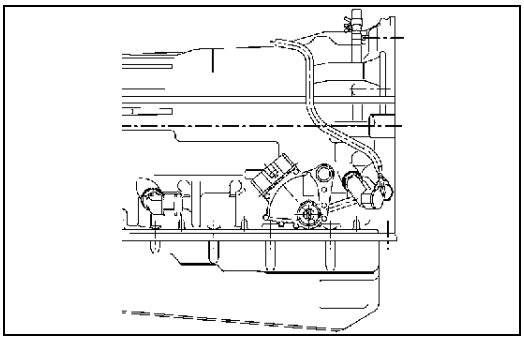
249L100001

6. Oil temperature sensor

Install the oil temperature sensor to the transmission case.

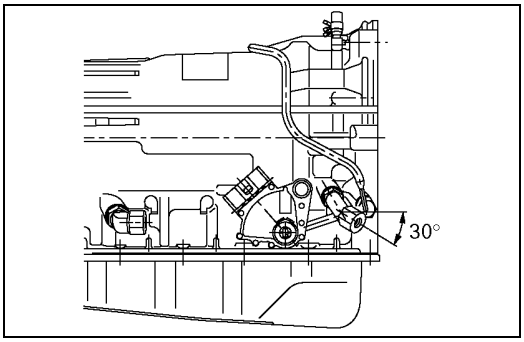
Torque: 15 N·m (1.5 kg·m/11 lb·ft)

UBS

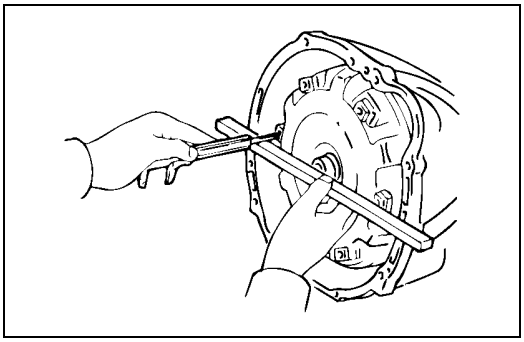


249RW003

TF



249R200009



240RY00005

7. Elbow

Coat new O-rings with ATF, install them to the two elbows.

Install the two elbows as shown in the figure.

Torque: 29 N·m (3.0 kg·m/22 lb·ft)

8. Transmission control rod and select lever (UBS and TFR/S)

9. Transmission control rod and select lever ('01 TFR)

Torque: 29 N·m (3.0 kg·m/22 lb·ft)

10. Output revolution sensor (4×2)

11. Output revolution sensor (4×4)

12. Input revolution sensor

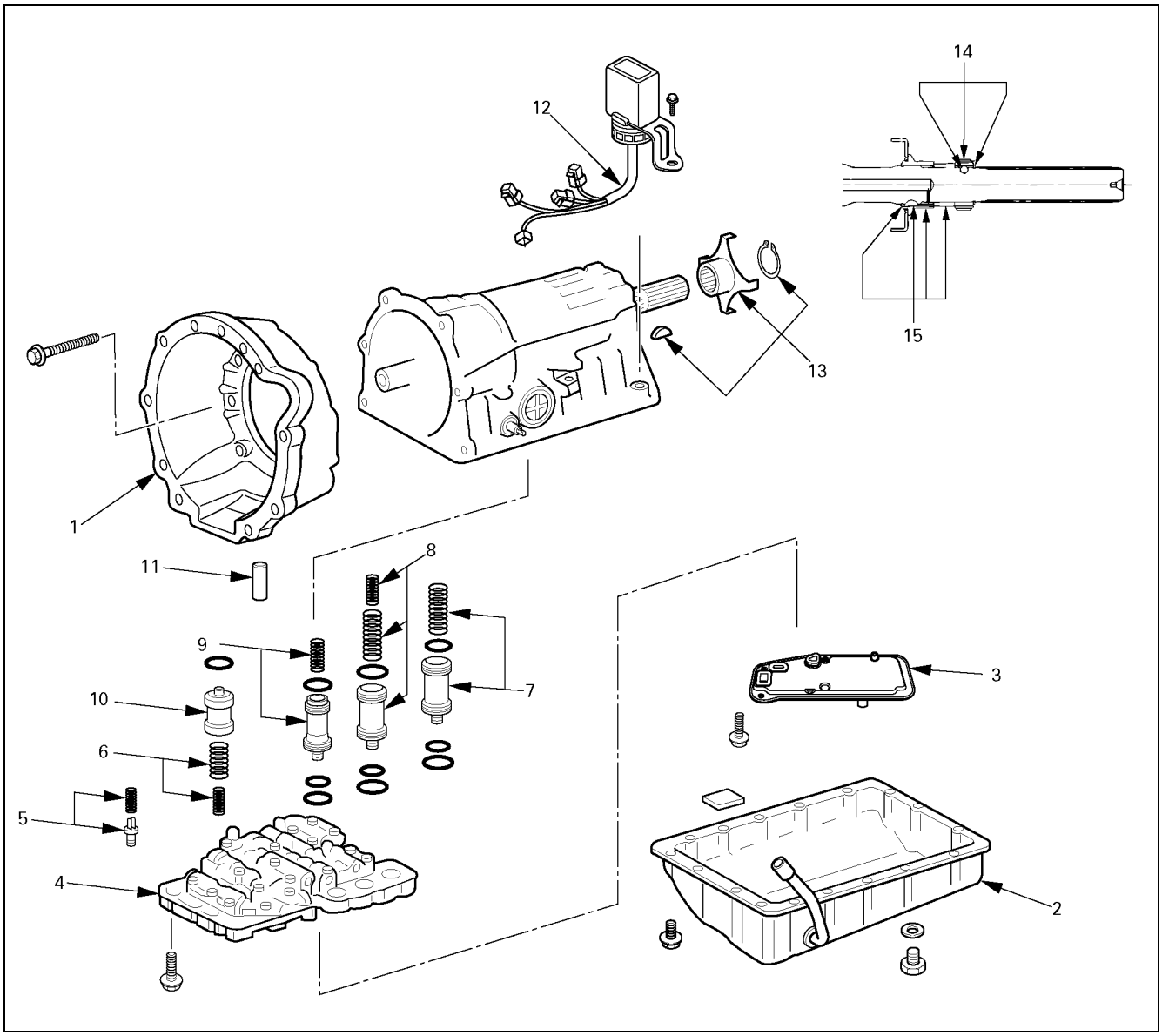
13. Breather hose

14. Torque converter

Using calipers and a straight edge, measure from the installed surface of the transmission housing.

Correct distance: 67 mm (2.64 in) or more

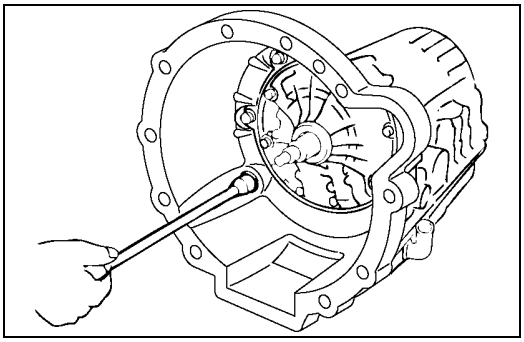
DISASSEMBLY OF MAJOR COMPONENTS (2)



242R200006

Disassembly steps

1. Converter housing
2. Oil pan
3. Oil strainer assembly
4. Valve body
5. Check valve, spring
6. Spring
7. Accumulator piston (B-2)
8. Accumulator piston (C-2)
9. Accumulator piston (B-0)
10. Accumulator piston (C-0)
11. Second brake drum gasket
12. Solenoid wiring
13. Snap ring, rotor, key (4×4)
14. Snap ring, speedometer sensor drive gear, ball (4×2)
15. Spacer, rotor, key, snap ring (4×2)

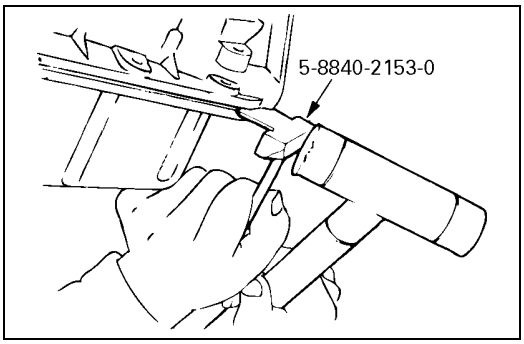

240R200022

Disassembly steps

1. **Converter housing**

   Remove the six bolts.

   Remove the converter housing.



240RY00007

2. **Oil pan**

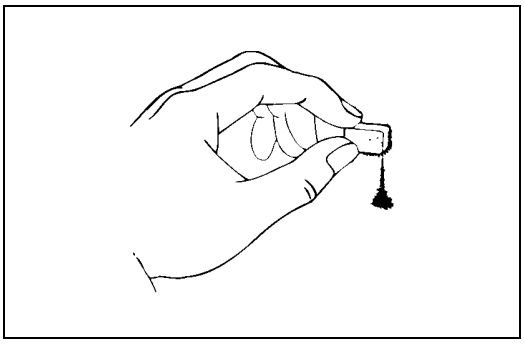
   NOTE:

   Do not turn over the transmission as this will contaminate the valve body with foreign materials in the bottom of the oil pan.

   Remove the nineteen bolts.

   Remove oil pan by lifting the transmission case.

   Oil pan seal cutter: 5-8840-2153-0 (J-37228)


240RY00008

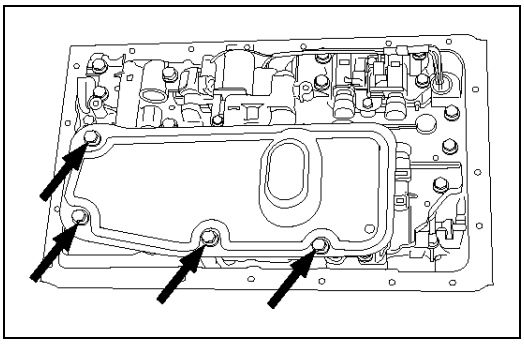
Examine particles in oil pan

Remove the magnet and use it to collect any steel chips.

Look carefully at the chips and particles in the oil pan and on the magnet to anticipate what type of wear you will find in the transmission:

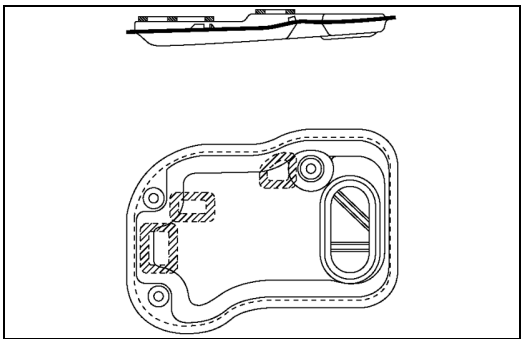
Steel (magnetic) …… bearing, gear and clutch plate wear

Brass (non-magnetic)… bushing wear


244RY00003

3. **Oil strainer assembly**

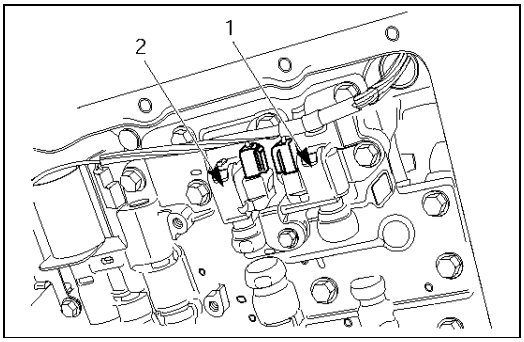
   Remove four bolts holding the oil strainer (UBS and TFR/S).


244L100001

Remove three bolts holding the oil strainer (’01 TFR).

NOTE:

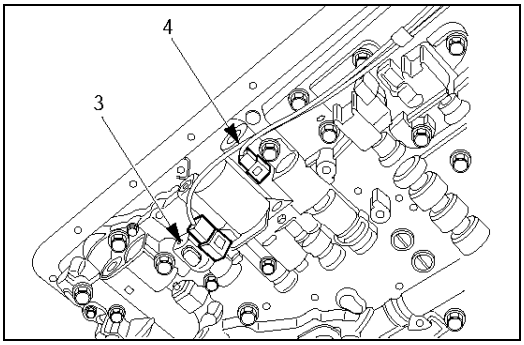
When reassembling components, install a new oil strainer assembly.



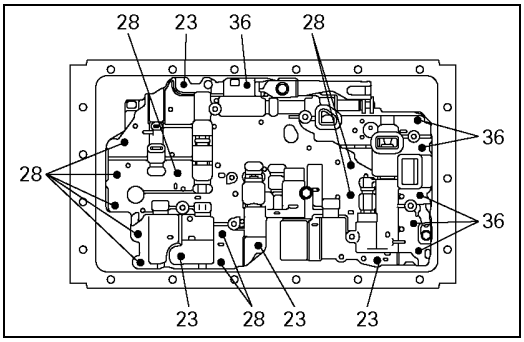
249RY00011

4. Valve body

Disconnect the connectors from the solenoid S1 (1), S2 (2), lock-up solenoid (3) and pressure control solenoid (4).

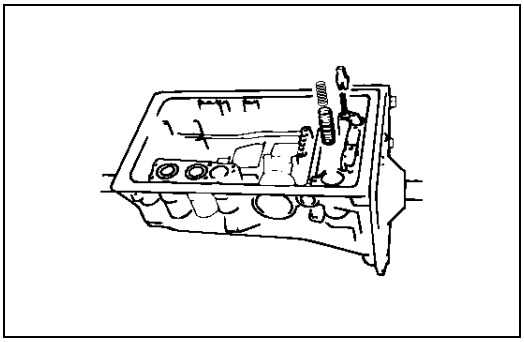


249RY00012



244R200078

Remove the twenty bolts from valve body.

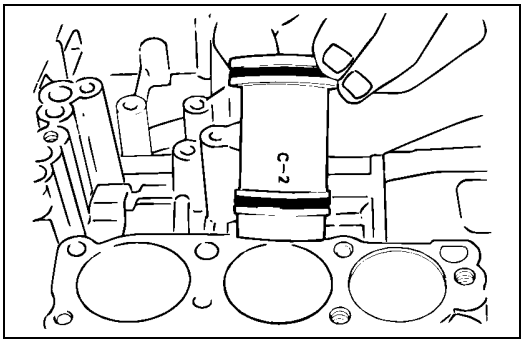

240RY00028

5. Check valve, spring

6. Spring

Remove the check valve and spring.

Remove two springs from C-0 accumulator piston.

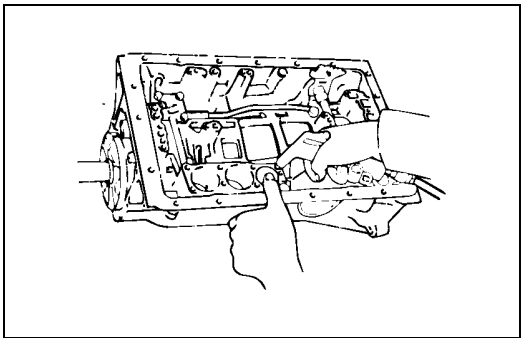


240RY00010

7. Accumulator piston (B-2)

8. Accumulator piston (C-2)

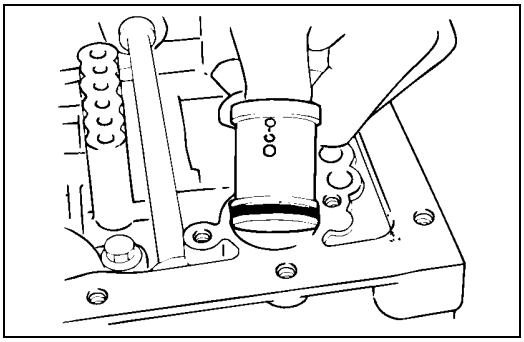
Remove accumulator pistons and springs from transmission case.



240RY00011

9. Accumulator piston (B-0)

Applying compressed air to the oil hole, remove the B-0 accumulator piston and spring.



240RY00012

10. Accumulator piston (C-0)

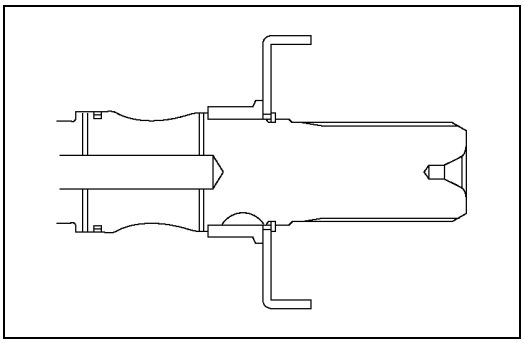
Remove the C-0 accumulator piston.

11. Second brake drum gasket

12. Solenoid wiring

Turn over transmission, remove the solenoid wiring stopper plate from the case.

Pull the wiring out of the transmission case.

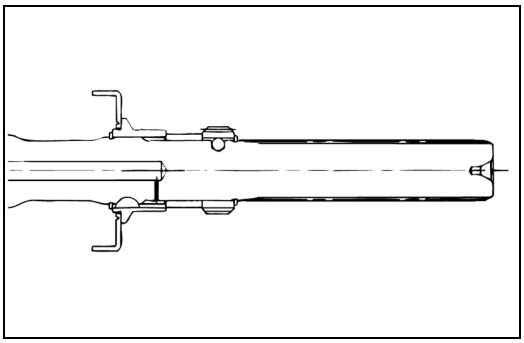


247R200002

13. Snap ring, rotor, key (4×4)

Remove the snap ring from the output shaft.

Remove the rotor and key.



247L100001

14. Snap ring, speedometer sensor drive gear, ball (4×2)

Remove the snap ring from the output shaft.

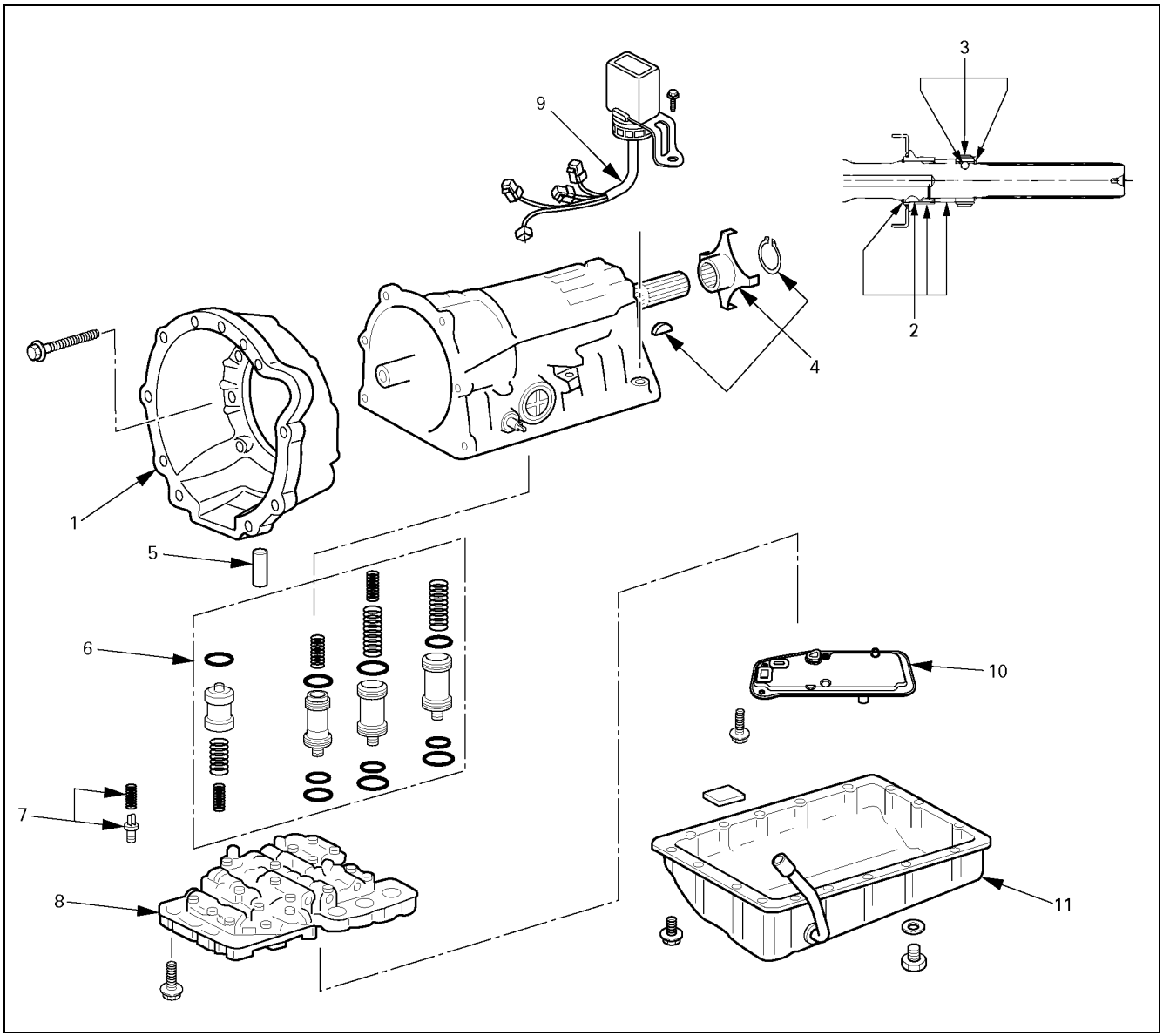
Remove the speedometer sensor drive gear, and ball.

15. Spacer, rotor, key, snap ring (4×2)

Remove the spacer, rotor and key.

Remove the snap ring from the output shaft.

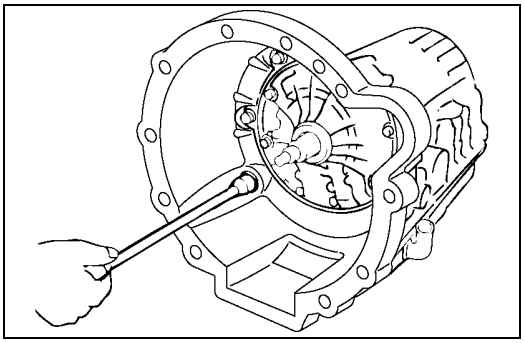
REASSEMBLY OF MAJOR COMPONENTS (2)



242R200007

Reassembly steps

1. Converter housing
2. Snap ring, key, rotor (4×2)
3. Spacer, ball, speedometer sensor drive gear, snap ring (4×2)
4. Key, rotor, snap ring (4×4)
5. Second brake drum gasket
6. Accumulator piston
7. Check valve, spring
8. Valve body
9. Solenoid wiring
10. Oil strainer assembly
11. Oil pan



240R200022

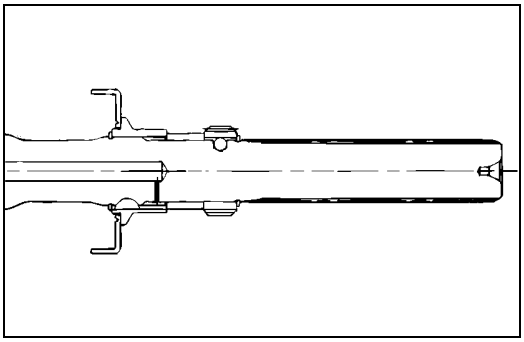
Reassembly steps

1. **Converter housing**

   Torque:

   M10 - 34 N·m (3.5 kg·m/25 lb·ft)

   M12 - 57 N·m (5.8 kg·m/42 lb·ft)



247L100001

2. **Snap ring, key, rotor (4×2)**

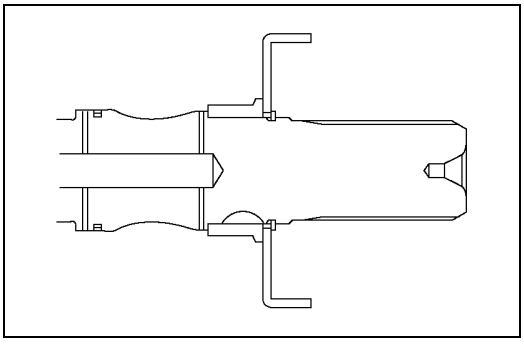
   Install the snap ring to the output shaft.

   Install the key and rotor.

3. **Spacer, ball, speedometer sensor drive gear, snap ring (4×2)**

   Install the spacer, ball and speedometer sensor drive gear.

   Install the snap ring to the output shaft.

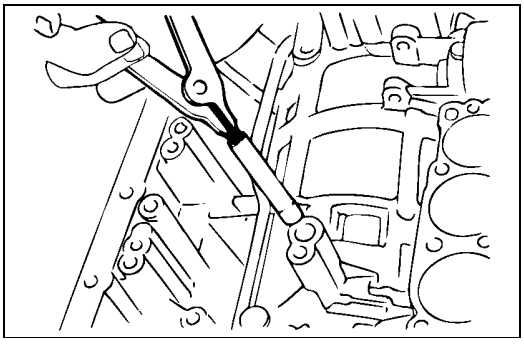


247R200002

4. **Key, rotor, snap ring (4×4)**

   Install the key and rotor.

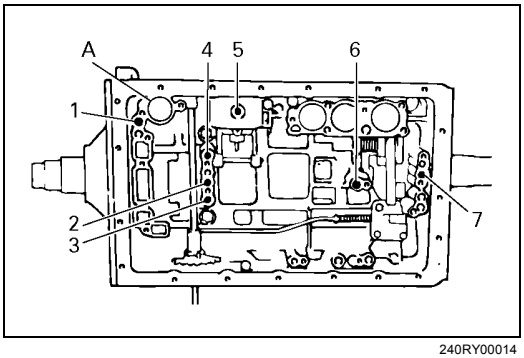
   Install the snap ring to the output shaft.



240RY00013

5. **Second brake drum gasket**

   Install a new second brake drum gasket to the transmission case.



240RY00014

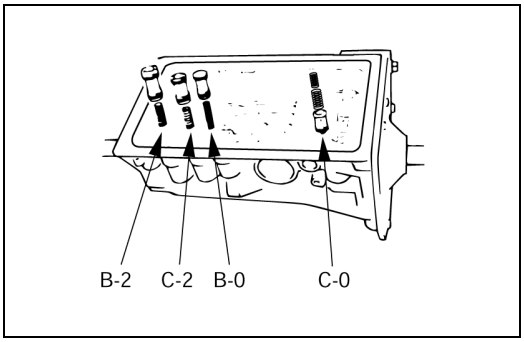
Individual piston operation inspection

Check for the sound of operation while injecting compressed air into the oil hole indicated in the figure.

1: OD direct clutch
2: Direct clutch
3: Forward clutch
4: OD brake
5: Second coast brake
6: Second brake
7: First and reverse brake
A: C-0 Accumulator piston hole

NOTE:

When inspecting the direct clutch, check with the C-0 accumulator piston hole closed. If there is no noise, disassemble and check the condition of the parts.

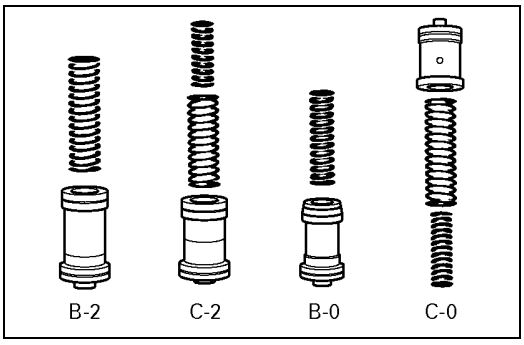


240RY00027

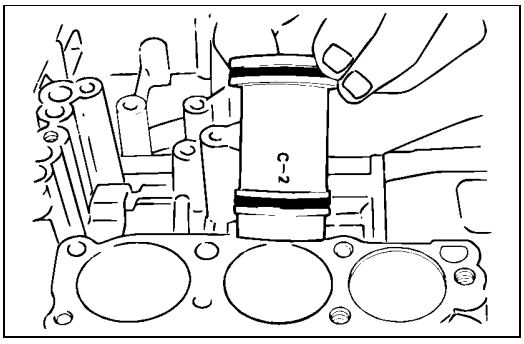
6. Accumulator piston

Coat the O-ring with ATF and install it to the piston.

Install the three springs and four accumulator pistons to the bore as shown in th figure.



240RY00029



240RY00010

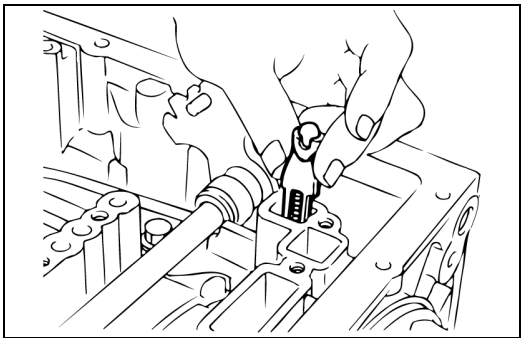
Piston	Outer diameter	Height
B-2	36.8 mm (1.449 in)	62.5 mm (2.461 in)
C-2	36.8 mm (1.449 in)	56.6 mm (2.228 in)
B-0	31.8 mm (1.252 in)	52.0 mm (2.047 in)
C-0	29.8 mm (1.173 in)	44.0 mm (1.732 in)

UBS

Spring	Free length	Outer diameter
B-2	75.8 mm (2.984 in)	20.1 mm (0.791 in)
C-2 (Outer)	64.0 mm (2.520 in)	20.2 mm (0.795 in)
C-2 (Inner)	42.1 mm (1.658 in)	14.7 mm (0.579 in)
B-0	63.6 mm (2.504 in)	16.0 mm (0.630 in)
C-0 (Outer)	74.6 mm (2.937 in)	20.9 mm (0.823 in)
C-0 (Inner)	46.0 mm (1.811 in)	14.0 mm (0.551 in)

TFR/S

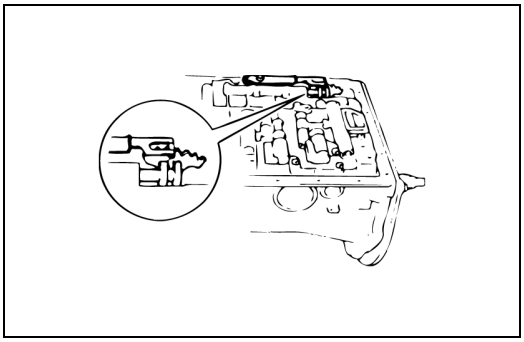
Spring	Free length	Outer diameter
B-2	73.4 mm (2.890 in)	19.9 mm (0.783 in)
C-2 (Outer)	70.3 mm (2.768 in)	20.2 mm (0.795 in)
C-2 (Inner)	42.1 mm (1.658 in)	14.7 mm (0.579 in)
B-0	62.0 mm (2.441 in)	16.0 mm (0.630 in)
C-0 (Outer)	74.6 mm (2.937 in)	20.9 mm (0.823 in)
C-0 (Inner)	46.0 mm (1.811 in)	14.0 mm (0.551 in)



240RY00016

7. Check valve, spring

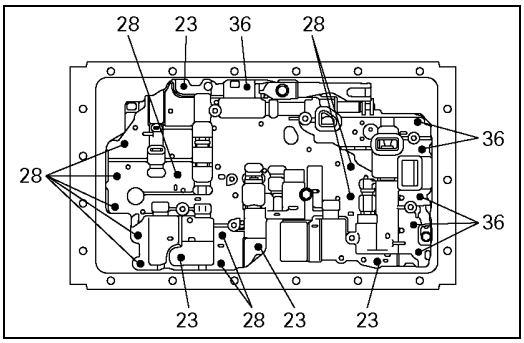
Install new check valve and spring.



240RY00017

8. Valve body

Align the groove of the manual valve to the pin of the lever.



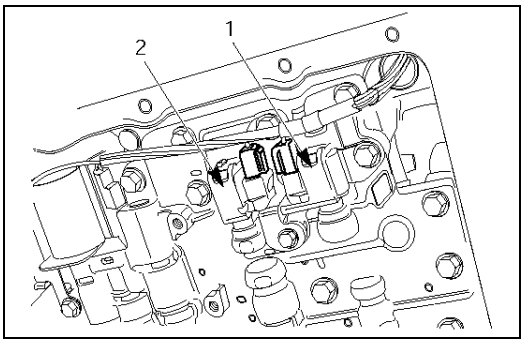
244R200078

Install the twenty bolts.

NOTE:

Each bolt length (mm) is indicated in the figure.

Torque: 10 N·m (1.0 kg·m/87 lb·in)



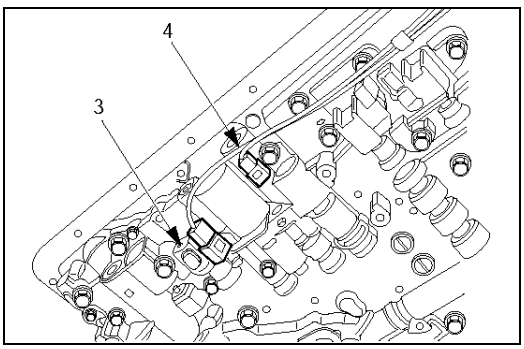
249RY00011

9. Solenoid wiring

Coat a new O-ring with ATF, and install it to the solenoid wiring.

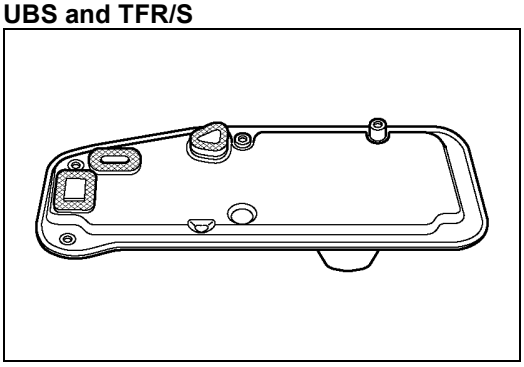
Insert the solenoid wiring to the case and install the stopper plate.

Connect the connectors to the solenoid S1 (1), S2 (2), lock-up solenoid (3), and pressure control solenoid (4).



249RY00012

UBS and TFR/S

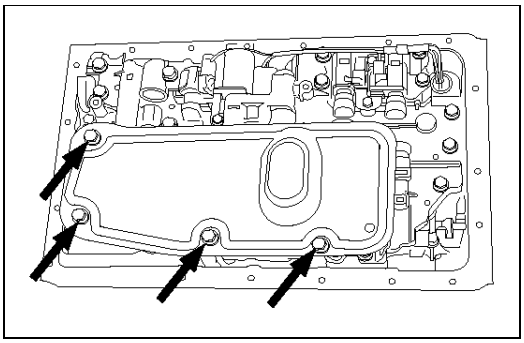


244RY00002

10. Oil strainer assembly

Install a new oil strainer assembly with gaskets.

UBS and TFR/S

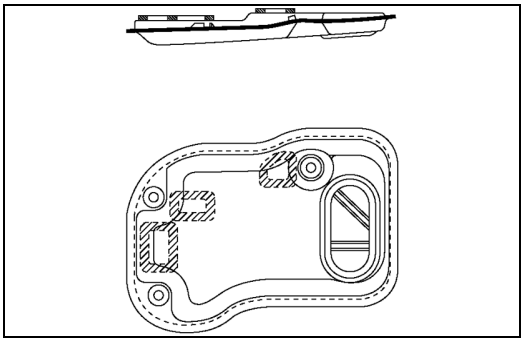


244RY00003

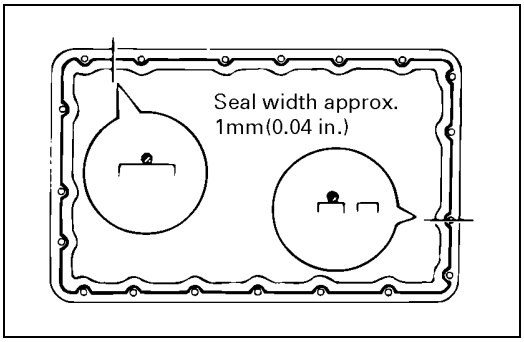
Install the oil strainer with the gaskets to the valve body. Tighten the four (UBS and TFR/S) or three ('01 TFR) bolts.

Torque: 10 N·m (1.0 kg·m/87 lb·in)

'01 TFR



244L100001



240RY00019

11. Oil pan

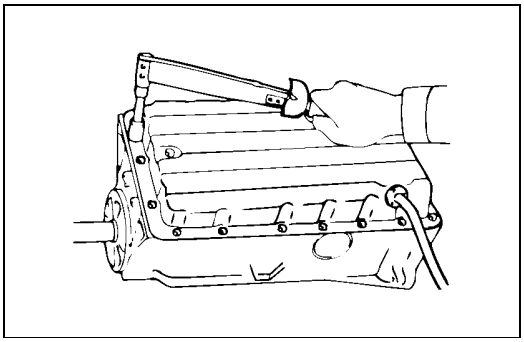
Install two magnets in oil pan.

Remove any gasket material and be careful not to drop oil on the contacting surfaces of the transmission case and oil pan.

Apply liquid gasket (TB1281 or its equivalent) to the oil pan as shown in the figure.

NOTE:

Install the oil pan as soon as the seal gasket is applied.

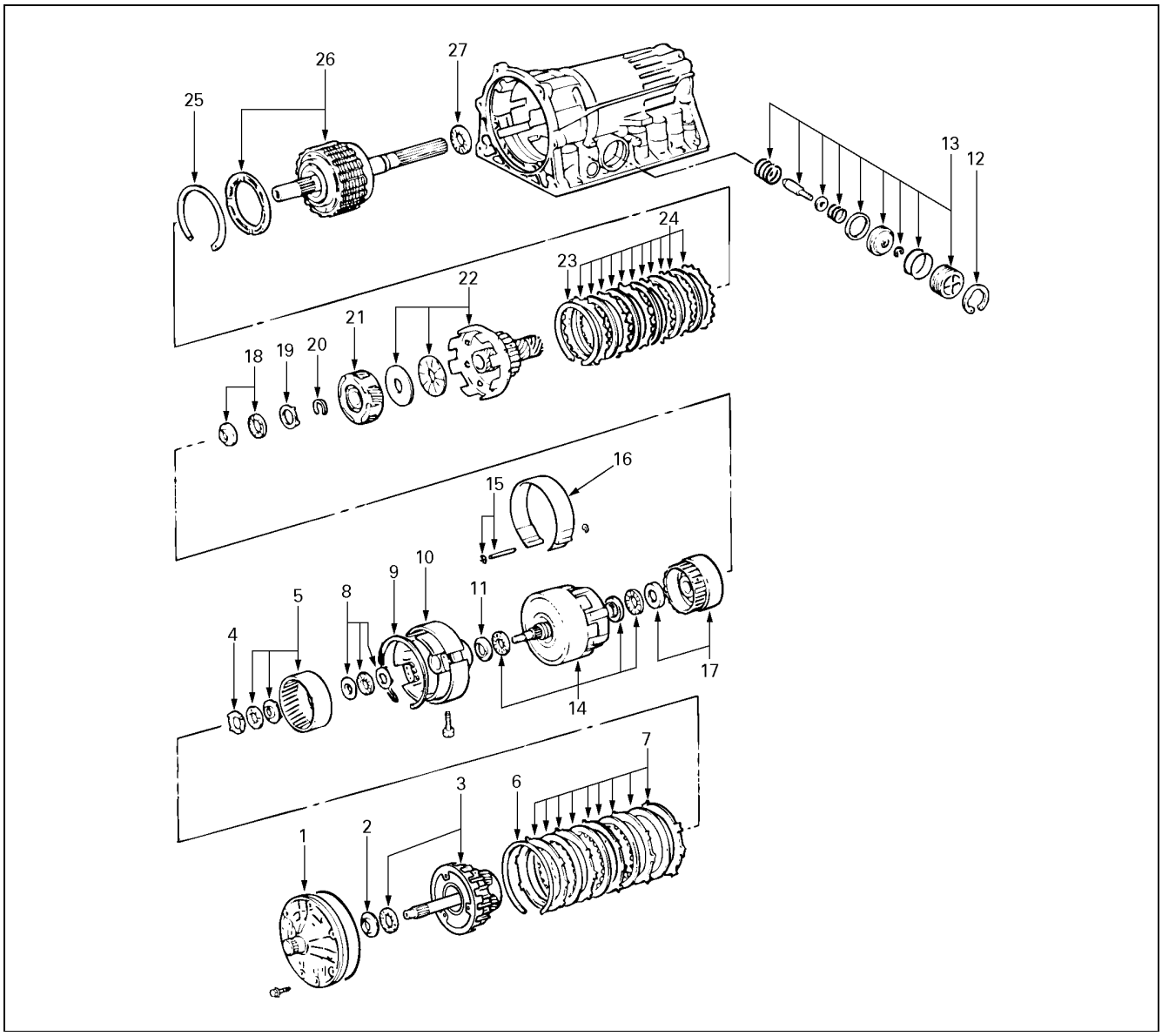


240RY00020

Install and tighten the nineteen bolts.

Torque: 7.4 N·m (0.75 kg·m/65 lb·in)

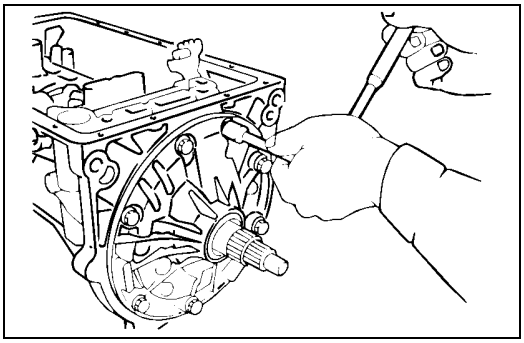
DISASSEMBLY OF MAJOR COMPONENTS (3)



248L100001

Disassembly steps

1. Oil pump
2. Race
3. OD planetary gear and OD direct clutch
4. Race
5. OD planetary ring gear
6. Snap ring
7. Flange, plate and disc (B-0)
8. Bearing and race
9. Snap ring
10. OD support
11. Race
12. Snap ring
13. Second coast brake piston assembly
14. Direct clutch and forward clutch
15. E-ring and pin
16. Second coast brake band
17. Front planetary ring gear
18. Bearing and race
19. Race
20. Snap ring
21. Front planetary gear
22. Drum and one-way clutch
23. Snap ring
24. Flange, plate and disc (B-2)
25. Snap ring
26. Rear planetary gear, second brake drum and output shaft
27. Bearing



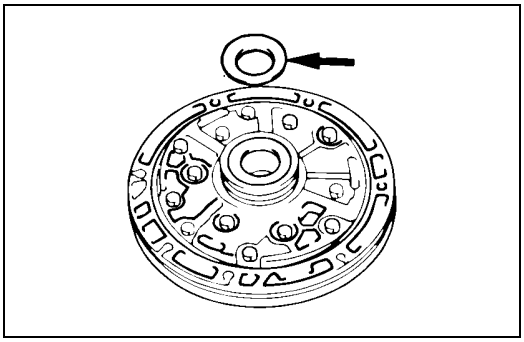
241RY00003

Disassembly steps

1. **Oil pump**

   Remove seven bolts fixing the oil pump to the transmission case.

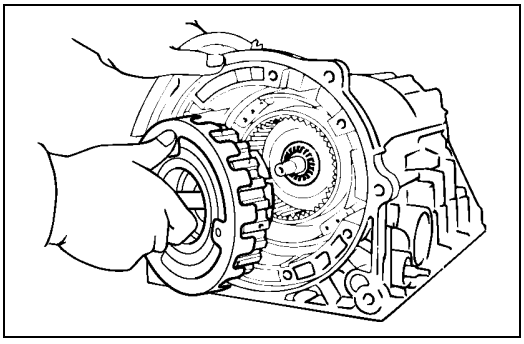
   Remove the oil pump.



241RY00002

2. **Race**

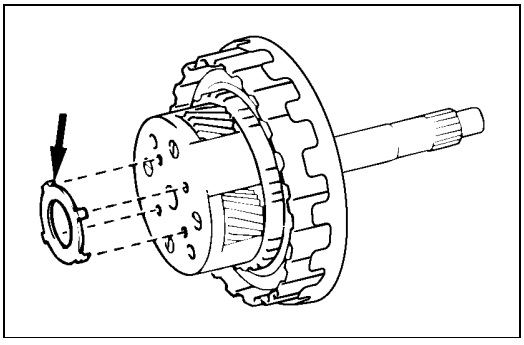
   Remove race from oil pump.



252L100001

3. **OD planetary gear and OD direct clutch**

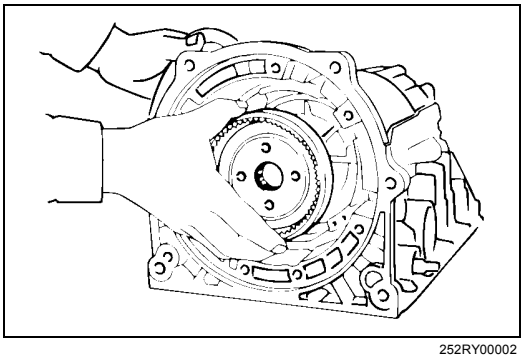
   Remove the overdrive planetary gear and overdrive direct clutch with thrust needle bearing from the transmission case.



252L100017

4. **Race**

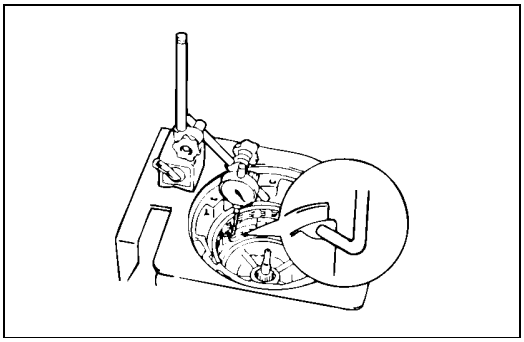
   Remove the race from OD planetary gear.



252RY00002

5. **OD planetary ring gear**

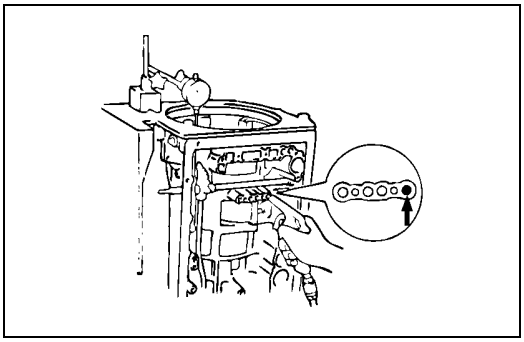
   Remove the overdrive planetary ring gear from the transmission case.



252RY00003

Check piston stroke of overdrive brake

Place a dial indicator onto the overdrive brake piston as shown in the figure.



244RY00001

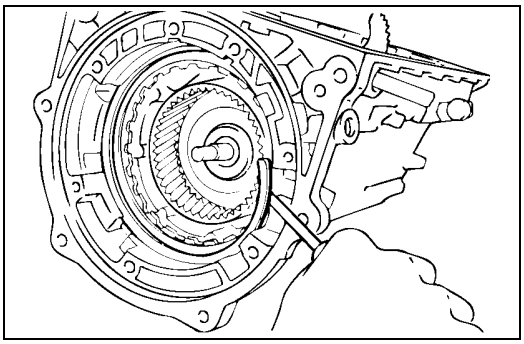
Measure the stroke applying and releasing the compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown in the figure.

Piston stroke: 1.40 – 1.70 mm (0.0551 – 0.0669 in)

If the values are nonstandard, select another flange.

Available flange sizes

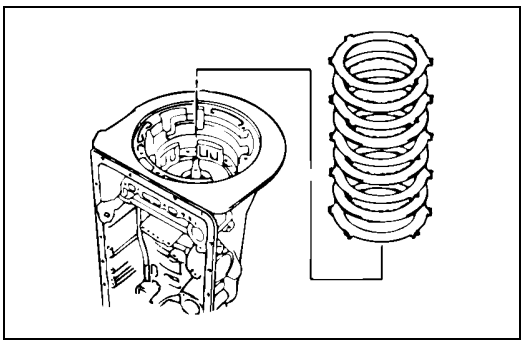
3.3 mm (0.130 in)	3.8 mm (0.150 in)
3.5 mm (0.138 in)	3.9 mm (0.154 in)
3.6 mm (0.142 in)	4.0 mm (0.158 in)
3.7 mm (0.146 in)	



246RY00001

6. Snap ring

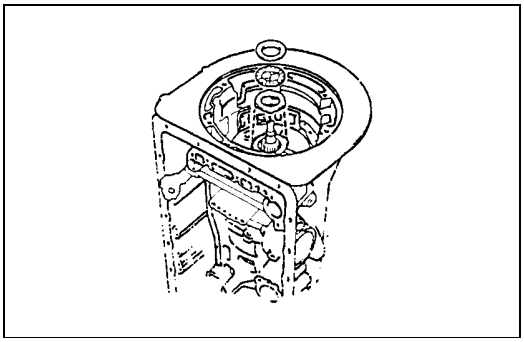
Remove the snap ring.



246RY00026

7. Flange, plate and disc (B-0)

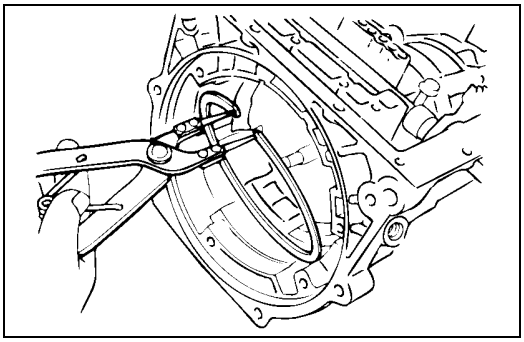
Remove two flange, three plates and four discs.



247RY00003

8. Bearing and race

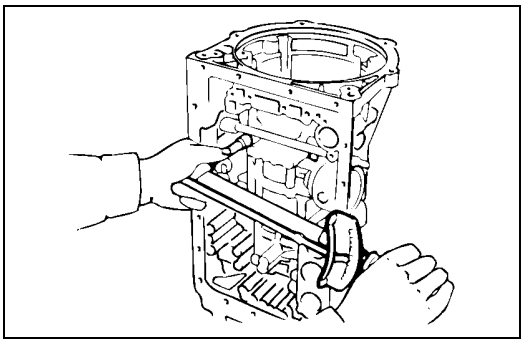
Remove the thrust bearing and two races.



246RY00002

9. Snap ring

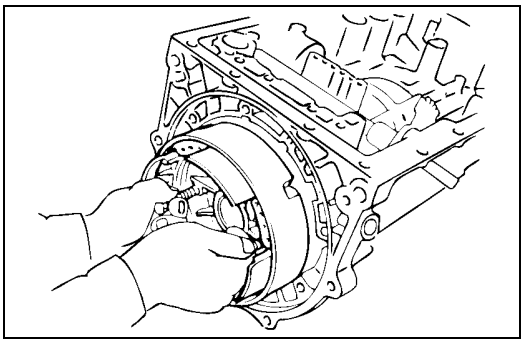
Using snap ring pliers, remove the snap ring.



252RY00004

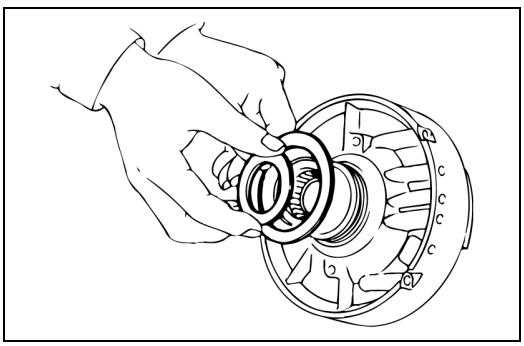
10. OD support

Remove two bolts fixing the overdrive support assembly to the transmission case.



252RY00005

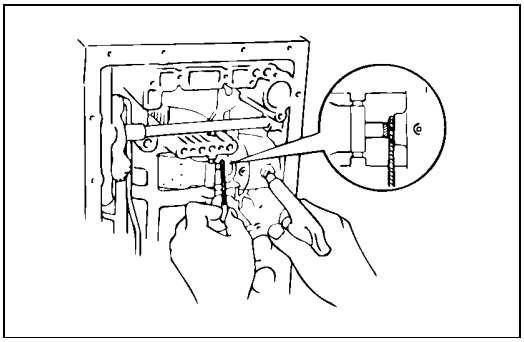
Install two removed bolts to the OD support, and pull out the OD support assembly.



252RY00006

11. Race

Remove the race from OD support.



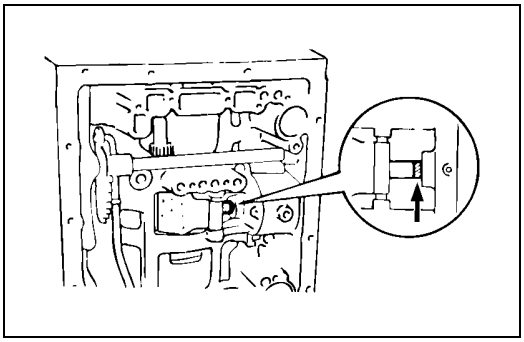
248RY00004

Check piston stroke of second coast brake (B-1)

Place a mark on the second coast brake piston rod as shown in the figure.

Using feeler gauge, measure the stroke applying the compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown in the figure.

Piston stroke: 1.5 – 3.0 mm (0.059 – 0.118 in)



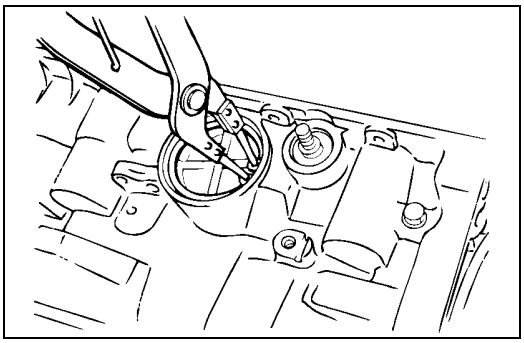
248RY00005

If the values are nonstandard, replace piston rod and recheck piston stroke.

If piston stroke is nonstandard, replace brake band.

There are two piston rods.

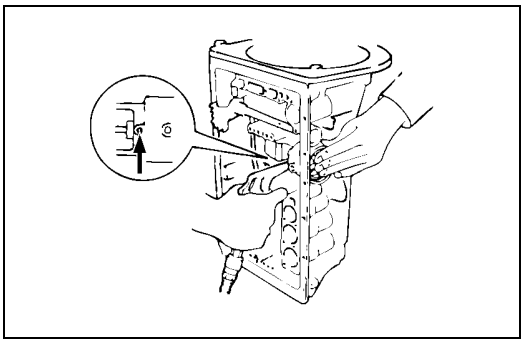
Rod length	71.4 mm (2.811 in) 72.9 mm (2.870 in)



248RY00006

12. Snap ring

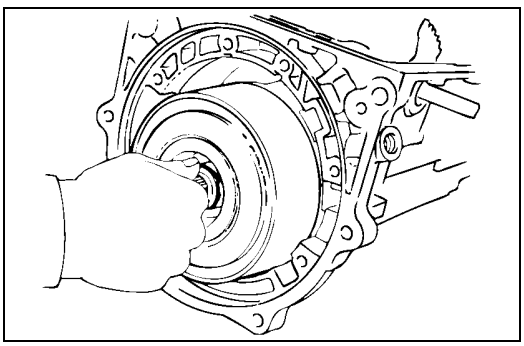
Using snap ring pliers, remove the snap ring.



248RY00007

13. Second coast brake piston assembly

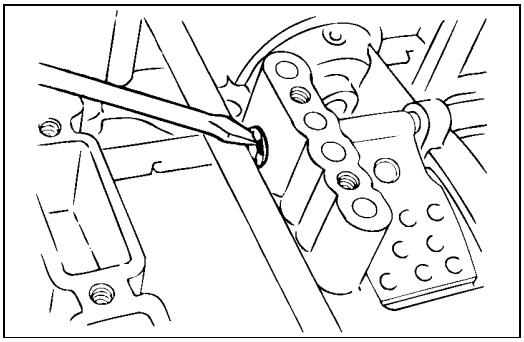
Applying compressed air to the oil hole, remove the second coast brake piston assembly.



248RY00008

14. Direct clutch and forward clutch

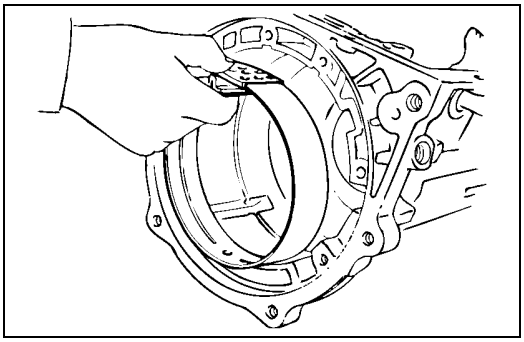
Remove the direct clutch and forward clutch from the transmission case.


248RY00009

15. E-ring and pin

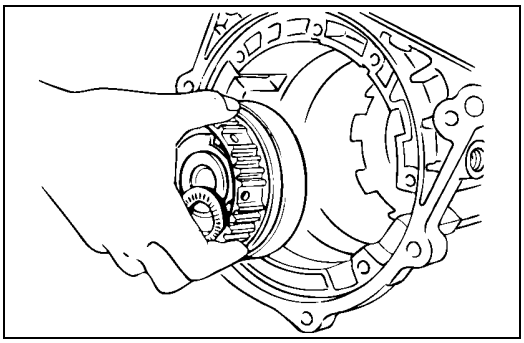
Remove the E-ring from the pin.

Remove the pin from the brake band.


248RY00010

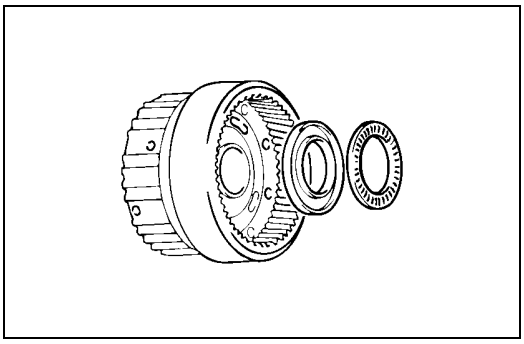
16. Second coast brake band

Remove the second coast brake band from the transmission case.


247RY00004

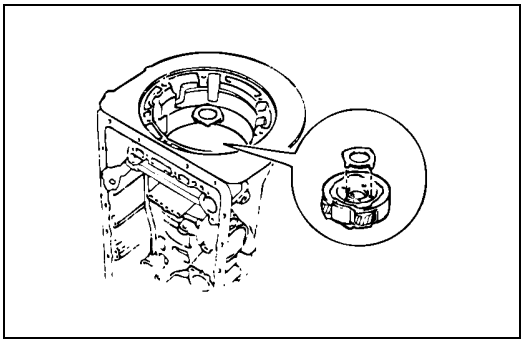
17. Front planetary ring gear

Remove the front planetary ring gear from the transmission case.


247RY00005

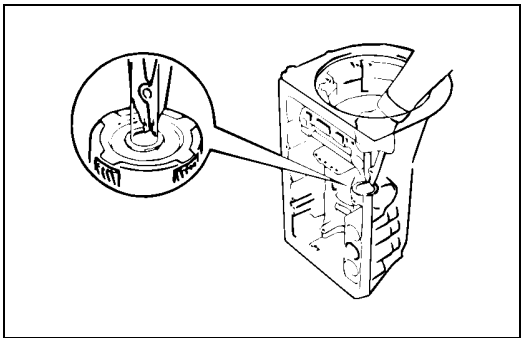
18. Bearing and race

Remove the bearing and race.


247RY00006

19. Race

Remove the race.



248RY00011

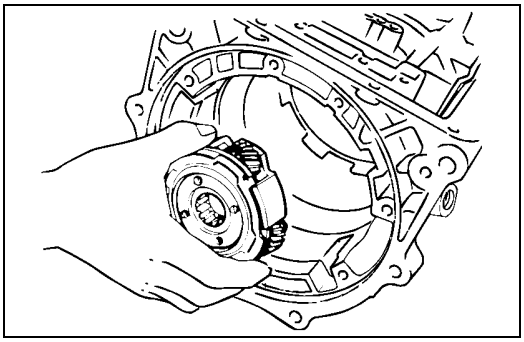
20. Snap ring

Using snap ring pliers, remove the snap ring.

NOTE:

Hold the output shaft to prevent it from falling.

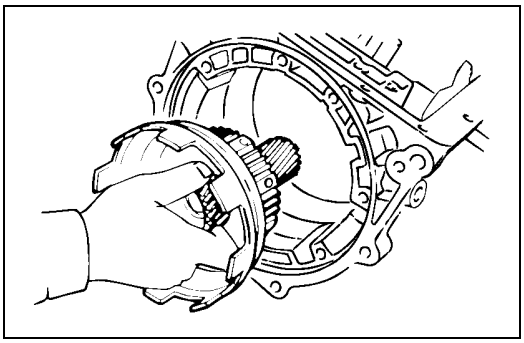
The output shaft falls when the snap ring is removed.



247RY00007

21. Front planetary gear

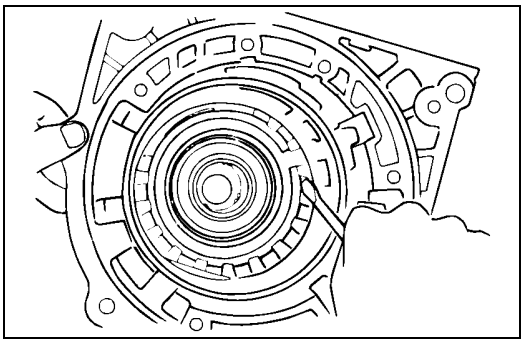
Remove the front planetary gear from the transmission case.



248RY00012

22. Drum and one-way clutch

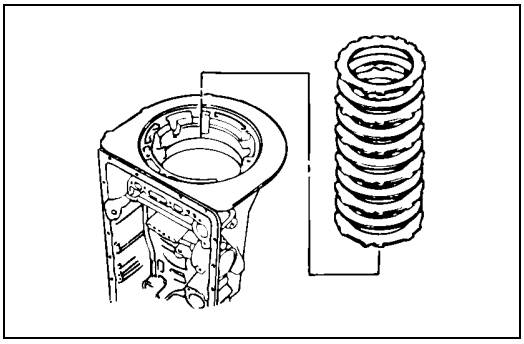
Remove sun gear input drum and one-way clutch.



248RY00014

23. Snap ring

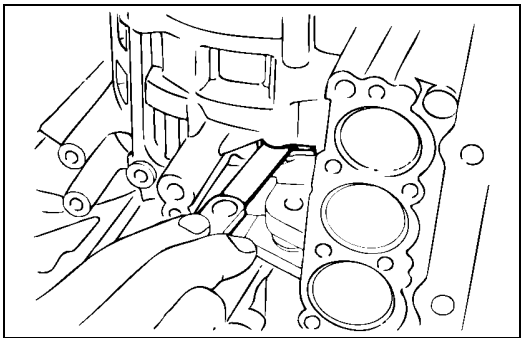
Using two screwdrivers, remove the snap ring.



248RY00015

24. Flange, plate and disc (B-2)

Remove the flange, five discs and five plates.



248RY00016

Check pack clearance of first and reverse brake (B-3)

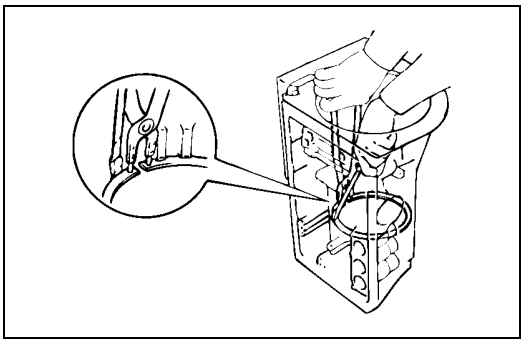
Using a feeler gauge, measure the clearance between the plate and second brake drum as shown in the figure.

Clearance: 0.7 – 1.22 mm (0.0276 – 0.0480 in) (UBS)
: 0.6 – 1.12 mm (0.0236 – 0.0441 in) (TFR/S)

If the values are nonstandard, replace the discs.

Available flange sizes

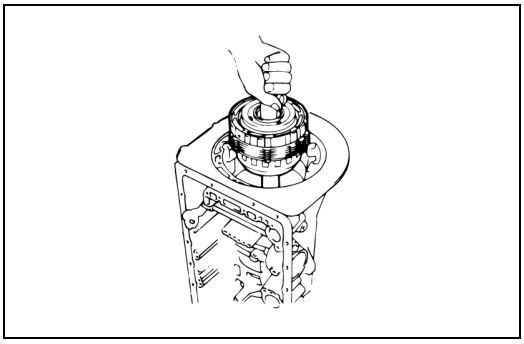
4.0 mm (0.158 in)	4.8 mm (0.189 in)
4.2 mm (0.165 in)	5.0 mm (0.197 in)
4.4 mm (0.173 in)	5.2 mm (0.205 in)
4.6 mm (0.181 in)	5.4 mm (0.213 in)



248RY00017

25. Snap ring

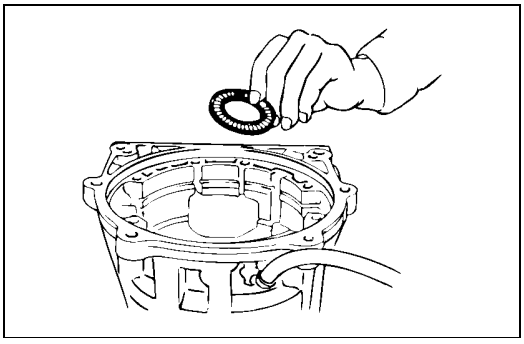
Using snap ring pliers, remove the snap ring.



247R200001

26. Rear planetary gear, second brake drum and output shaft

Remove the rear planetary gear, second brake drum and output shaft as an assembly.

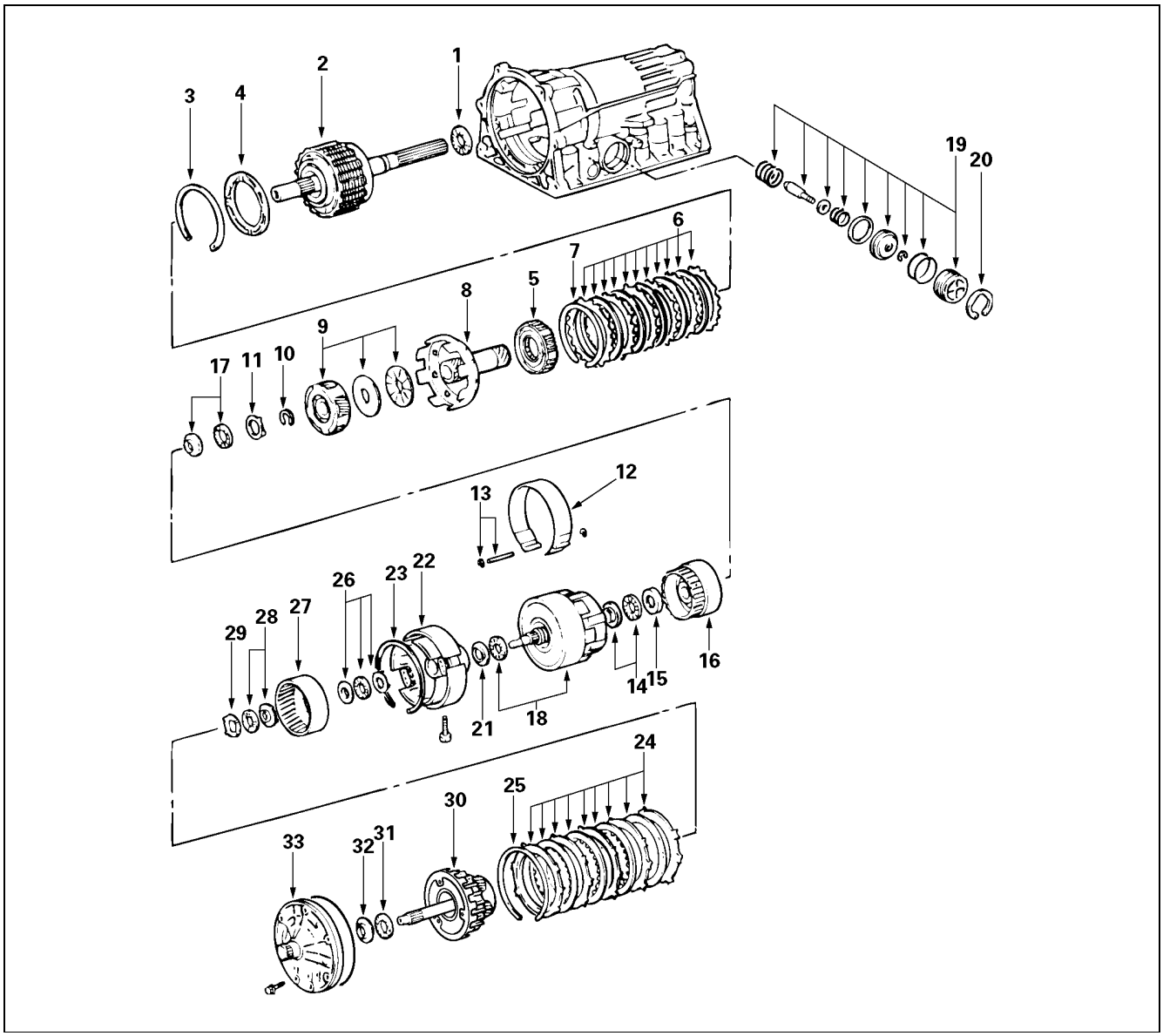


248RY00018

27. Bearing

Remove the assembled thrust bearing and race from the transmission case.

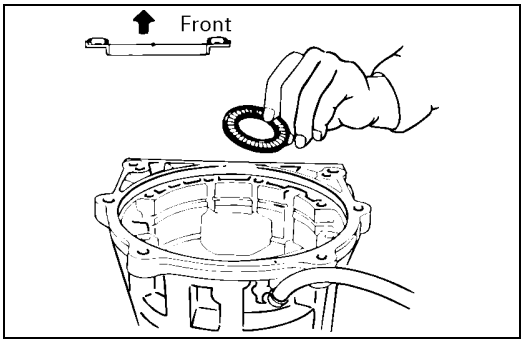
REASSEMBLY OF MAJOR COMPONENTS (3)



248L100002

Reassembly steps

1. Bearing
2. Rear planetary gear, second brake drum and output shaft
3. Snap ring
4. Second brake piston sleeve
5. One-way clutch
6. Flange, plate and disc (B-2)
7. Snap ring
8. Drum
9. Front planetary gear and bearing
10. Snap ring
11. Race
12. Second coast brake band
13. E-ring and pin
14. Bearing and race
15. Race
16. Front planetary ring gear
17. Bearing and race
18. Direct clutch and forward clutch
19. Second coast brake piston assembly
20. Snap ring
21. Race
22. OD support
23. Snap ring
24. Flange, plate and disc (B-0)
25. Snap ring
26. Bearing and race
27. OD planetary ring gear
28. Bearing and race
29. Race
30. OD planetary gear and OD direct clutch
31. Bearing
32. Race
33. Oil pump



247RY00008

Reassembly steps

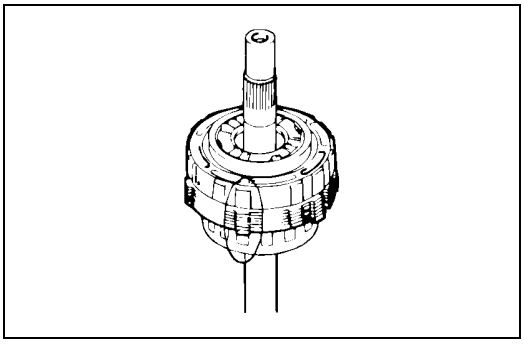
1. **Bearing**

   Coast the assembled bearing and race with petroleum jelly and install it onto the transmission case.

   Assembled bearing and race

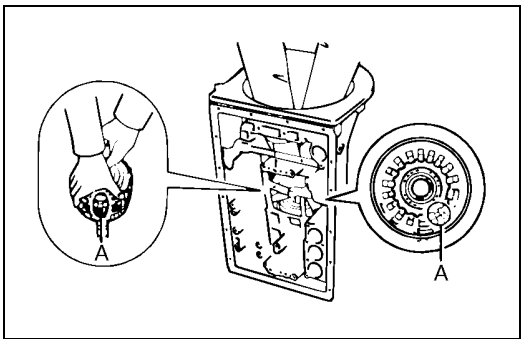
   (Reference)

Bearing and race	Diameter
Inside	39.38 mm (1.550 in)
Outside	58.15 mm (2.289 in)


247RY00009

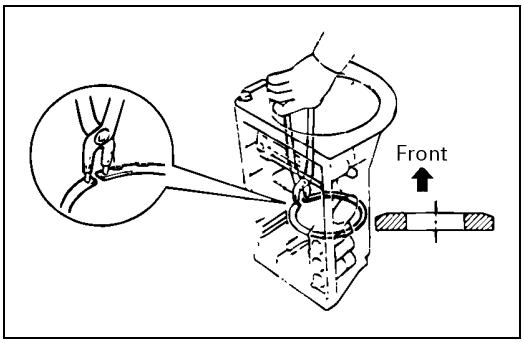
2. **Rear planetary gear, second brake drum and output shaft.**

   Align the teeth of the second brake drum, flanges, discs and plates as shown in the figure.



247RY00010

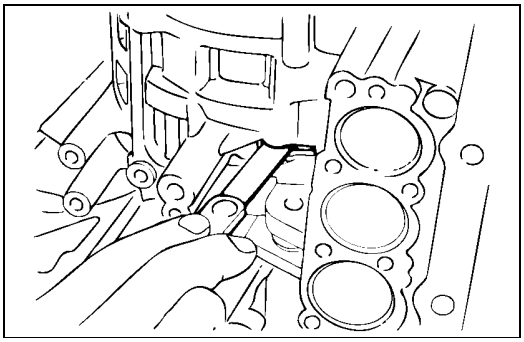
   Align the splines of the transmission case and the assembled rear planetary gear, second brake drum and output shaft, indicated by A in the figure.



246RY00003

3. **Snap ring**

   Using snap ring pliers, install the snap ring.

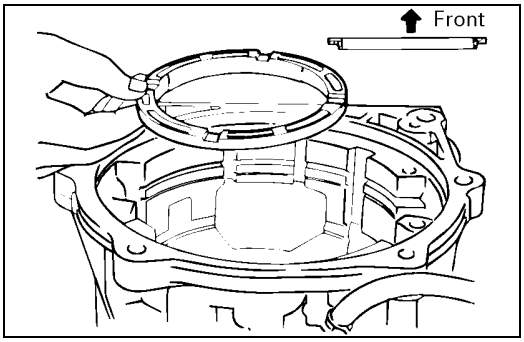

248RY00016

Check pack clearance of first and reverse brake

Using a thickness gauge, measure the clearance between the plate and second brake drum as shown in the figure.

Clearance: 0.7 – 1.22 mm (0.0276 – 0.0480 in) (UBS)
0.6 – 1.12 mm (0.0236 – 0.0441 in) (TFR/S)

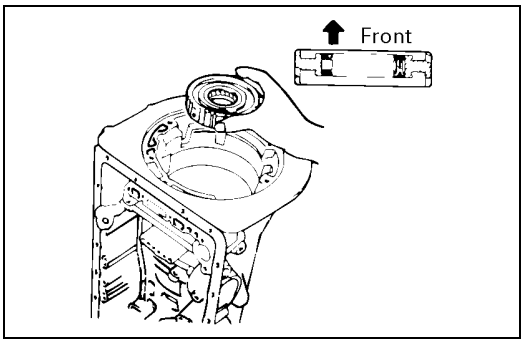
If the values are nonstandard, check for an improper installation.



246RY00004

4. Second brake piston sleeve

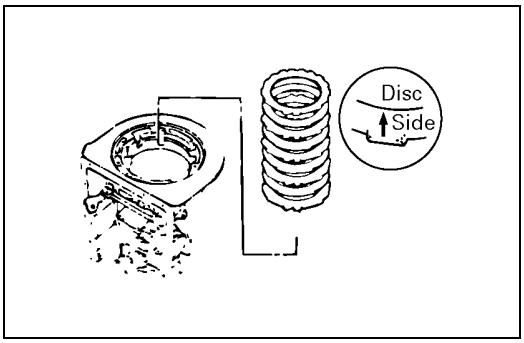
Install second brake piston sleeve.



247RY00011

5. One-way clutch

Install one-way clutch.



246RY00005

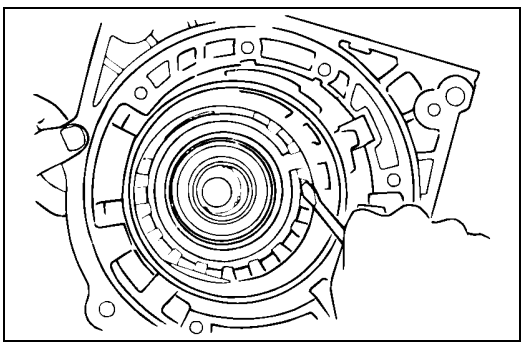
6. Flange, plate and disc (B-2)

Install flange, discs and plates.

Install the 2.5 mm (0.098 in) thick plate with the rounded edge side of the plate facing the disc.

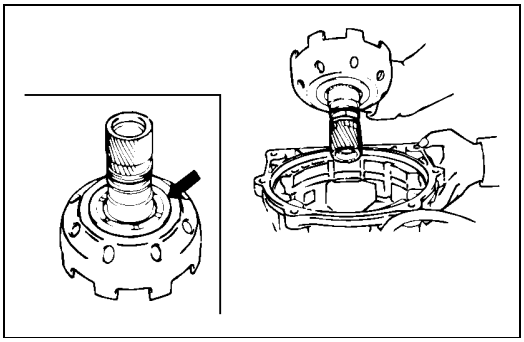
Alternately install five discs and five plates (Disc first)

Install the flange with the rounded edge of the flange facing the disc.


248RY00014

7. Snap ring

Install the snap ring.



248RY00020

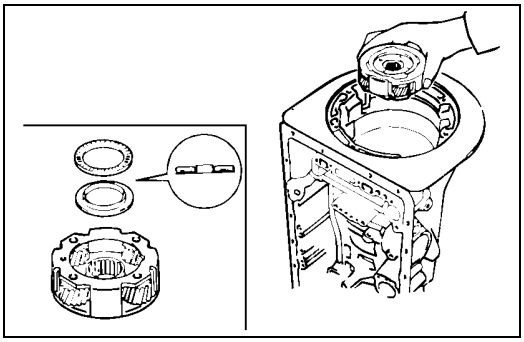
8. Drum

While turning the sun gear input drum clockwise.

Install it into the one-way clutch.

NOTE:

Confirm the thrust washers are installed correctly.



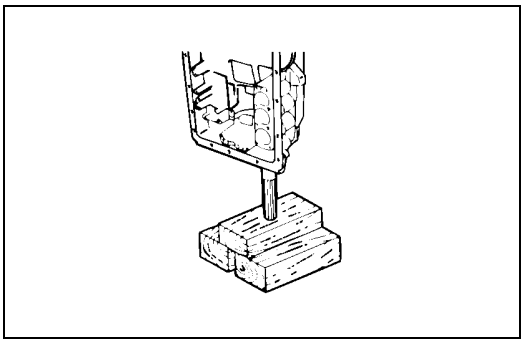
247RY00012

9. Front planetary gear and bearing

Install the front planetary gear to the sun gear.

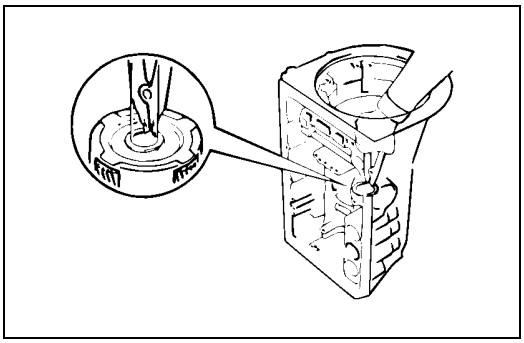
NOTE:

Confirm the bearing and race is installed correctly.



247RY00013

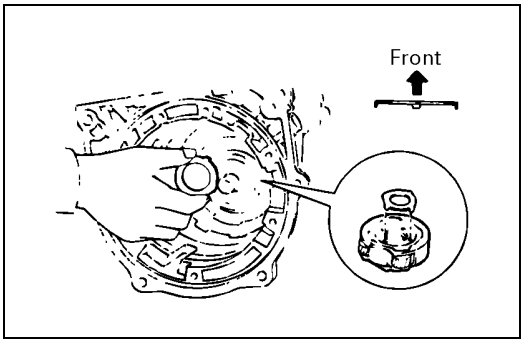
With wooden blocks under the output shaft, stand the transmission on the output shaft.



248RY00011

10. Snap ring

Using snap ring pliers, install the snap ring.



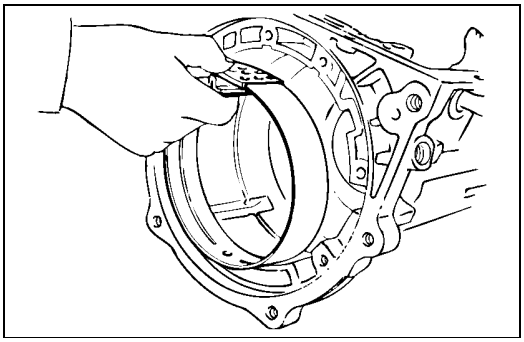
247RY00014

11. Race

Coat the bearing race with petroleum jelly and install it onto the front planetary gear.

Bearing race diameter (Reference)

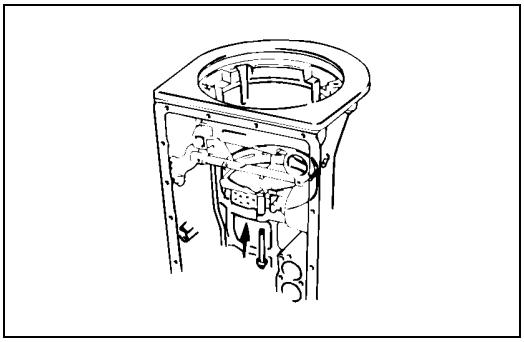
Bearing race	Diameter
Inside	34.3 mm (1.350 in)
Outside	47.8 mm (1.882 in)



248RY00010

12. Second coast brake band

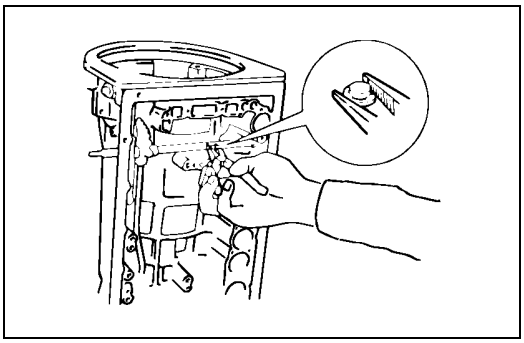
Insert the second coast brake band to the transmission case.



248RY00021

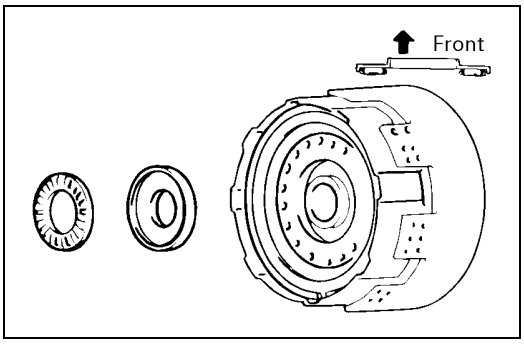
13. E-ring and pin

Install the pin through the brake band.



248RY00022

Install the E-ring to the pin.



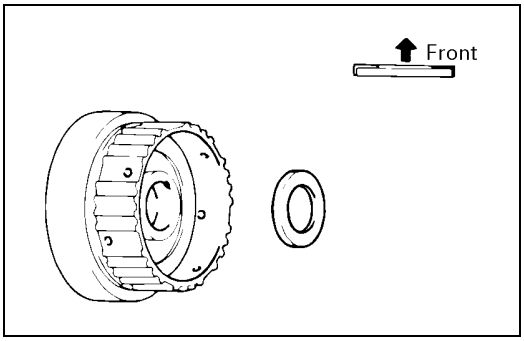
248RY00023

14. Bearing and race

Coat the bearing and race with petroleum jelly and install them onto the forward clutch.

Bearing and race diameter (Reference)

	Inside	Outside
Bearing	26.0 mm (1.024 in)	46.7 mm (1.839 in)
Race	26.0 mm (1.024 in)	48.9 mm (1.925 in)



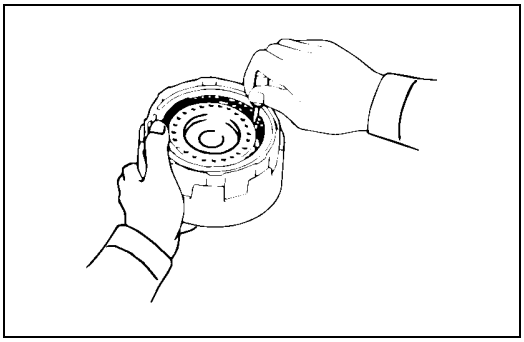
247RY00015

15. Race

Coat the race with petroleum jelly and install it onto the front planetary ring gear.

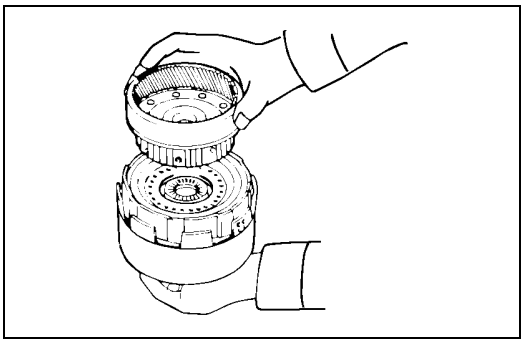
Race diameter (Reference)

	Inside	Outside
Race	26.8 mm (1.055 in)	47.0 mm (1.850 in)



247RY00016

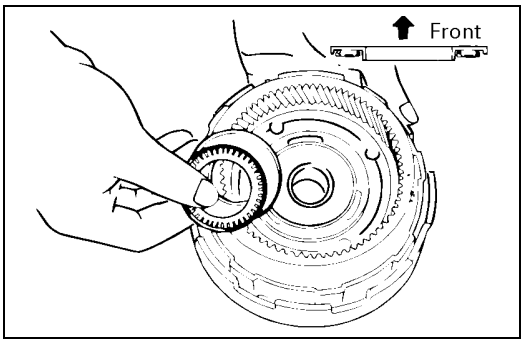
Align the flukes of the discs in the forward clutch.



247RY00017

16. Front planetary ring gear

Align the spline of the front planetary gear with the flukes of the discs and install the front planetary gear to the forward clutch.



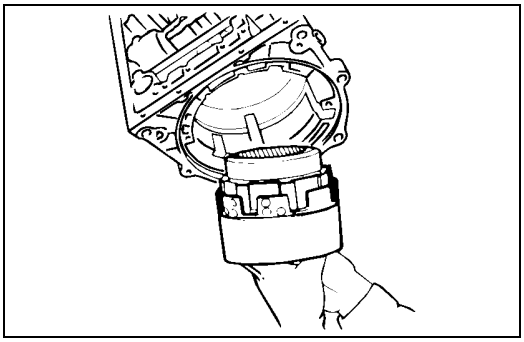
247RY00019

17. Bearing and race

Coat the bearing and race with petroleum jelly and install them onto the ring gear.

Bearing and race diameter (Reference)

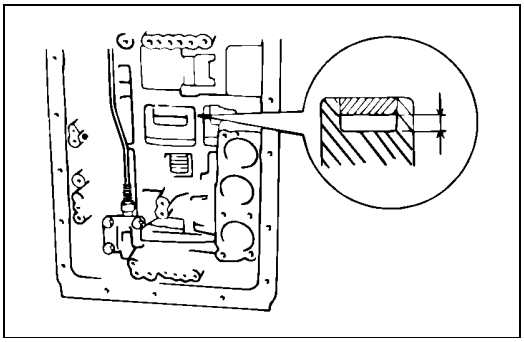
	Inside	Outside
Bearing	32.6 mm (1.283 in)	47.7 mm (1.878 in)
Race	30.6 mm (1.205 in)	53.6 mm (2.110 in)



247RY00018

18. Direct clutch and forward clutch

Install the assembled direct clutch, forward clutch and front planetary ring gear into the transmission case.

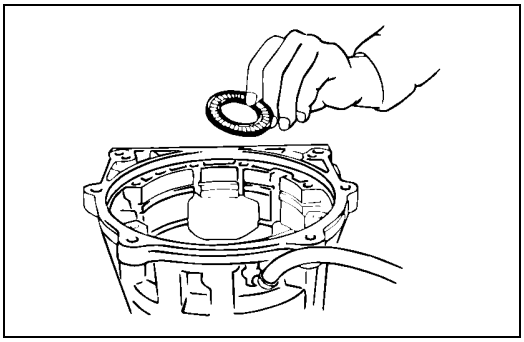


248RY00024

Using vernier calipers, measure the distance between the sun gear input drum and direct clutch drum as shown in the figure.

Height: 9.8 – 11.8 mm (0.386 – 0.465 in)

If the values are nonstandard, check for an improper installation.



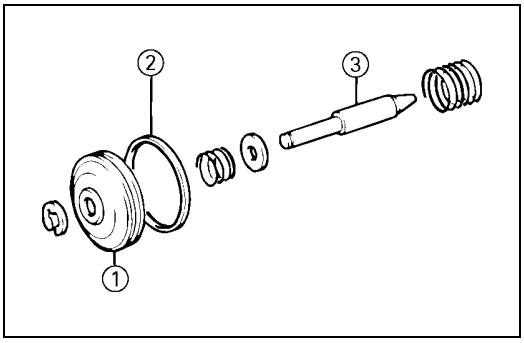
248RY00025

Coat the assembled bearing and race with petroleum jelly and install it onto the forward clutch.

Assembled bearing and race diameter

(Reference)

	Inside	Outside
Bearing and race	29.1 mm (1.146 in)	50.2 mm (1.976 in)



248RY00026

19. Second coast brake piston assembly

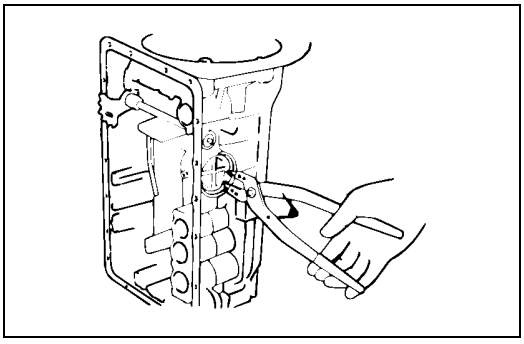
Coat the oil seal ring with ATF and install it to the second coast brake piston.

Install the washer, spring and piston to the piston rod. Install the E-ring.

①: Second coast brake piston

②: Oil seal

③: Piston rod



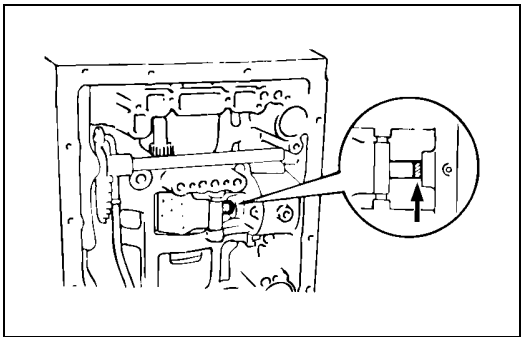
248RY00027

20. Snap ring

Coat two new oil seals with ATF and install them to the piston cover.

Install the spring, second coast brake piston assembly and piston cover to the transmission case.

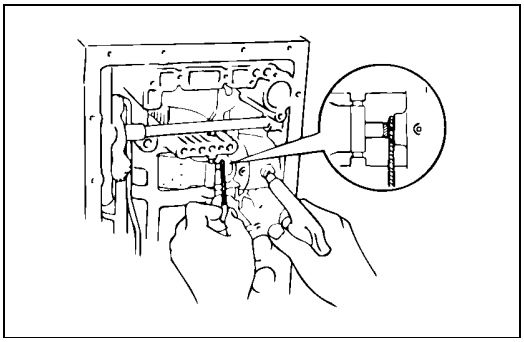
Using snap ring pliers, install the snap ring.



248RY00005

Check piston stroke of second coast brake

Place a mark on the second coast brake piston rod as shown in the figure.

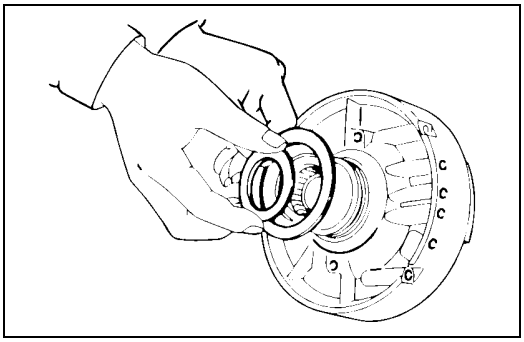


248RY00004

Using wire gauge, measure the stroke by applying the compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown in the figure.

Piston stroke: 1.5 – 3.0 mm (0.059 – 0.118 in)

If the values are nonstandard, check for an improper installation.



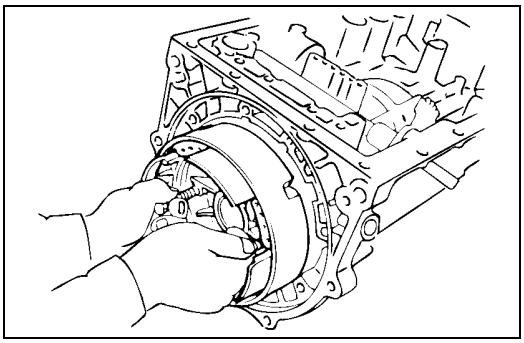
252RY00007

21. Race

Coat the race with petroleum jelly and install it onto the overdrive support assembly.

Race diameter (Reference)

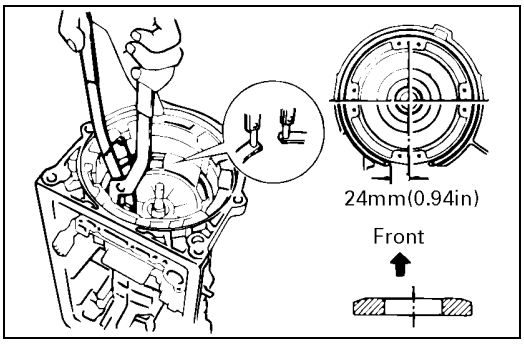
	Inside	Outside
Race	28.45 mm (1.120 in)	47.3 mm (1.862 in)



252RY00005

22. OD support

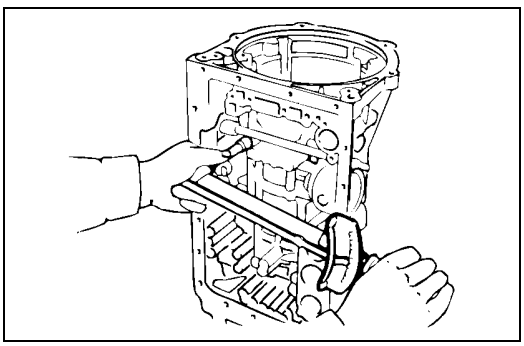
Aim the bolt and oil holes of the overdrive support toward the valve hole side, and align them with the bolt hole of the transmission case and insert.



252RY00008

23. Snap ring

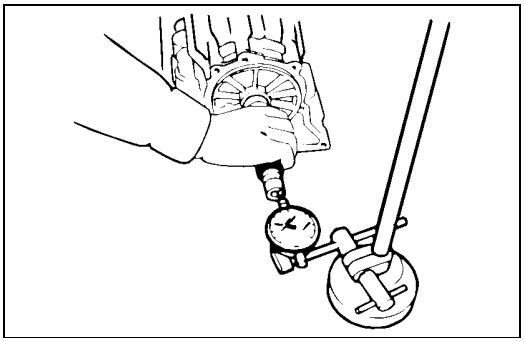
Using snap ring pliers, install the snap ring as shown in the figure.



252RY00004

Install and tighten the two bolts.

Torque: 25 N·m (2.6 kg·m/19 lb·ft)

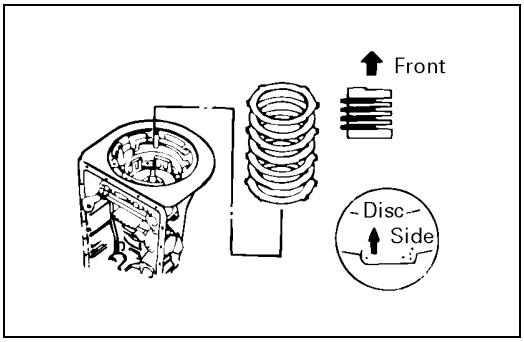


247RY00020

Check end of output shaft

Using a dial indicator, measure the end play of the output shaft by hand.

End play: 0.27 – 0.86 mm (0.0106 – 0.0339 in)

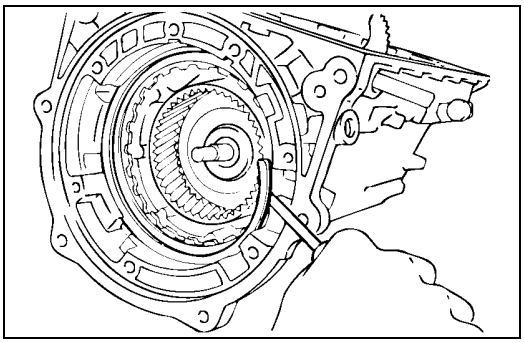


252RY00009

24. Flange, plate and disc (B-0)

Install the (flat ring) 4.0 mm (0.157 in) thick flange with the rounded edge side of the flange facing the disc.

Alternately install four discs and three plates. (Disc first)



246RY00001

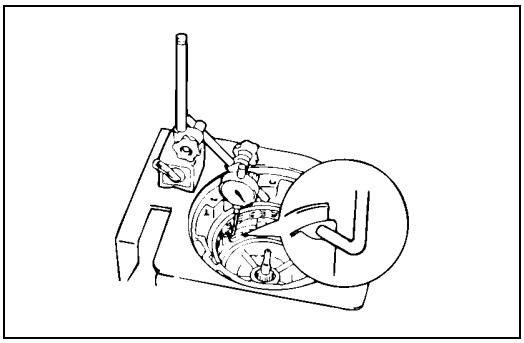
25. Snap ring

Install the (stepped ring) flange with the flat side of the flange facing the disc.

Install the snap ring.

Snap ring (Reference)

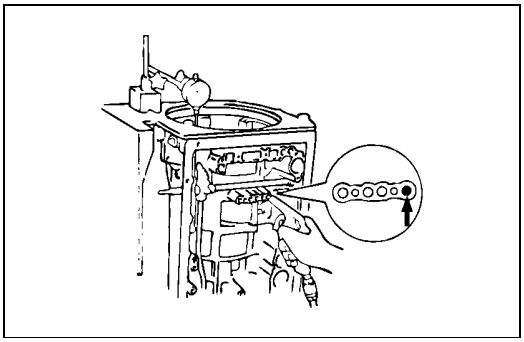
Inside diameter	167.9 mm (6.61 in)



252RY00003

Check piston stroke of overdrive brake

Place a dial indicator onto the overdrive brake piston as shown in the figure.



244RY00001

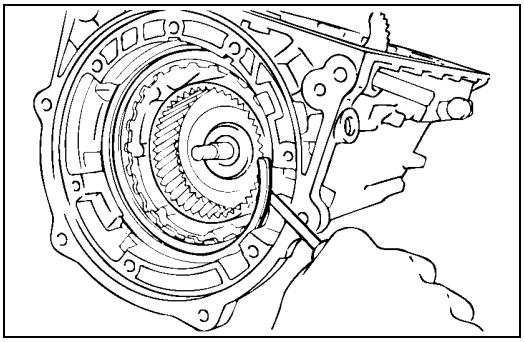
Measure the stroke by applying and releasing the compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown in the figure.

Piston stroke: 1.40 – 1.70 mm (0.0551 – 0.0669 in)

If the values are nonstandard, check for an improper installation.

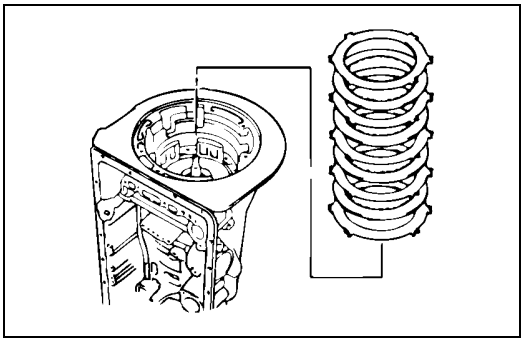
Available flange size

3.3 mm (0.130 in)	3.8 mm (0.150 in)
3.5 mm (0.138 in)	3.9 mm (0.154 in)
3.6 mm (0.142 in)	4.0 mm (0.158 in)
3.7 mm (0.146 in)	



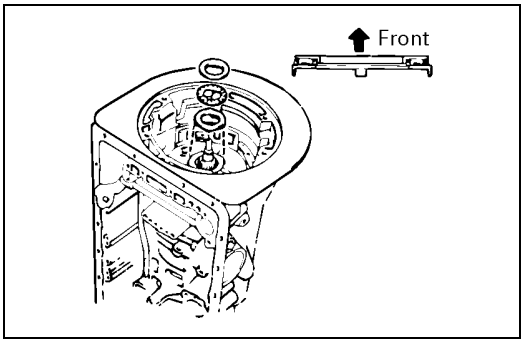
246RY00001

Remove the snap ring.



246RY00026

Remove two flanges, three plates and four discs.



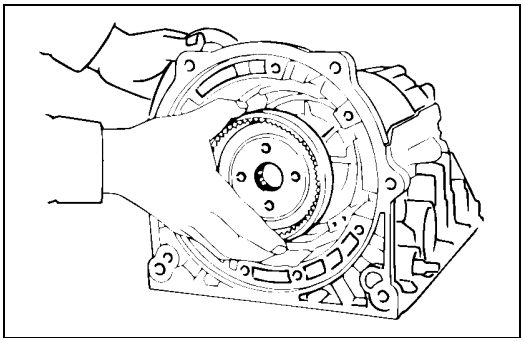
252RY00010

26. Bearing and race

Coat the bearing and races with petroleum jelly and install them onto the overdrive support.

Bearing and races diameter (Reference)

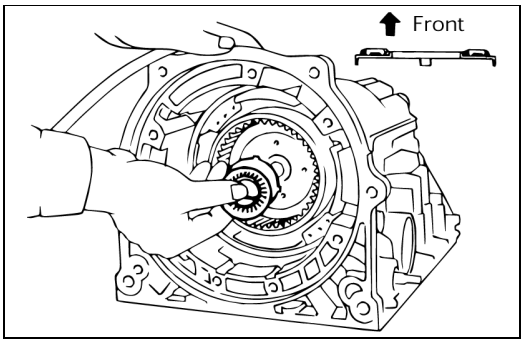
	Inside	Outside
Race (Front)	37.2 mm (1.465 in)	58.8 mm (2.315 in)
Bearing and race (Rear)	33.7 mm (1.327 in)	50.1 mm (1.972 in)



252RY00002

27. OD planetary ring gear

Install the overdrive planetary ring gear.



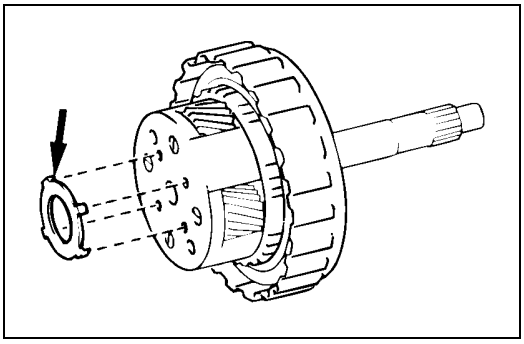
252RY00011

28. Bearing and race

Coat the bearing and race with petroleum jelly and install them onto the planetary ring gear.

Bearing and race diameter (Reference)

	Inside	Outside
Bearing and race	24.2 mm (0.953 in)	47.8 mm (1.882 in)



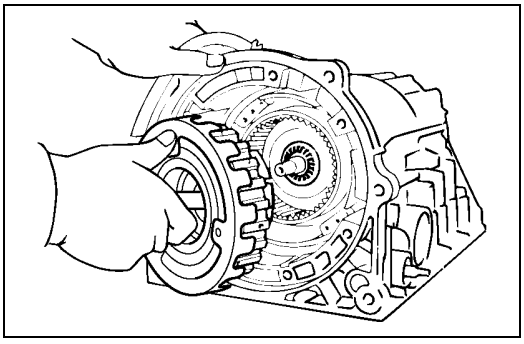
252RY00001

29. Race

Coat the race with petroleum jelly and install it onto the planetary gear.

Race diameter (Reference)

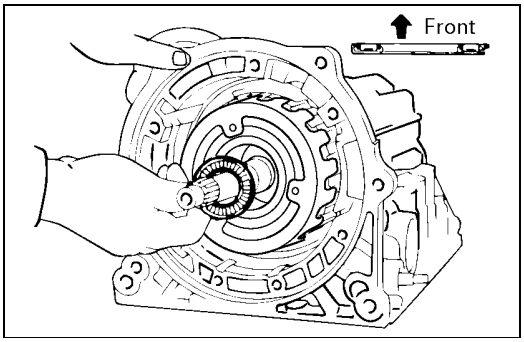
	Inside	Outside
Race	24.7 mm (0.972 in)	41.8 mm (1.646 in)



252L100001

30. OD planetary gear and OD direct clutch

Install the overdrive planetary gear and direct clutch.



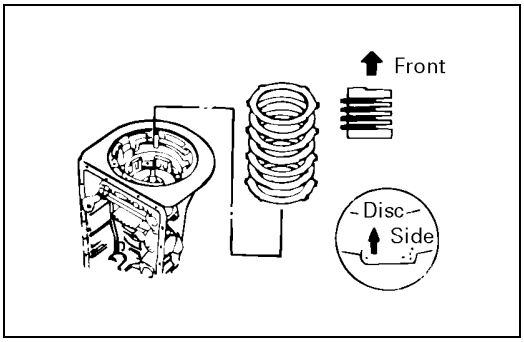
252L100018

31. Bearing

Coat the assembled bearing and race with petroleum jelly and install it onto the direct clutch.

Bearing and race diameter (Reference)

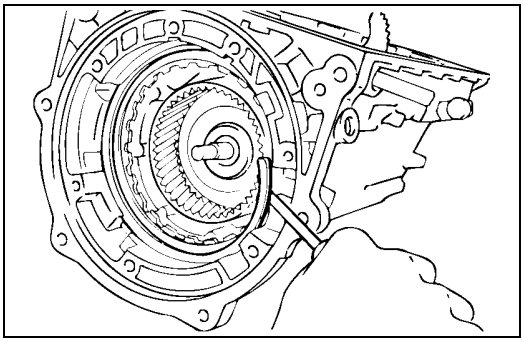
	Inside	Outside
Bearing and race	28.9 mm (1.138 in)	50.2 mm (1.976 in)



252RY00009

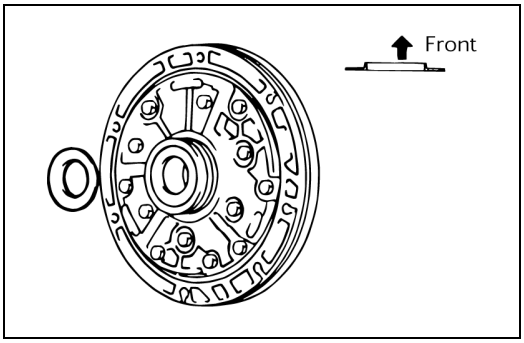
Install the (flat ring) 4.0 mm (0.157 in) thick flange with the rounded edge side of the flange facing the disc.

Alternately install four discs and three plates. (Disc first)


246RY00001

Install the (stepped ring) flange with the flat side of the flange facing the disc.

Install the snap ring.



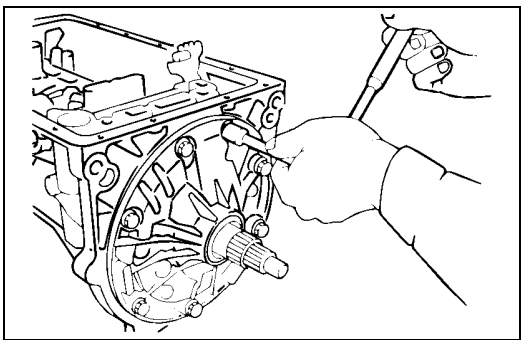
252RY00014

32. Race

Coat the race with petroleum jelly and install it onto the oil pump.

Race diameter (Reference)

	Inside	Outside
Race	28.6 mm (1.126 in)	46.5 mm (1.831 in)



241RY00003

33. Oil pump

Coat the O-ring with ATF and install it around the pump body.

Place the oil pump through the input shaft, and align the bolt holes of the pump body with the transmission case.

Hold the input shaft, and lightly press the oil pump body to slide the oil seal rings on the stator shaft through the direct clutch drum.

CAUTION:

Do not push on the oil pump strongly or the oil seal ring will stick to the direct clutch drum.

Install the seven bolts.

Torque: 22 N·m (2.2 kg·m/16 lb·ft)

Check input shaft rotation

Make sure the input shaft rotates smoothly.

DISASSEMBLY, INSPECTION AND REASSEMBLY OF MINOR COMPONENTS

NOTE:

The instructions here are organized so that you work on only one component group at a time.
This will help avoid confusion from similar-looking parts of different subassemblies being on your workbench at the same time.
The component groups are inspected and repaired from the converter housing side.
As much as possible, complete the inspection, repair and reassembly before proceeding to the next component group. If a component group cannot be reassembled because parts are being ordered, be sure to keep all parts of that group in separate container while proceeding with disassembly, inspection, repair and reassembly of other component groups.
Recommended ATF type BESCO ATF Ⅲ.

GENERAL CLEANING NOTES:

1. All disassembled parts should be washed clean and any fluid passages and holes blown through with compressed air.
2. When using compressed air to dry parts, always aim away from yourself to prevent accidentally spraying automatic transmission fluid in your face.
3. The recommended automatic transmission fluid should be used for cleaning.

PARTS ARRANGEMENT:

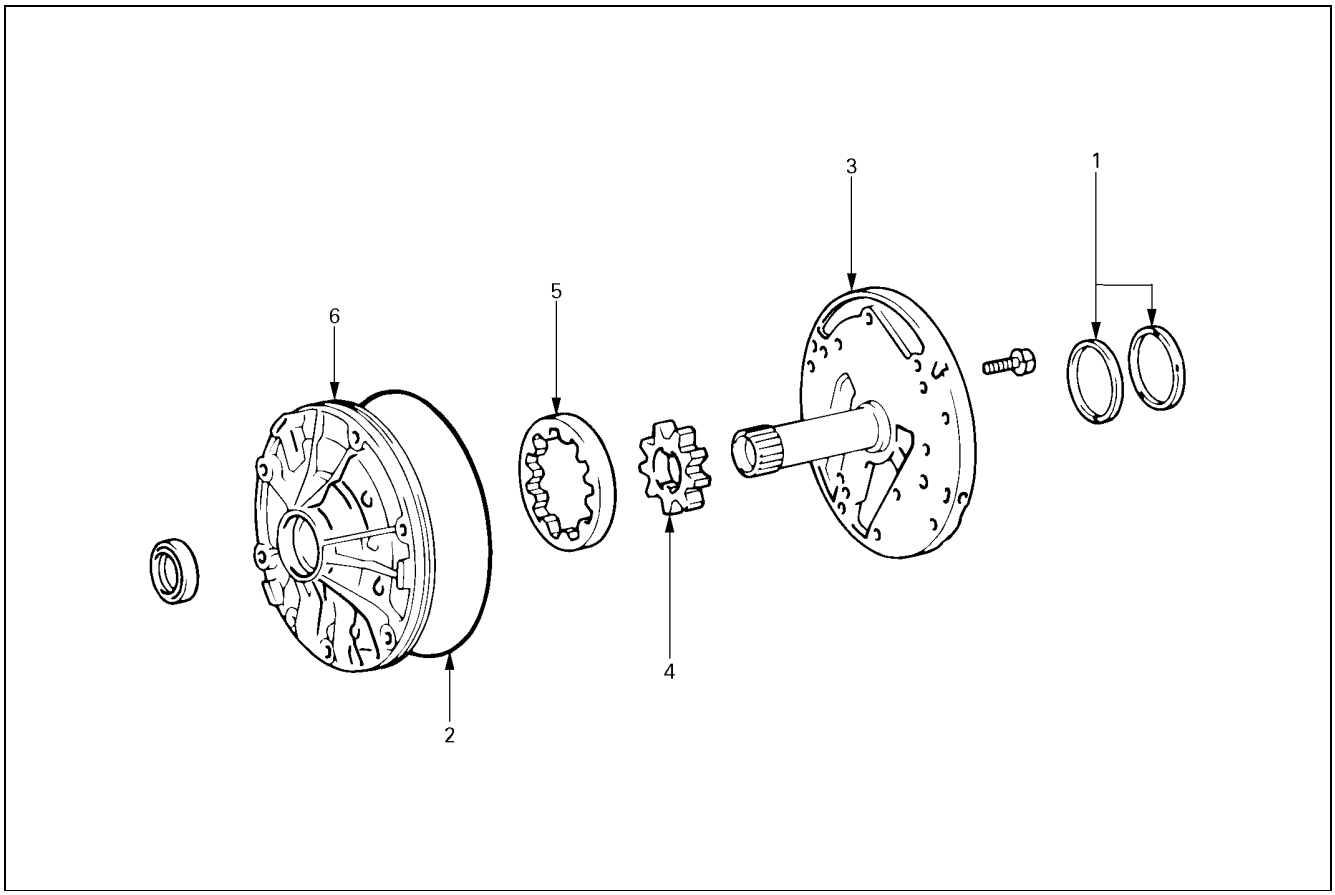
1. After cleaning, the parts should be arranged in proper order to allow performing inspection, repairs, and reassembly with efficiency.
2. When disassembling a valve body, be sure to keep each valve together with the corresponding spring.
3. New brakes and clutches that are to be used for replacement must be soaked in transmission fluid for at least thirty minutes before assembly.

GENERAL ASSEMBLY:

1. All oil seal rings, clutch discs, clutch plates, rotating parts, and sliding surfaces should be coated with transmission fluid prior to reassembly.
2. All gaskets and rubber O-ring should be replaced.
3. Make sure that the ends of a snap ring are not aligned with one of the cutouts and are installed in the groove correctly.
4. If a worn bushing is to be replaced, the subassembly containing that bushing must be replaced.
5. Check thrust bearings and races for wear or damage. Replace if necessary.
6. Use petroleum jelly or vaseline to keep parts in place.

OIL PUMP

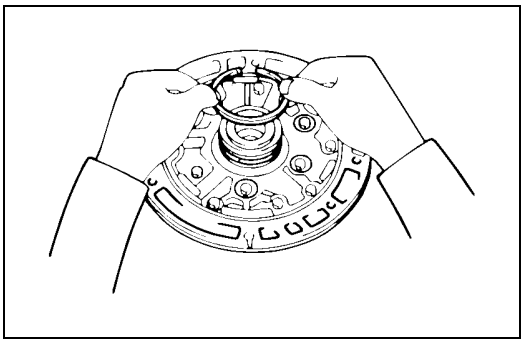
DISASSEMBLY



241R200003

Disassembly steps

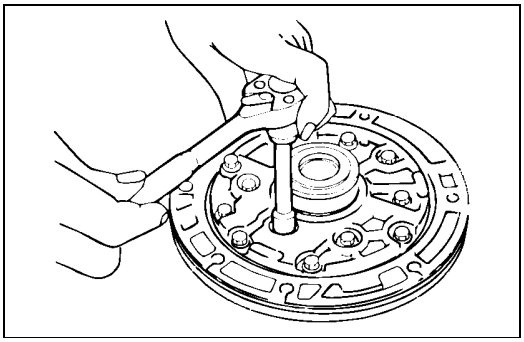
1. Oil seal ring
2. O-ring
3. Stator shaft
4. Oil pump drive gear
5. Oil pump driven gear
6. Oil pump body



241RY00005

Disassembly steps

1. **Oil seal ring**
   Use torque converter as work stand.
   Remove 2 oil seal rings from stator shaft.
2. **O-ring**
   Remove O-ring.



241RY00006

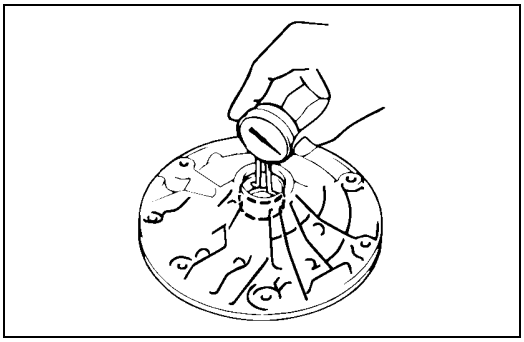
3. **Stator shaft**
4. **Oil pump drive gear**
5. **Oil pump driven gear**
6. **Oil pump body**

Remove 13 bolts, and then remove the stator shaft from oil pump body.

Then remove drive and driven gear.

INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage or any abnormal conditions are found through inspection.



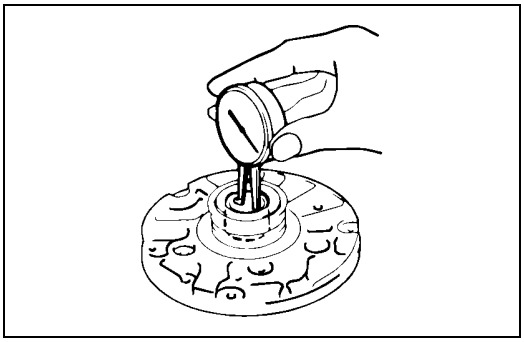
241RY00007

Check oil pump body bushing

Using a dial indicator, measure the inside diameter of the oil pump body bushing.

Maximum inside diameter: 38.19 mm (1.5035 in)

If the inside diameter is greater than the maximum, replace the oil pump body.



241RY00008

Check stator shaft bushing

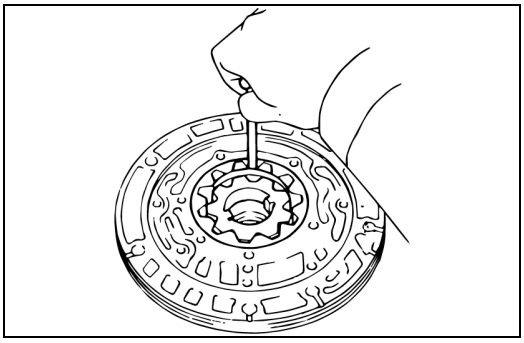
Using a dial indicator, measure the inside diameter of the stator shaft bushing.

Maximum inside diameter:

Front side: 21.58 mm (0.8496 in)

Rear side: 27.08 mm (1.0661 in)

If the inside diameter is greater than the maximum, replace the stator shaft.



241RY00009

Check tip clearance of both gears

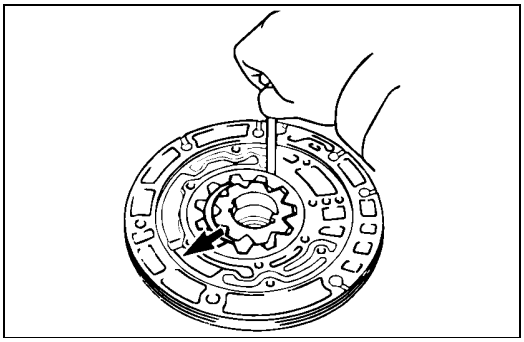
Measure between the gear teeth and the cresent-shaped part of the pump body.

Standard tip clearance: 0.11 – 0.14 mm

(0.0043 – 0.0055 in)

Maximum tip clearance: 0.19 mm (0.0075 in)

If the tip clearance is greater than the maximum, replace the drive gear, driven gear or pump body.



241RY00010

Check body clearance of driven gear

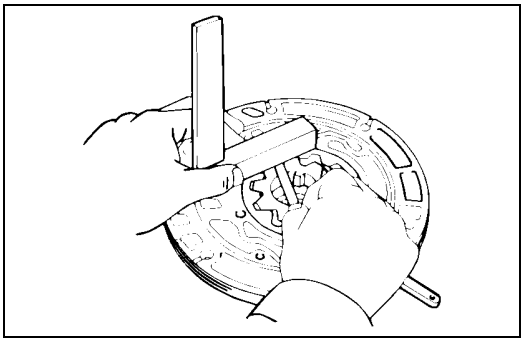
Push the driven gear to one side of the body.

Use a feeler gauge, measure the clearance.

Standard body clearance: 0.07 – 0.15 mm (0.0028 – 0.0059 in)

Maximum body clearance: 0.2 mm (0.0079 in)

If the body clearance is greater than the maximum, replace the drive gear, driven gear or pump body.



241RY00011

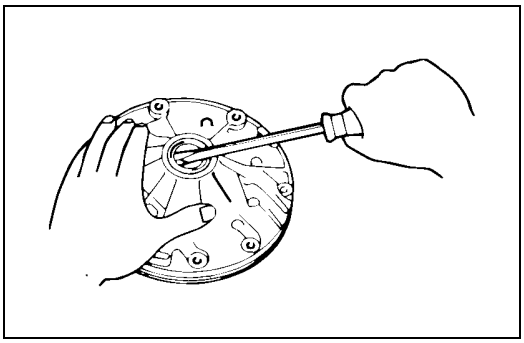
Check side clearance of both gears

Using a steel straightedge and a feeler gauge, measure the side clearance of both gears.

Standard side clearance: 0.02 – 0.05 mm (0.0008 – 0.0020 in)

Maximum side clearance: 0.1 mm (0.004 in)

If the side clearance is greater than the maximum, replace the drive gear, driven gear or pump body.



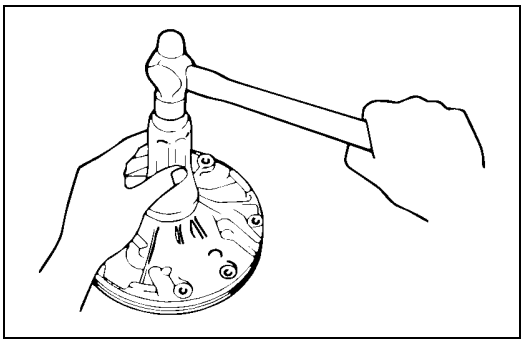
241RY00012

Check oil seal

Check for wear, damage or cracks.

If necessary, replace oil seal.

Pry off the oil seal with a screwdriver.



241RY00013

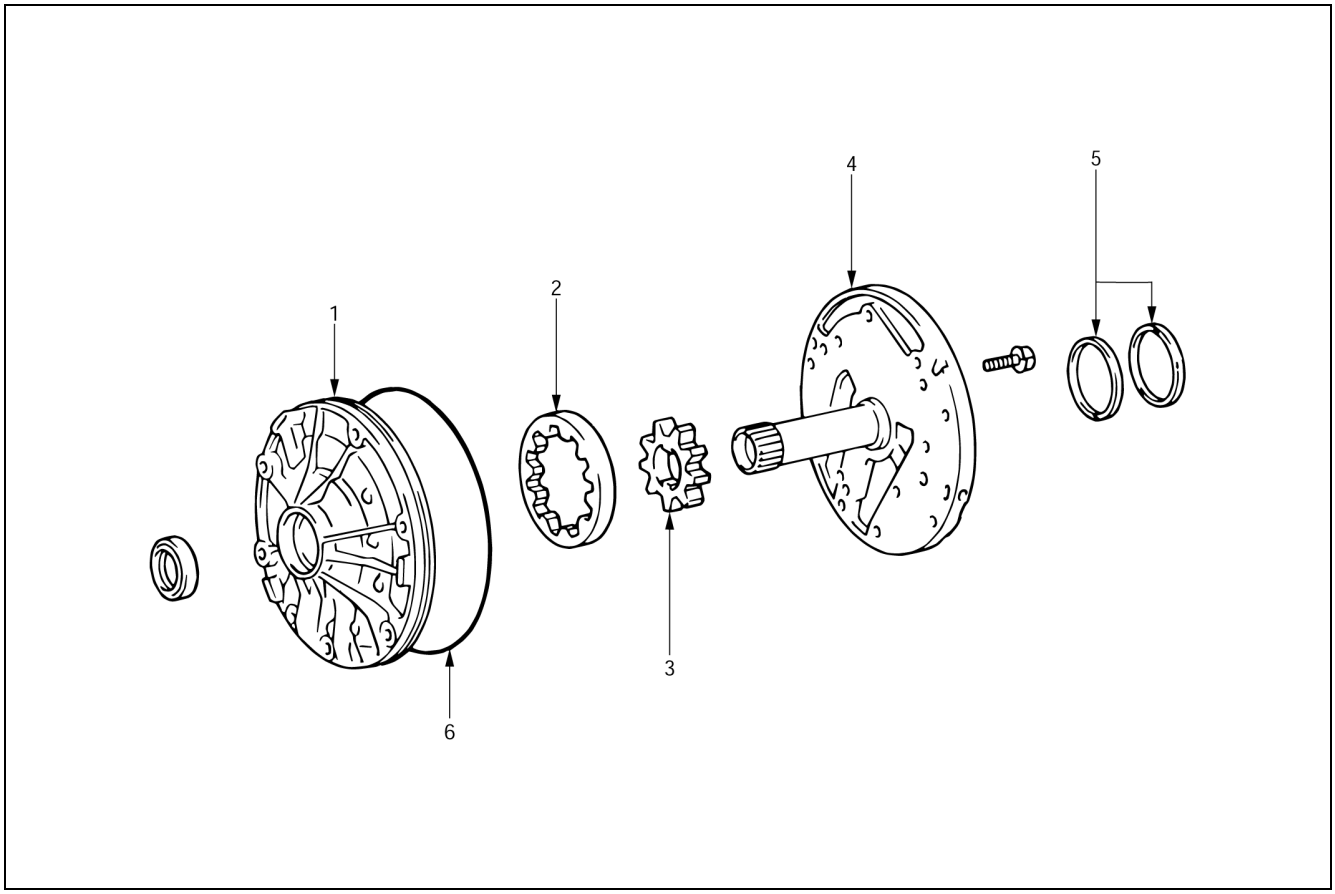
Using special tool, install a new oil seal.

The oil seal end should be flush with the outer edge of the pump body.

Oil seal installer : 5-8840-2256-0 (J-9617)

Coat the oil seal lip with multi purpose grease.

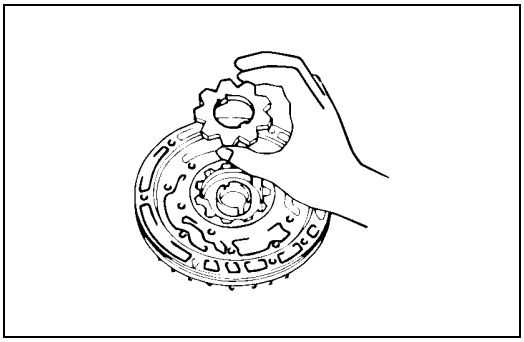
REASSEMBLY



241R200004

Reassembly steps

1. Oil pump body
2. Oil pump driven gear
3. Oil pump drive gear
4. Stator shaft
5. Oil seal ring
6. O-ring



241RY00014

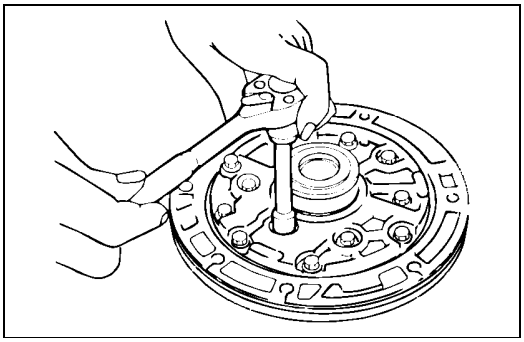
Reassembly steps

1. **Oil pump body**
2. **Oil pump driven gear**
3. **Oil pump drive gear**

   Place the oil pump body on the torque converter.

   Coat the driven gear and drive gear with ATF.

   Install the driven gear and drive gear.



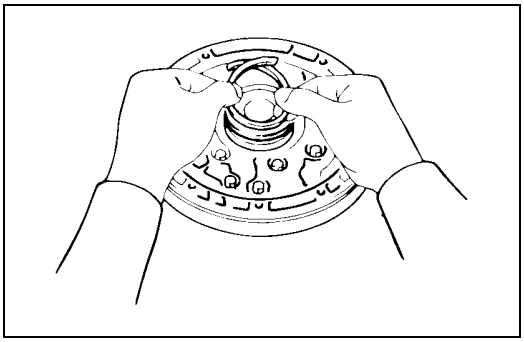
241RY00006

4. Stator shaft

Align the stator shaft with the bolt holes.

Tighten the thirteen bolts.

Torque: 11 N·m (1.1 kg·m/95 lb·in)



241RY00015

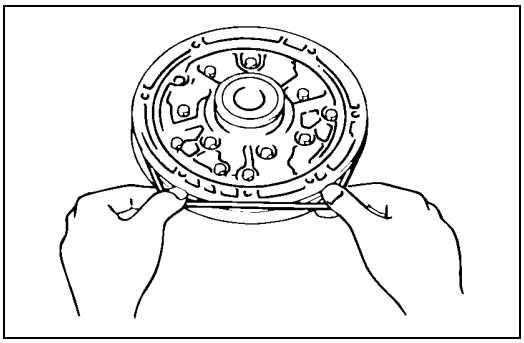
5. Oil seal ring

Coat the oil seal rings with ATF.

Contract the oil seal rings as shown, and install them onto the stator shaft.

NOTE:

Do not spread the ring ends too much.



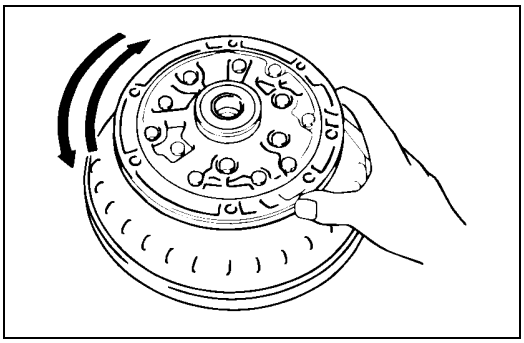
241RY00016

6. O-ring

Coat a new O-ring with ATF and install it to the oil pump body.

O-ring size (Reference)

Inside diameter	204.9 mm (8.067 in)
Thickness	3.5 mm (0.138 in)



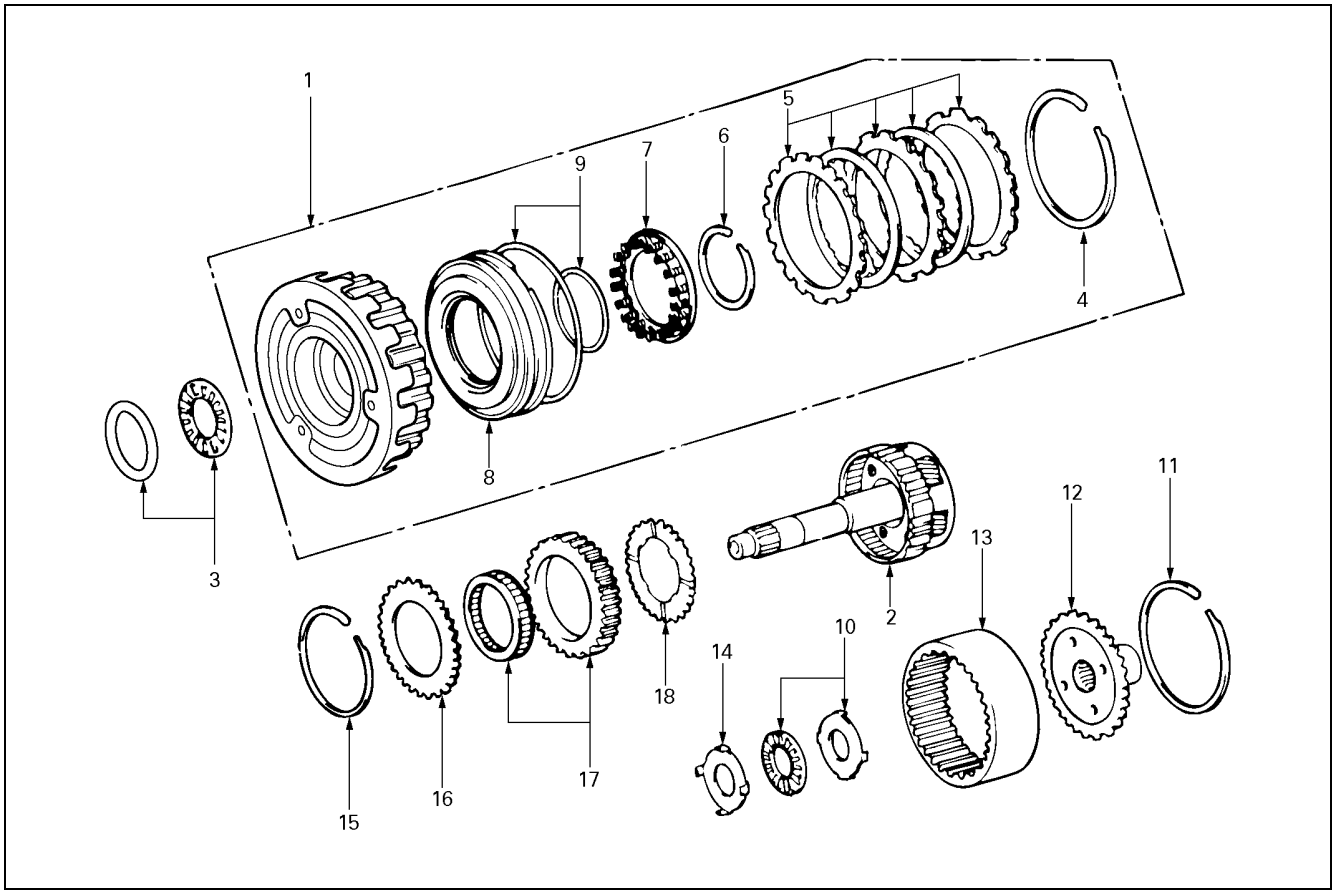
241RY00017

Check oil pump drive gear rotation

Make sure the drive gear rotates smoothly when installed to the torque converter.

OD PLANETARY GEAR AND OD DIRECT CLUTCH ASSEMBLY (C-0)

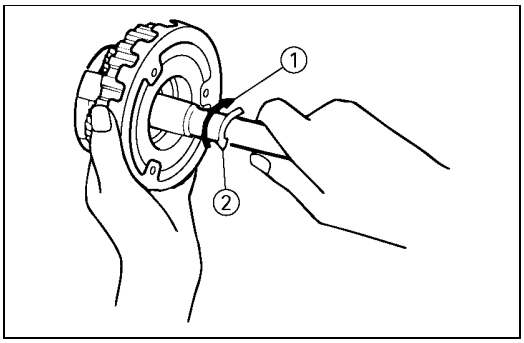
DISASSEMBLY



252R200007

Disassembly steps

1. OD direct clutch assembly
2. OD planetary gear assembly
3. Thrust bearing
4. Snap ring
5. Flange, disk and plate
6. Snap ring
7. Piston return spring
8. OD direct clutch piston with O-ring
9. O-ring
10. Thrust bearing
11. Snap ring
12. Ring gear flange
13. OD planetary ring gear
14. Race
15. Snap ring
16. Retaining plate
17. OD one-way clutch
18. Thrust washer



252L100003

Disassembly steps

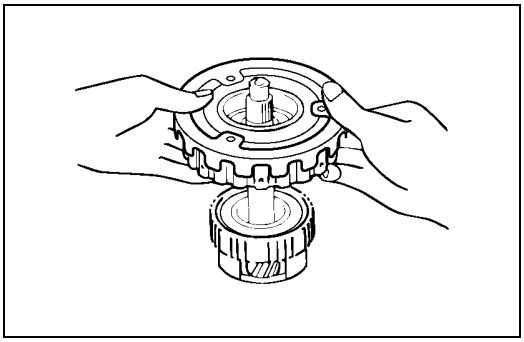
Check operation of one-way clutch

Hold the OD direct clutch drum and turn the input shaft.

The input shaft should turn freely clockwise and should lock counterclockwise.

① : Free

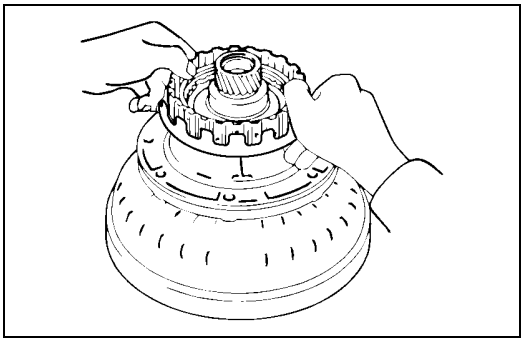
② : Lock


252L100004

1. **OD direct clutch assembly**
2. **OD planetary gear assembly**

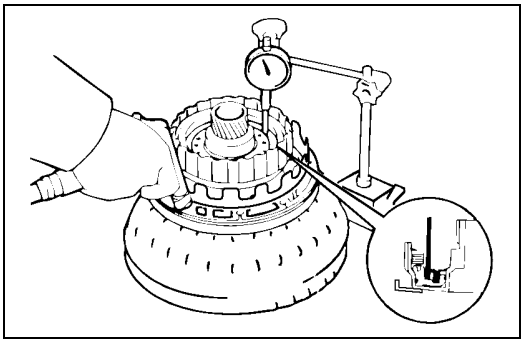
   Remove OD direct clutch assembly from OD planetary gear assembly.
3. **Thrust bearing**

   Then remove thrust bearing with the race from OD direct clutch drum.


252L100005

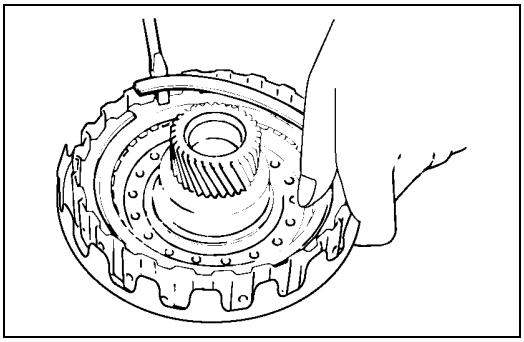
Check piston stroke of OD direct clutch (C-0)

Place the oil pump onto the torque converter, and then place the OD direct clutch assembly onto the oil pump.


252L100016

Use a dial indicator, measure the OD direct clutch piston stroke applying and releasing the compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown.

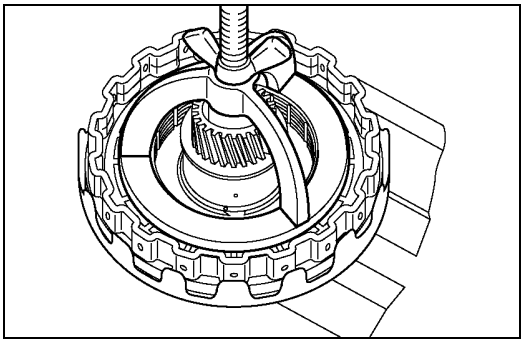
Piston stroke: 1.85 – 2.15 mm (0.0728 – 0.0846 in)


252L100006

4. **Snap ring**

   Remove snap ring from clutch drum.
5. **Flange, disc and plate**

   Remove flange, two discs and two plates.



252L100007

6. Snap ring

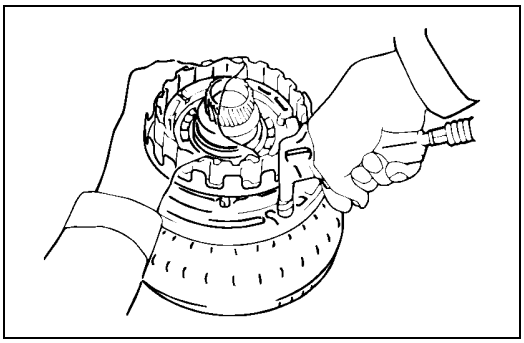
Place special tool on the spring retainer and compress the return spring.

Using snap ring pliers, remove the snap ring.

Spring compressor : 5-8840-0195-0 (J-23327-1)

7. Piston return spring

Remove piston return spring



252L100008

8. OD direct clutch piston with O-ring.

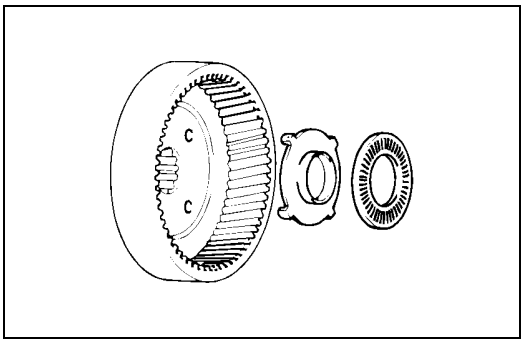
Place the oil pump onto the torque converter and then place the OD direct clutch onto the oil pump.

Holding the OD direct clutch piston by hand, apply compressed air to the oil pump to remove the OD direct clutch piston.

Remove the OD direct clutch piston.

9. O-ring

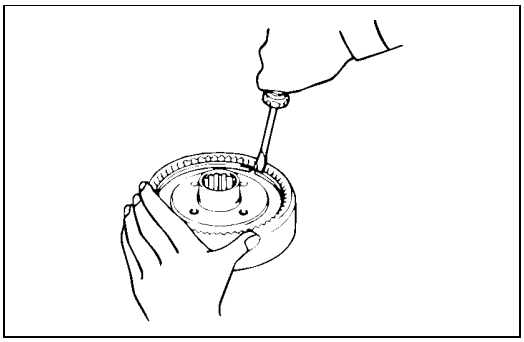
Remove two O-rings from piston.



252RY00021

10. Thrust bearing

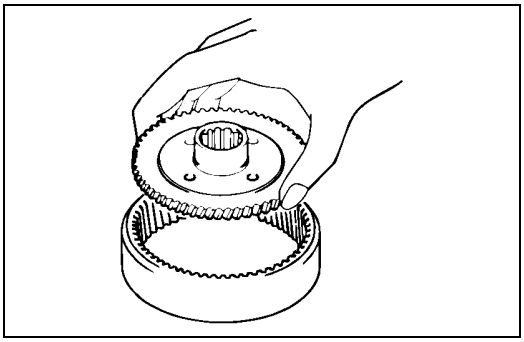
Remove bearing and race from OD planetary ring gear.



252RY00022

11. Snap ring

Remove snap ring.

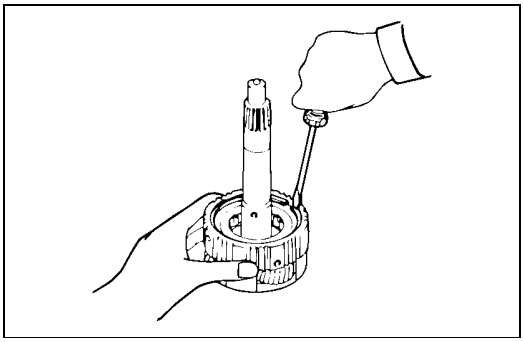


252RY00023

12. Ring gear flange

13. OD planetary ring gear

Remove ring gear flange from OD planetary ring gear.

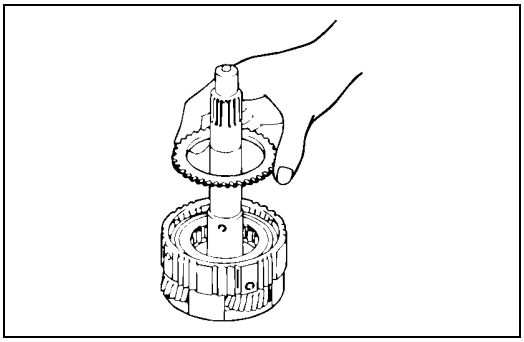


252RY00024

14. Race

15. Snap ring

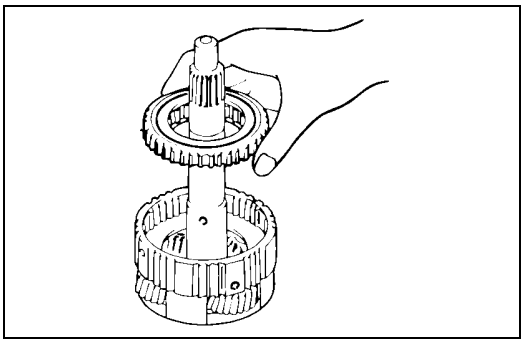
Remove snap ring, using screwdriver.



252RY00025

16. Retaining plate

Remove retaining plate from OD planetary gear.

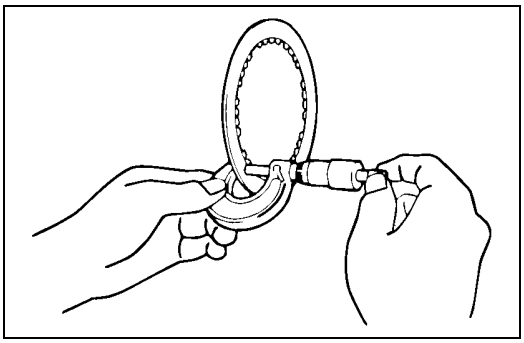


252RY00026

17. OD one-way clutch

Remove OD one-way clutch with outer race.

18. Thrust washer



252RY00027

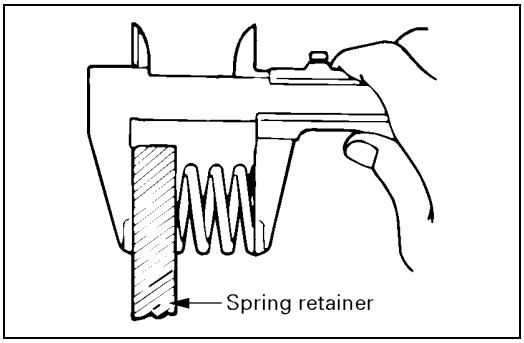
INSPECTION AND REPAIR

Check discs

Using a micrometer, measure the thickness of the discs.

Minimum thickness: 2.04 mm (0.0803 in)

If the thickness is less than the minimum, replace the disc.

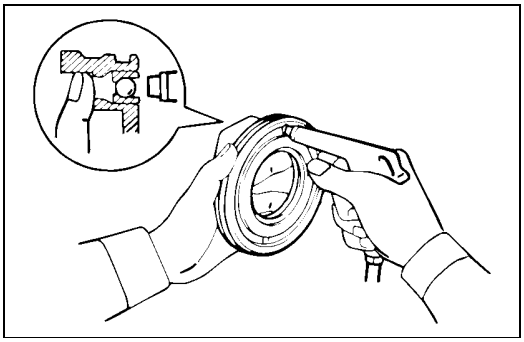


252RY00028

Check piston return spring

Using calipers, measure the free length of the return spring.

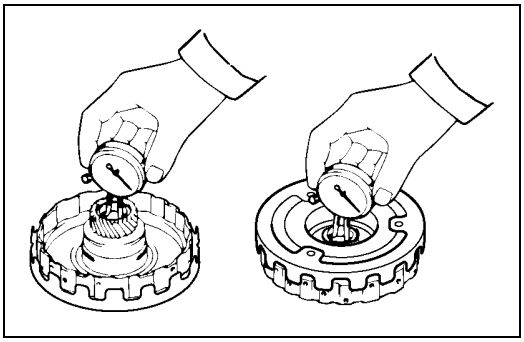
Standard length: 15.8 mm (0.622 in)



252RY00029

Check OD direct clutch piston

Check that the check ball is free by shaking the piston. Check that the valve does not leak by applying low-pressure compressed air.



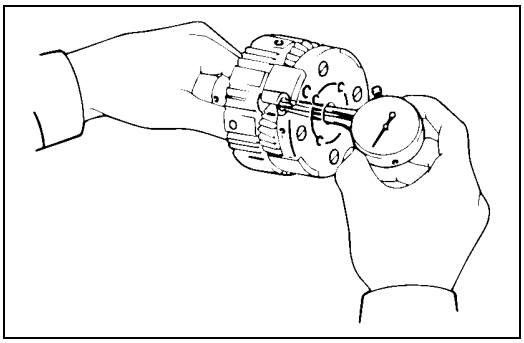
252L100009

Check OD direct clutch drum bushings

Using a dial indicator, measure the inside diameter of the OD direct clutch drum bushings.

Maximum inside diameter: 27.11 mm (1.0673 in)

If the inside diameter is greater than the maximum, replace the OD direct clutch drum.



252RY00031

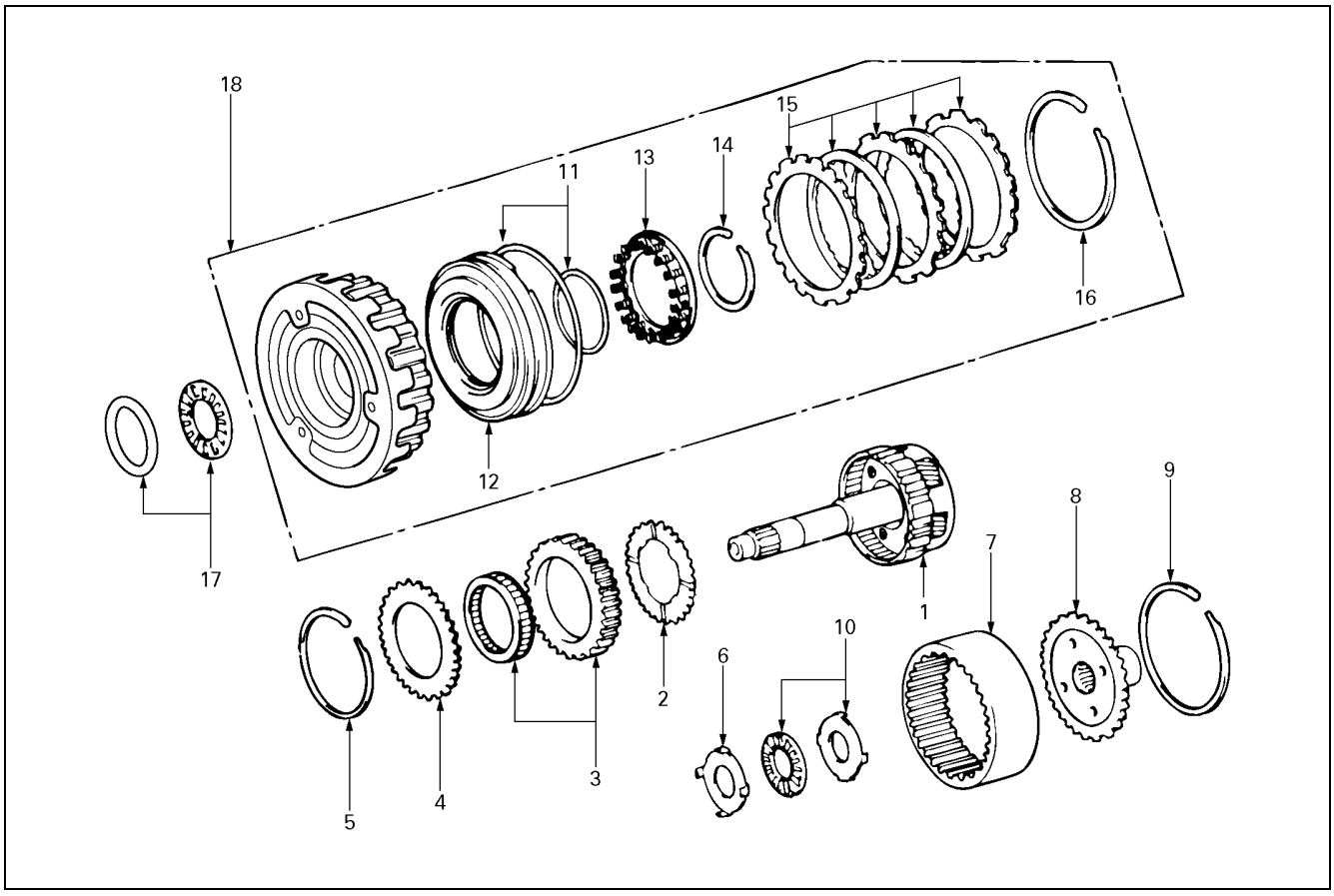
Check OD planetary gear bushing

Using a dial indicator, measure the inside diameter of replace the OD planetary gear bushing.

Maximum inside diameter: 11.27 mm (0.4437 in)

If the inside diameter is greater than the maximum, replace the OD planetary gear.

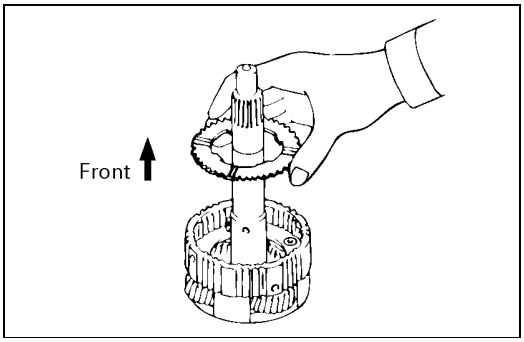
REASSEMBLY



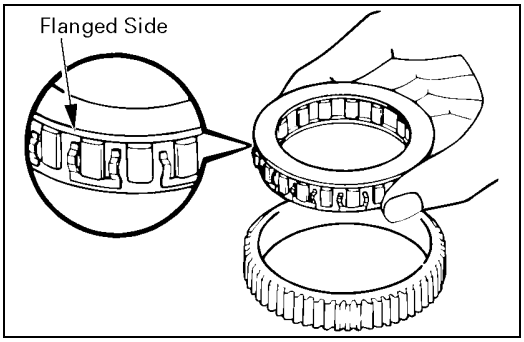
252R200008

Reassembly steps

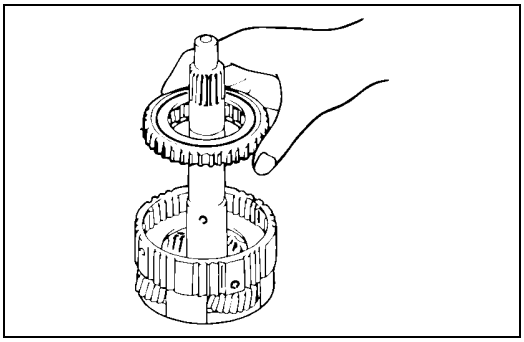
1. OD planetary gear assembly
2. Thrust washer
3. OD one-way clutch
4. Retaining plate
5. Snap ring
6. Race
7. OD planetary ring gear
8. Ring gear flange
9. Snap ring
10. Thrust bearing
11. O-ring
12. OD direct clutch piston with O-ring
13. Piston return spring
14. Snap ring
15. Flange, disc and plate
16. Snap ring
17. Thrust bearing
18. OD direct clutch assembly

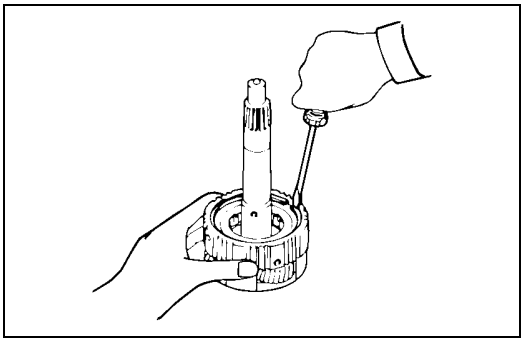


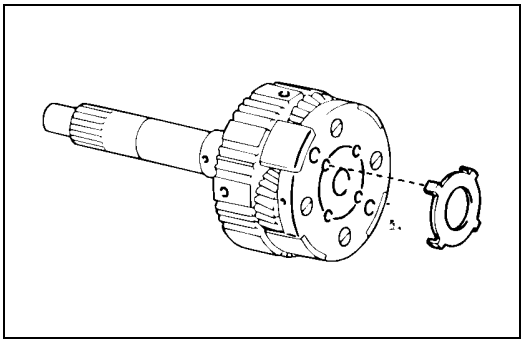
252RY00032



252RY00033


252RY00026


252RY00024


252RY00034

Reassembly steps

1. **OD planetary gear assembly**
2. **Thrust washer**

   Install the thrust washer to the OD planetary gear, facing the grooved side upward.

3. **OD one-way clutch**

   Install the one-way clutch into the outer race, with the flanged side of the one-way clutch facing upward.

   Install OD one-way clutch with outer race to overdrive planetary gear.

4. **Retaining plate**
5. **Snap ring**

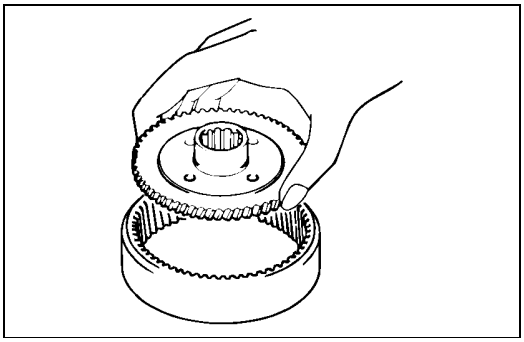
   Install retaining plate, then install snap ring, using a screwdriver.

6. **Race**

   Coat the race with petroleum jelly and install it to the planetary gear.

   Race diameter (Reference)

Inside diameter	24.7 mm (0.972 in)
Outside diameter	41.8 mm (1.646 in)

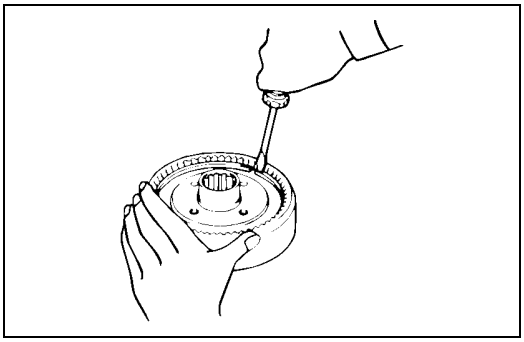


252RY00023

7. OD planetary ring gear

8. Ring gear flange

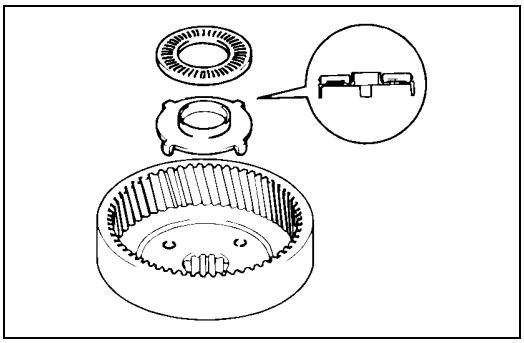
Install ring gear flange to OD planetary ring gear.



252RY00022

9. Snap ring

Install snap ring, using a screwdriver.



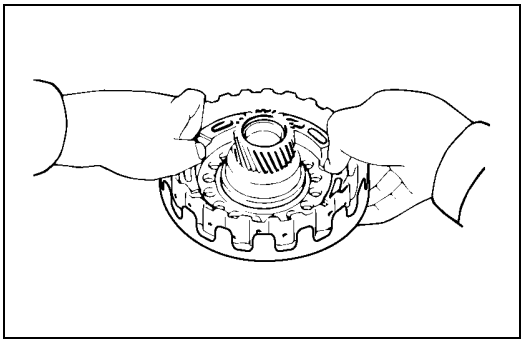
252RY00035

10. Thrust bearing

Coat the race and bearing with petroleum jelly and install them onto the OD planetary ring gear.

Race and bearing diameter (Reference)

	Inside	Outside
Bearing and race	24.2 mm (0.953 in)	47.8 mm (1.882 in)



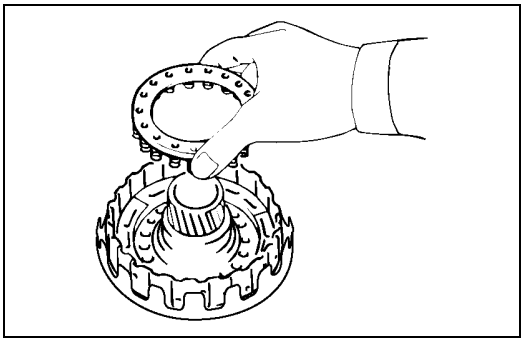
252L100011

11. O-ring

Coat new O-rings with ATF and install them on the OD direct clutch piston.

12. OD direct clutch piston with O-ring

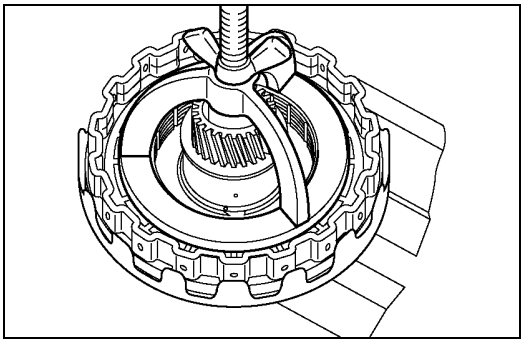
Being careful not to damage the O-rings, press in the OD direct clutch piston into the clutch drum, using both hands.



252L100012

13. Piston return spring

Install piston return spring.



252L100007

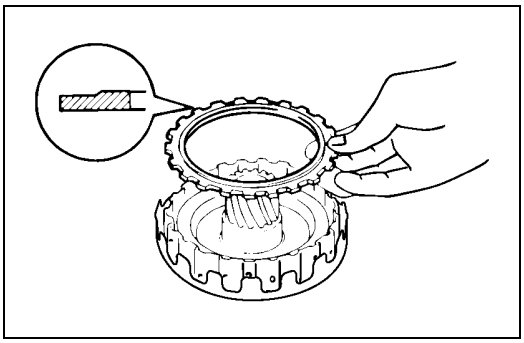
14. Snap ring

Place special tool on the spring retainer, and compress the return spring.

Spring compressor : 5-8840-0195-0 (J-23327-1)

Install the snap ring with snap ring pliers.

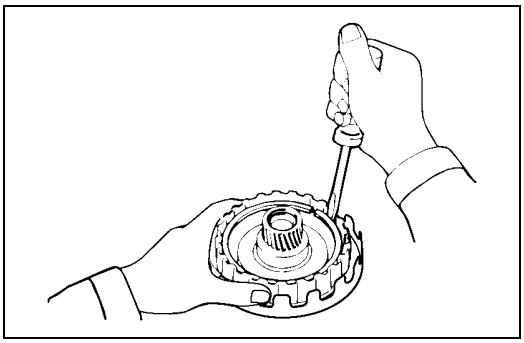
Be sure the end gap of the snap ring is not aligned with the spring retainer claw.



252L100013

15. Flange, disc and plate

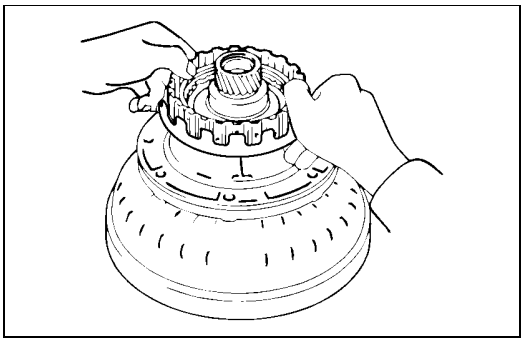
Install two plates and tow discs then install the flange, with the flat side facing downward.



252L100014

16. Snap ring

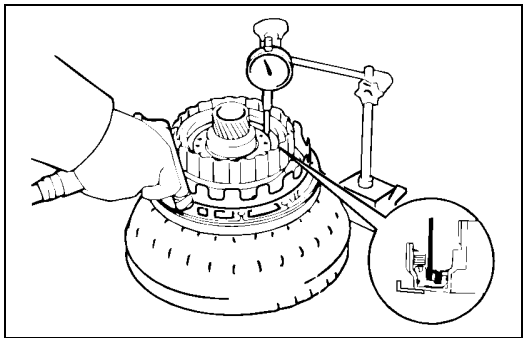
Install snap ring.



252L100005

Check piston stroke of OD direct clutch (C-0)

Place the oil pump onto the torque converter, and then place the OD direct clutch assembly onto the oil pump.



252L100016

Using a dial indicator, measure the OD direct clutch piston stroke by applying and releasing the compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown.

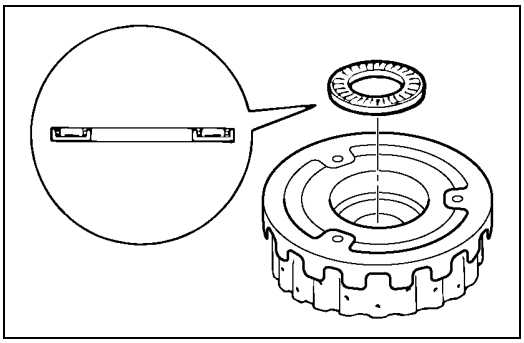
Piston stroke: 1.85 – 2.15 mm (0.0729 – 0.0847 in)

If the piston stroke is not within specification, replace the disc and recheck the piston stroke.

If the piston stroke is non standard, select another flange.

Flange sizes

Flange thickness	Flange thickness
3.8 mm (0.150 in)	3.4 mm (0.134 in)
3.7 mm (0.146 in)	3.3 mm (0.130 in)
3.6 mm (0.142 in)	3.2 mm (0.126 in)
3.5 mm (0.138 in)	3.1 mm (0.122 in)



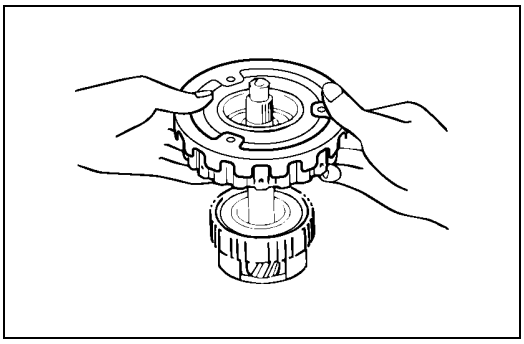
252L100015

17. Thrust bearing

Coat the assembled bearing and race with petroleum jelly and install it with the race side facing downward.

Bearing and race (Reference)

Inside diameter	28.9 mm (1.138 in)
Outside diameter	50.2 mm (1.976 in)

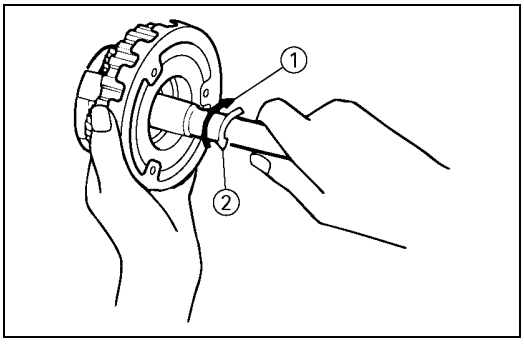


252L100004

18. OD direct clutch assembly

Align the flukes of discs in the direct clutch.

Install the OD direct clutch assembly onto the OD planetary gear.



252L100003

Check operation of one-way clutch

Hold the OD direct clutch drum and turn the input shaft.

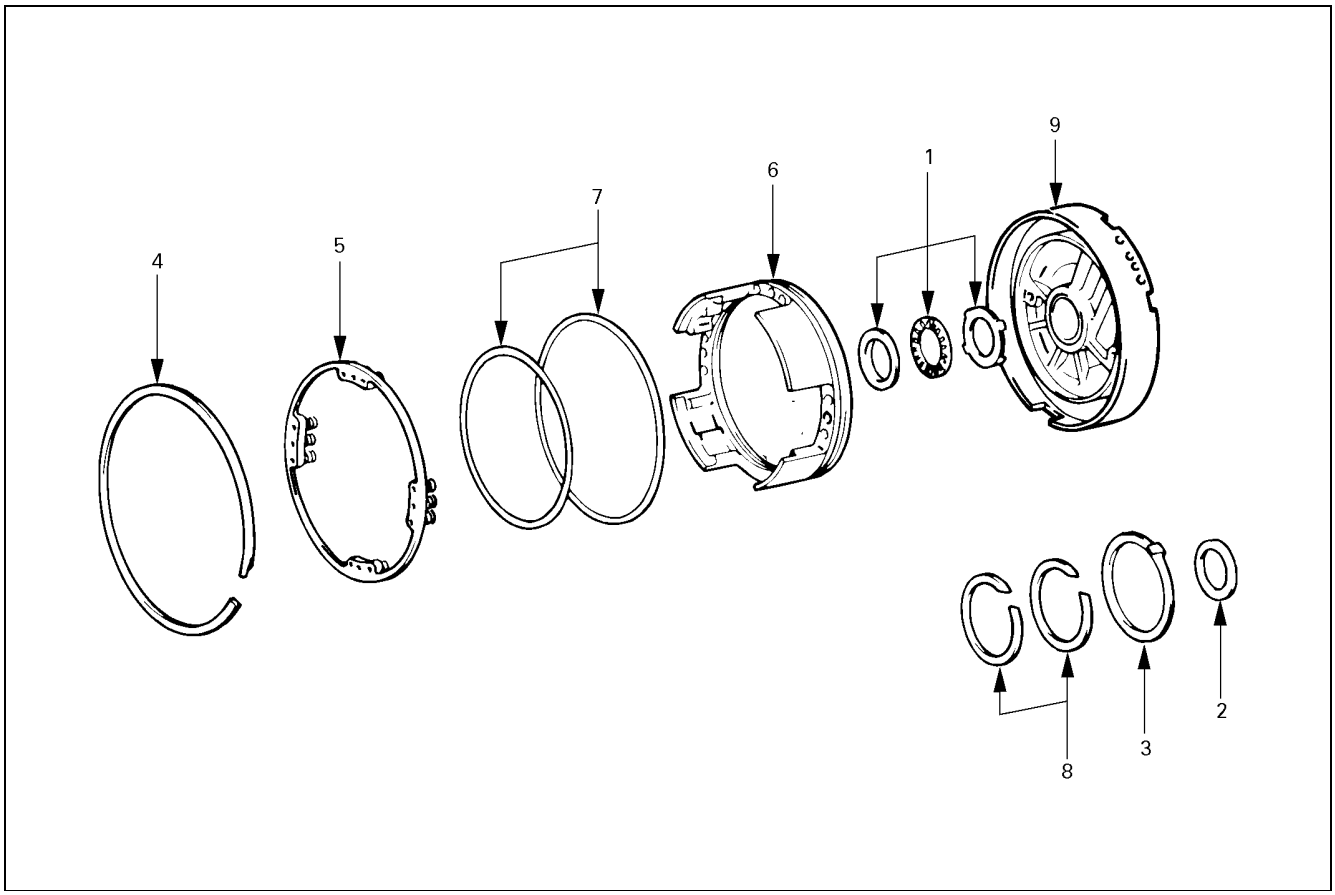
The input shaft should turn freely clockwise and should lock counterclockwise.

① : Free

② : Lock

OD SUPPORT ASSEMBLY

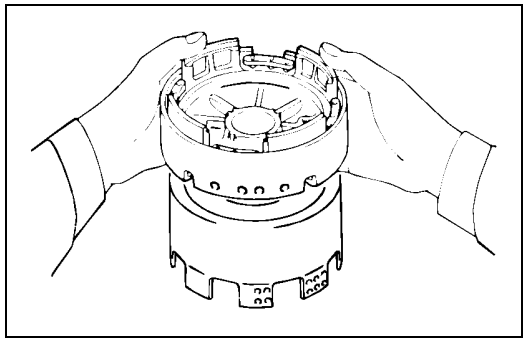
DISASSEMBLY



252R200003

Disassembly steps

1. Thrust bearing
2. Race
3. Thrust washer (plastic)
4. Snap ring
5. Piston return spring
6. OD brake piston
7. O-ring
8. Oil seal ring
9. OD support

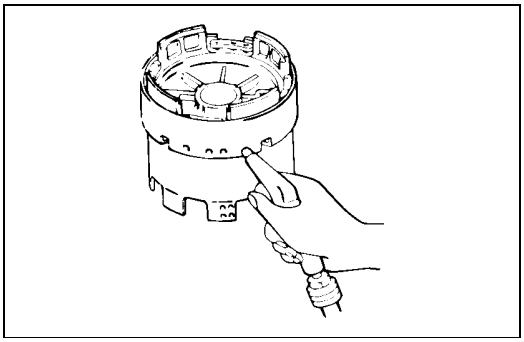


252RY00042

Disassembly steps

Check OD brake piston movement

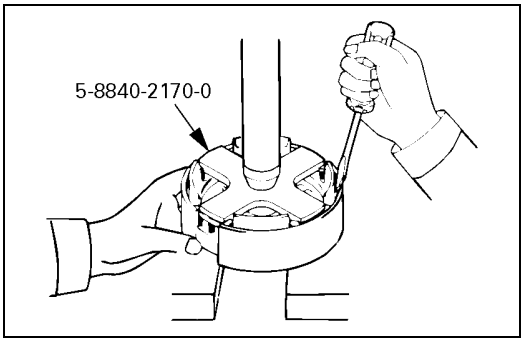
Place the OD support assembly onto the direct clutch assembly.



252RY00043

Apply compressed air into the oil passage as shown, and be sure that the OD brake piston moves smoothly.

1. **Thrust bearing**
2. **Race**
3. **Thrust washer (plastic)**



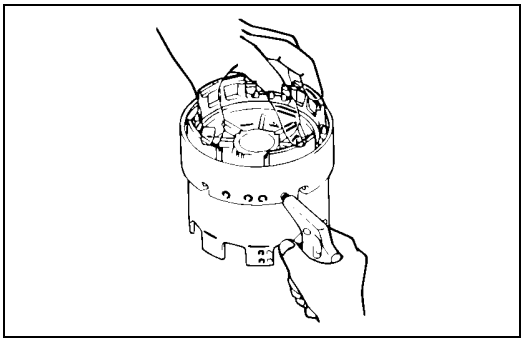
252RY00044

4. **Snap ring**

   Place special tool on the spring retainer, and compress the return spring with a shop press.

   Spring compressor : 5-8840-2170-0 (J-37233)

   Remove the snap ring with a screwdriver.
5. **Piston return spring**



252RY00045

6. **OD brake piston**

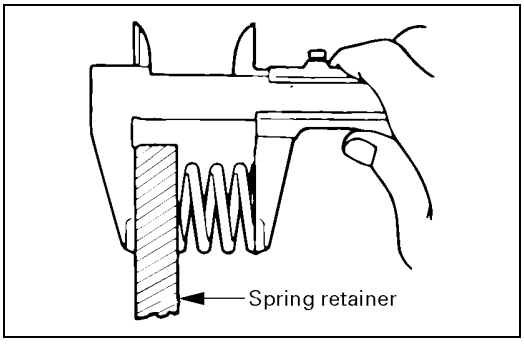
   Place the OD support onto the direct clutch assembly.

   Hold the OD brake piston so it is not slanted and apply compressed air into the passage to remove the OD brake piston.

   Remove the OD brake piston.
7. **O-ring**
8. **Oil seal ring**
9. **OD support**

INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage or any abnormal conditions are found through inspection.



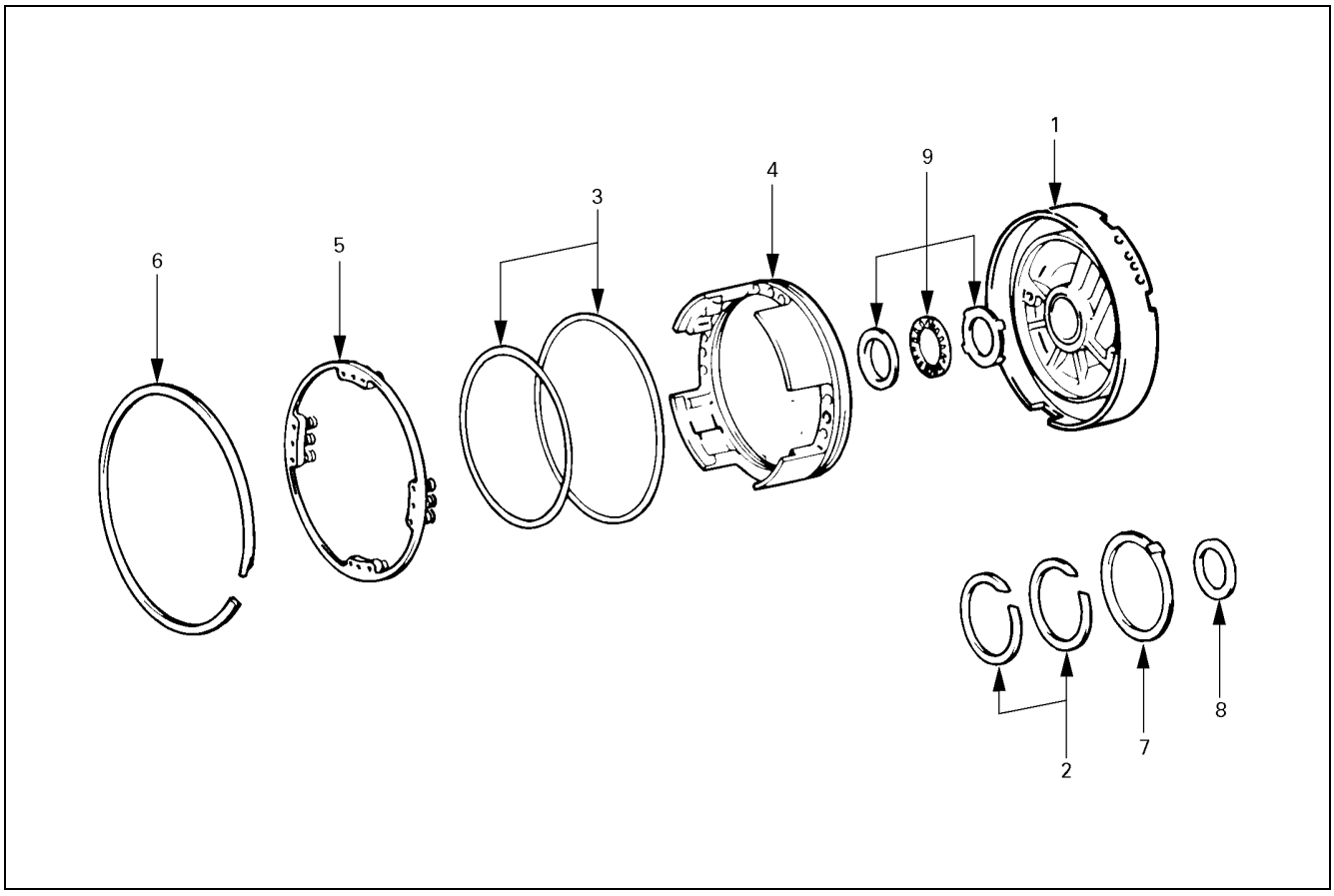
252RY00046

Check piston return spring

Using calipers, measure the free length of the return spring.

Standard length: 17.2 mm (0.677 in)

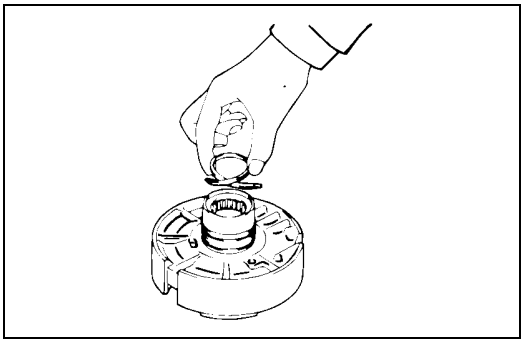
REASSEMBLY



252R200004

Reassembly steps

1. OD support
2. Oil seal ring
3. O-ring
4. OD brake piston
5. Piston return spring
6. Snap ring
7. Thrust washer (Plastic)
8. Race
9. Thrust bearing



252RY00047

Reassembly steps

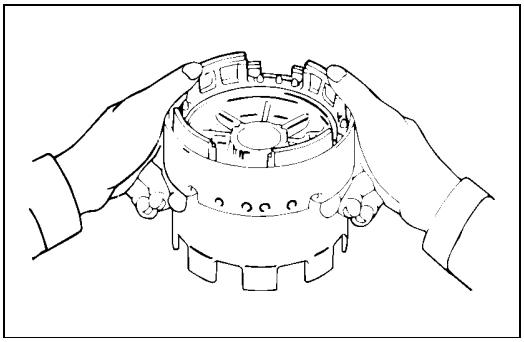
1. **OD support**
2. **Oil seal ring**

   Coat the two oil seal rings with ATF.

   Contract the oil seals as shown, and install them onto the OD support.

   NOTE :

   Do not spread the ring ends more than necessary.



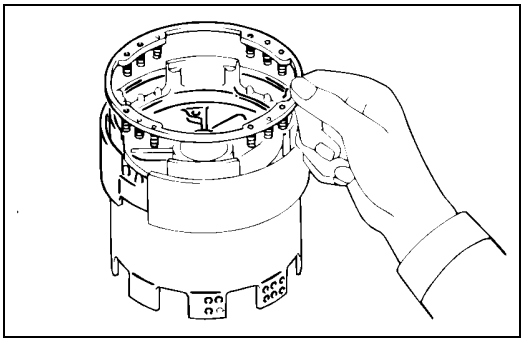
252RY00048

3. O-ring

Coat two new O-rings with ATF and install them on the OD brake piston.

4. OD brake piston

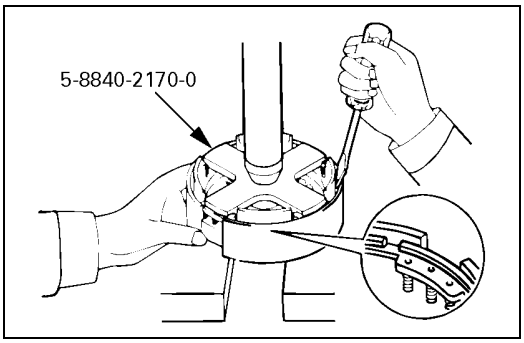
Being careful not to damage the O-rings, press in the brake piston into the OD support, using both hands.



252RY00049

5. Piston return spring

Install piston return spring.



252RY00050

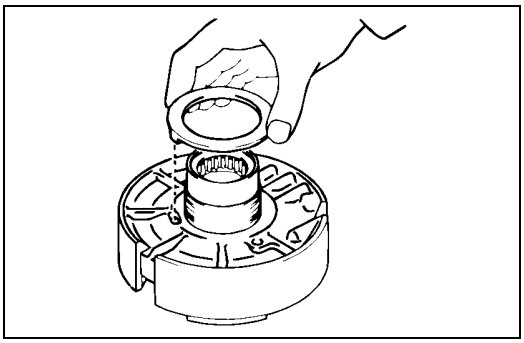
6. Snap ring

Place special tool on the spring retainer, and compress the return spring with a shop press.

Spring compressor : 5-8840-2170-0 (J-37233)

Install the snap ring with a screwdriver.

Be sure the end gap of the snap ring is not aligned with cutout portion of the OD support.



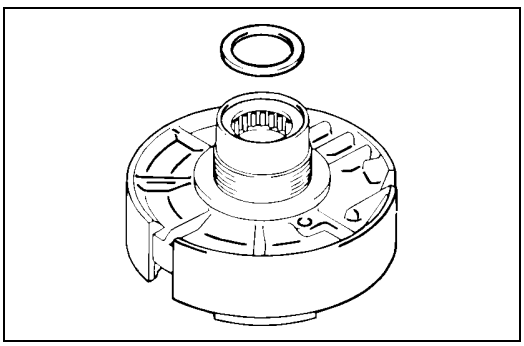
252RY00051

7. Thrust washer (plastic)

Coat the thrust washer with petroleum jelly and install it onto the OD support.

NOTE :

Make sure that the lug fits into the hole on the OD support.



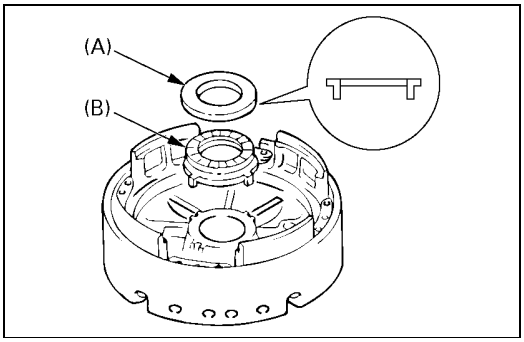
252RY00052

8. Race

Coat the race with petroleum jelly, and install it onto the OD support.

Race diameter (Reference)

Inside diameter	28.45 mm (1.120 in)
Outside diameter	47.3 mm (1.862 in)



252RY00069

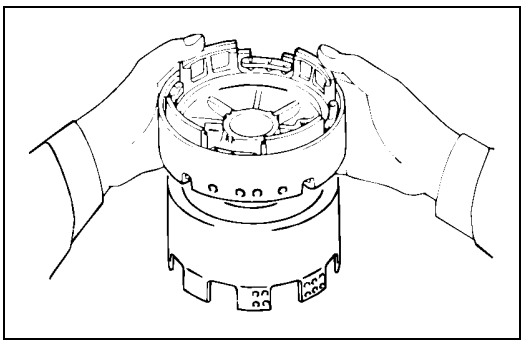
9. Thrust bearing

Turn over OD support.

Coat the two races with petroleum jelly, and install them onto the OD support.

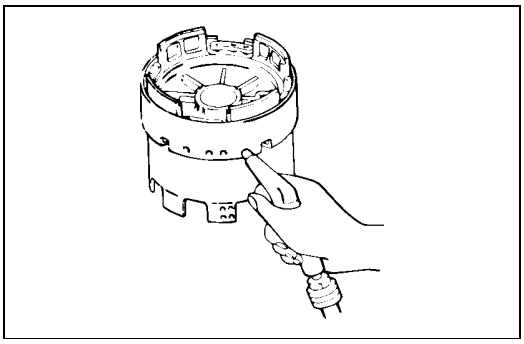
Race and bearing diameter (Reference)

	Inside	Outside
Race (A)	37.2 mm (1.465 in)	58.8 mm (2.315 in)
Bearing and race (B)	33.7 mm (1.327 in)	50.1 mm (1.972 in)


252RY00042

Check OD brake piston movement

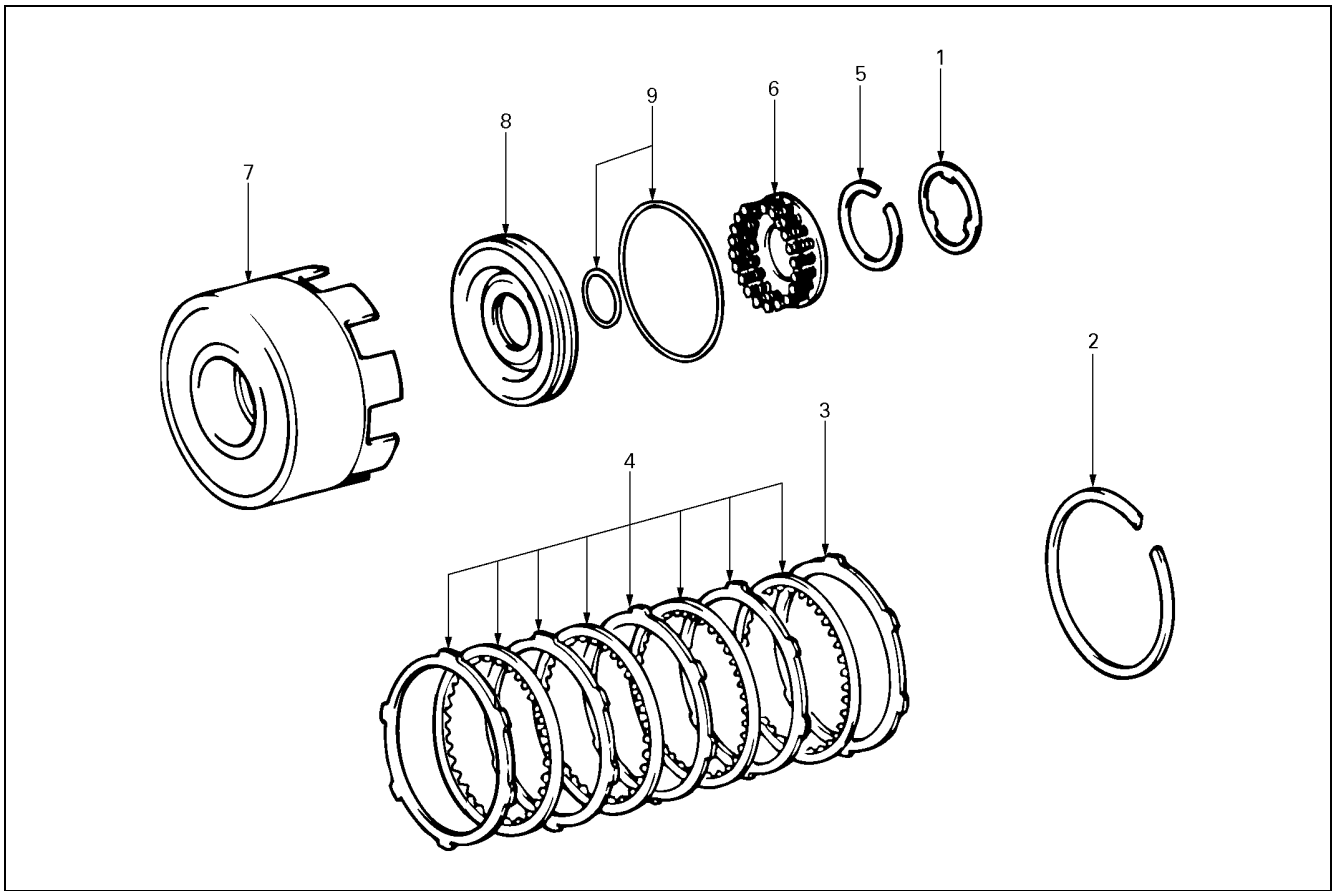
Place the OD support assembly onto the direct clutch assembly.


252RY00043

Apply compressed air into the oil passage as shown, and be sure that the OD brake piston moves smoothly.

DIRECT CLUTCH ASSEMBLY (C-2)

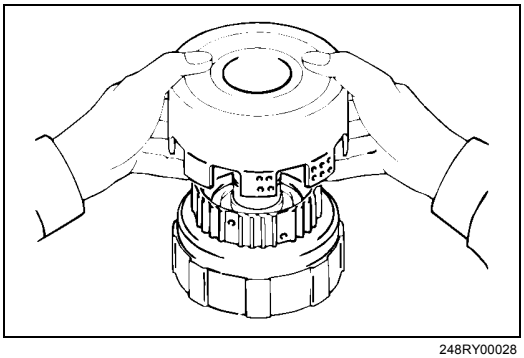
DISASSEMBLY



248R200001

Disassembly steps

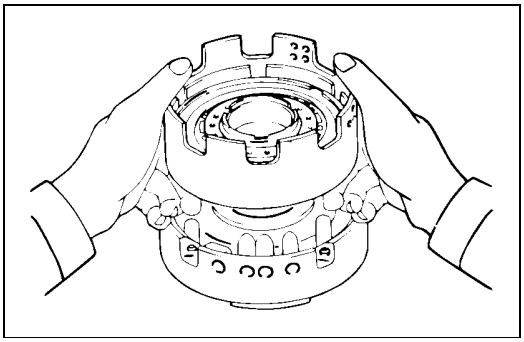
1. Clutch drum thrust washer (Plastic)
2. Snap ring
3. Flange
4. Plate and disc
   Five plates and five discs (UBS)
   Four plates and four discs (TFR/S)
5. Snap ring
6. Piston return spring
7. Direct clutch drum
8. Direct clutch piston
9. O-ring



248RY00028

Disassembly steps

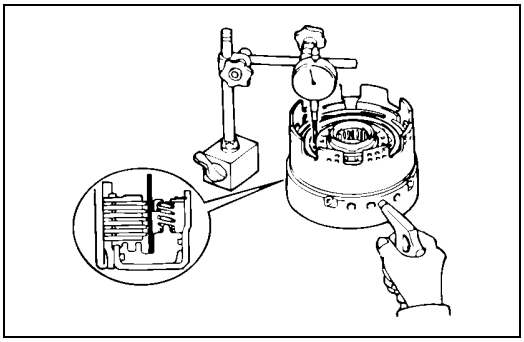
Remove direct clutch drum assembly from forward clutch assembly.



248RY00029

Check piston stroke of direct clutch (C-2)

Place the direct clutch assembly onto the OD support assembly.



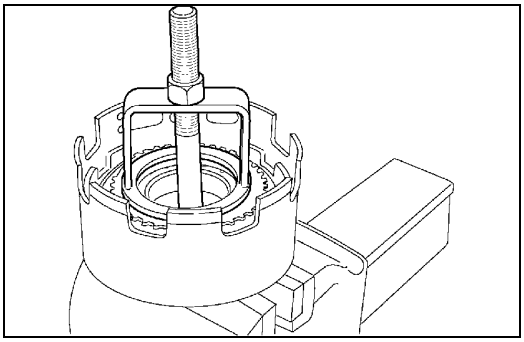
248RY00061

Using a dial indicator, measure the direct clutch piston stroke by applying and releasing compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown.

Piston stroke: 1.6 – 1.9 mm (0.0630 – 0.0748 in) (UBS)

Pack clearance: 0.4 – 0.7 mm (0.0157 – 0.0276 in) (TFR/S)

1. **Clutch drum thrust washer (Plastic)**
2. **Snap ring**
3. **Flange**
4. **Plate and disc**



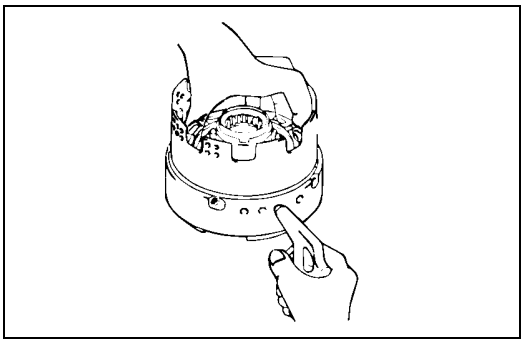
248RY00002

5. **Snap ring**

   Place special tool on the spring retainer and compress the return spring.

   Using snap ring pliers, remove the snap ring.

   Spring compressor : 5-8840-0254-0 (J-25048)
6. **Piston return spring**



248RY00030

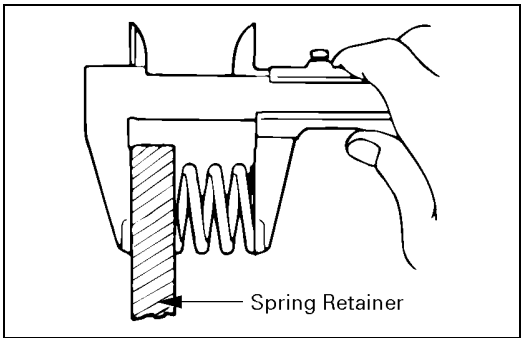
7. **Direct clutch drum**
8. **Direct clutch piston**
9. **O-ring**

   Place the direct clutch drum onto the OD support.

   Holding the direct clutch piston by hand, apply compressed air to the OD support to remove the direct clutch piston.

   Remove the direct clutch piston.

   Remove two O-rings from piston.



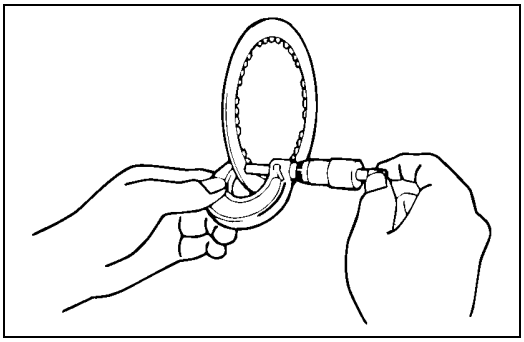
247RY00034

INSPECTON AND REPAIR

Check piston return spring

Using calipers, measure the free length of the return spring.

Standard length: 21.3 mm (0.839 in)



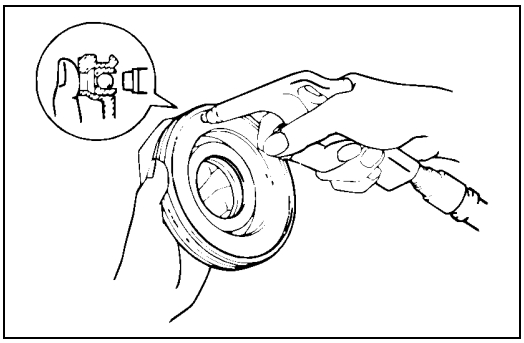
252RY00027

Check discs

Using micrometer, measure the thickness of the discs.

Minimum thickness: 2.04 mm (0.0803 in)

If the thickness is less than the minimum, replace the disc.

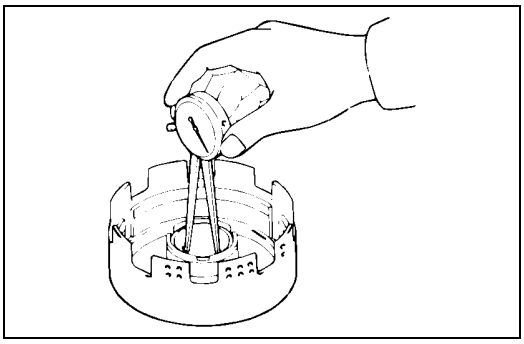


248RY00031

Check direct clutch piston

Check that check ball is free by shaking the piston.

Check that the valve does not leak by applying low-pressure compressed air.



248RY00032

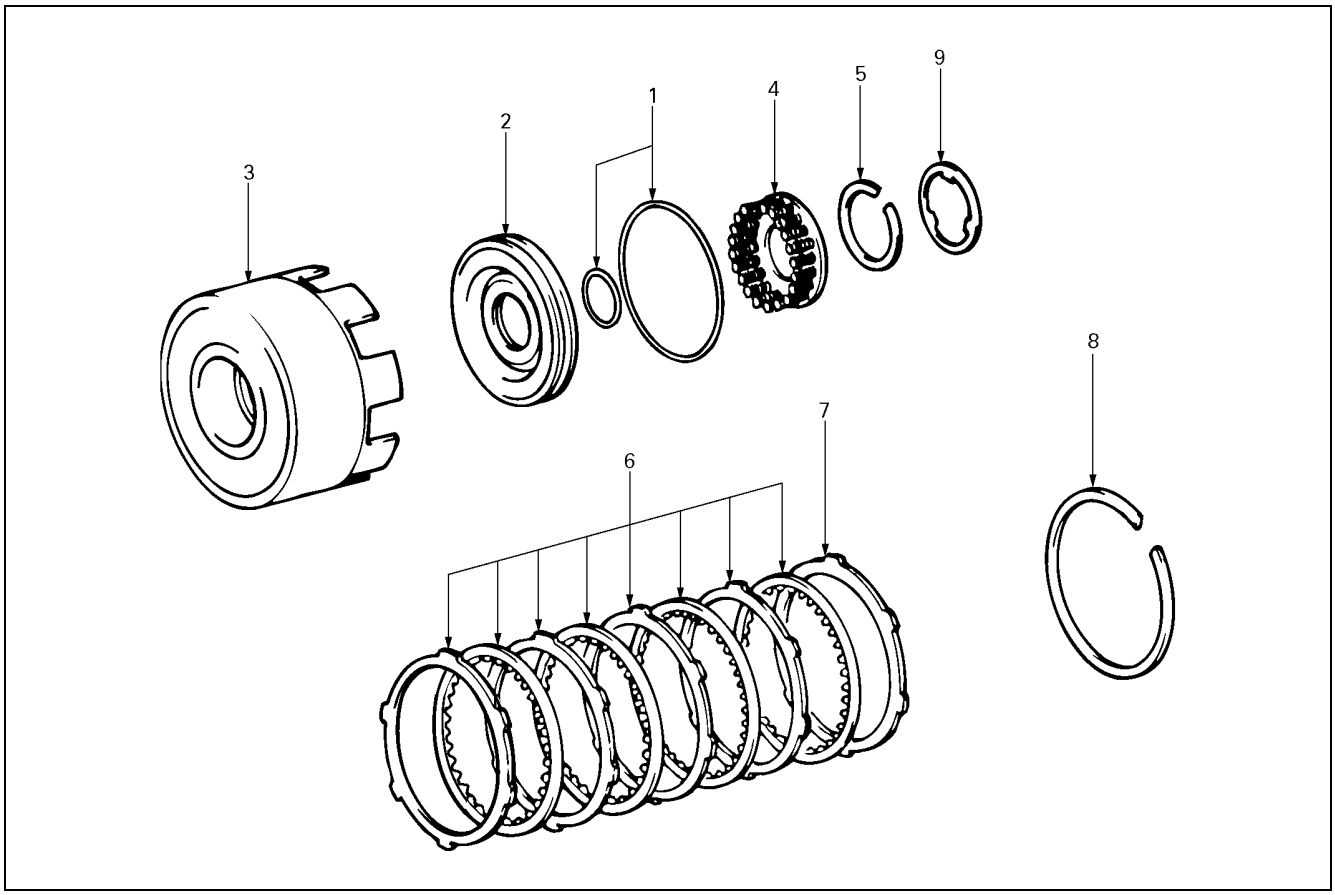
Check direct clutch drum bushing

Using a dial indicator, measure the inside diameter of the clutch drum bushing.

Maximum inside diameter: 53.99 mm (2.1256 in)

If the inside diamater is greater than the maximum, replace the clutch drum.

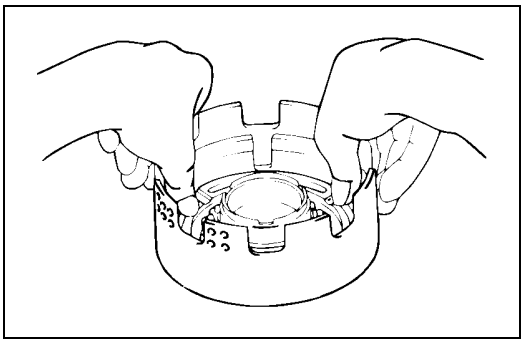
REASSEMBLY



248R200002

Reassembly steps

1. O-ring
2. Direct clutch piston
3. Direct clutch drum
4. Piston return spring
5. Snap ring
6. Disc and plate
   Five discs and five plates (UBS)
   Four discs and four plates (TFR/S)
7. Flange
8. Snap ring
9. Clutch drum thrust washer (Plastic)



248RY00033

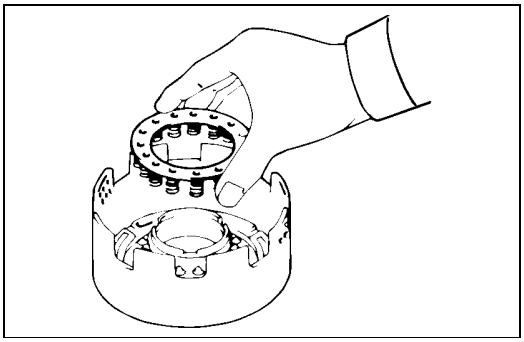
Reassembly steps

1. **O-ring**
2. **Direct clutch piston**
3. **Direct clutch drum**

   Coat new O-rings with ATF and install them on the direct clutch piston.

   Install direct clutch piston to direct clutch drum.

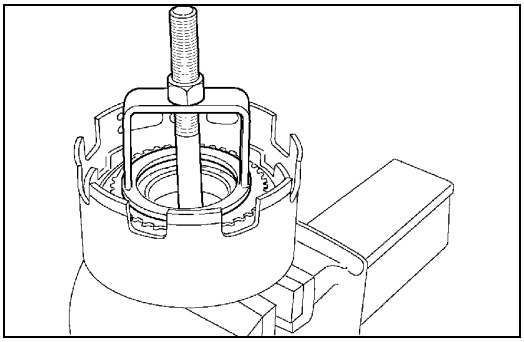
   Being careful not to damage the O-rings, press in the direct clutch piston into the clutch drum, using both hands.



248RY00034

4. Piston return spring

Install piston return spring.



248RY00002

5. Snap ring

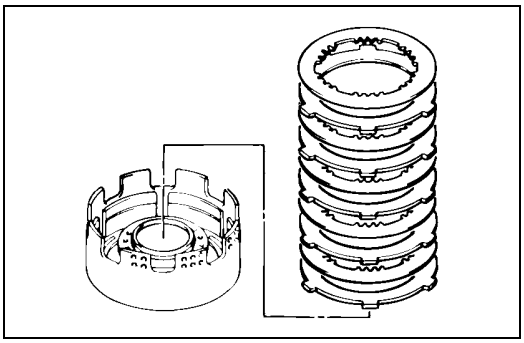
Compress piston return spring and install snap ring in groove.

Place special tool on the spring retainer, and compress the return spring.

Install the snap ring with snap ring pliers.

Be sure the end gap of the snap ring is not aligned with the spring retainer claw.

Spring compressor: 5-8840-0254-0 (J-25048)



248RY00062

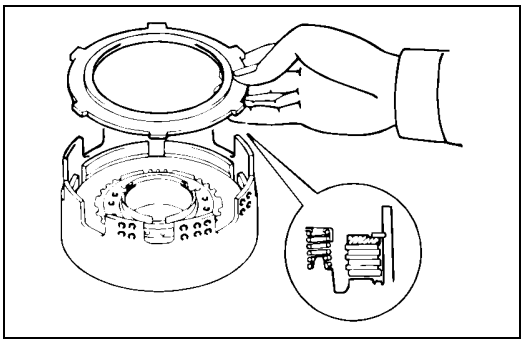
6. Disc and plate

Install plates and discs.

Install in order : P-D-P-D-P-D-P-D-P-D (UBS)

: P-D-P-D-P-D-P-D (TFR/S)

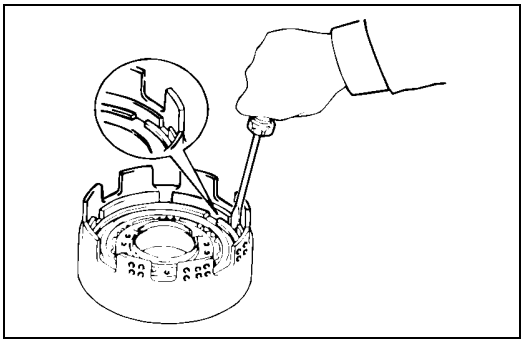
P : Plate, D : Disc



248RY0035

7. Flange

Install the flange, with the flat side facing downward.

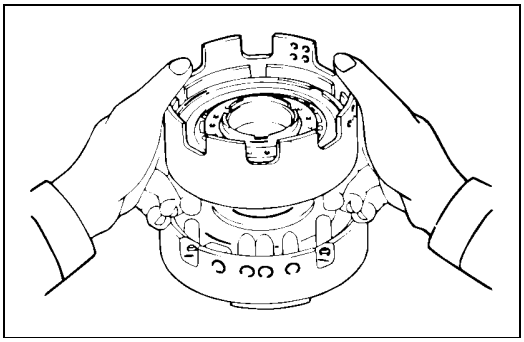


248RY00036

8. Snap ring

Install the snap ring with a screwdriver.

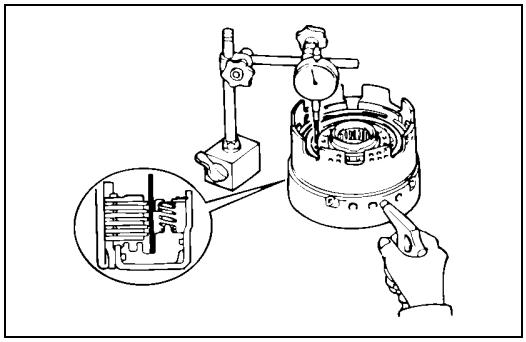
Be sure the end gap of the snap ring is not aligned with the cutout portion of the direct clutch drum.



248RY00029

Check piston stroke of direct clutch (C-2)

Place the direct clutch assembly onto the OD support assembly.



248RY00061

Using a dial indicator, measure the direct clutch piston stroke by applying and releasing compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown.

Piston stroke: 1.6 – 1.9 mm (0.0630 – 0.0748 in) (UBS)

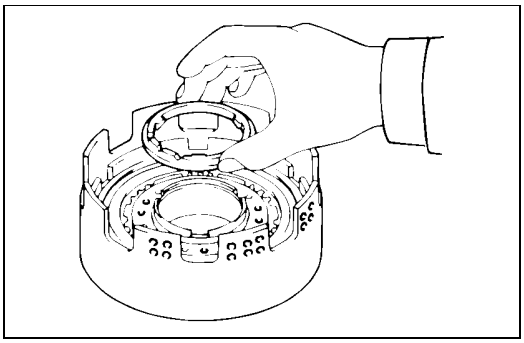
Pack clearance: 0.4 – 0.7 mm (0.0157 – 0.0276 in) (TFR/S)

If the piston stroke is not within specification, replace the discs and recheck the piston stroke.

If the piston stroke is non standard, select another flange.

Flange sizes

Flange thickness	Flange thickness
3.3 mm (0.130 in)	3.8 mm (0.150 in)
3.4 mm (0.134 in)	3.9 mm (0.154 in)
3.5 mm (0.138 in)	4.0 mm (0.157 in)
3.6 mm (0.142 in)	4.1 mm (0.161 in)
3.7 mm (0.146 in)	4.2 mm (0.165 in)



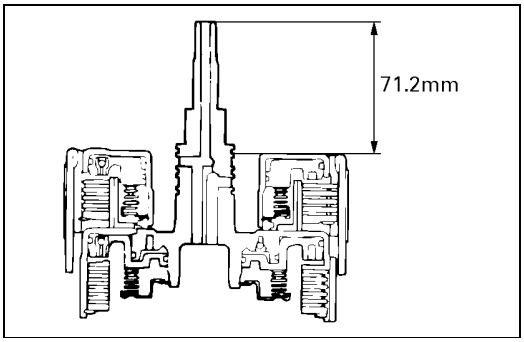
248RY00037

9. Clutch drum thrust washer (plastic)

Coat the thrust washer with petroleum jelly and install it onto the direct clutch.

NOTE :

Make sure that the lugs fit into the cutout portions on the direct clutch.



248RY00038

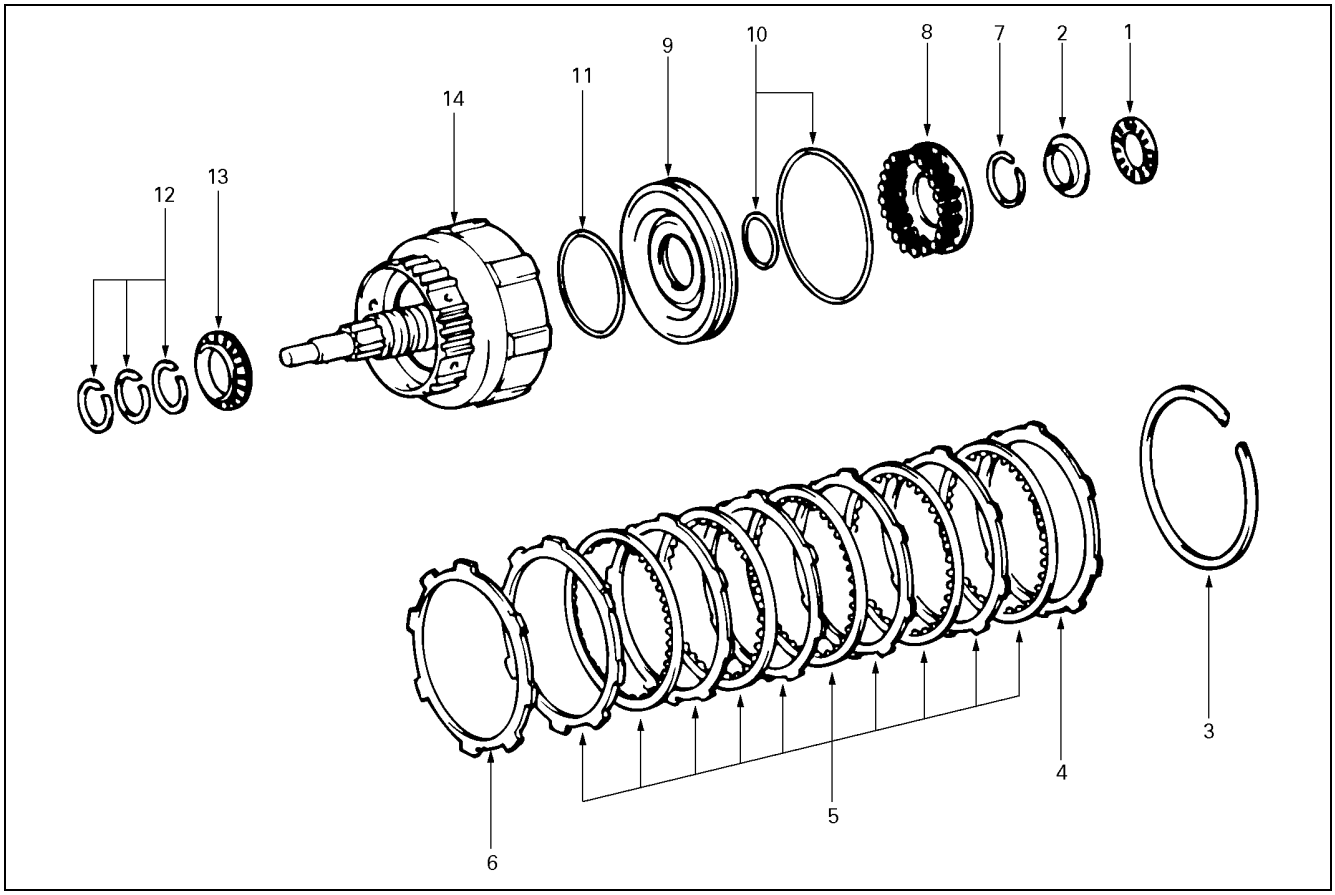
Align the flukes of discs in the direct clutch.

Install the direct clutch assembly onto the forward clutch assembly.

Check that the distance from the direct clutch end to the forward clutch end is 71.2 mm (2.803 in).

FORWARD CLUTCH ASSEMBLY (C-1)

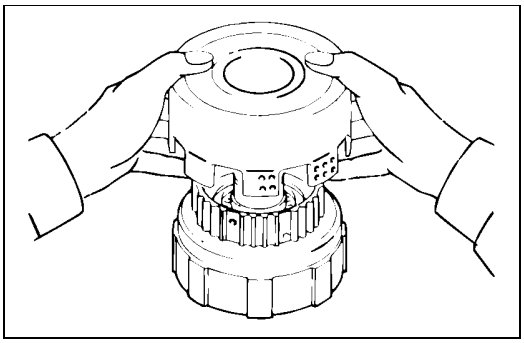
DISASSEMBLY



248R200003

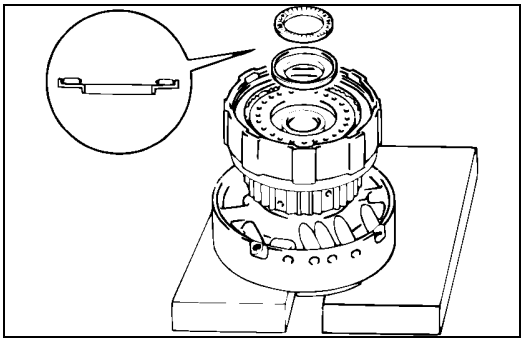
Disassembly steps

1. Thrust bearing
2. Race
3. Snap ring
4. Flange
5. Disc and plate
   Six discs and six plates (UBS)
   Five discs and five plates (TFR/S)
6. Cushion plate
7. Snap ring
8. Piston return spring
9. Piston
10. O-ring
11. O-ring
12. Oil seal ring
13. Thrust bearing
14. Forward clutch drum


248RY00039

Disassembly steps

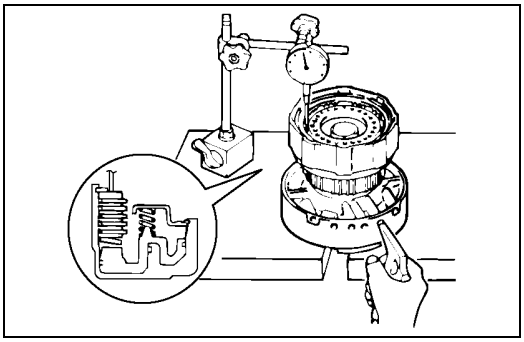
Remove forward clutch assembly from direct clutch assembly.


248RY00048

1. **Thrust bearing**
2. **Race**

Place wooden blocks, etc. to prevent forward clutch shaft from touching the work stand, and place the OD support on them.

Place the forward clutch onto the OD support and remove the bearing and race.

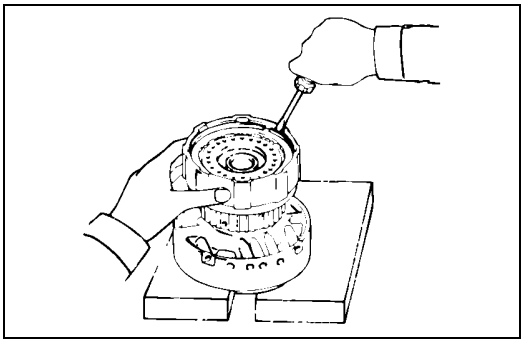

248R200008

Check piston stroke of forward clutch (C-1)

Using a dial indicator, measure the forward clutch piston stroke by applying and releasing compressed air (390 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown.

Pack clearance: 0.6 – 1.0 mm (0.0236 – 0.0394 in) (UBS)

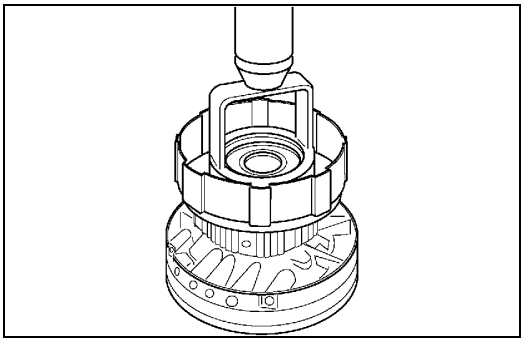
: 0.5 – 0.9 mm (0.0197 – 0.0354 in) (TFR/S)


248RY00041

3. **Snap ring**

Remove snap ring from clutch drum.

4. **Flange**
5. **Disc and plate**
6. **Cushion plate**


248RY00003

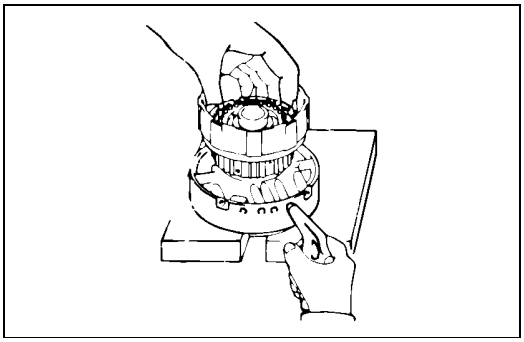
7. **Snap ring**

Place special tool on the sparing retainer and compress the return spring.

Using snap ring pliers, remove the snap ring.

Spring compressor : 5-8840-0254-0 (J-25048)

8. **Piston return spring**



248RY00042

9. Piston

Place the forward clutch drum onto the OD support. Holding the forward clutch piston by hand, apply compressed air to the OD support to remove the forward clutch piston.

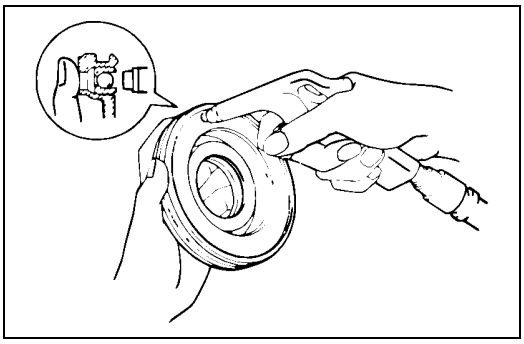
10. O-ring

11. O-ring

12. Oil seal ring

13. Thrust bearing

14. Forward clutch drum

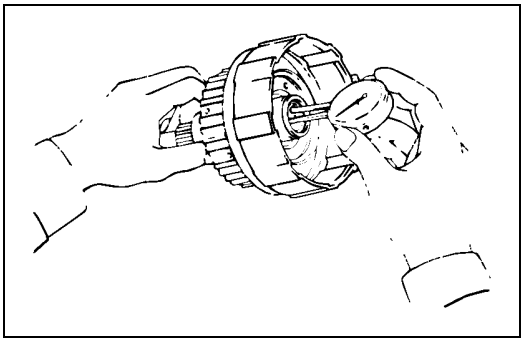


248RY00031

INSPECTION AND REPAIR

Check forward clutch piston

Check that check ball is free by shaking the piston. Check that the valve does not leak by applying low-pressure compressed air.



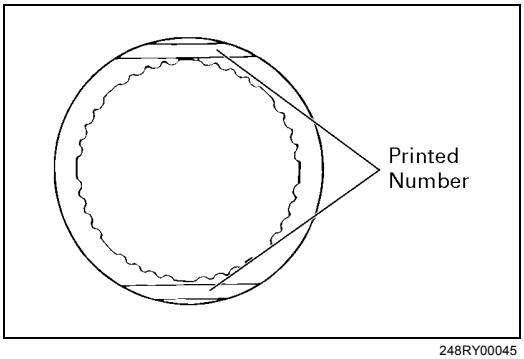
248RY00043

Check forward clutch drum bushing

Using a dial indicator, measure the inside diameter of the forward clutch drum bushing.

Maximum inside diameter: 24.08 mm (0.948 in)

If the inside diameter is greater then the maximum, replace the forward clutch drum.

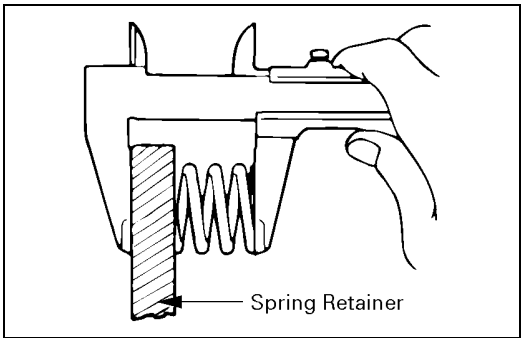


248RY00045

Check disc, plate and flange

Check to see if the sliding surface of the disc, plate and flange are worn or burnt. If necessary, replace them.

- If the lining of the disc is peeling off or discolored, or even if parts of the printed numbers are defaced, replace all discs.
- Before assembling new discs, soak them in ATF for at least fifteen minutes.



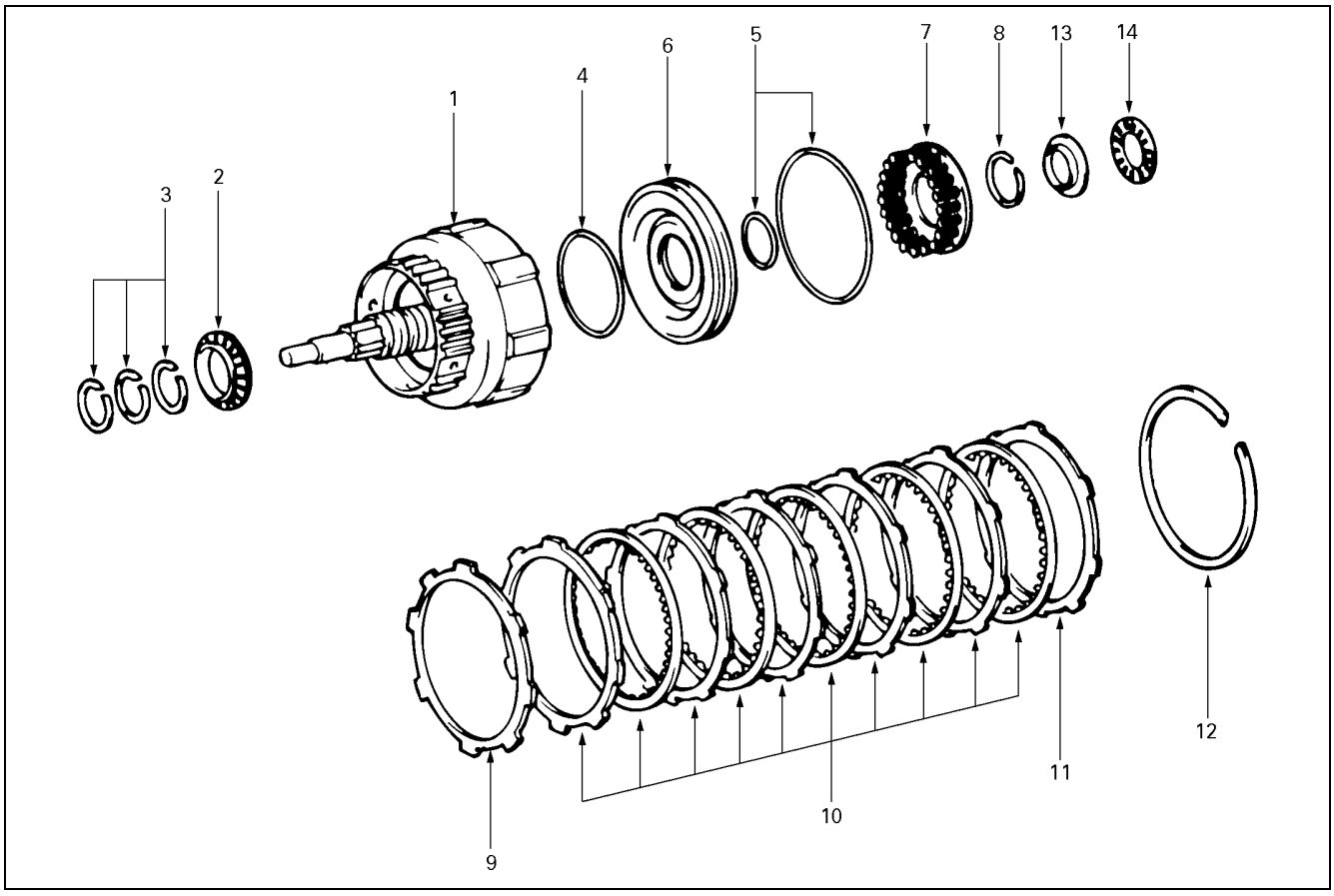
247RY00034

Check piston return spring

Using calipers, measure the free length of the return spring.

Standard length: 19.47 mm (0.7665 in)

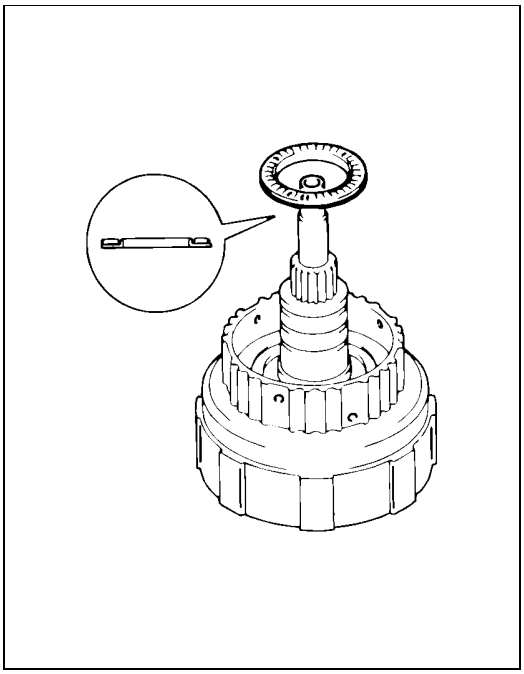
REASSEMBLY



248R200004

Reassembly steps

1. Forward clutch drum
2. Thrust bearing
3. Oil seal ring
4. O-ring
5. O-ring
6. Forward clutch piston
7. Piston return spring
8. Snap ring
9. Cushion plate
10. Disc and plate
    Six discs and six plates (UBS)
    Five discs and five plates (TFR/S)
11. Flange
12. Snap ring
13. Race
14. Thrust bearing



248RY00044

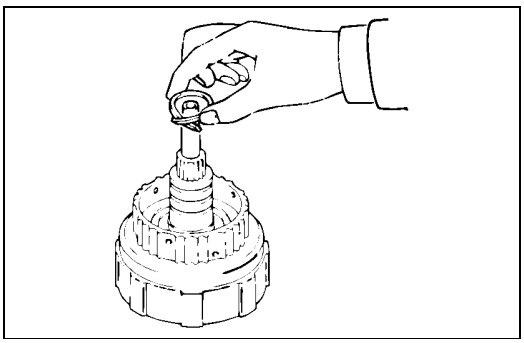
Reassembly steps

1. **Forward clutch drum**
2. **Thrust bearing**

   Coat the assembled bearing and race with petroleum jelly and install it onto the forward clutch drum, with the race side facing downward.

   Bearing and race (Reference)

Inside diameter	33.7 mm (1.327 in)
Outside diameter	47.8 mm (1.882 in)



248RY00046

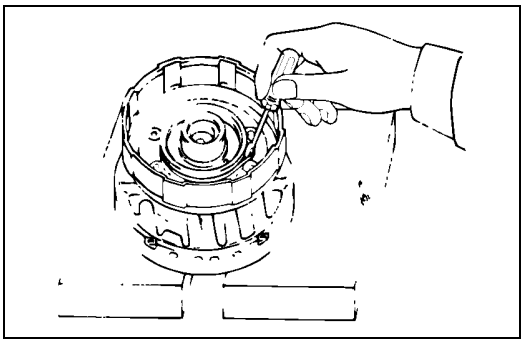
3. **Oil seal ring**

   Coat the three oil rings with ATF.

   Contract the oil seal rings as shown, and install three oil seal rings onto the forward clutch drum.

   NOTE:

   Do not spread the ring ends more than necessary.



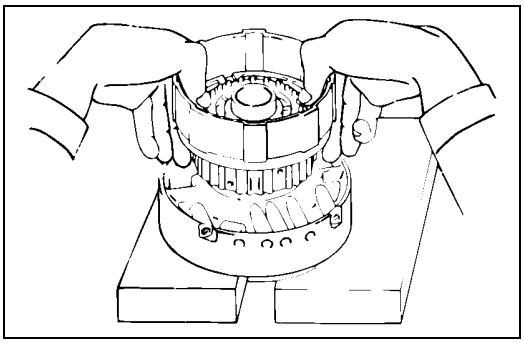
248RY00047

4. **O-ring**

   Coat a new O-ring with ATF and install O-ring on the forward clutch drum.

5. **O-ring**

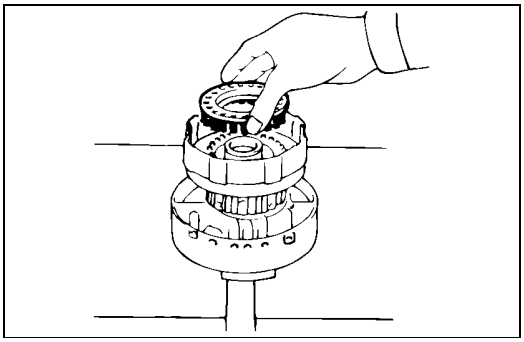
   Coat new O-rings with ATF and install two O-rings on the forward clutch piston.



248RY00049

6. **Forward clutch piston**

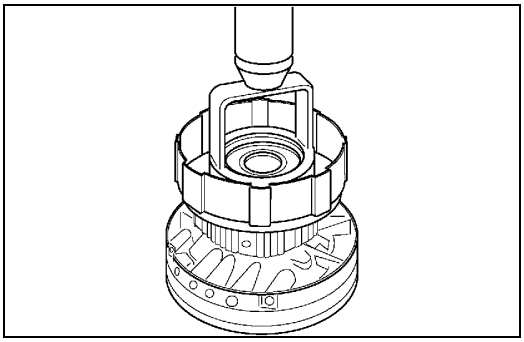
   Being careful not to damage the O-rings, press the forward clutch piston into the forward clutch drum.



248RY00065

7. Piston return spring

Install piston return spring.



248RY00003

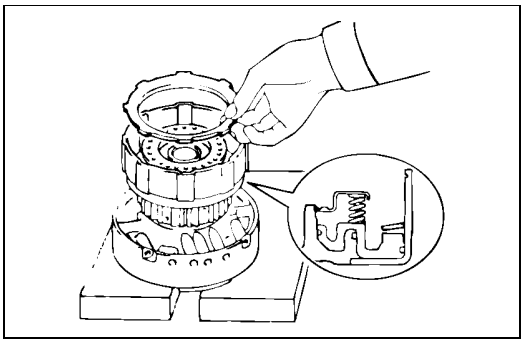
8. Snap ring

Place special tool on the spring retainer, and compress the return spring.

Spring compressor: 5-8840-0254-0 (J-25048)

Install the snap ring with snap ring pliers.

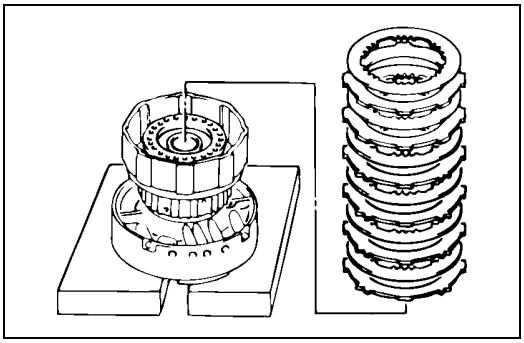
Be sure the end gap of the snap ring is not aligned with the spring retainer claw.



248RY00069

9. Cushion plate

Install cushion plate rounded side down as shown.



248RY00070

10. Disc and plate

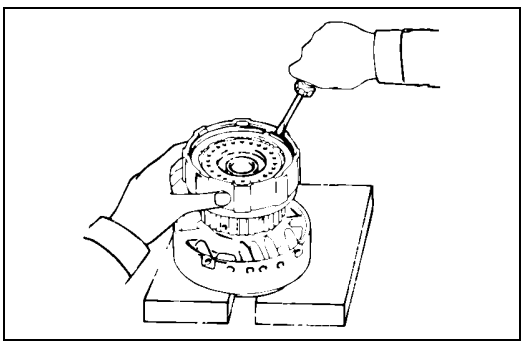
Install discs and plates.

Install in order: P-D-P-D-P-D-P-D-P-D-P-D (UBS)

: P-D-P-D-P-D-P-D-P-D (TFR/S)

11. Flange

And then install the flange, with the rounded edge facing downward.

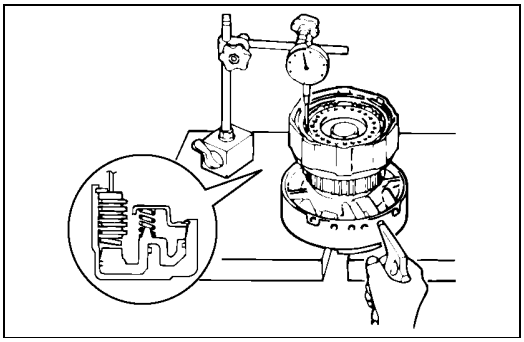


248RY00041

12. Snap ring

Install the snap ring with a screwdriver.

Be sure the end gap of the snap ring is not aligned with the cutout portion of the forward clutch drum.



248R200008

Check piston stroke of forward clutch (C-1)

Using a dial indicator, measure the forward clutch piston stroke by applying and releasing the compressed air (380 – 780 kPa, 4 – 8 kg/cm^2 or 57 – 114 psi) as shown.

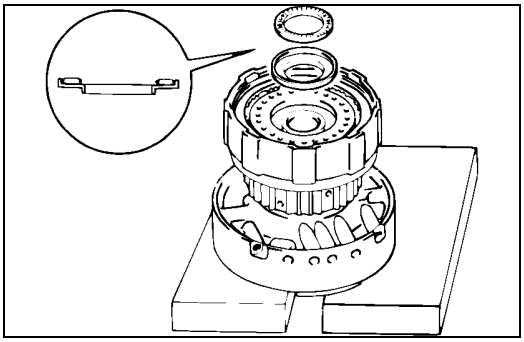
Pack clearance: 0.6 – 1.0 mm (0.0236 – 0.0394 in) (UBS)

: 0.5 – 0.9 mm (0.0197 – 0.0354 in) (TFR/S)

If the piston stroke is not within specification, replace the discs, and recheck the piston stroke.

Available flange sizes

3.0 mm (0.118 in)	3.4 mm (0.134 in)
4.2 mm (0.165 in)	3.6 mm (0.142 in)
4.4 mm (0.173 in)	3.8 mm (0.150 in)
3.2 mm (0.126 in)	4.0 mm (0.158 in)



248RY00048

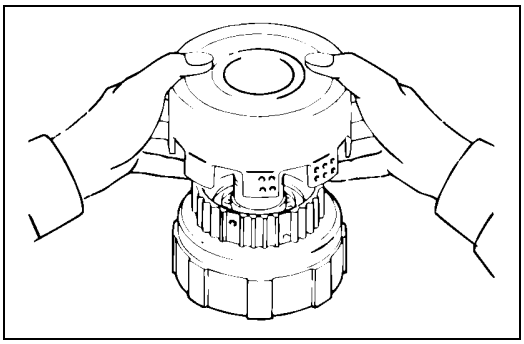
13. Race

14. Thrust bearing

Coat the race and bearing with petroleum jelly, and install them onto the forward clutch drum.

Race and bearing diameter (Reference)

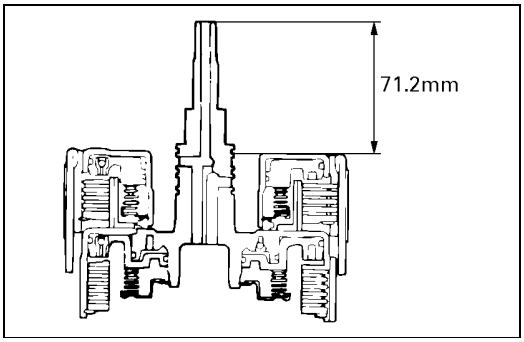
	Inside	Outside
Race	26.0 mm (1.024 in)	48.9 mm (1.925 in)
Bearing	26.0 mm (1.024 in)	46.7 mm (1.839 in)



248RY00039

Align the flukes of discs in the direct clutch.

Install the direct clutch assembly onto the forward clutch assembly.

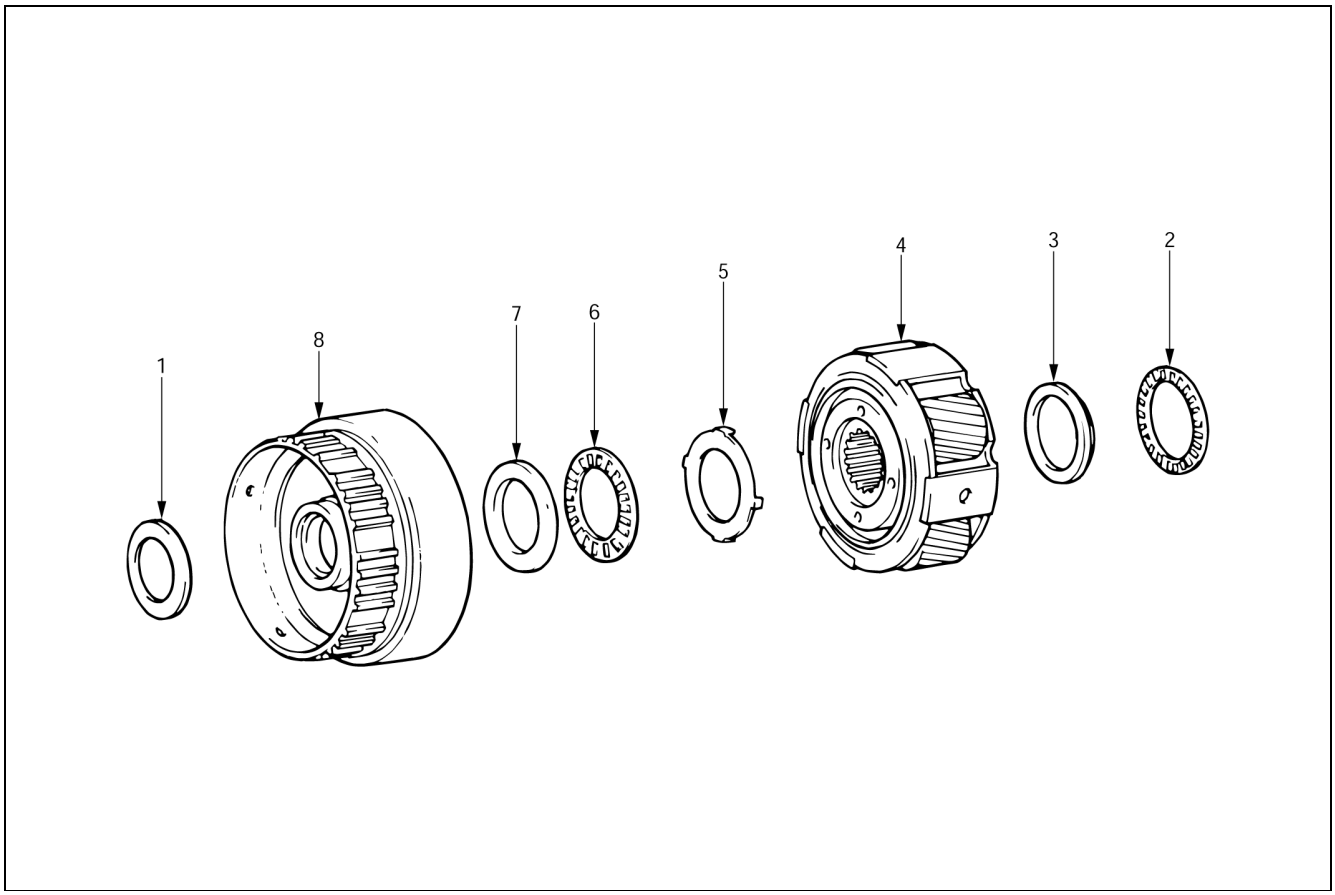


248RY00038

Check that the distance from the direct clutch end to the forward clutch end is 71.2 mm (2.803 in).

FRONT PLANETARY GEAR

DISASSEMBLY



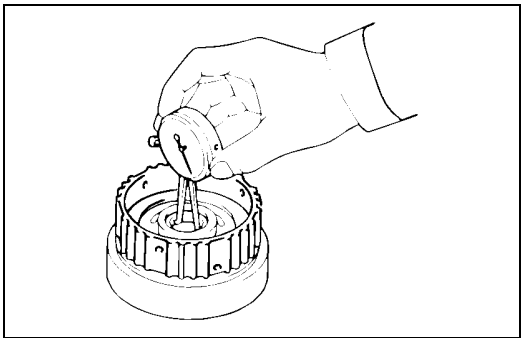
247R200003

Disassembly steps

1. Race
2. Thrust bearing
3. Race
4. Front planetary gear
5. Race (Metal)
6. Thrust bearing
7. Race
8. Front planetary ring gear

Disassembly steps

1. **Race**
2. **Thrust bearing**
3. **Race**
4. **Front planetary gear**
5. **Race (Metal)**
6. **Thrust bearing**
7. **Race**
8. **Front planetary ring gear**



247RY00021

INSPECTION AND REPAIR

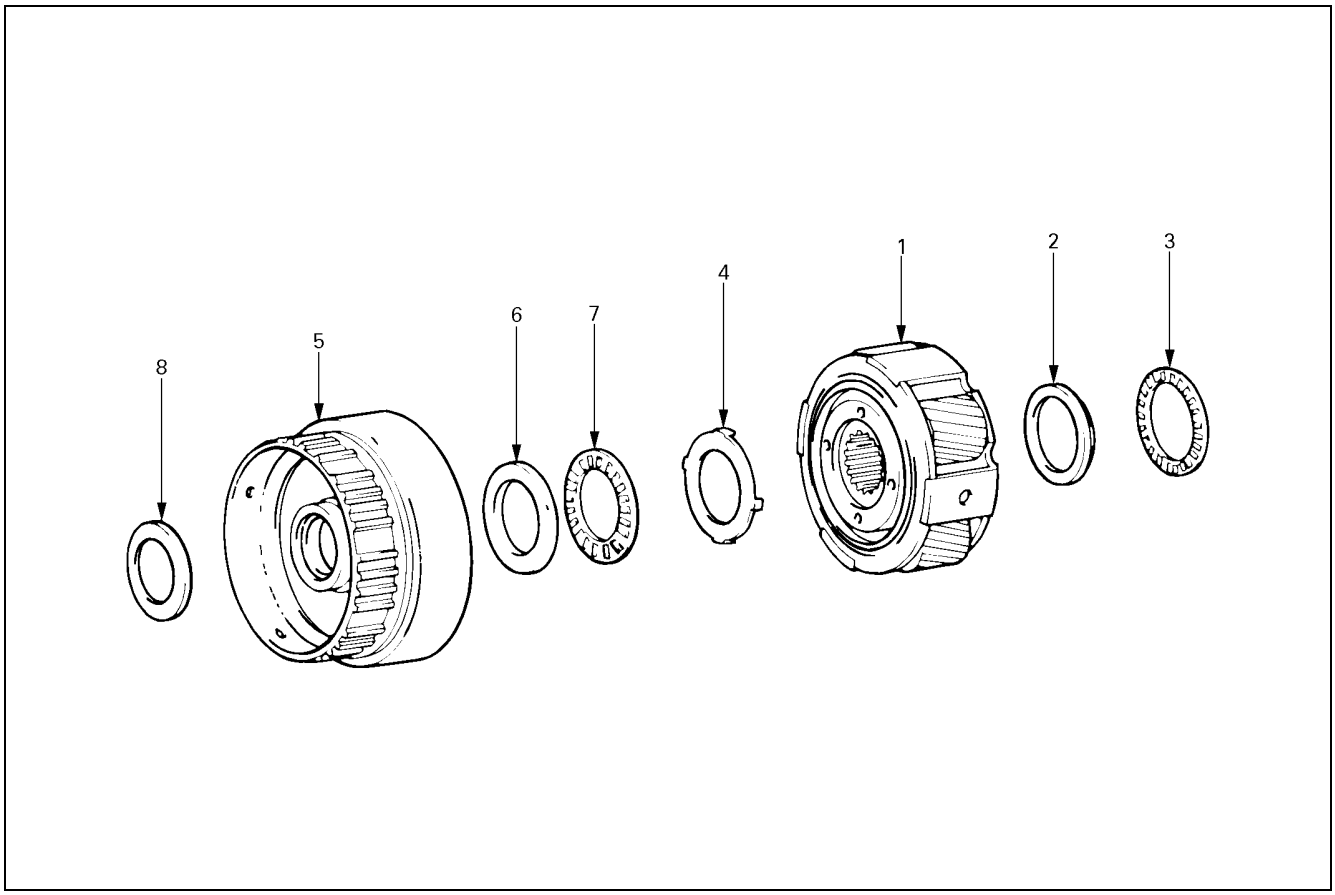
Check front planetary ring gear bushing

Using a dial indicator, measure the inside diameter of the front planetary ring gear bushing.

Maximum inside diameter: 24.08 mm (0.9480 in)

If the inside diameter is greater than the maximum, replace the front planetary ring gear.

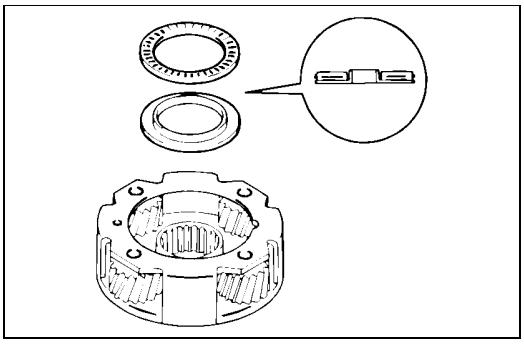
REASSEMBLY



247R200004

Reassembly steps

1. Front planetary gear
2. Race
3. Thrust bearing
4. Race (Metal)
5. Front planetary ring gear
6. Race
7. Thrust bearing
8. Race



247RY00023

Reassembly steps

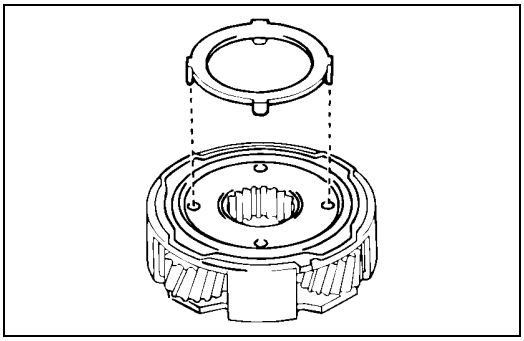
1. **Front planetary gear**
2. **Race**
3. **Thrust bearing**

   Coat the race and bearing with petroleum jelly.

   Install the race and bearing to the rear side of the front planetary gear.

Bearing and race diameter (Reference)

	Inside	Outside
Bearing	35.6 mm (1.402 in)	47.7 mm (1.878 in)
Race	33.7 mm (1.327 in)	47.6 mm (1.874 in)



247RY00024

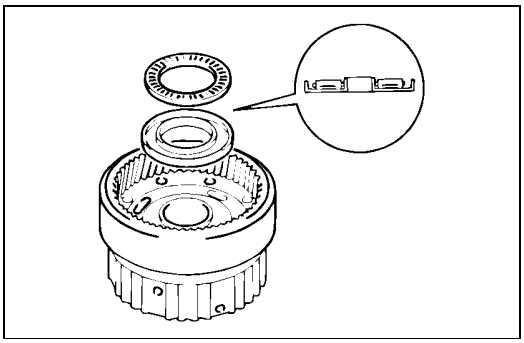
4. Race (Metal)

Turn over the planetary gear and install the race.

Make sure that the lugs fit into the holes on the front planetary gear.

Race diameter (Reference)

	Inside	Outside
Race	34.3 mm (1.350 in)	47.8 mm (1.882 in)



247RY00025

5. Front planetary ring gear

6. Race

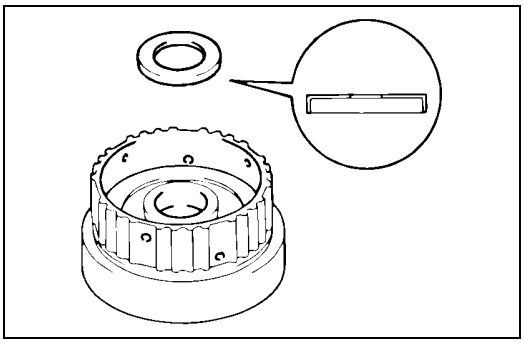
7. Thrust bearing

Coat the race and bearing with petroleum jelly.

Install the race and bearing onto the rear side of the front planetary ring gear.

Race and bearing diameter (Reference)

	Inside	Outside
Race	30.6 mm (1.205 in)	53.6 mm (2.110 in)
Bearing	32.7 mm (1.287 in)	47.7 mm (1.878 in)



247RY00026

8. Race

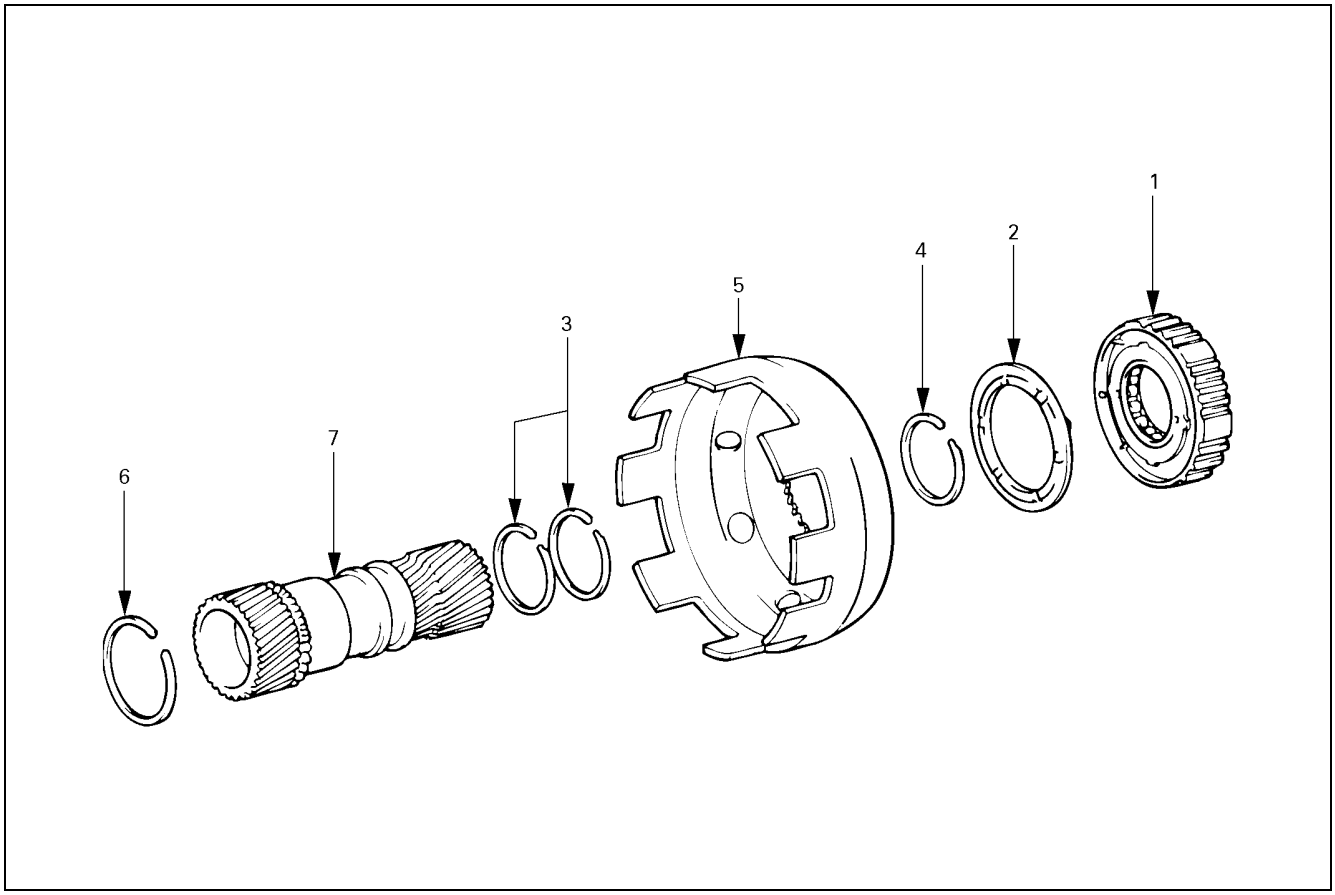
Turn over the planetary ring gear and install the race onto the front side of the front planetary ring gear.

Race diameter (Reference)

	Inside	Outside
Race	26.8 mm (1.055 in)	47.0 mm (1.850 in)

PLANETARY SUN GEAR AND NO.1 ONE-WAY CLUTCH

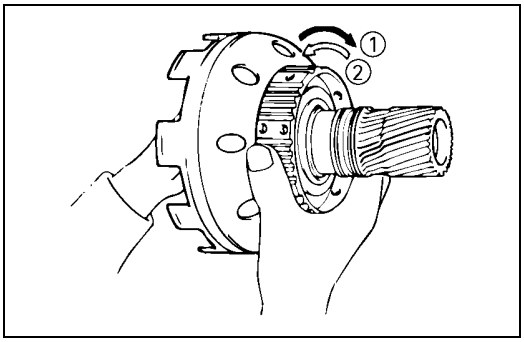
DISASSEMBLY



248R200005

Disassembly steps

1. One-way clutch and second brake hub
2. Thrust washer (plastic)
3. Oil seal ring (Metal)
4. Snap ring
5. Sun gear input drum
6. Snap ring
7. Planetary sun gear



248RY00051

Disassembly steps

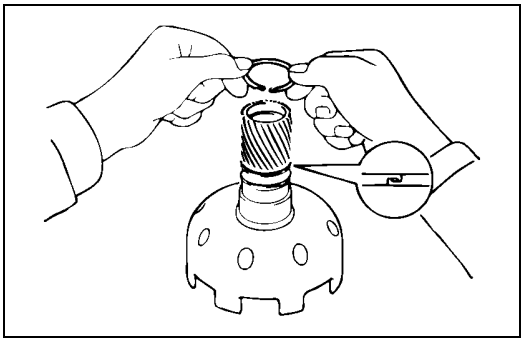
Check operation of No.1 one-way clutch

Hold the planetary sun gear and turn the second brake hub.

The second brake hub should turn freely clockwise and should lock counterclockwise.

①: Free

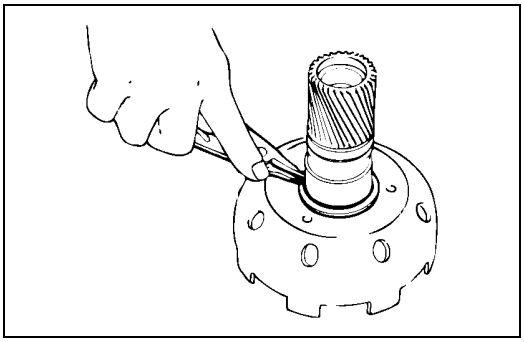
②: Lock



248RY00052

1. **One-way clutch and second brake hub**
2. **Thrust washer (plastic)**
3. **Oil seal ring (Metal)**

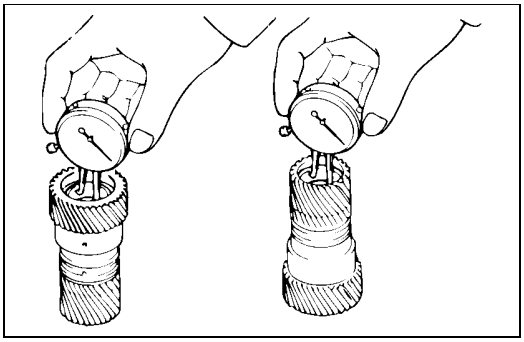
   Remove two oil seal rings.



248RY00053

4. **Snap ring**

   Remove the snap ring with snap ring pliers.
5. **Sun gear input drum**
6. **Snap ring**
7. **Planetary sun gear**



248RY00054

INSPECTION AND REPAIR

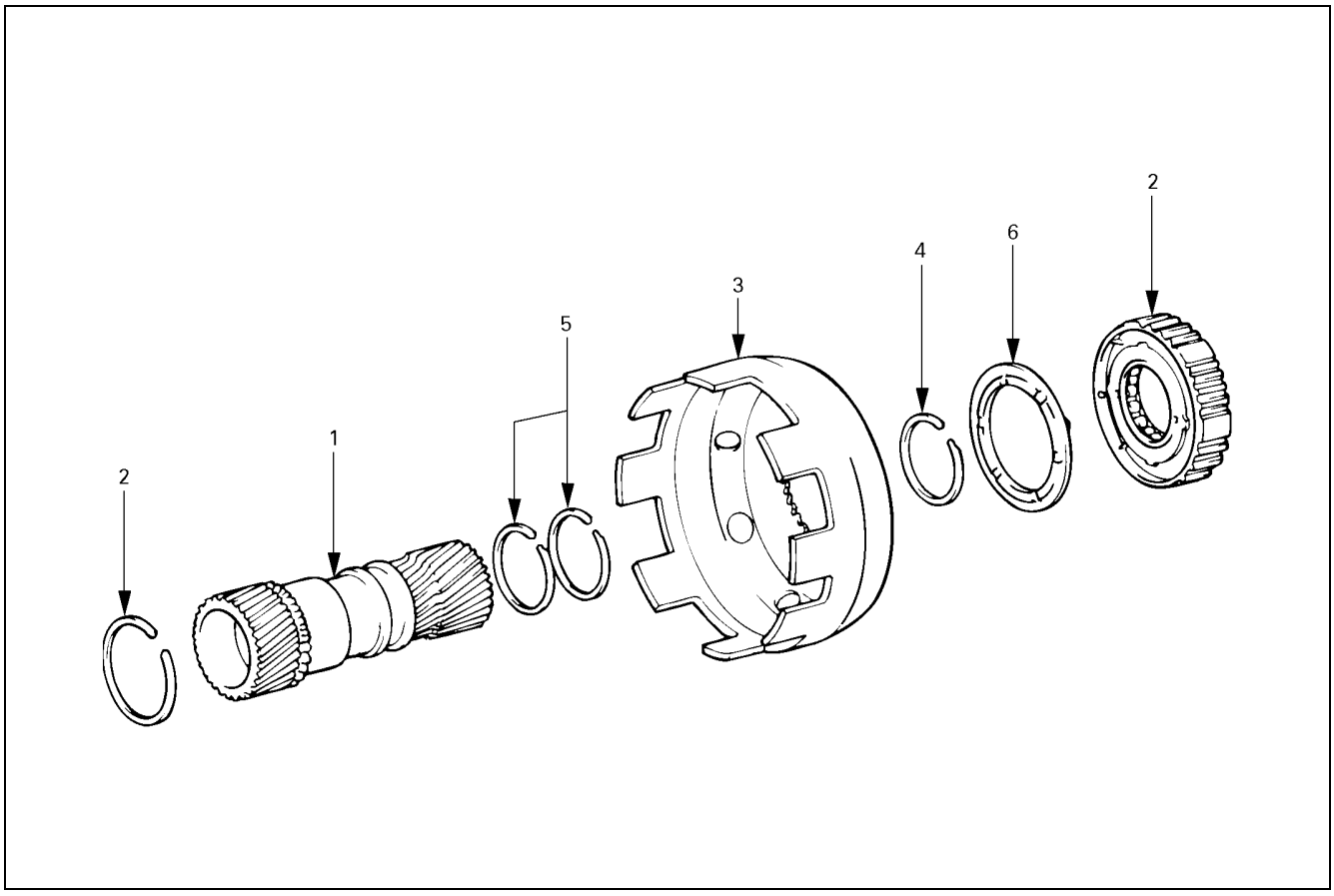
Check planetary sun gear bushing

Using a dial indicator, measure the inside diameter of the planetary sun gear bushing.

Maximum inside diameter: 27.01 mm (1.0634 in)

If the inside diameter is greater than the maximum, replace the planetary sun gear.

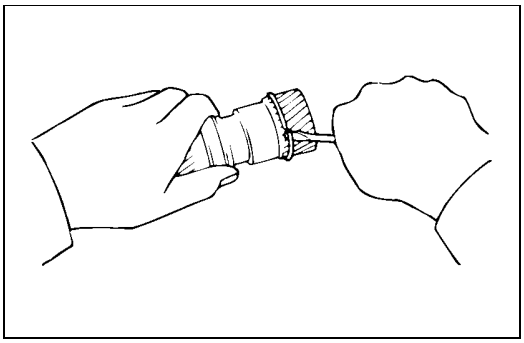
REASSEMBLY



248R200006

Reassembly steps

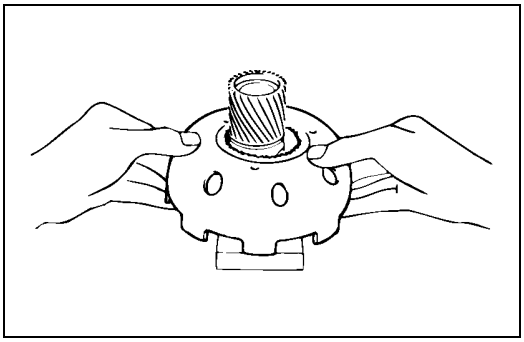
1. Planetary sun gear
2. Snap ring
3. Sun gear input drum
4. Snap ring
5. Oil seal ring (Metal)
6. Thrust washer (Plastic)
7. One-way clutch and second brake hub


248RY00055

Reassembly steps

1. **Planetary sun gear**
2. **Snap ring**

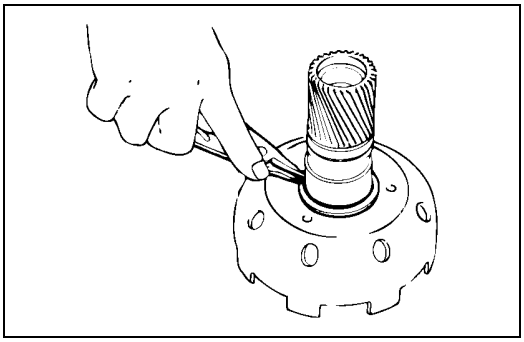
   Install snap ring to planetary sun gear.


248RY0056

3. **Sun gear input drum**

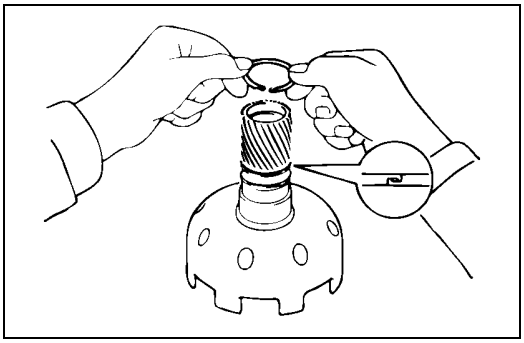
   Place a wooden block, etc. as a work stand and place the planetary sun gear onto it.

   Install the sun gear input drum onto the planetary sun gear.


248RY00053

4. **Snap ring**

   Install snap ring with snap ring pliers.


248RY00052

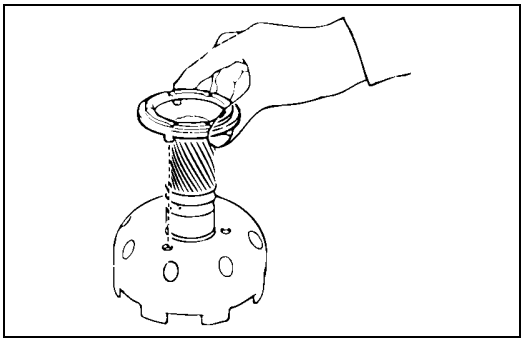
5. **Oil seal ring (Metal)**

   Coat the two oil seal rings with ATF.

   Install the two oil seal rings onto the planetary sun gear.

   NOTE:

   Do not spread the ring ends too much.

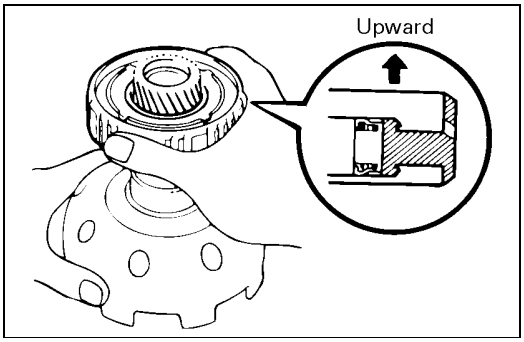

248RY00057

6. **Thrust washer (Plastic)**

   Install thrust washer.

   NOTE:

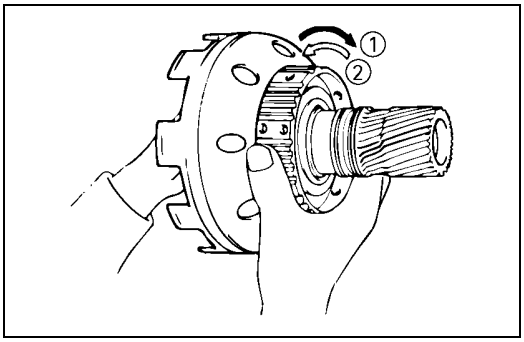
   Make sure that the lugs fit into the holes on the sun gear input drum.



248RY00058

7. One-way clutch and second brake hub

Install assembled No.1 one-way clutch and second brake hub onto planetary sun gear as shown.



248RY00051

Check operation of No.1 one-way clutch

Hold the planetary sun gear and turn the second brake hub.

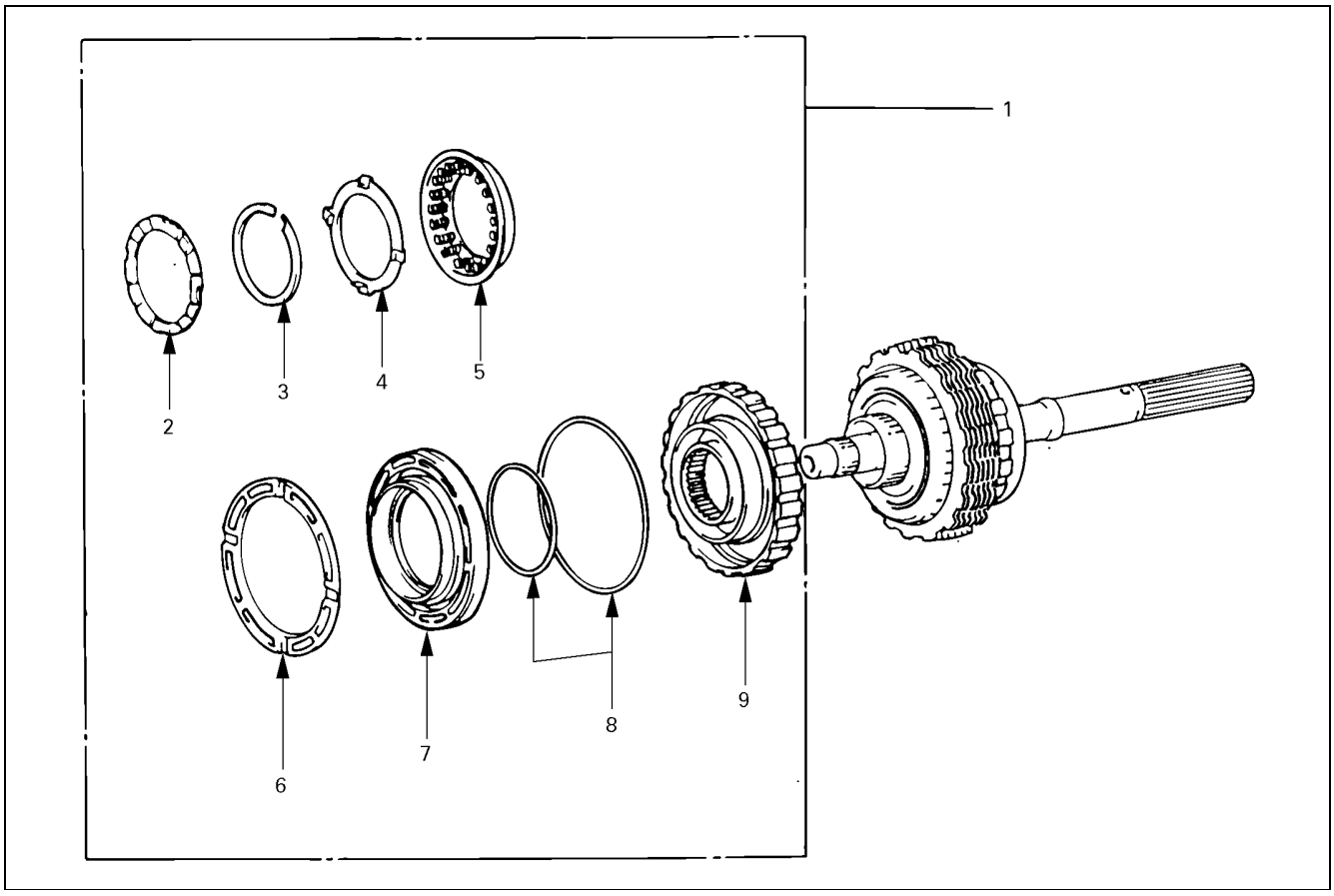
The second brake hub should turn freely clockwise and should lock counterclockwise.

①: Free

②: Lock

SECOND BRAKE ASSEMBLY (B-2)

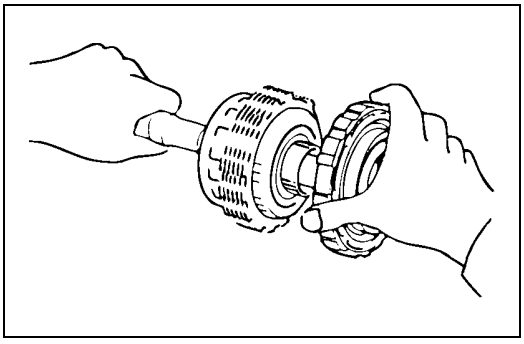
DISASSEMBLY



246R200001

Disassembly steps

1. Second brake assembly
2. Thrust washer (Plastic)
3. Snap ring
4. Spring retainer
5. Piston return spring
6. Piston sleeve
7. Second brake piston
8. O-ring
9. Second brake drum

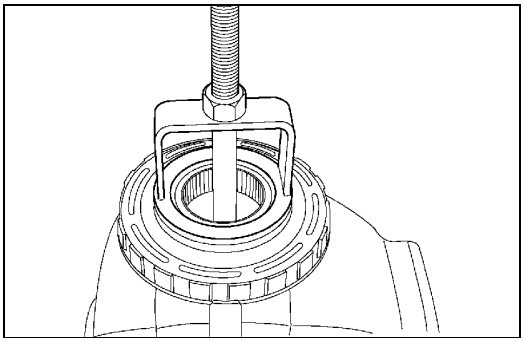


246RY00007

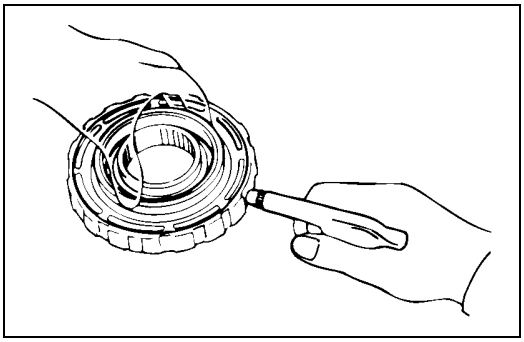
Disassembly steps

1. **Second brake assembly**

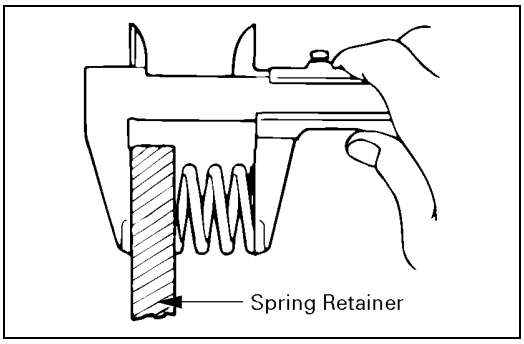
   Remove second brake assembly from output shaft.



247RY00001



246RY00008



247RY00034

2. **Thrust washer (Plastic)**
3. **Snap ring**

   Place special tool on the spring retainer, and compress the return spring.

   Spring compressor: 5-8840-0254-0 (J-25048)

   Remove the snap ring with snap ring pliers.
4. **Spring retainer**
5. **Piston return spring**
6. **Piston sleeve**
7. **Second brake piston**

   Holding the second brake piston by hand, apply compressed air to the second brake drum to remove the second brake piston.

   Remove the second brake piston.
8. **O-ring**
9. **Second brake drum**

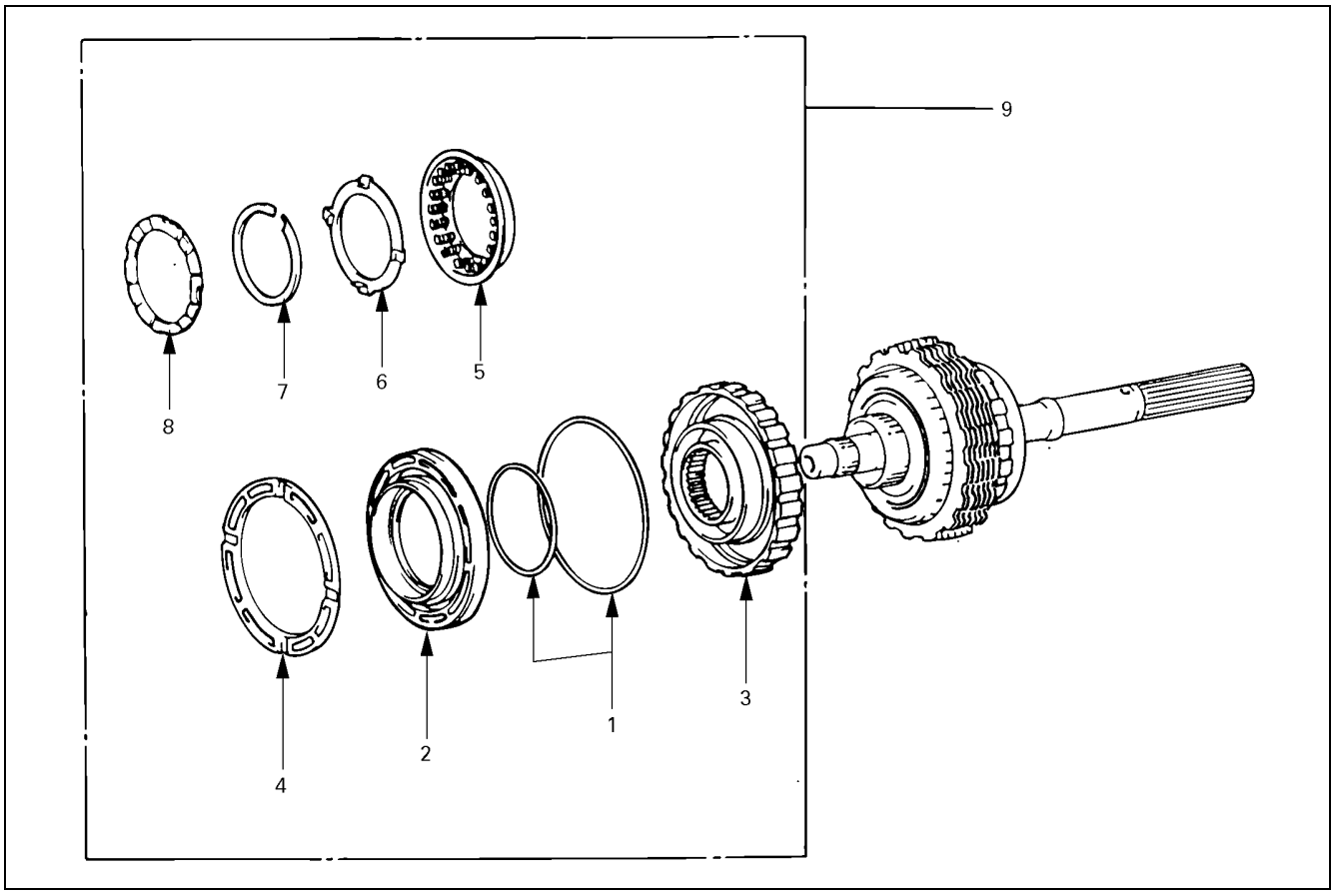
INSPECTION AND REPAIR

Check piston return spring

Using calipers, measure the free length of the return spring.

Standard length: 16.05 mm (0.6319 in)

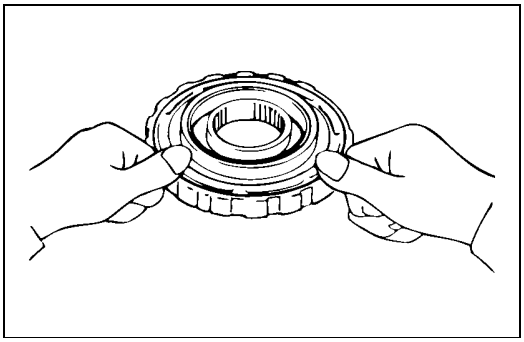
REASSEMBLY



246R200002

Reassembly steps

1. O-ring
2. Second brake piston
3. Second brake drum
4. Piston sleeve
5. Piston return spring
6. Spring retainer
7. Snap ring
8. Thrust washer (Plastic)
9. Second brake assembly



246RY00009

Reassembly steps

1. **O-ring**

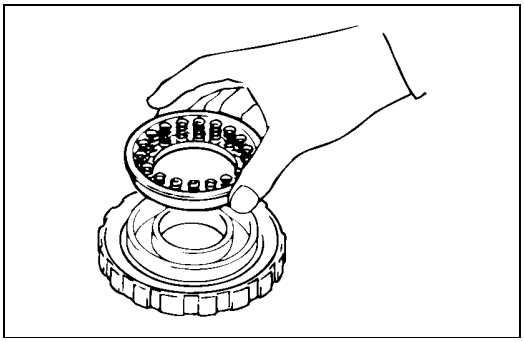
   Coat new O-rings with ATF and install them on the second brake piston.

2. **Second brake piston**
3. **Second brake drum**

   Being careful not to damage the O-rings, press in the second brake piston into the second brake drum.

4. **Piston sleeve**

   Install piston sleeve.



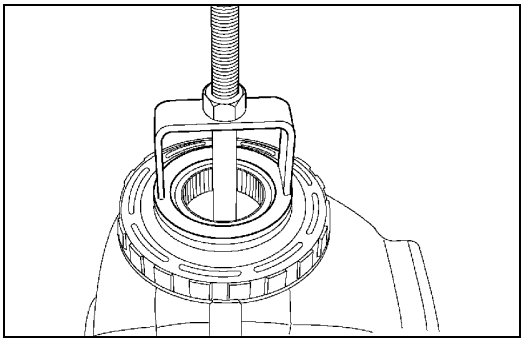
246RY00010

5. Piston return spring

Install piston return spring.

6. Spring retainer

Install spring retainer.



247RY00001

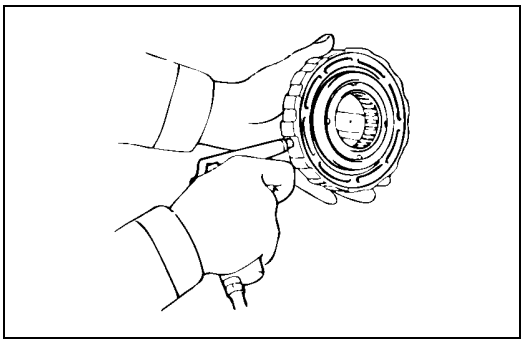
7. Snap ring

Place special tool on the spring retainer, and compress the return spring.

Spring compressor: 5-8840-0254-0 (J-25048)

Install the snap ring with snap ring pliers.

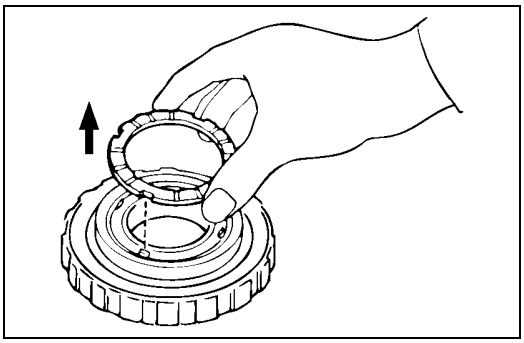
Be sure the end gap of the snap ring is not aligned with the spring retainer claw.



246RY00011

Check second brake piston movement

Make sure the second brake piston moves smoothly when applying and releasing the low compressed air to the second brake drum.



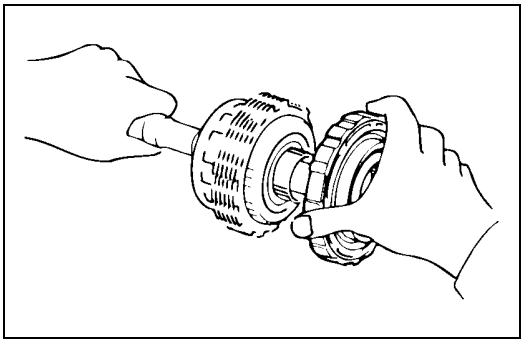
246RY00012

8. Thrust washer (plastic)

Coat the thrust washer with petroleum jelly and install it to the second brake piston, with the grooved side facing upward.

NOTE:

Make sure that the cutout portions of the thrust washer match the teeth of the spring retainer.



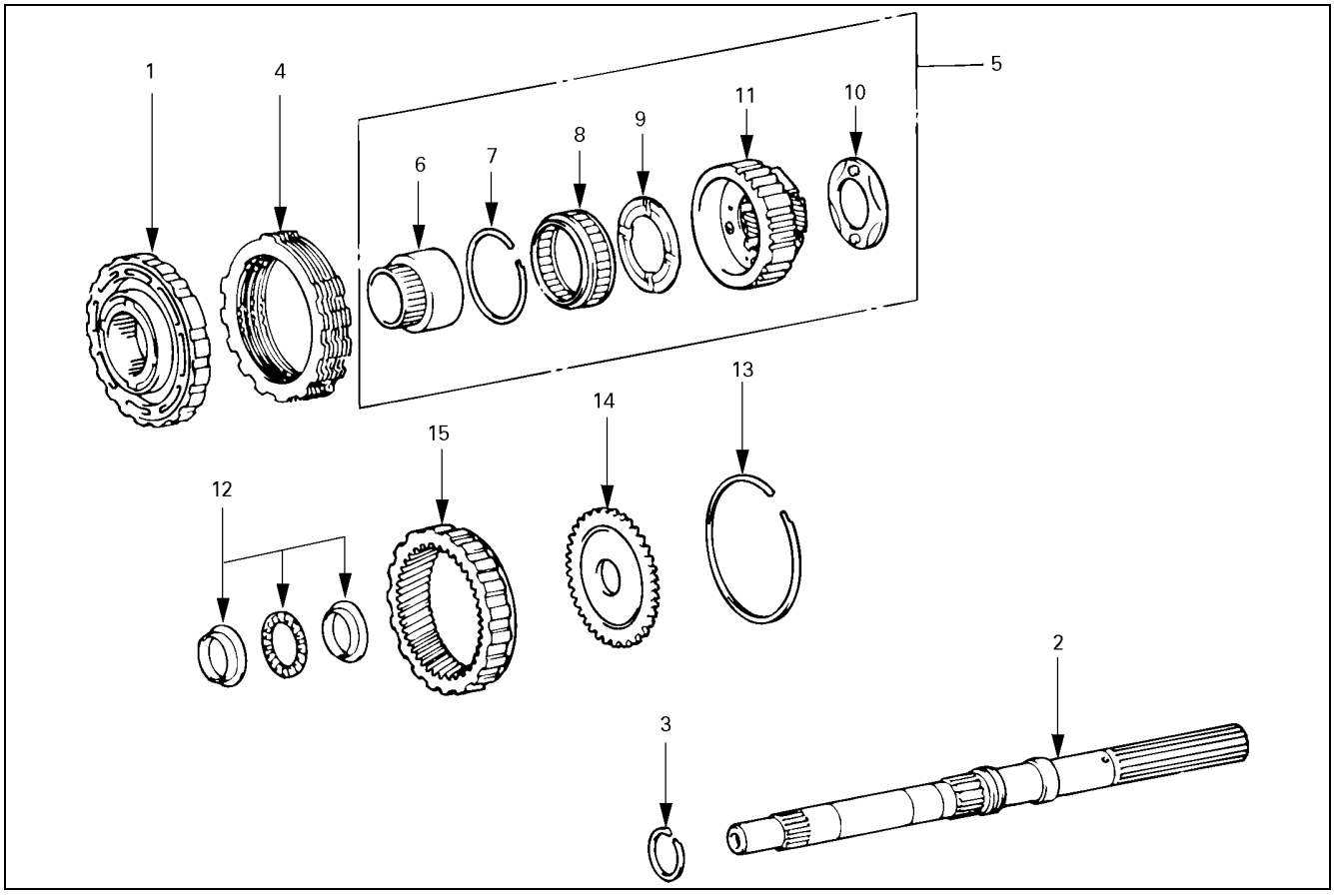
246RY00014

9. Second brake assembly

Install second brake assembly to output shaft.

REAR PLANETARY GEAR ASSEMBLY AND OUTPUT SHAFT

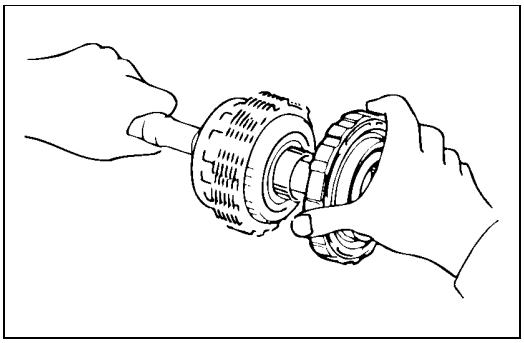
DISASSEMBLY



247R200005

Disassembly steps

1. Second brake assembly
2. Output shaft
3. Oil seal ring
4. Disc, plate and flange (B-3)
   Seven discs and seven plates (UBS)
   Six discs and six plates (TFR/S)
5. Rear planetary gear assembly
6. One-way clutch inner race
7. Snap ring
8. One-way clutch
9. Thrust washer (Plastic)
10. Thrust washer (Plastic)
11. Rear planetary gear
12. Thrust bearing and race
13. Snap ring
14. Ring gear flange
15. Rear planetary ring gear

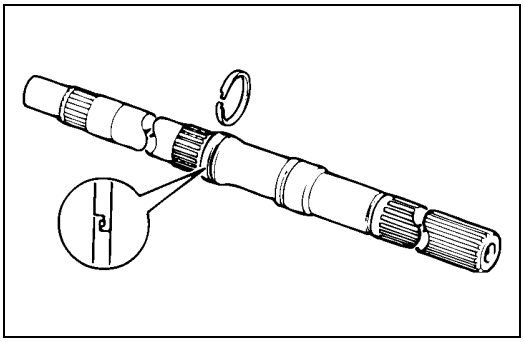


246RY00014

Disassembly steps

1. **Second brake assembly**
2. **Output shaft**

   Remove second brake assembly from output shaft.



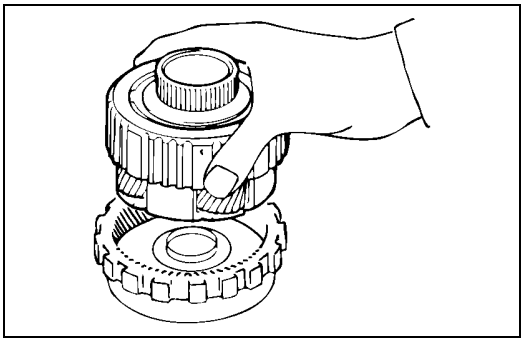
247RY00028

3. **Oil seal ring**

   Remove oil seal ring from output shaft.
4. **Disc, plate and flange (B-3)**

   Seven discs and seven plates (UBS)

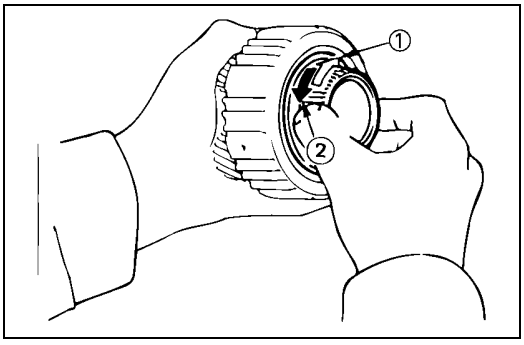
   Six discs and six plates (TFR/S)



247RY00029

5. **Rear planetary gear assembly**

   Remove rear planetary gear from rear planetary ring gear.



247RY00030

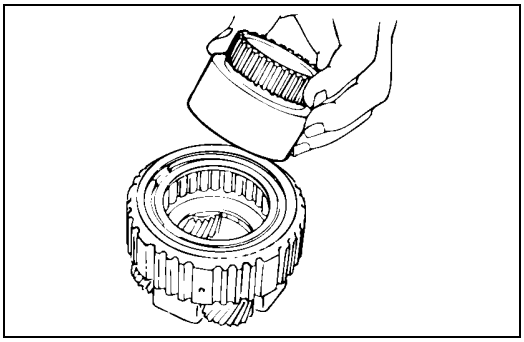
Check operation of No.2 one-way clutch

Hold the planetary gear and turn the one-way clutch inner race.

The one-way clutch inner race should turn freely counterclockwise and should lock clockwise.

①: Lock

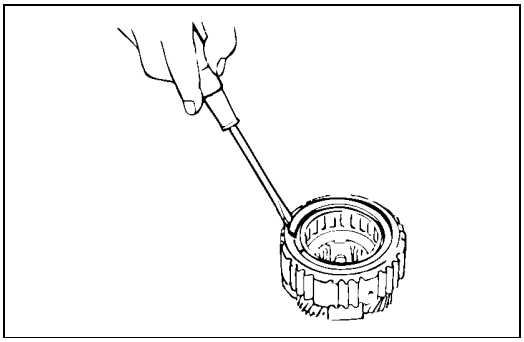
②: Free



247RY00031

6. **One-way clutch inner race**

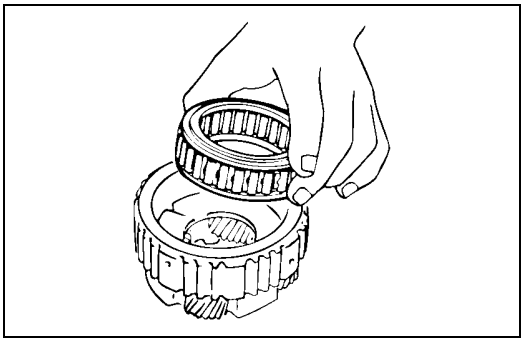
   Remove the one-way clutch inner race from the rear planetary gear.



247RY00032

7. Snap ring

Remove the snap ring with a screwdriver.



247RY00033

8. One-way clutch

Remove the one-way clutch with retainers from the planetary gear.

9. Thrust washer (Plastic)

10. Thrust washer (Plastic)

11. Rear planetary gear

12. Thrust bearing and race

13. Snap ring

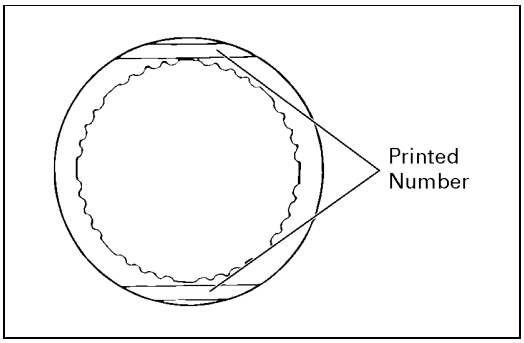
14. Ring gear flange

15. Rear planetary ring gear

Check disc, plate and flange

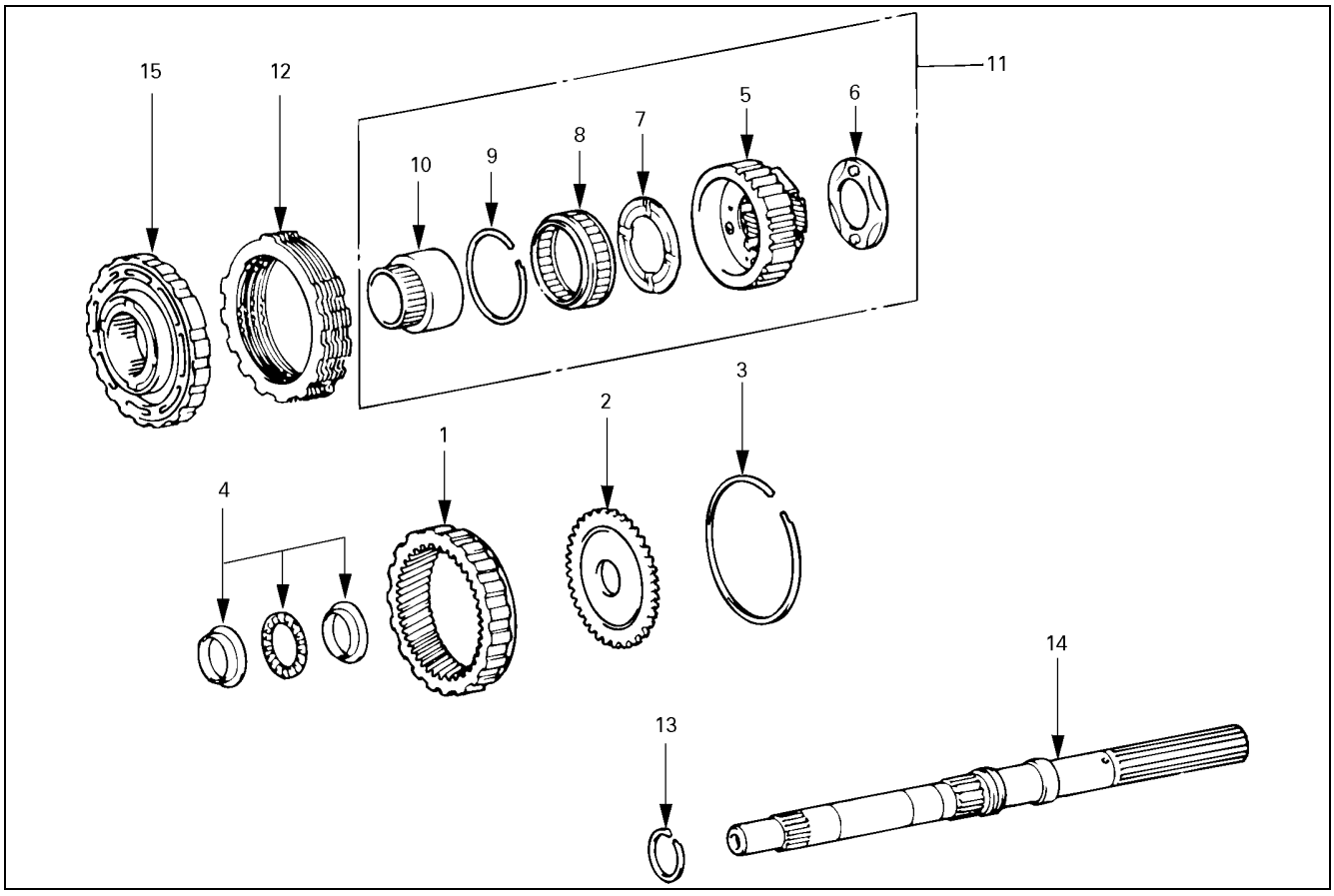
Check to see if the sliding surface of the disc, plate and flange are worn or burnt. If necessary, replace them.

- If the lining of the disc is peeling off or discolored, or even if parts of the printed numbers are defaced, replace all discs.
- Before assembling new discs, soak them in ATF for at least fifteen minutes.



248RY00045

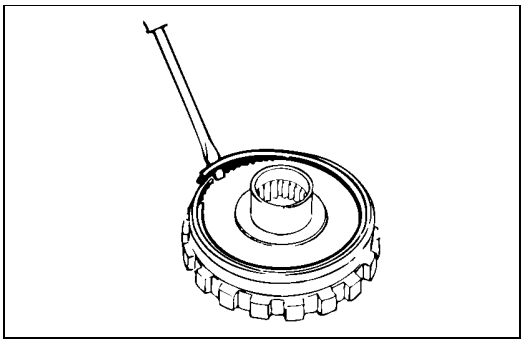
REASSEMBLY



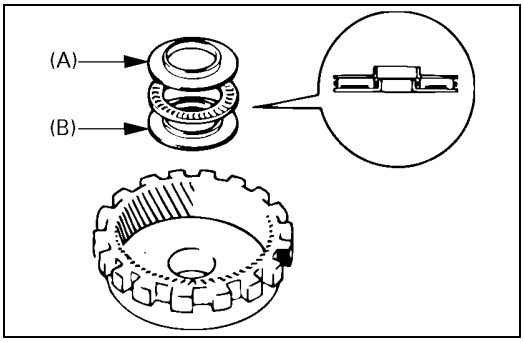
247R200006

Reassembly steps

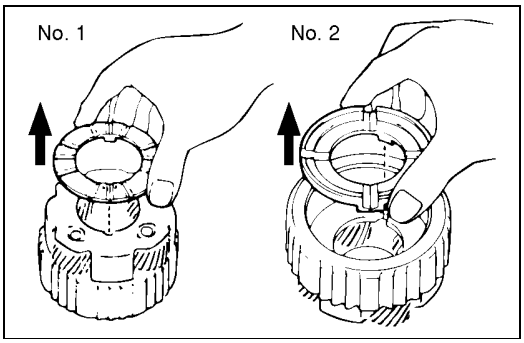
1. Rear planetary ring gear
2. Ring gear flange
3. Snap ring
4. Thrust bearing and race
5. Rear planetary gear
6. Thrust washer (Plastic)
7. Thrust washer (Plastic)
8. One-way clutch
9. Snap ring
10. One-way clutch inner race
11. Rear planetary gear assembly
12. Disc, plate and flange (B-3)
    Seven discs and seven plates (UBS)
    Six discs and six plates (TFR/S)
13. Oil seal ring
14. Output shaft
15. Second brake assembly



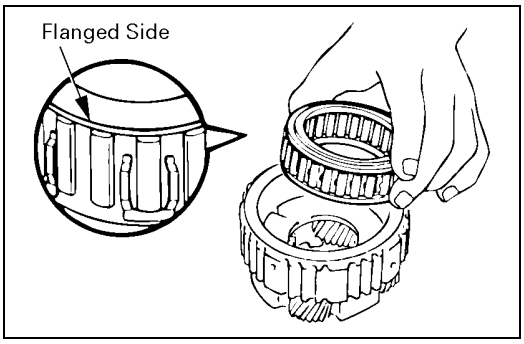
247RY00035



247RY00036



247RY00037



247RY00038

Reassembly steps

1. **Rear planetary ring gear**
2. **Ring gear flange**

   Install ring gear flange to the rear planetary ring gear.
3. **Snap ring**

   Install snap ring to the rear planetary ring gear.
4. **Thrust bearing and race**

   Coat the races and bearing with petroleum jelly, and install them onto the rear planetary ring gear.

   Races and bearing diameter (Reference)

	Inside	Outside
Race (A)	28.5 mm (1.122 in)	44.2 mm (1.740 in)
Bearing and race (B)	27.7 mm (1.091 in)	44.2 mm (1.740 in)

5. **Rear planetary gear**
6. **Thrust washer (Plastic)**
7. **Thrust washer (Plastic)**

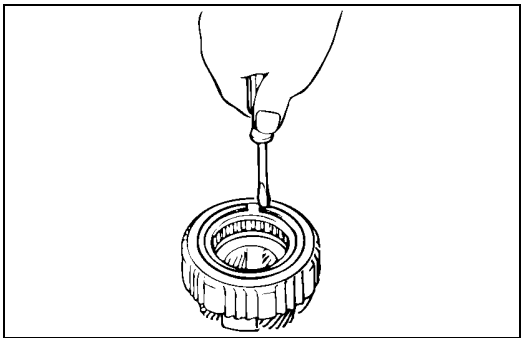
   Coat the thrust washers with petroleum jelly.

   Install the thrust washers onto both sides of the rear planetary gear, facing the grooved side upward.

   NOTE:

   Make sure that the lugs fit into the cutout portions on the rear planetary gear.
8. **One-way clutch**

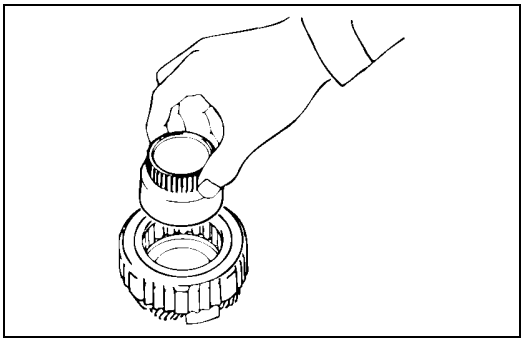
   Install the one-way clutch with the flanged side facing upward onto the rear planetary gear.



247RY00039

9. Snap ring

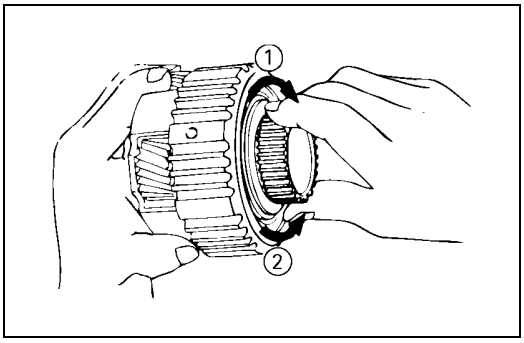
Install snap ring.



247RY00040

10. One-way clutch inner race

While turning counterclockwise, install one-way clutch inner race to rear planetary gear.



247RY00041

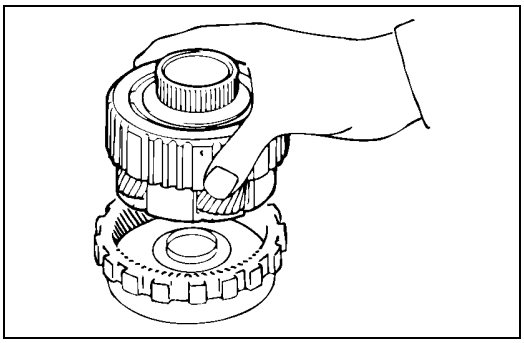
Check operation of one-way clutch

Hold the planetary gear and turn the one-way clutch inner race.

The one-way clutch inner race should turn freely counterclockwise and should lock clockwise.

①: Lock

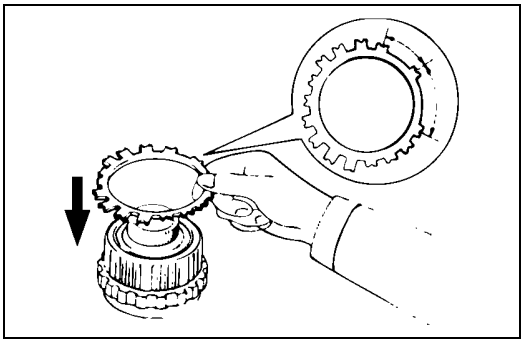
②: Free



247RY00029

11. Rear planetary gear assembly

Install rear planetary gear onto rear planetary ring gear.



246RY00013

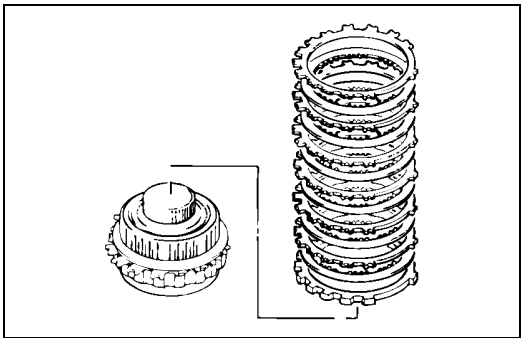
12. Disc, plate and flange (B-3)

Install a brake flange onto the rear planetary gear assembly.

Install a clutch plate onto the rear planetary gear assembly.

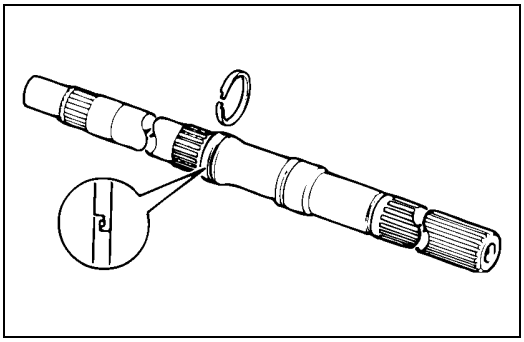
NOTE:

The claw interval of the plate should be as shown in the figure when viewing the clutch plate from the arrow direction.



247RY00047

Install seven clutch discs and seven brake plates (UBS) or six clutch discs and six brake plates (TFR/S) alternately, starting with clutch disc, onto the rear planetary gear assembly.



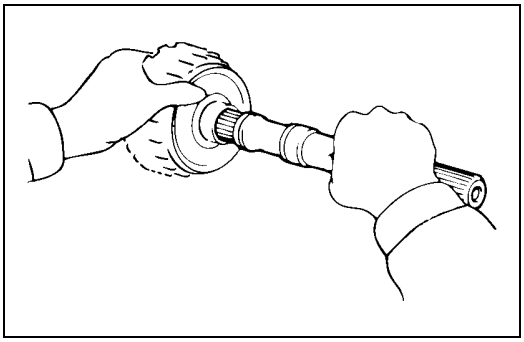
247RY00028

13. Oil seal ring

Coat the oil seal ring with ATF and install it to the output shaft.

NOTE:

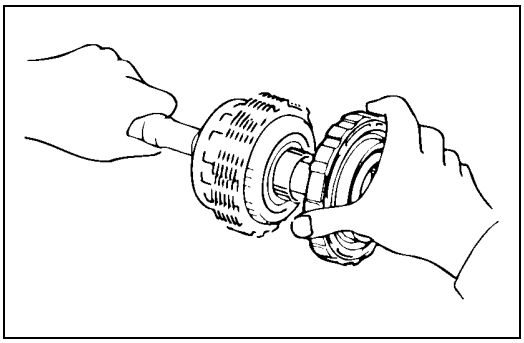
Do not spread the ring ends too much.



247RY00042

14. Output shaft

Install output shaft into rear planetary gear assembly.



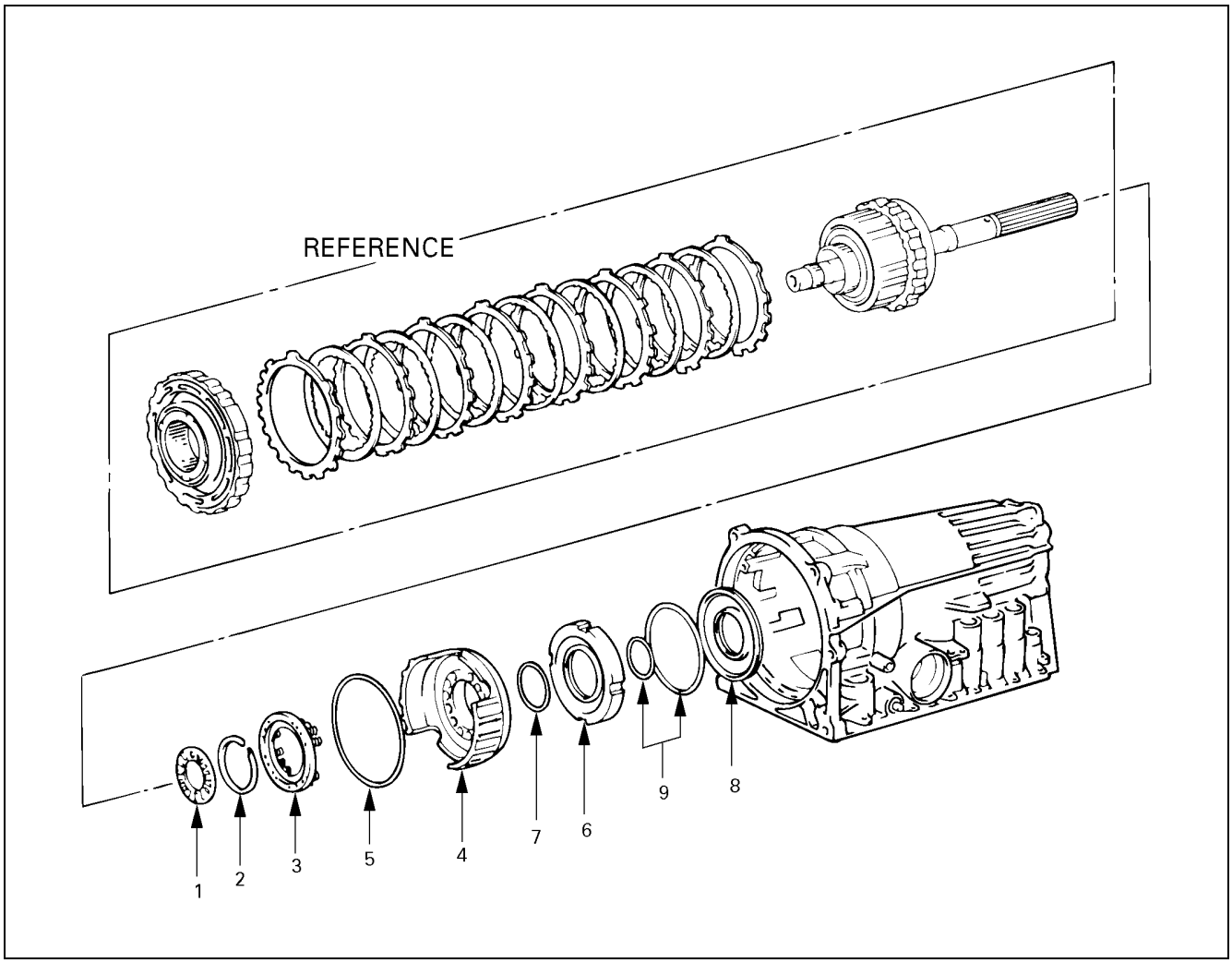
246RY00014

15. Second brake assembly

Install second brake assembly to output shaft.

FIRST AND REVERSE BRAKE (B-3)

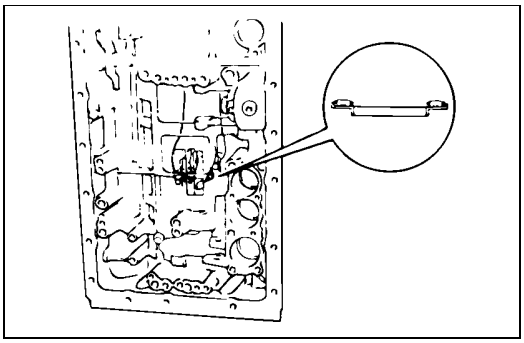
DISASSEMBLY



246RY00024

Disassembly steps

1. Thrust bearing and race
2. Snap ring
3. Piston return spring
4. First and reverse brake piston No.2
5. O-ring
6. Reaction sleeve
7. O-ring
8. First and reverse brake piston No.1
9. O-ring

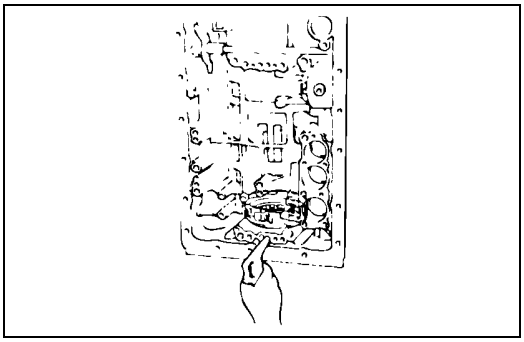


247RY00043

Disassembly steps

1. **Thrust bearing and race**

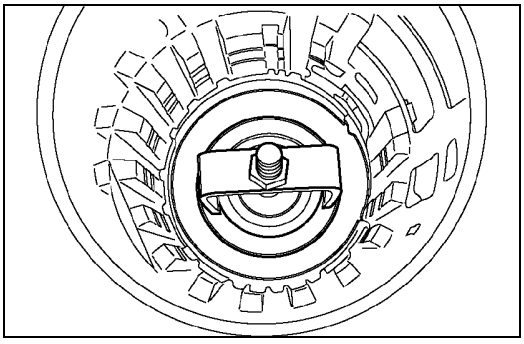
   Remove assembled bearing and race from transmission case.



246RY00016

Check first and reverse brake piston movement

Make sure that first and reverse brake piston moves smoothly when applying and releasing the compressed air into the transmission case.



247RY00002

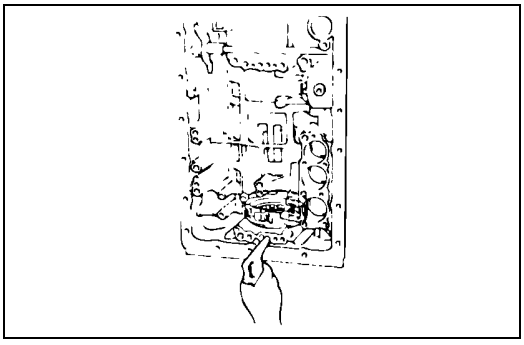
2. **Snap ring**

   Set special tool on the spring retainer, and compress the return spring.

   Spring compressor: 5-8840-0254-0 (J-25048)

   Remove the snap ring with snap ring pliers.

3. **Piston return spring**



246RY00016

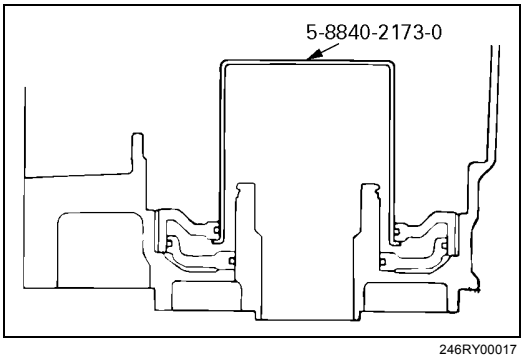
4. **First and reverse brake piston No.2**

   Holding the first and reverse brake piston No.2 by hand, apply compressed air to the transmission case to remove the first and reverse brake piston No.2.

   Remove the first and reverse brake piston No.2.

   If the piston does not pop out with compressed air, lift the piston out with needle-nose pliers.

5. **O-ring**



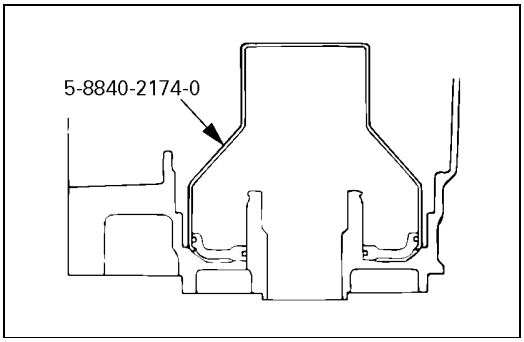
246RY00017

6. **Reaction sleeve**

   Insert special tool behind the reaction sleeve and gradually lift it out of the transmission case.

   Reaction sleeve puller: 5-8840-2173-0 (J-37236)

7. **O-ring**



247RY00044

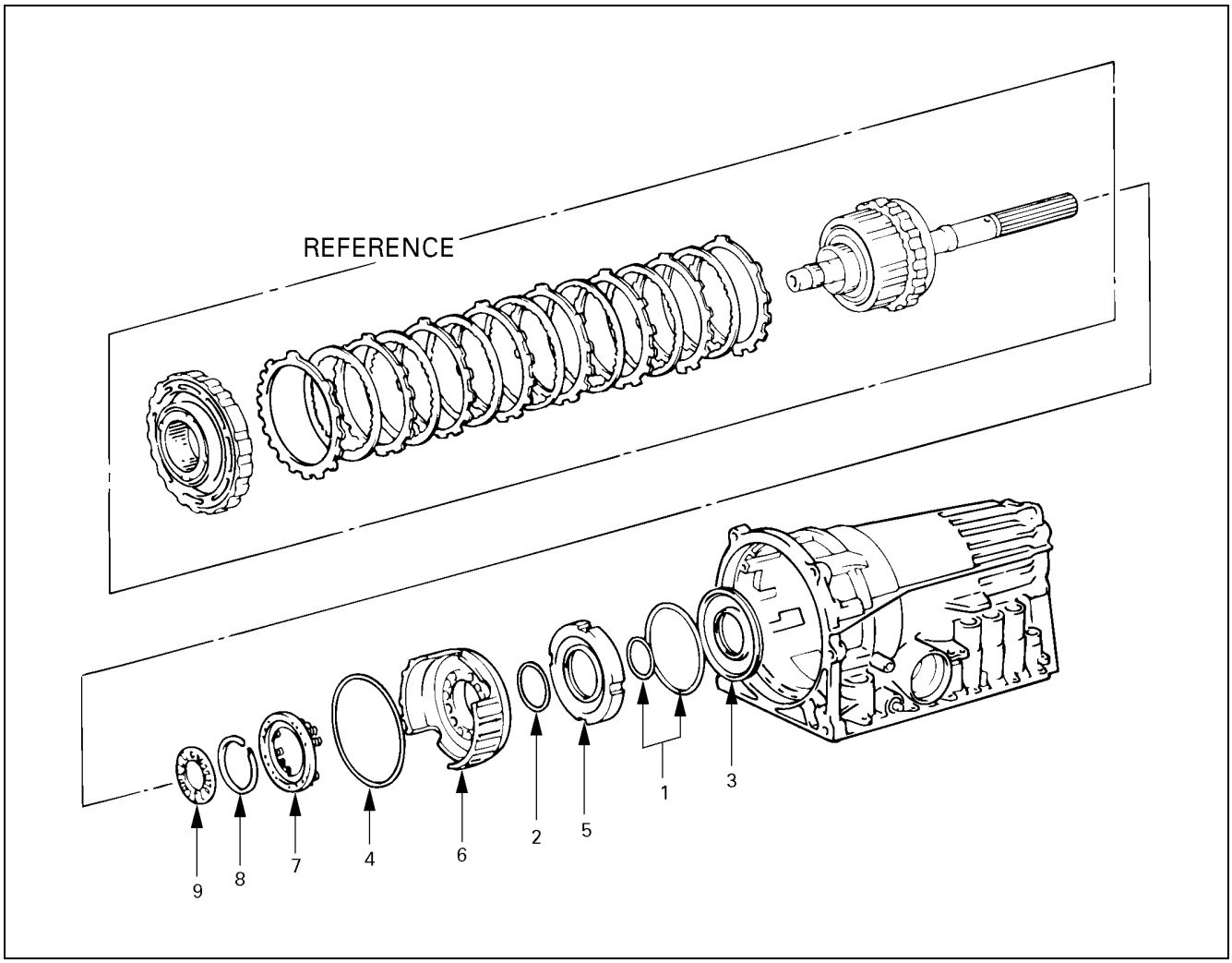
8. **First and reverse brake piston No.1**

   Insert special tool behind the first and reverse brake piston No.1 and gradually lift it out of the transmission case.

   Piston puller: 5-8840-2174-0 (J-37237)

9. **O-ring**

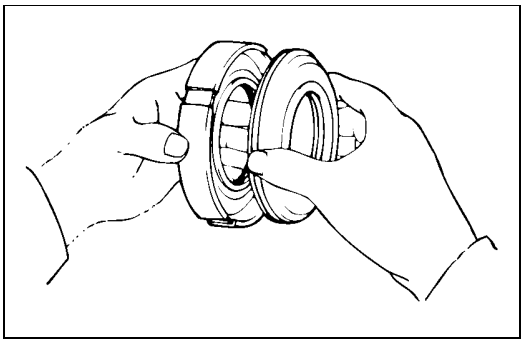
REASSEMBLY



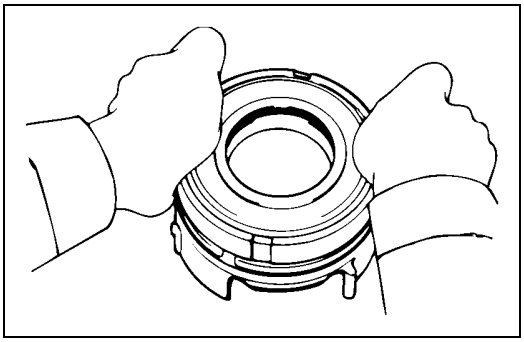
246RY00025

Reassembly steps

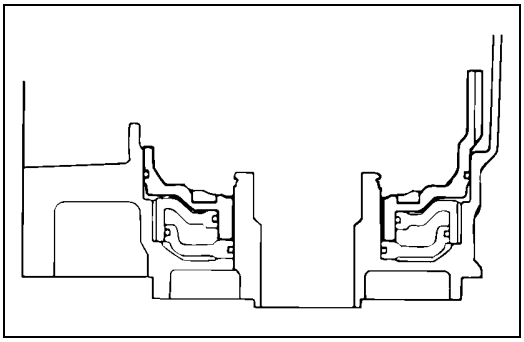
1. O-ring
2. O-ring
3. First and reverse brake piston No.1
4. O-ring
5. Reaction sleeve
6. First and reverse brake piston No.2
7. Return spring
8. Snap ring
9. Thrust bearing and race



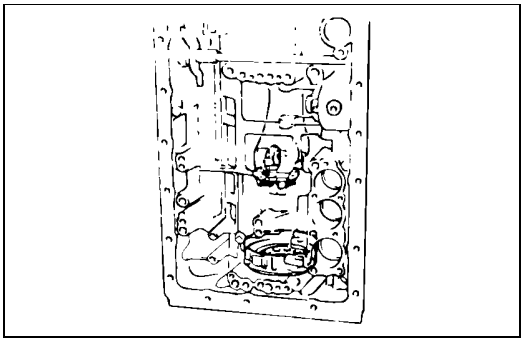
246RY00018



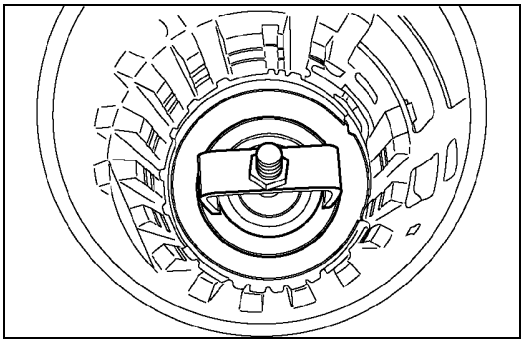
246RY00019



246RY00020



246RY00021



247RY00002

Reassembly steps

1. **O-ring**

   Coat three new O-rings with ATF.

   Install the two O-rings on the No.1 piston.

2. **O-ring**

   Install the O-ring on the reaction sleeve.

3. **First and reverse brake piston No.1**

   Install the first and reverse brake piston No.1 to the reaction sleeve.

4. **O-ring**

   Coat a new O-ring with ATF and install it on the first and reverse brake piston No.2.

5. **Reaction sleeve**

   Install the first and reverse brake piston No.1 with reaction sleeve onto the first and reverse brake piston No.2.

6. **First and reverse brake piston No.2**

   Align the teeth of the first and reverse brake piston No.2 into the proper grooves.

   Being careful not to damage the O-rings, press in the first and reverse brake piston No.2 with No.1 into the transmission case.

7. **Return spring**

   Place piston return spring onto first and reverse brake piston No.2.

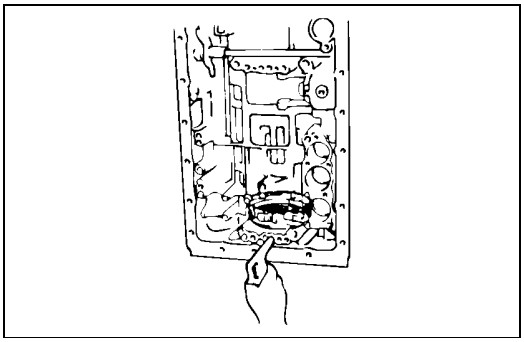
8. **Snap ring**

   Set special tool as shown, and compress the return spring with special tool.

   Spring compressor: 5-8840-0254-0 (J-25048)

   Install the snap ring with snap ring pliers.

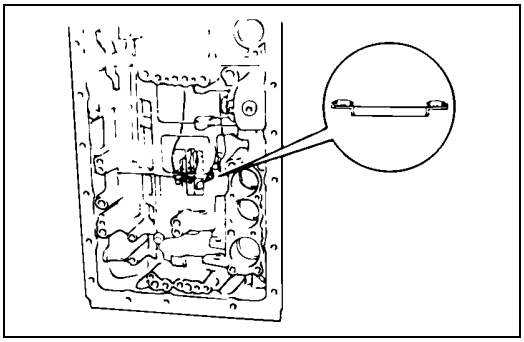
   Be sure the end gap of the snap ring is not aligned with the spring retainer claw.



246RY00022

Check first and reverse brake piston movement

Make sure the first and reverse brake piston moves smoothly when applying and releasing the compressed air into the transmission case.



247RY00043

9. Thrust bearing and race

Coat the assembled bearing and race with petroleum jelly.

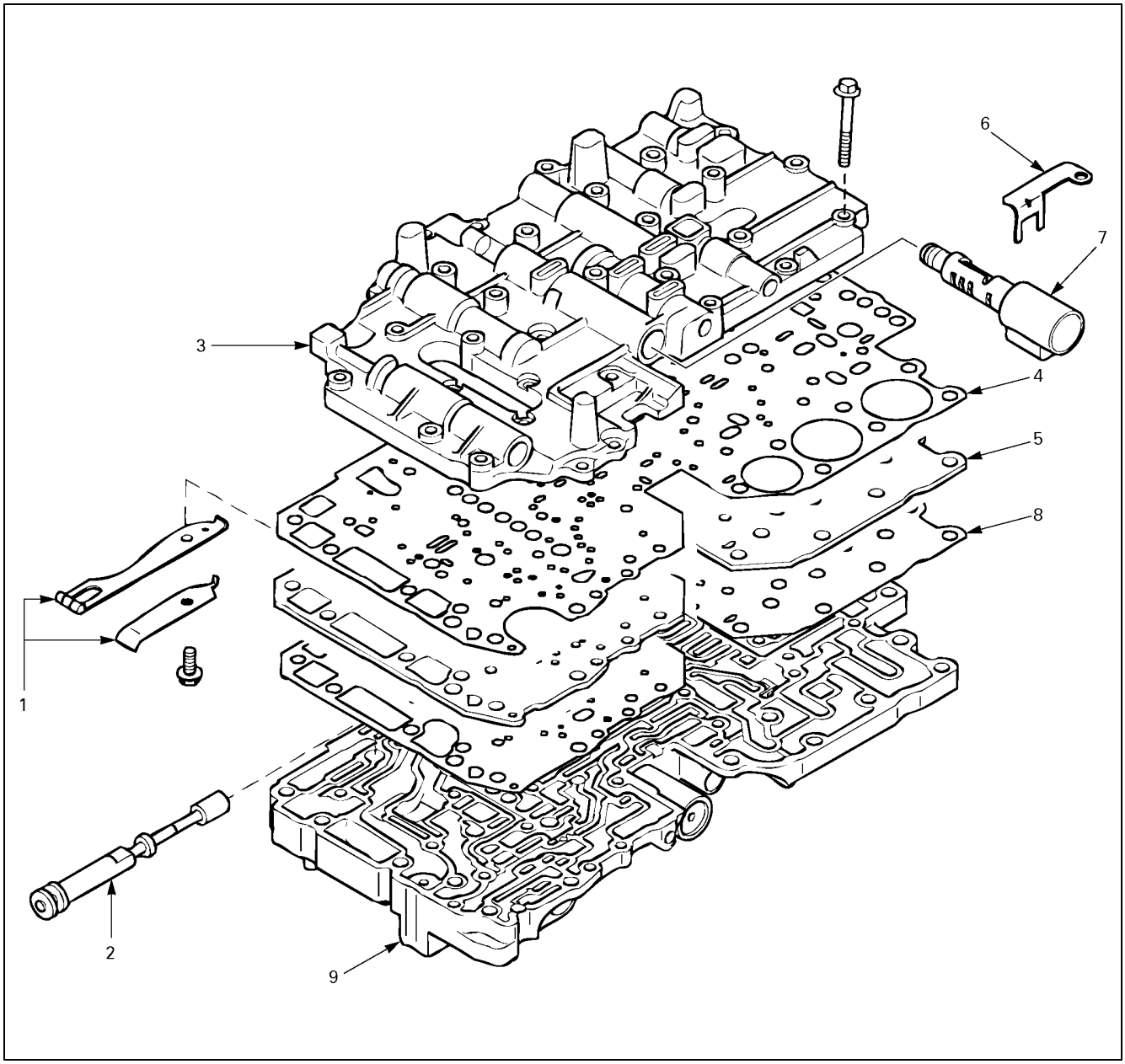
Install the assembled bearing and race facing the bearing side upward.

Bearing and race diameter (Reference)

Inside diameter	39.38 mm (1.550 in)
Outside diameter	58.15 mm (2.289 in)

TRANSMISSION VALVE BODY ASSEMBLY

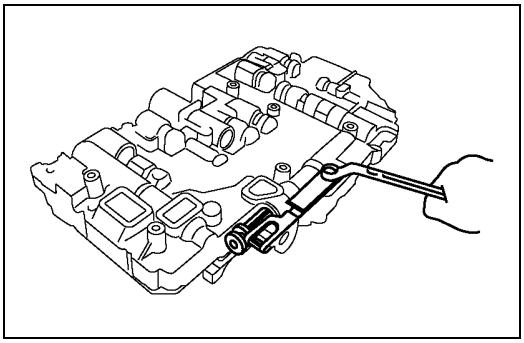
DISASSEMBLY



240R200039

Disassembly steps

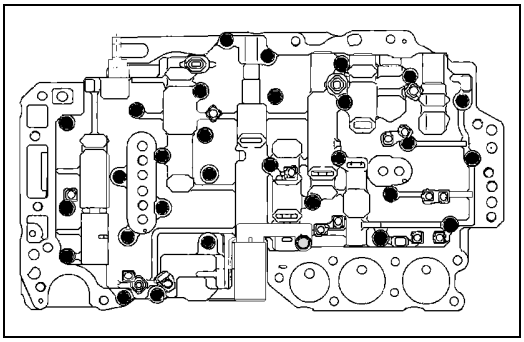
1. Detent spring
2. Manual shift valve
3. Upper valve body
4. No.1 gasket (Upper valve body side)
5. Valve body plate
6. Clamp
7. Pressure control solenoid
8. No.2 gasket (Lower valve body side)
9. Lower valve body



240R200040

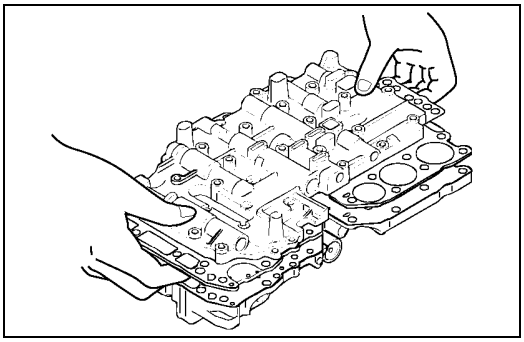
Disassembly steps

1. **Detent spring**
   Remove detent spring from valve body.
2. **Manual shift valve**
   Remove manual shift valve.



244R200049

3. **Upper valve body**
4. **No.1 gasket (Upper valve body side)**
5. **Valve body plate**
   Turn over assembly and remove thirty bolts.
6. **Clamp**
7. **Pressure control solenoid**

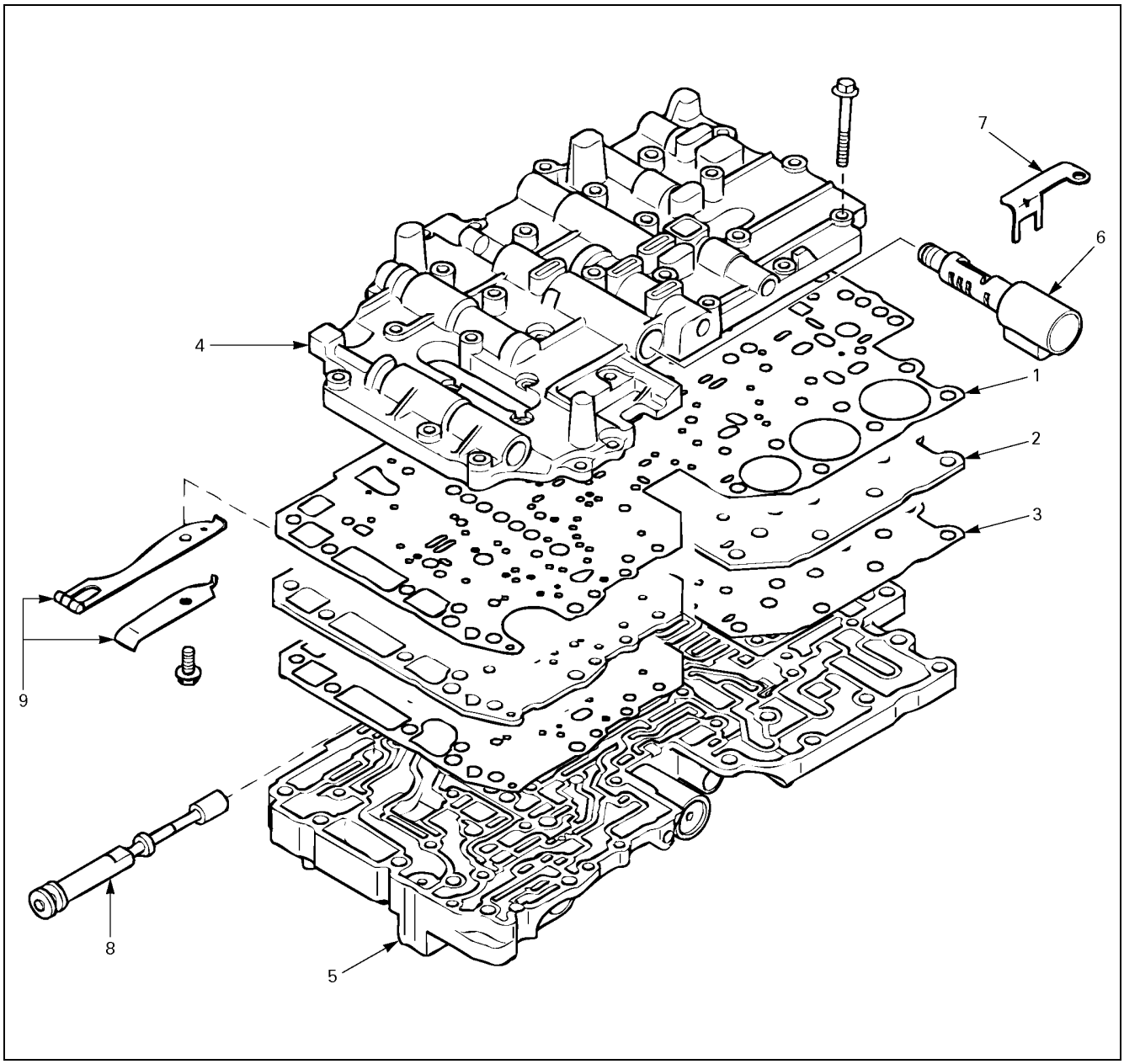


244R200061

Hold the valve body plate to the upper valve body.
Lift off upper valve body and plate as a single unit.
NOTE:
Be careful that the check balls and strainers do not fall out.

8. **No.2 gasket (Lower valve body side)**
9. **Lower valve body**

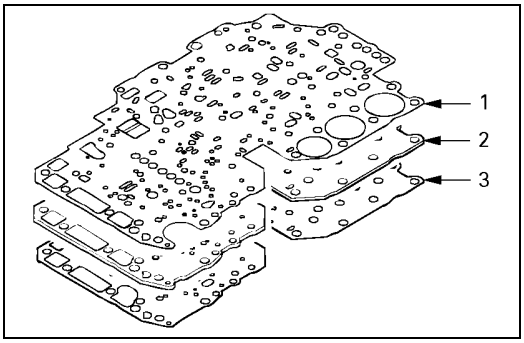
REASSEMBLY



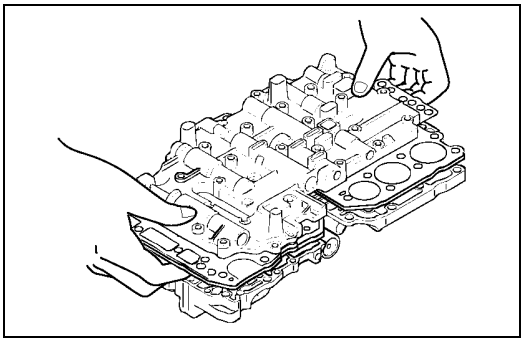
240R200041

Reassembly steps

1. No.1 gasket (Upper valve body side)
2. Valve body plate
3. No.2 gasket (Lower valve body side)
4. Upper valve body
5. Lower valve body
6. Pressure control solenoid
7. Clamp
8. Manual shift valve
9. Detent spring



244R200073


244R200074

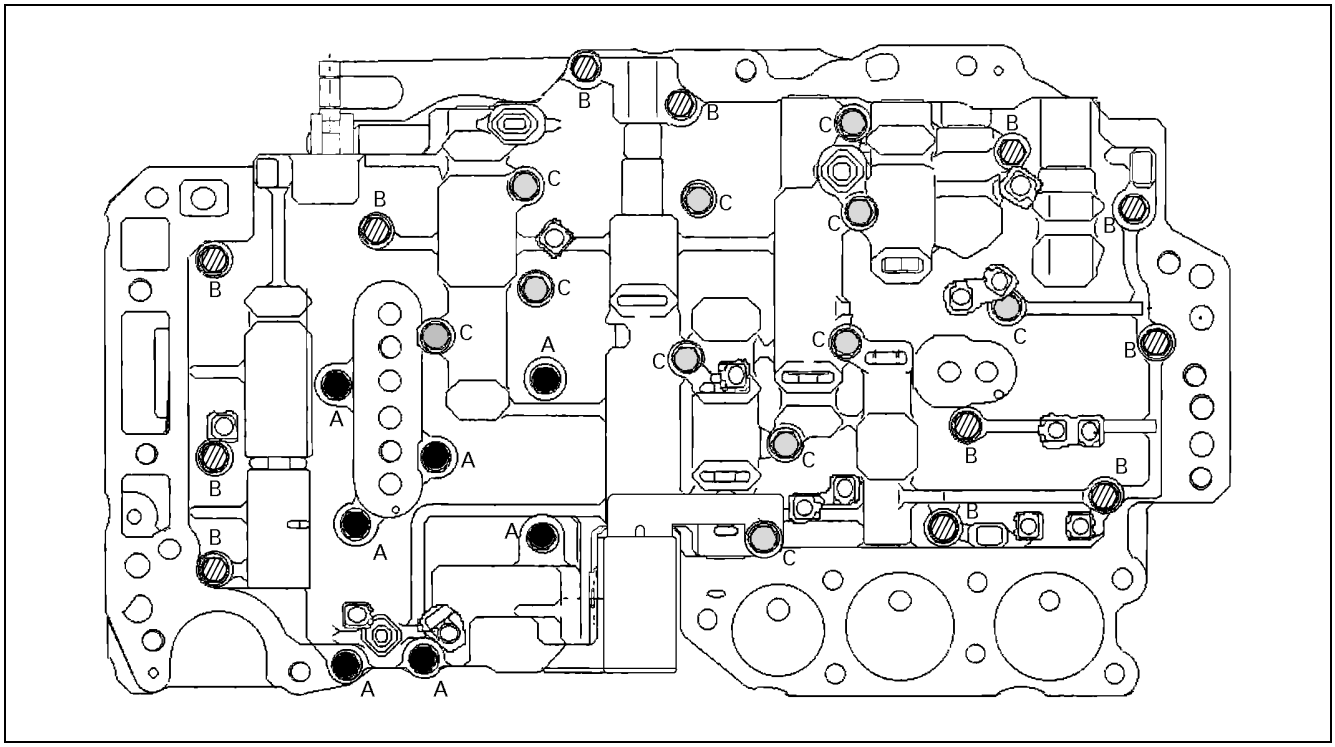
Reassembly steps

1. **No.1 gasket (Upper valve body side)**
   Position a new No.1 gasket (1) on upper valve body.
   Align the No.1 gasket at each bolt hole.
2. **Valve body plate**
   Position valve body plate (2) on No.1 gasket (1).
   Align the plate at each bolt hole.
3. **No.2 gasket (Lower valve body side)**
   Position a new No.2 gasket (3) on valve body plate (2).
   Align the No.2 gasket at each bolt hole.
4. **Upper valve body**
5. **Lower valve body**
   Place upper valve body with plate and gaskets on top lower valve body.
   Align each bolt hole and gasket in the valve body.
6. **Pressure control solenoid**
7. **Clamp**

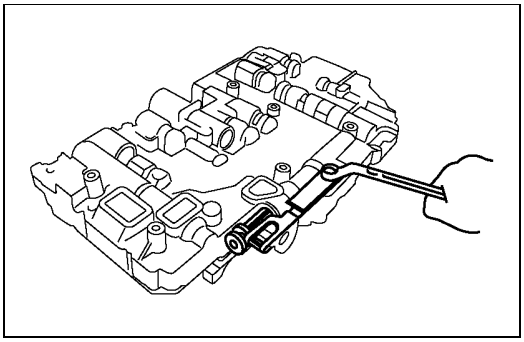
Install thirty bolts to upper valve body.
Each bolt is indicated in the figure.

	Length (mm)	Quantity
A	20	7
B	28	12
C	40	11

Torque: 6.4 N·m (0.65 kg·m/57 lb·in)



244R200050

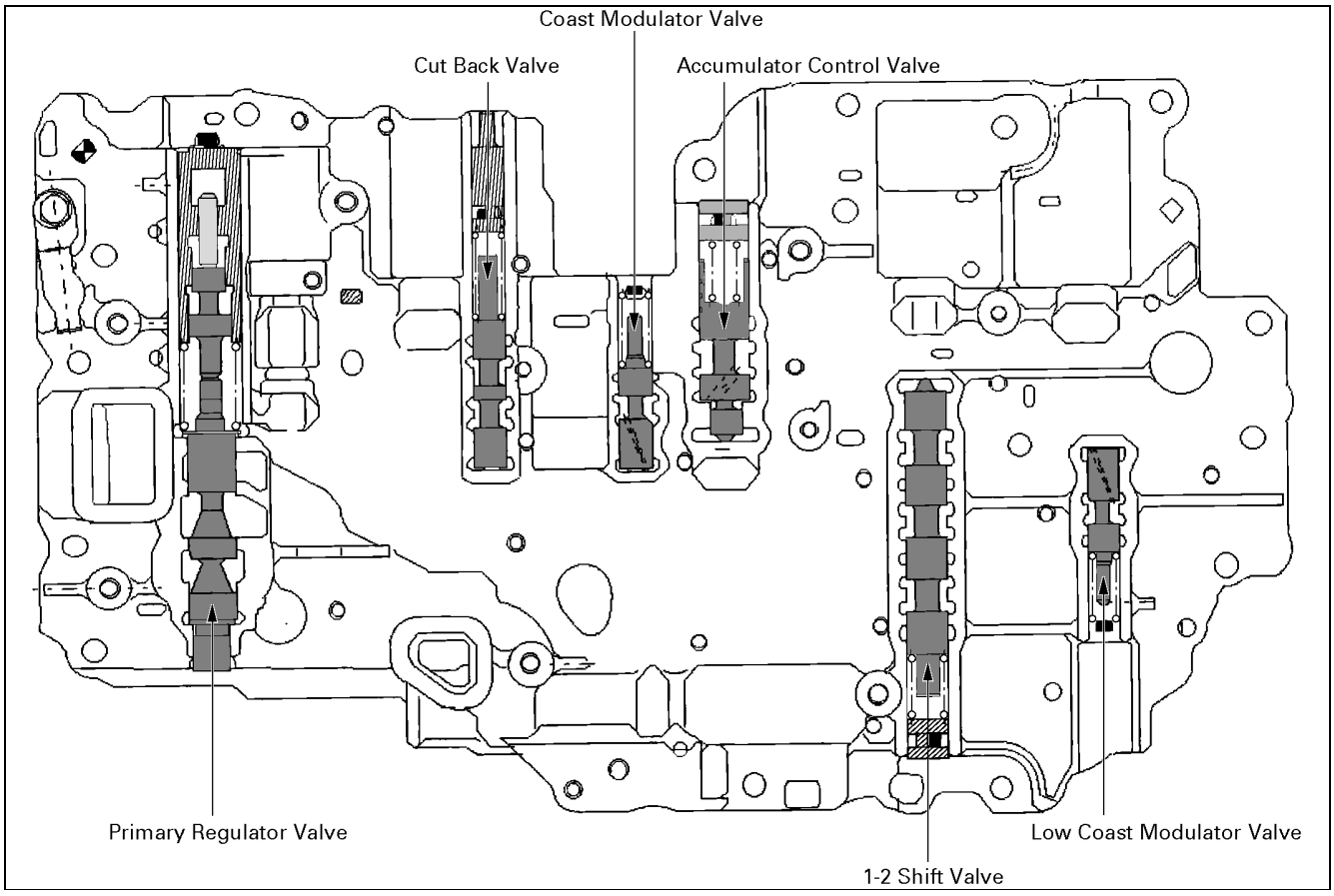


240R200040

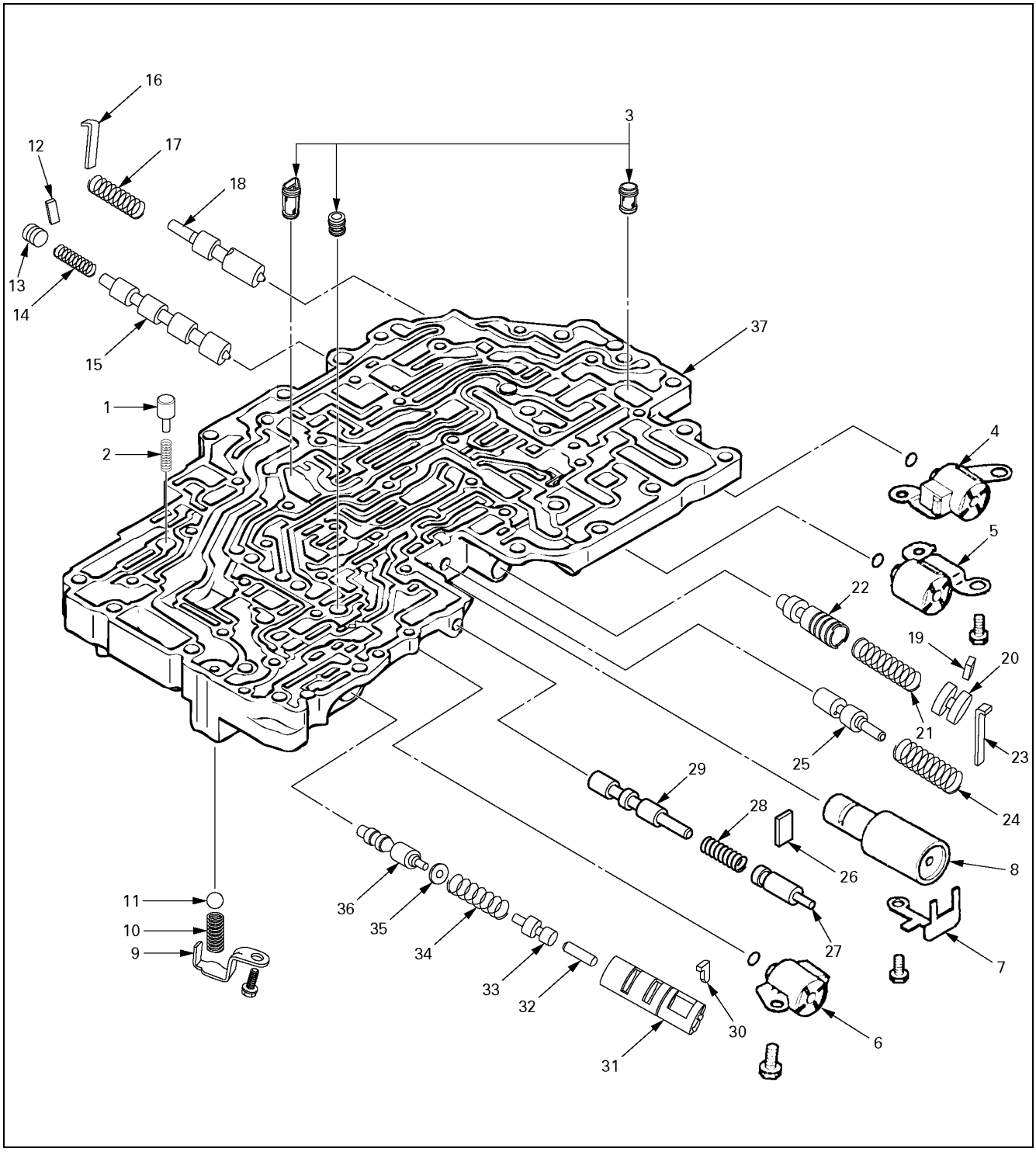
8. **Manual shift valve**
   Install manual shift valve.
9. **Detent spring**
   Install detent spring.
   Torque: 10 N·m (1.0 kg·m/87 lb·in)

LOWER VALVE BODY

DISASSEMBLY



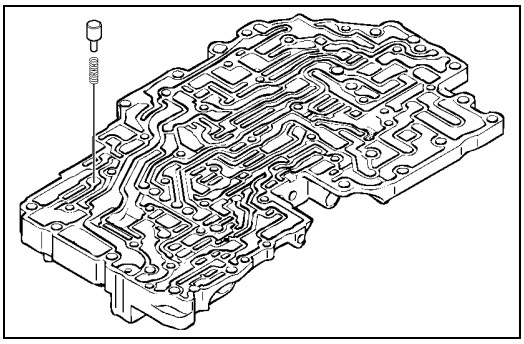
244R200046


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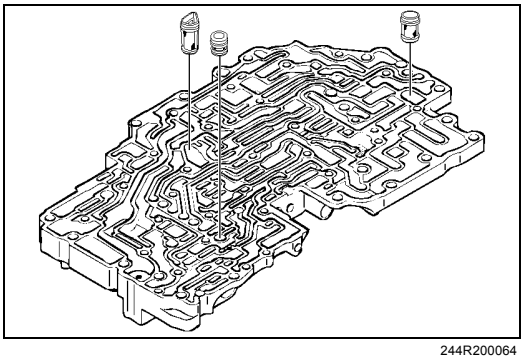
244R200075

Disassembly steps

1. By-pass valve
2. Spring
3. Strainer
4. Shift solenoid S1
5. Shift solenoid S2
6. Lock-up solenoid SL
7. Clamp
8. Accumulator sub-assembly
9. Retainer
10. Spring
11. Ball
12. Retainer
13. Plug
14. Spring
15. 1-2 shift valve
16. Retainer
17. Spring
18. Low coast modulator valve
19. Retainer
20. Plug
21. Spring
22. Accumulator control valve
23. Retainer
24. Spring
25. Coast modulator valve
26. Retainer
27. Plug
28. Spring
29. Cut back valve
30. Retainer
31. Sleeve
32. Plunger
33. Plunger
34. Spring
35. Washer
36. Primary regulator valve
37. Lower valve body



244R200063



244R200064

Disassembly steps

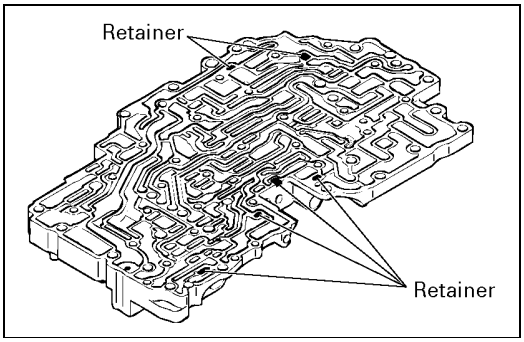
1. By-pass valve

2. Spring

Remove by-pass valve and spring.

3. Strainer

Remove three strainers.



244R200066

NOTE:

Confirm six retainers are installed correctly.

4. **Shift solenoid S1**
5. **Shift solenoid S2**

   Remove the fixing bolt.

   Remove the shift solenoid S1 (2) and S2 (1) from each bore.

   Remove the O-rings from each solenoid.
6. **Lock-up solenoid SL**

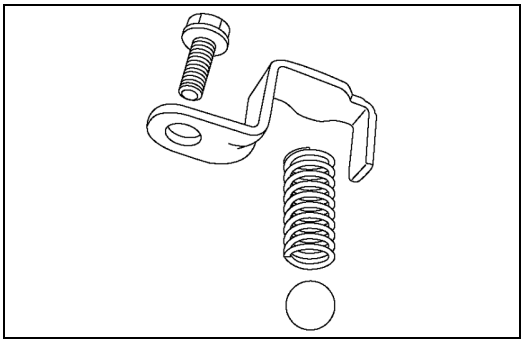
   Remove the fixing bolt.

   Remove the lock-up solenoid SL (3) from the bore.

   Remove the O-ring from solenoid.
7. **Clamp**
8. **Accumulator sub-assembly**

   Remove the clamp.

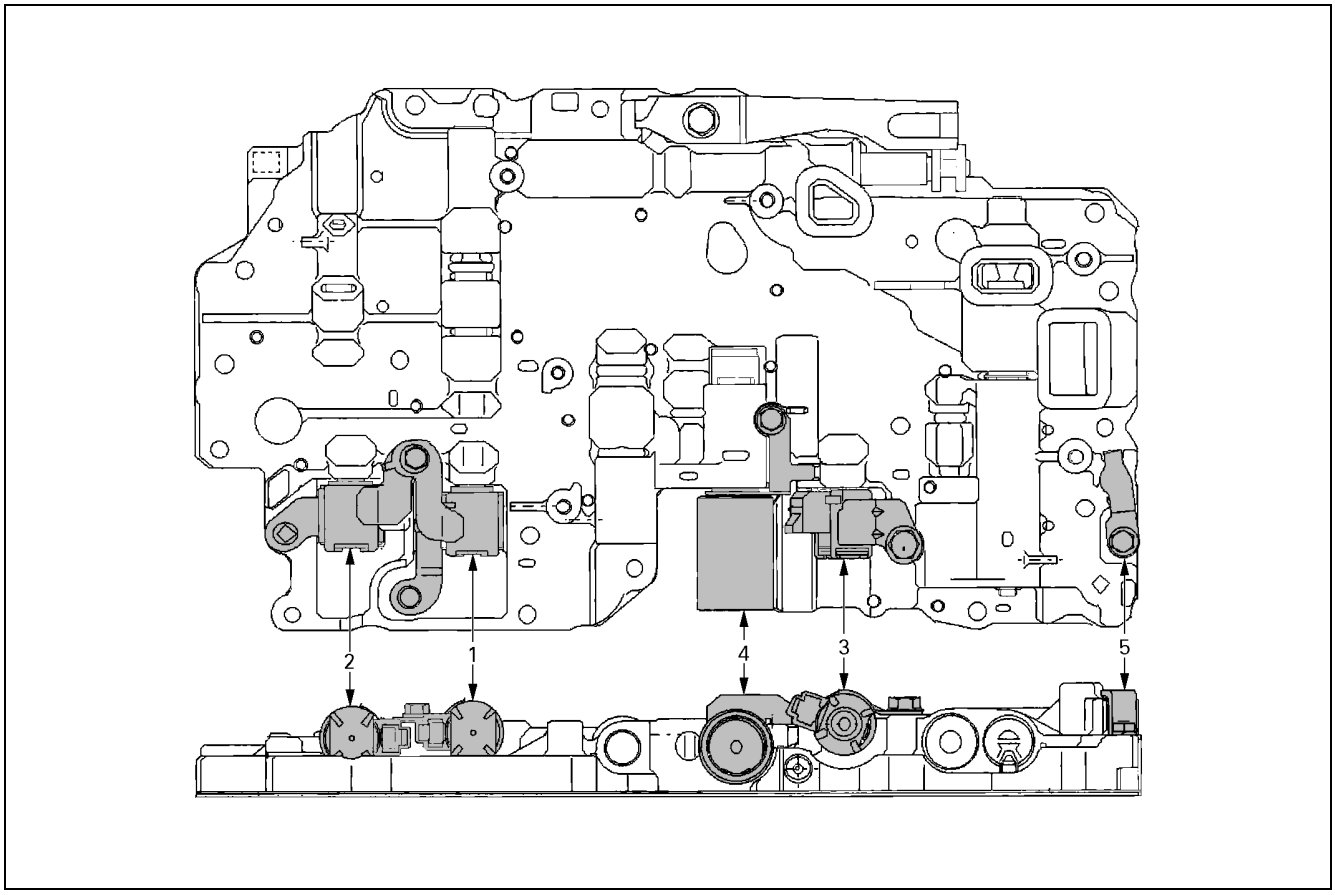
   Remove the accumulator sub-assembly (4) from the bore.


244R200052

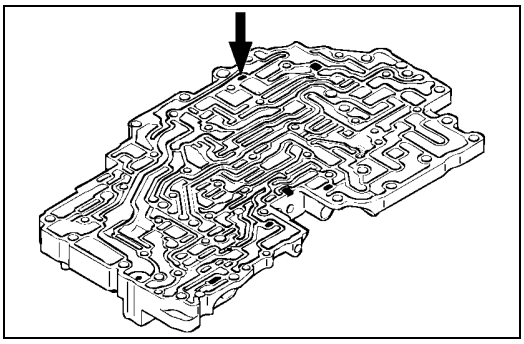
9. **Retainer**
10. **Spring**
11. **Ball**

    Remove the retainer (5).

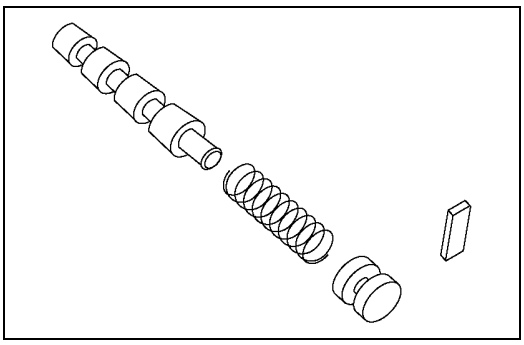
Remove the spring and ball from the valve body.



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244R200067



244R200054

12. Retainer

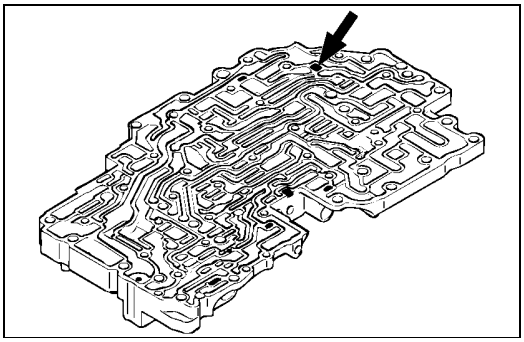
Remove the retainer with a magnetic finger by pushing in the plug.

13. Plug

14. Spring

15. 1-2 shift valve

Remove the plug, spring and 1-2 shift valve.



244R200068

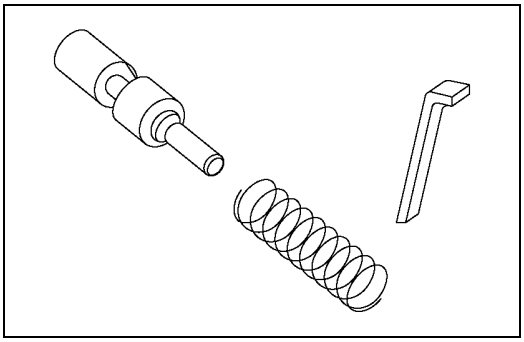
16. Retainer

Remove the retainer by pushing in the spring with a screwdriver.

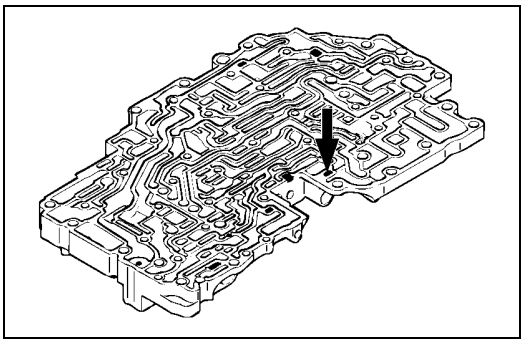
17. Spring

18. Low coast modulator valve

Remove the spring and low coast modulator valve.



244R200056



244R200069

19. Retainer

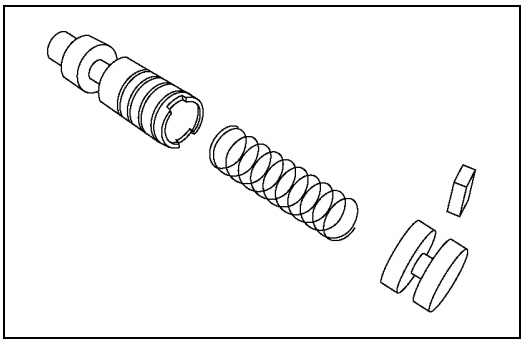
Remove the retainer with a magnetic finger by pushing in the plug.

20. Plug

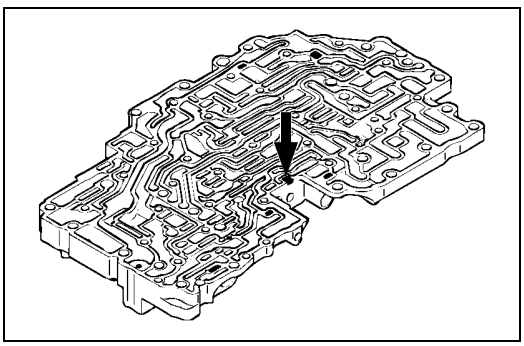
21. Spring

22. Accumulator control valve

Remove the plug, spring and accumulator control valve.



244R200057



244R200070

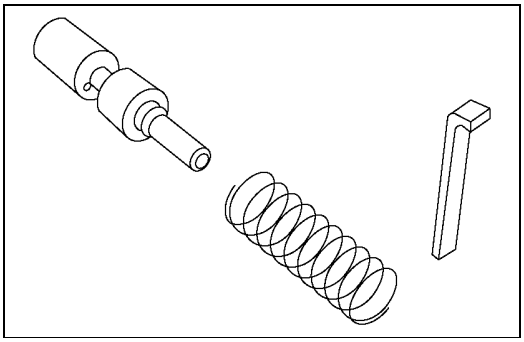
23. Retainer

Remove the retainer by pushing in the spring with a screwdriver.

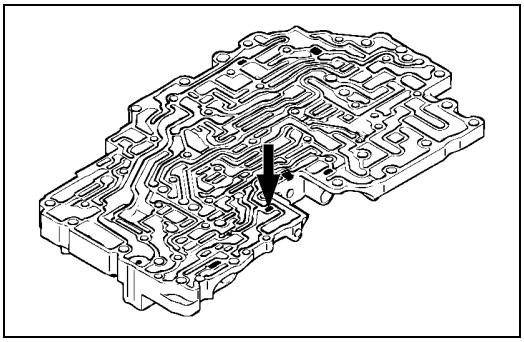
24. Spring

25. Coast modulator valve

Remove the spring and coast modulator valve.



244R200058



244R200071

26. Retainer

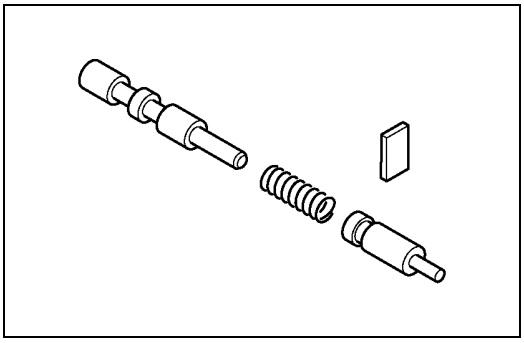
Remove the retainer with a magnetic finger by pushing in the plug.

27. Plug

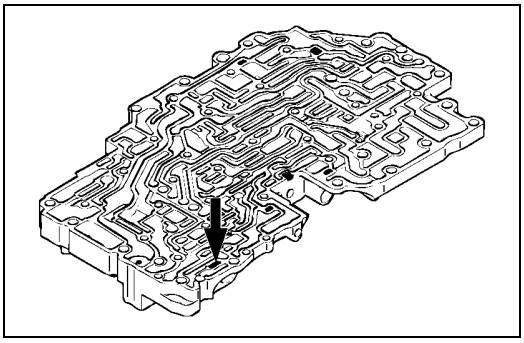
28. Spring

29. Cut back valve

Remove the plug, spring and cut back valve.



244R200065



244R200072

30. Retainer

Place a mark on the bevel when the retainer is positioned.

NOTE:

When reassembling, position the retainer in the same position.

Remove the retainer with a magnetic finger by pushing in the sleeve.

31. Sleeve

32. Plunger

33. Plunger

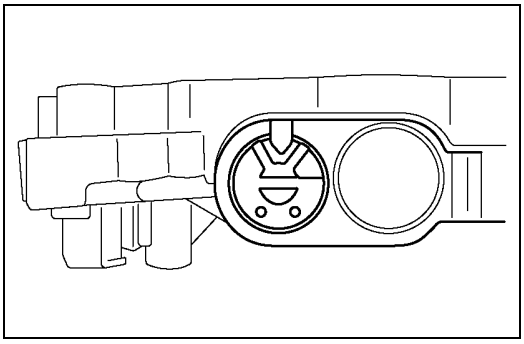
34. Spring

35. Washer

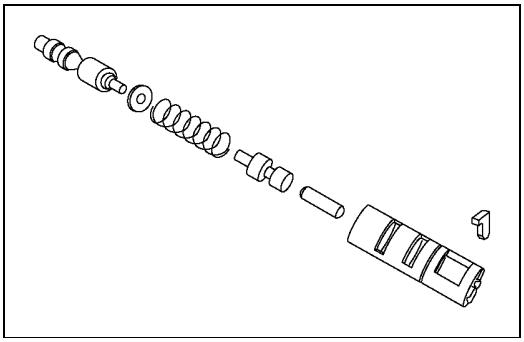
36. Primary regulator valve

Remove the sleeve with the plungers, spring and washer.

Remove the two plungers from the sleeve.



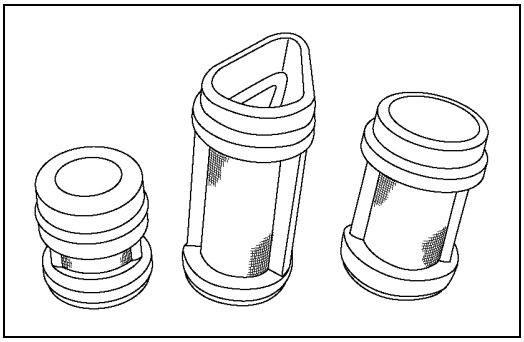
244R200059



244R200060

Remove the primary regulator valve from the valve body.

37. Lower valve body

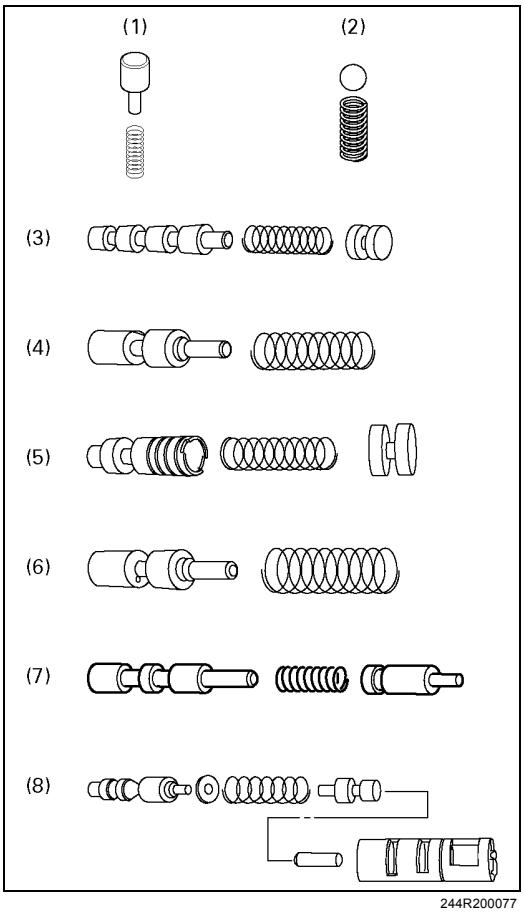


244R200051

INSPECTION AND REPAIR

Inspect strainer

Inspect strainer for residual adhesive and damage, and clean and replace as necessary.



244R200077

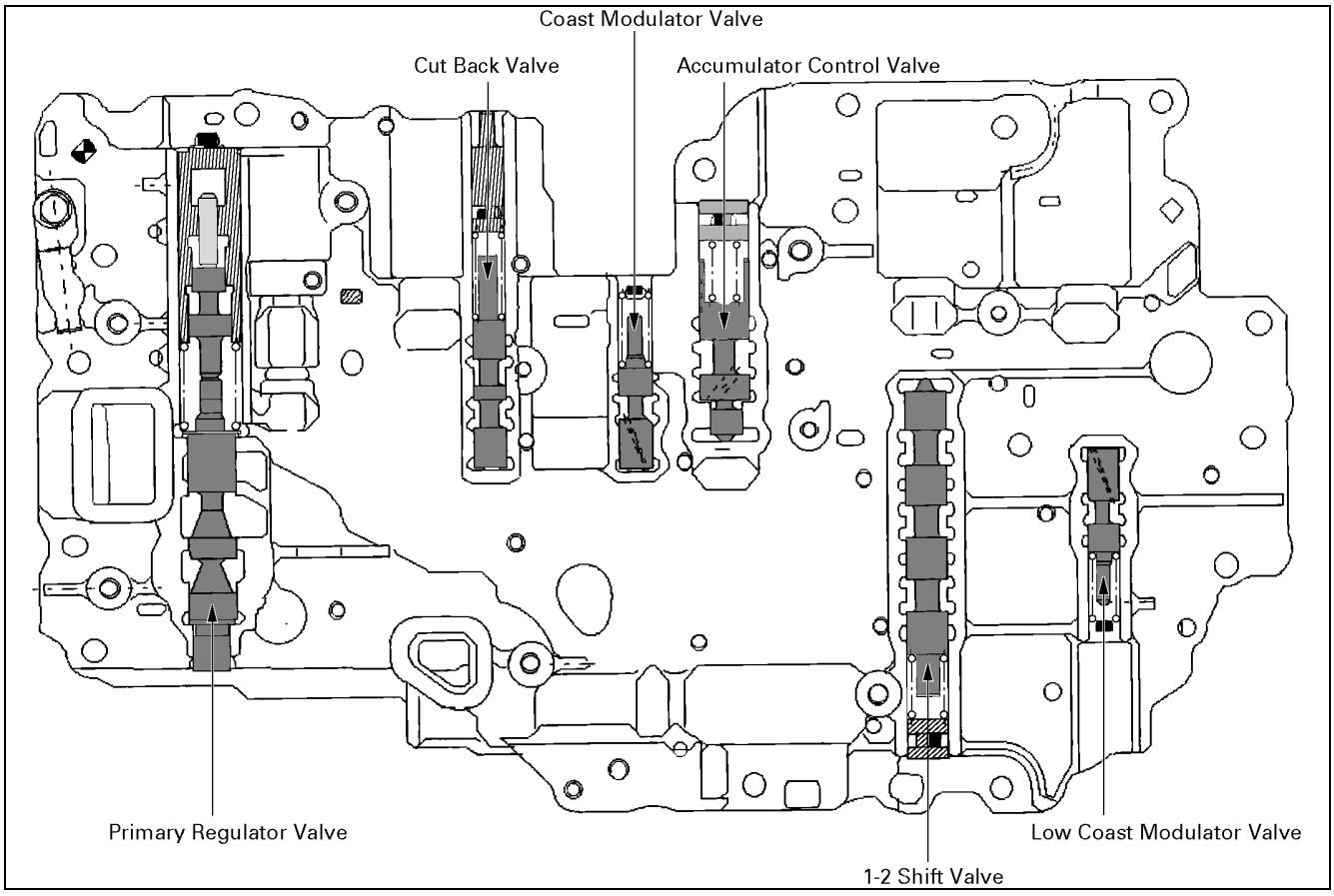
Inspect valve springs

Check for damage, squareness, rust and distorted coils.

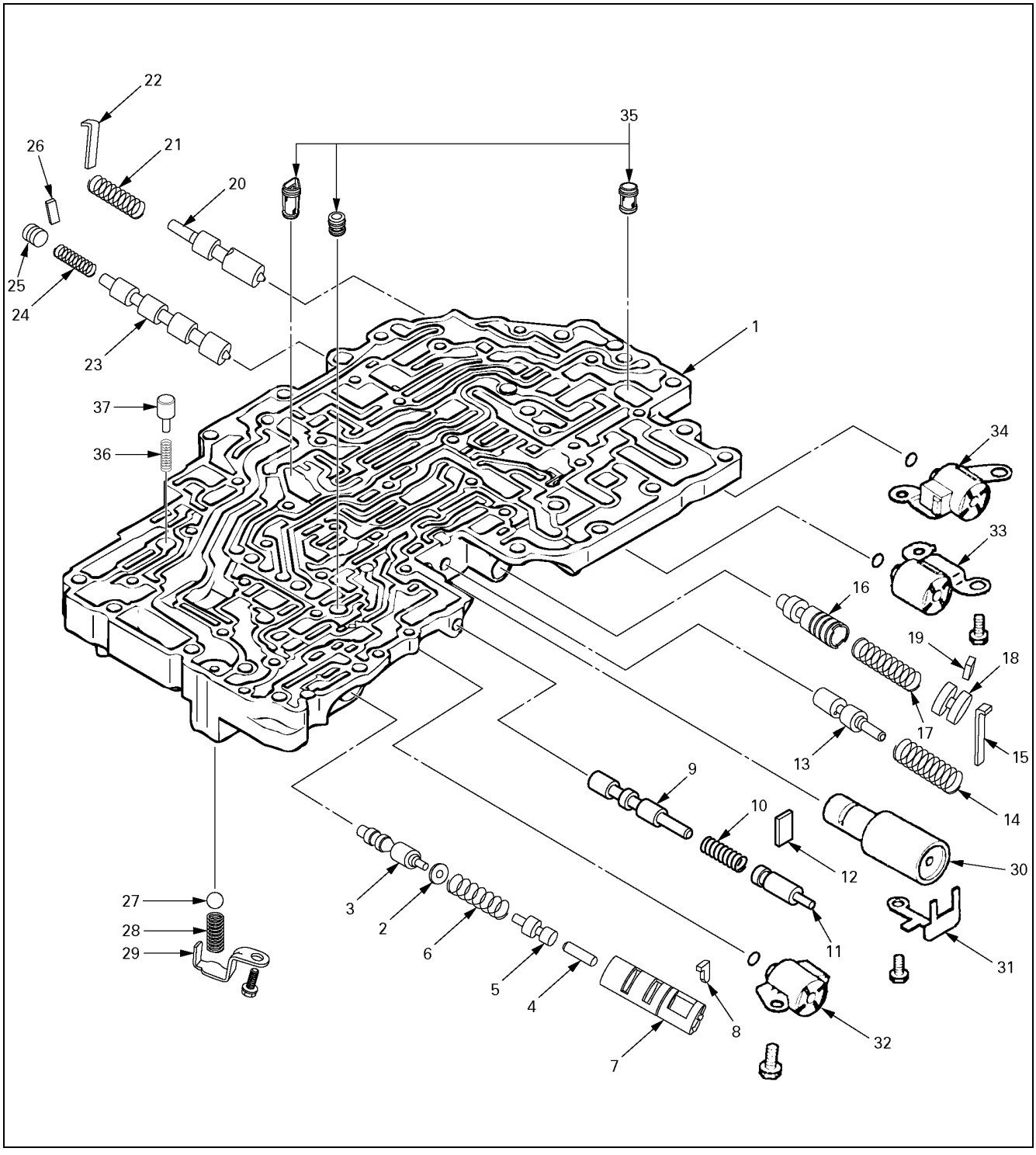
Measure the spring free height and replace if less than shown below.

Spring	Free length
(1) By-pass valve	21.3 mm (0.839 in)
(2) Steel ball	20.5 mm (0.807 in)
(3) 1-2 shift valve	30.8 mm (1.213 in)
(4) Low coast modulator valve	30.4 mm (1.197 in)
(5) Accumulator control valve	33.8 mm (1.331 in)
(6) Coast modulator valve	26.6 mm (1.047 in)
(7) Cut back valve	34.0 mm (1.339 in)
(8) Primary regulator valve	41.6 mm (1.638 in)

REASSEMBLY



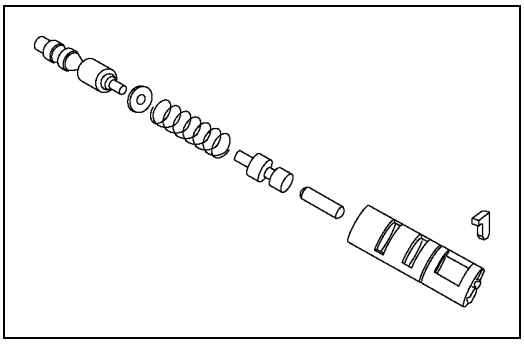
244R200046


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244R200076

Reassembly steps

1. Lower valve body
2. Washer
3. Primary regulator valve
4. Plunger
5. Plunger
6. Spring
7. Sleeve
8. Retainer
9. Cut back valve
10. Spring
11. Plug
12. Retainer
13. Coast modulator valve
14. Spring
15. Retainer
16. Accumulator control valve
17. Spring
18. Plug
19. Retainer
20. Low coast modulator valve
21. Spring
22. Retainer
23. 1-2 shift valve
24. Spring
25. Plug
26. Retainer
27. Ball
28. Spring
29. Retainer
30. Accumulator sub-assembly
31. Clamp
32. Lock-up solenoid SL
33. Shift solenoid S2
34. Shift solenoid S1
35. Strainer
36. Spring
37. By-pass valve



244R200060

Reassembly steps

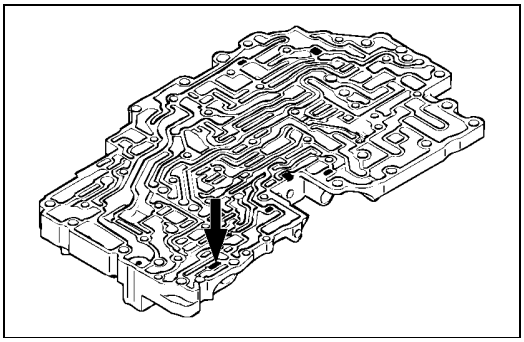
1. **Lower valve body**
2. **Washer**
3. **Primary regulator valve**

   Install the washer onto the primary regulator valve.

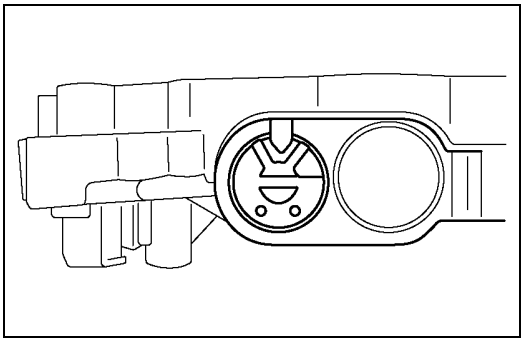
   Install the primary regulator valve with the washer into the bore.
4. **Plunger**
5. **Plunger**

   Install the two plungers into the sleeve.
6. **Spring**
7. **Sleeve**

   Install the sleeve with the two plungers and spring into the bore.



244R200072



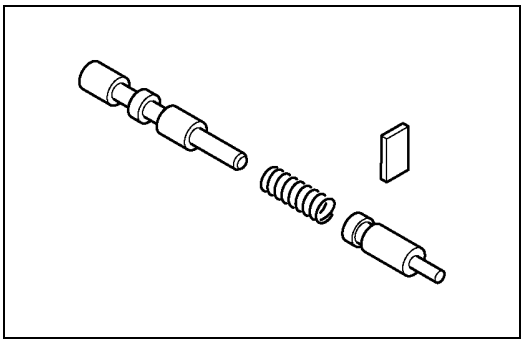
244R200059

8. **Retainer**

   Install the retainer to the bevel by pushing in the sleeve.

   NOTE:

   Install the retainer to the same position on the sleeve, as when disassembling.



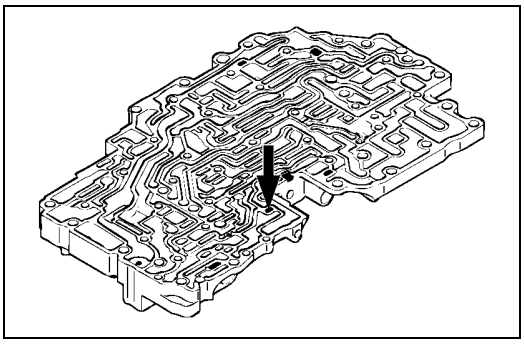
244R200065

9. **Cut back valve**
10. **Spring**
11. **Plug**

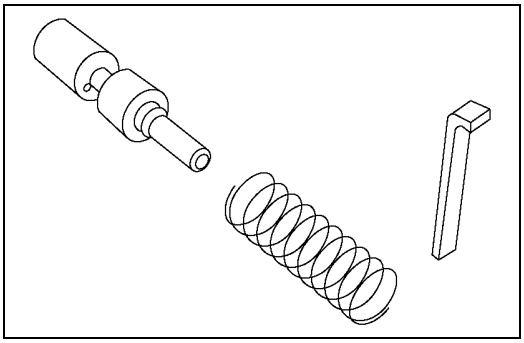
    Install the cut back valve, spring and plug into the bore.

12. **Retainer**

    Install the retainer by pushing in the plug.

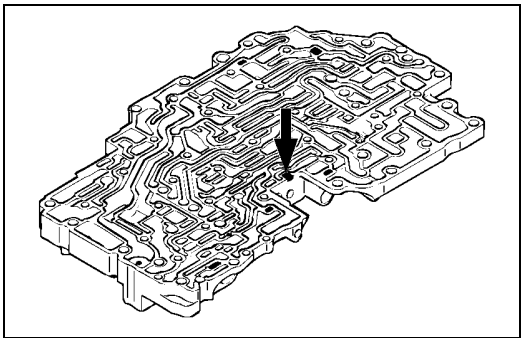


244R200071

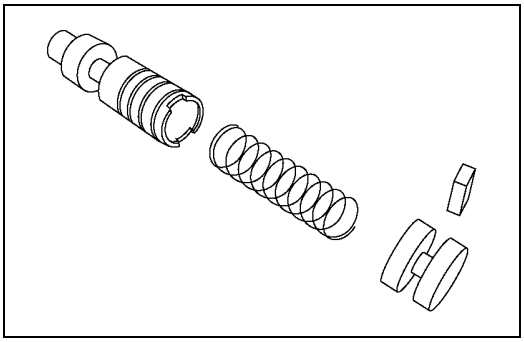


244R200058

13. **Coast modulator valve**
14. **Spring**
15. **Retainer**



244R200070



244R200057

16. Accumulator control valve

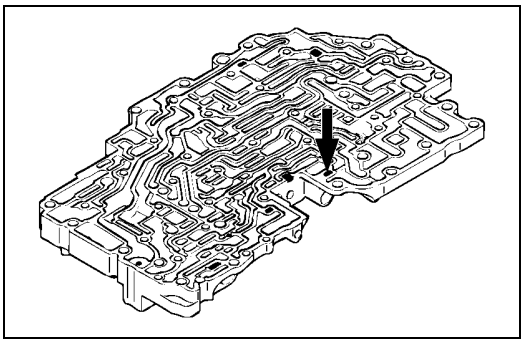
17. Spring

18. Plug

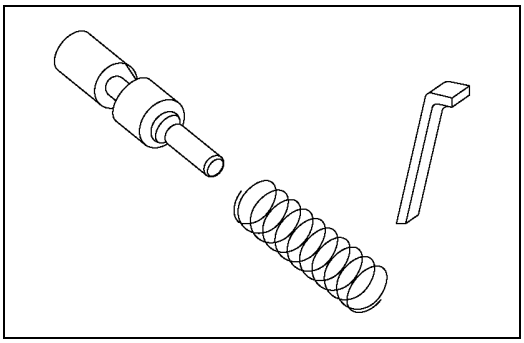
Install the accumulator control valve, spring and plug into the bore.

19. Retainer

Install the retainer by pushing in the plug.



244R200069



244R200056

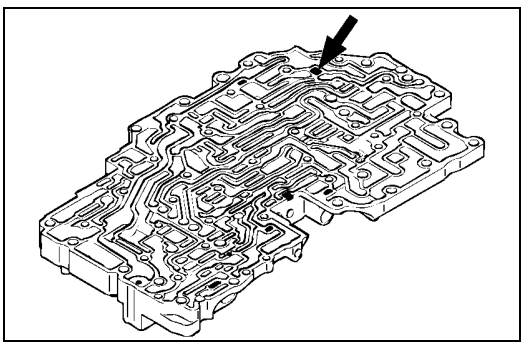
20. Low coast modulator valve

21. Spring

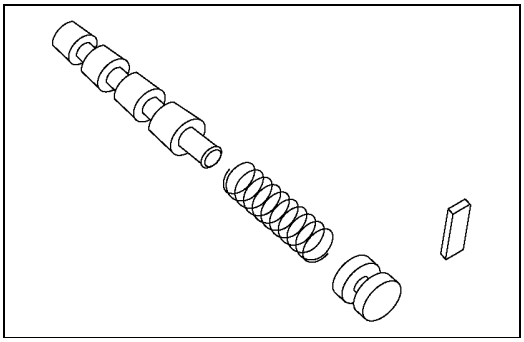
Install the low coast modulator valve and spring into the bore.

22. Retainer

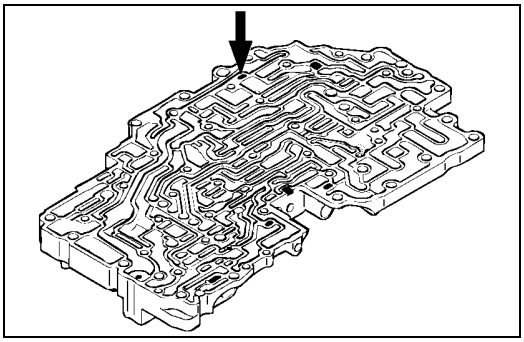
Install the retainer by pushing in the spring.



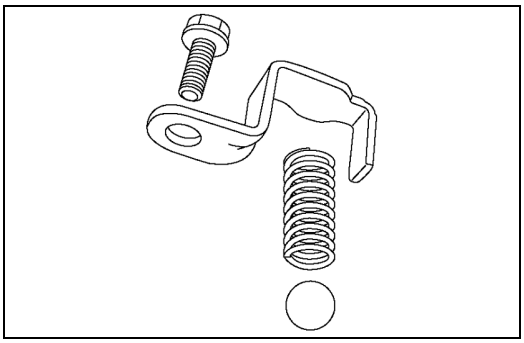
244R200068



244R200054



244R200067



244R200052

23. 1-2 shift valve

24. Spring

25. Plug

Install the 1-2 shift valve, spring and plug into the bore.

26. Retainer

Install the retainer by pushing in the plug.

27. Ball

28. spring

29. Retainer

Install the ball, spring and retainer (5) to the valve body.

Torque: 10 N·m (1.0 kg·m/87 lb·in)

30. Accumulator sub-assembly

31. Clamp

Install the accumulator sub-assembly (4) and clamp to the valve body.

Torque: 6.4 N·m (0.65 kg·m/57 lb·in)

32. Lock-up solenoid SL

Install a new O-ring to the solenoid (3).

Install the solenoid to the valve body.

Torque: 10 N·m (1.0 kg·m/87 lb·in)

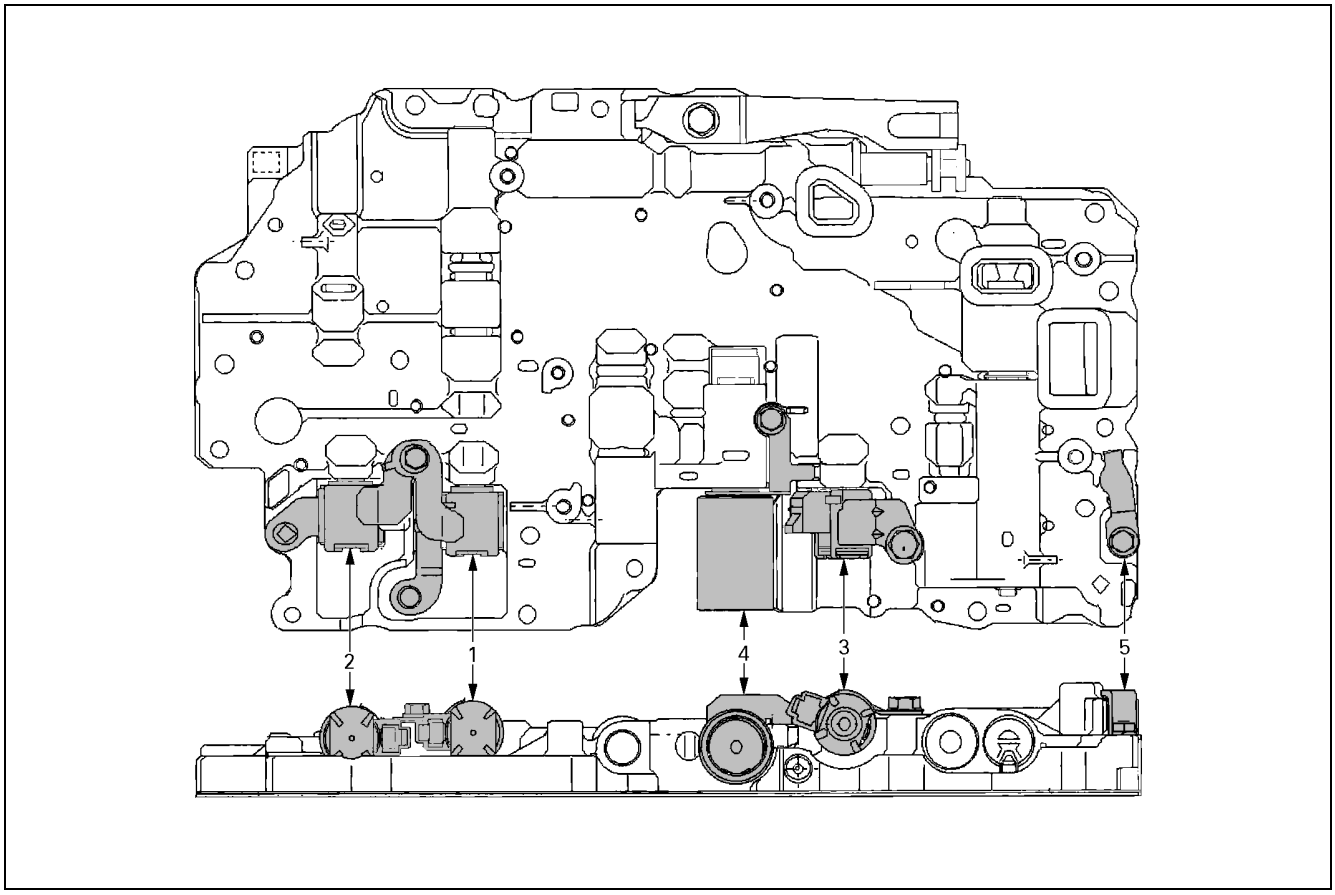
33. Shift solenoid S2

34. Shift solenoid S1

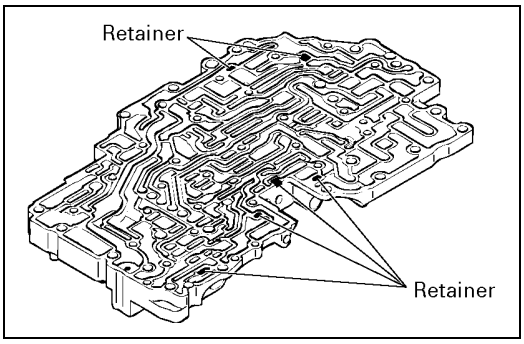
Install a new O-ring to the solenoids (1) and (2).

Install the solenoids to the valve body.

Torque: 6.4 N·m (0.65 kg·m/57 lb·in)



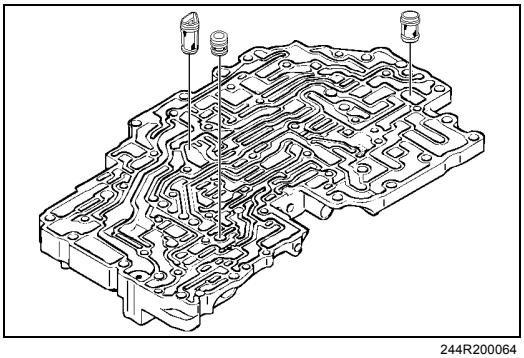
240R200042



244R200066

NOTE:

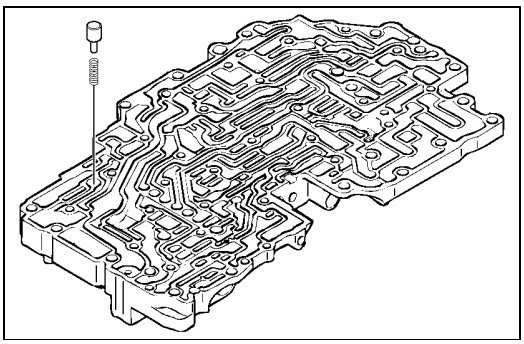
Make sure six retainers are installed correctly.



244R200064

35. Strainer

Install the three strainers to the valve body as shown.



244R200063

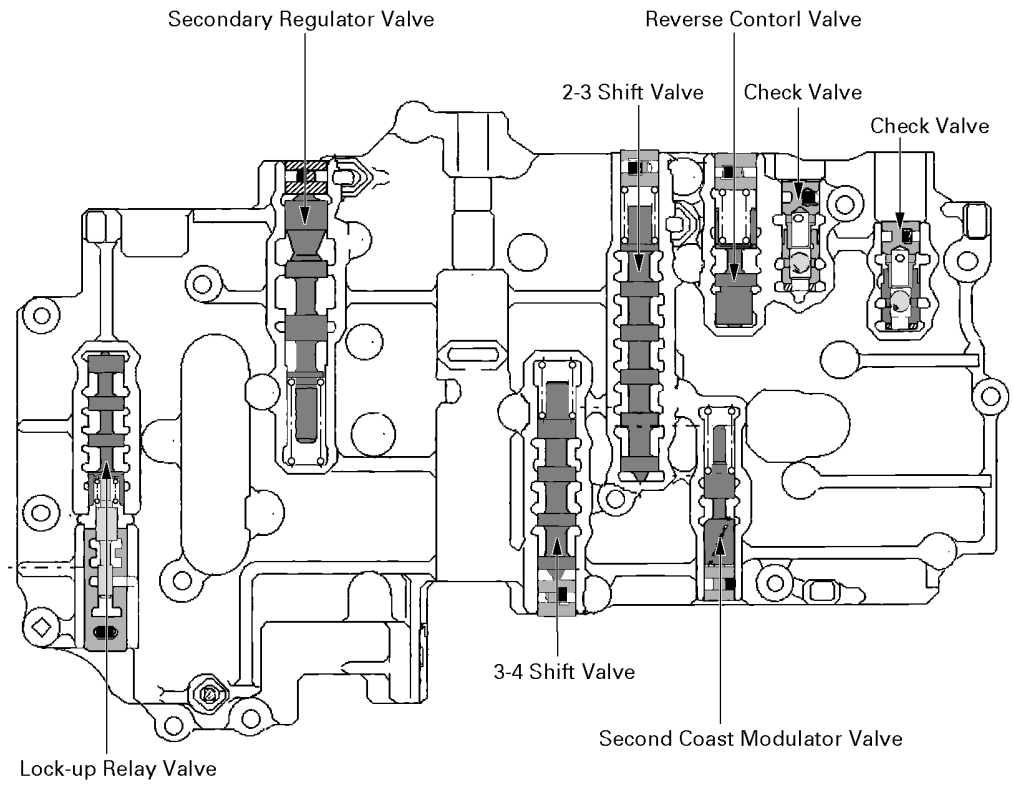
36. Spring

37. By-pass valve

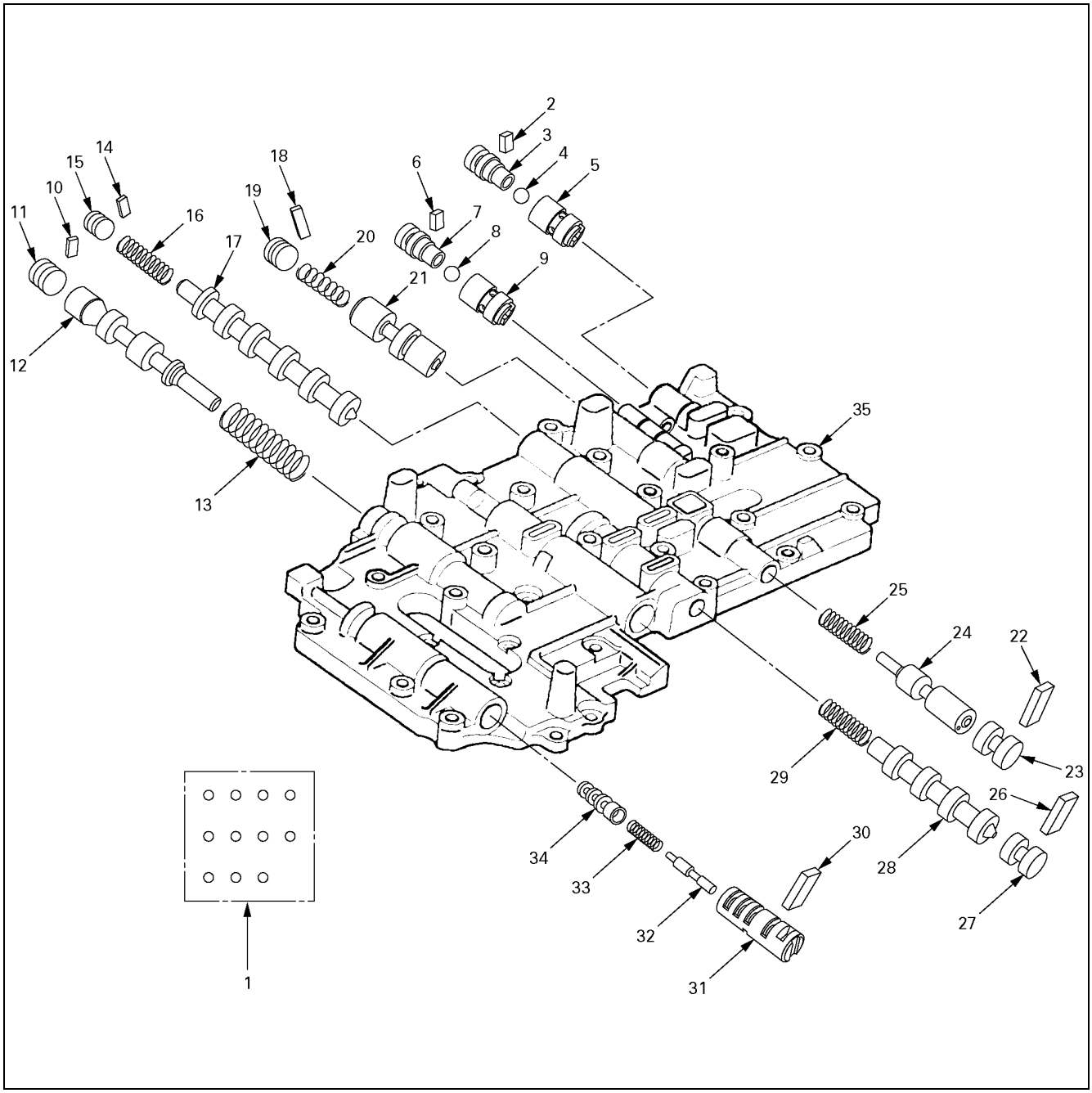
Install the spring and by-pass valve to the valve body as shown.

UPPER VALVE BODY

DISASSEMBLY



243R200052

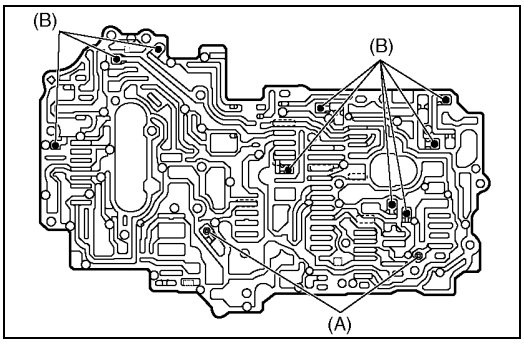

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243R200074

Disassembly steps

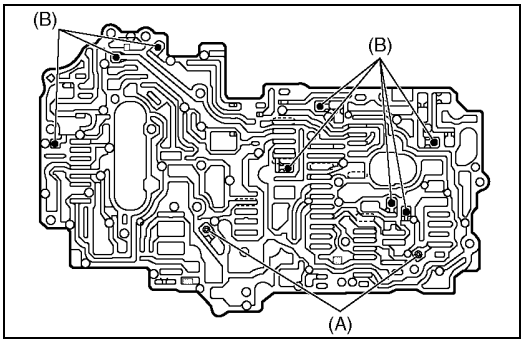
1. Check ball
2. Retainer
3. Check valve NO.2
4. Ball
5. Check valve NO.1
6. Retainer
7. Check valve NO.2
8. Ball
9. Check valve NO.1
10. Retainer
11. Plug
12. Secondary regulator valve
13. Spring
14. Retainer
15. Plug
16. Spring
17. 2-3 shift valve
18. Retainer
19. Plug
20. Spring
21. Reverse control valve
22. Retainer
23. Plug
24. Second coast modulator valve
25. Spring
26. Retainer
27. Plug
28. 3-4 shift valve
29. Spring
30. Retainer
31. Sleeve
32. Plunger
33. Spring
34. Lock-up relay valve
35. Upper valve body

UBS



243R200053

TFR/S



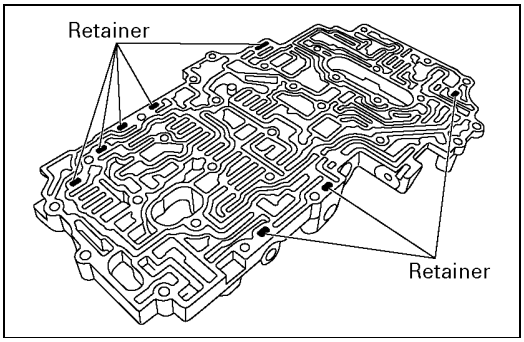
243L200001

Disassembly steps

1. Check ball

Remove the two types of check balls from the valve body.

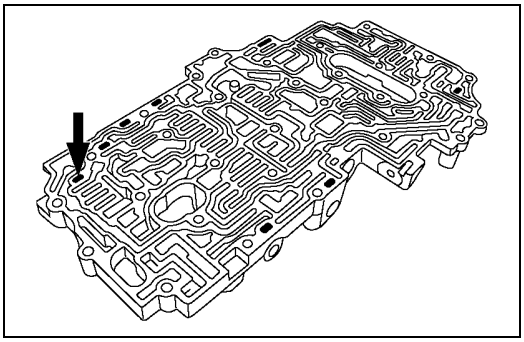
Number of check ball : UBS — 11
TFR/S — 10



243R200054

NOTE:

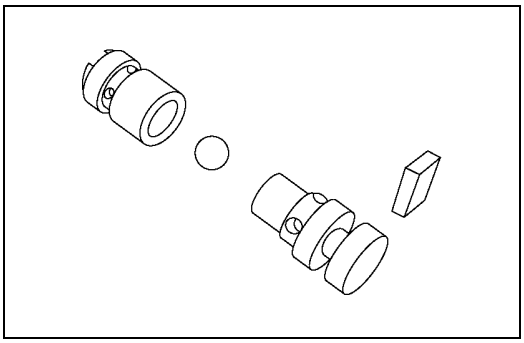
Confirm eight retainers are installed correctly.



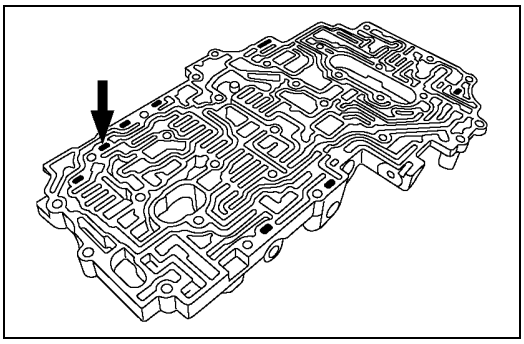
243R200066

2. **Retainer**
3. **Check valve NO.2**
4. **Ball**
5. **Check valve NO.1**

   Remove the check valve NO.2 ball and check valve NO.1 from the valve body.



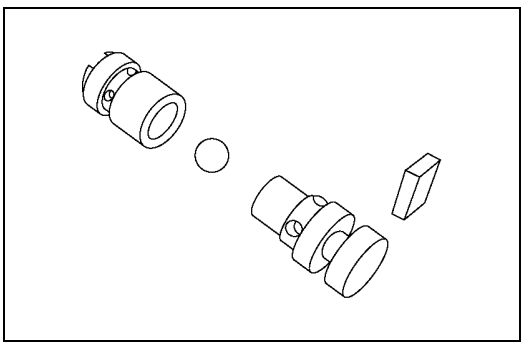
243R200062



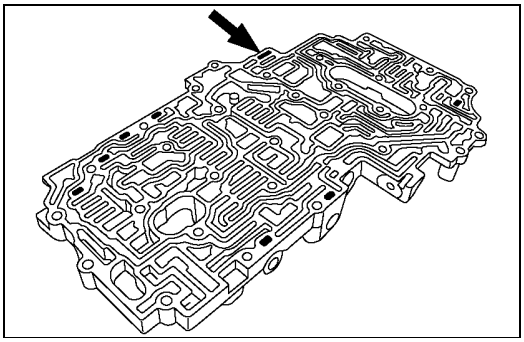
243R200067

6. **Retainer**
7. **Check valve NO.2**
8. **Ball**
9. **Check valve NO.1**

   Remove the check valve NO.2, ball and check valve NO.1 from the valve body.



243R200062



243R200070

10. Retainer

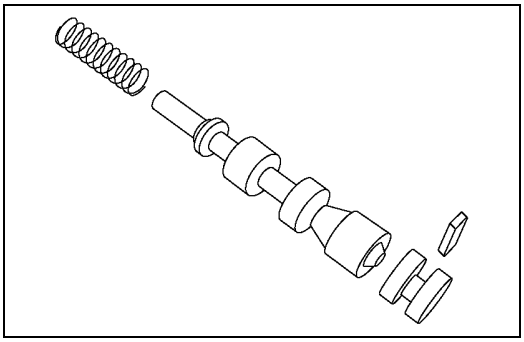
Remove the retainer with a magnetic finger by pushing in the plug.

11. Plug

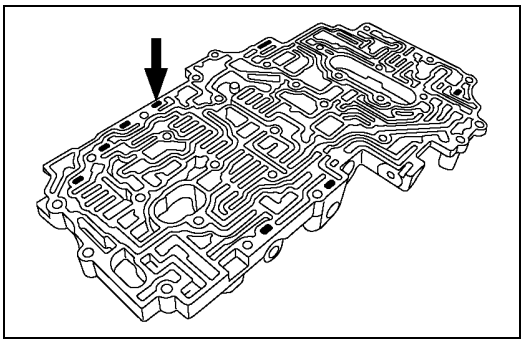
12. Secondary regulator valve

13. Spring

Remove the plug, secondary regulator valve and spring.



243R200056



243R200069

14. Retainer

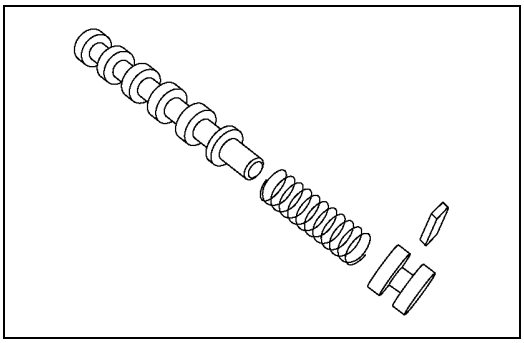
Remove the trainer with a magnetic finger by pushing in the plug.

15. Plug

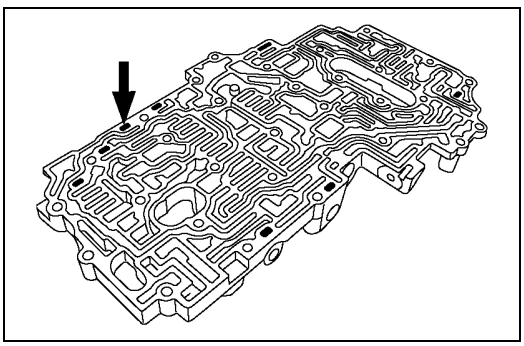
16. Spring

17. 2-3 shift valve

Remove the plug, spring and 2-3 shift valve.



243R200058



243R200068

18. Retainer

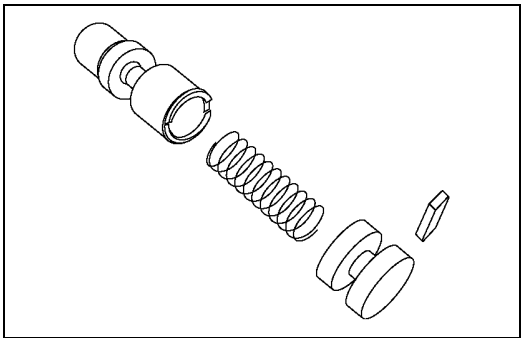
Remove the retainer with a magnetic finger by pushing in the plug.

19. Plug

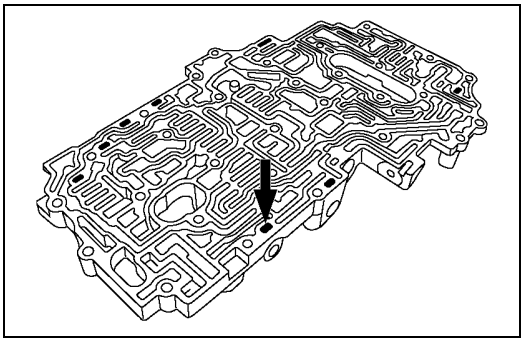
20. Spring

21. Reverse control valve

Remove the plug, spring and reverse control valve.



243R200060



243R200073

22. Retainer

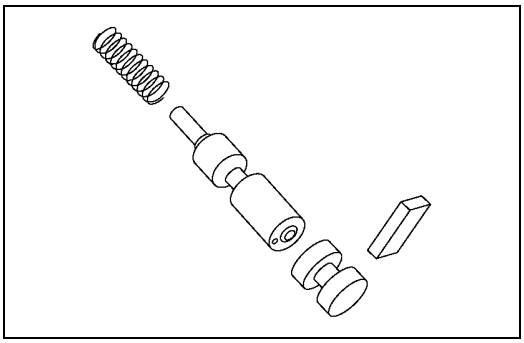
Remove the retainer with a magnetic finger by pushing in the plug.

23. Plug

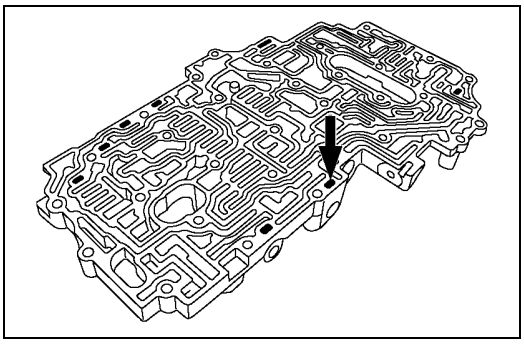
24. Second coast modulator valve

25. Spring

Remove the plug, second coast modulator valve and spring.



243R200063



243R200072

26. Retainer

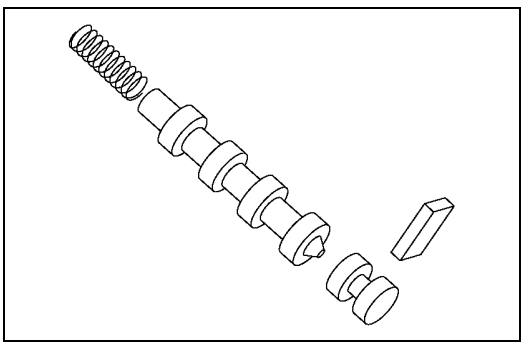
Remove the retainer with a magnetic finger by pushing in the plug.

27. Plug

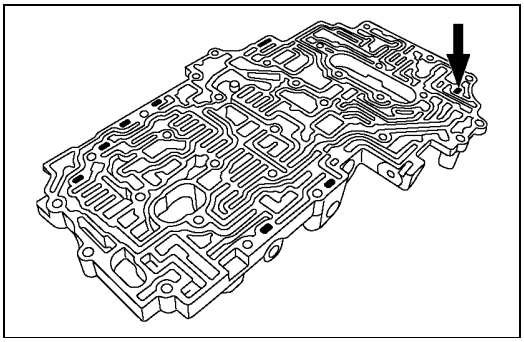
28. 3-4 shift valve

29. Spring

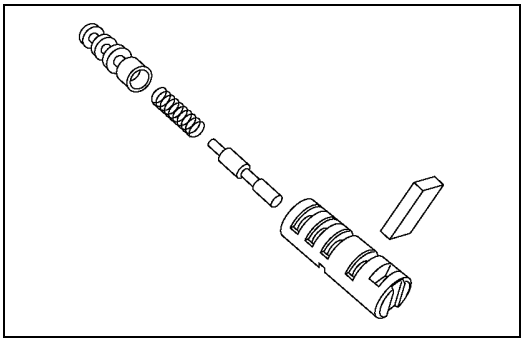
Remove the plug, 3-4 shift valve and spring.



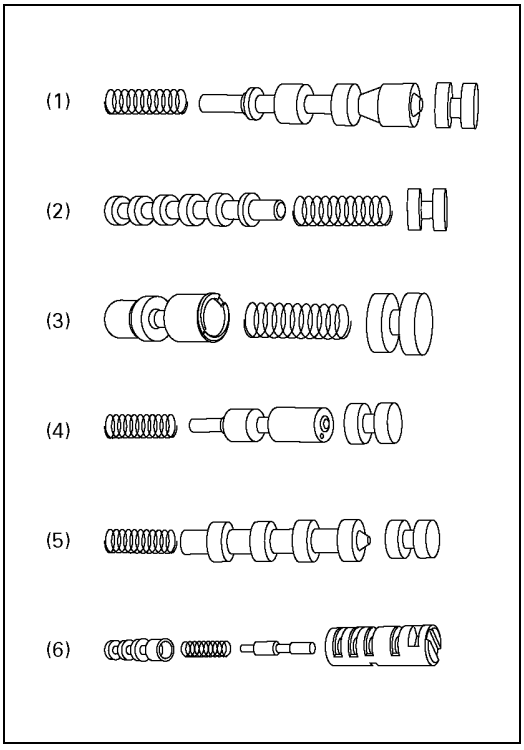
243R200064



243R200071



243R200065



243R200076

30. Retainer

Remove the retainer with a magnetic finger by pushing in the sleeve.

31. Sleeve

32. Plunger

33. Spring

34. Lock-up relay valve

Remove the sleeve with the plunger, spring and lock-up relay valve.

Remove the lock-up relay valve, spring and plunger from the sleeve.

35. Upper valve body

INSPECTION AND REPAIR

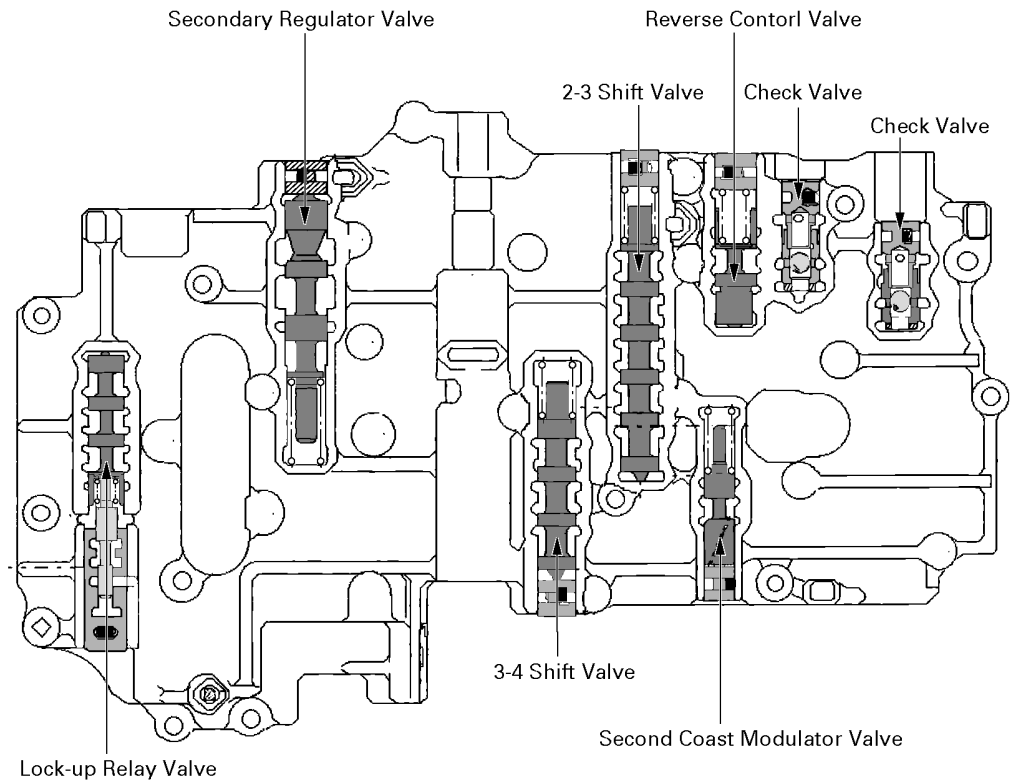
Inspect valve springs

Check for damage, squareness, rust and distorted coils.

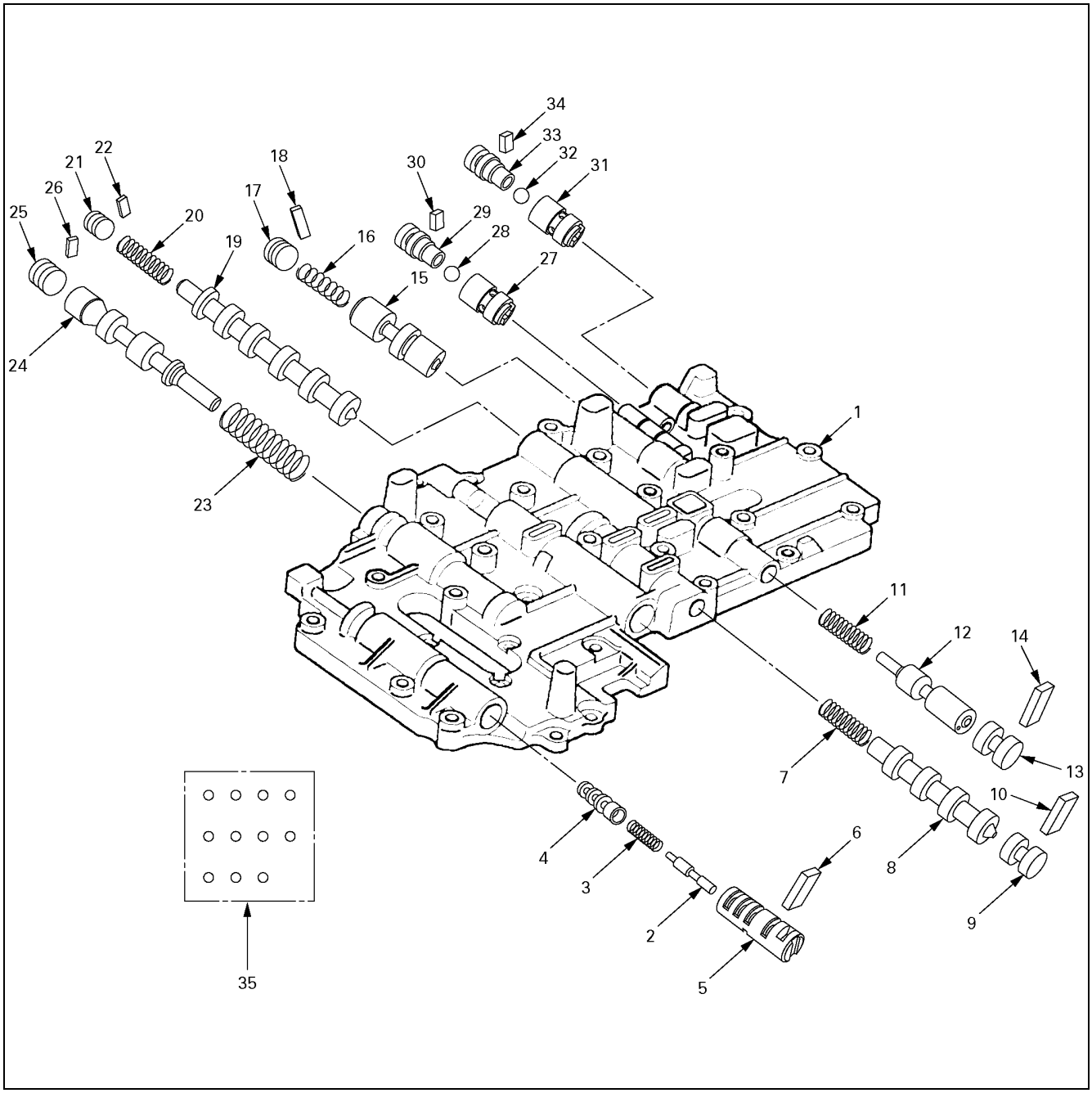
Measure the spring free height and replace if less than that down below.

Spring	Free length
(1) secondary regulator valve	32.9 mm (1.295 in)
(2) 2-3 shift valve	30.8 mm (1.213 in)
(3) Reverse control valve	25.6 mm (1.008 in)
(4) Second coast modulator valve	30.9 mm (1.217 in)
(5) 3-4 shift valve	30.8 mm (1.213 in)
(6) Lock-up relay valve	23.4 mm (0.912 in)

REASSEMBLY



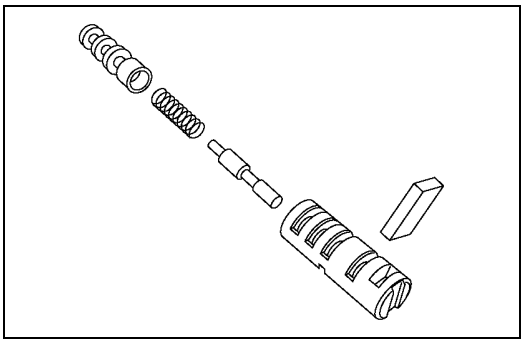
243R200052


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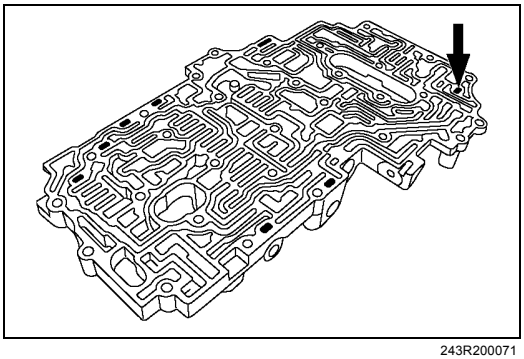
243R200075

Reassembly steps

1. Upper valve body
2. Plunger
3. Spring
4. Lock-up relay valve
5. Sleeve
6. Retainer
7. Spring
8. 3-4 shift valve
9. Plug
10. Retainer
11. Spring
12. Second coast modulator valve
13. Plug
14. Retainer
15. Reverse control valve
16. Spring
17. Plug
18. Retainer
19. 2-3 shift valve
20. Spring
21. Plug
22. Retainer
23. Spring
24. Secondary regulator valve
25. Plug
26. Retainer
27. Check valve NO.1
28. Ball
29. Check valve NO.2
30. Retainer
31. Check valve NO.1
32. Ball
33. Check valve NO.2
34. Retainer
35. Check ball



243R200065



243R200071

Reassembly steps

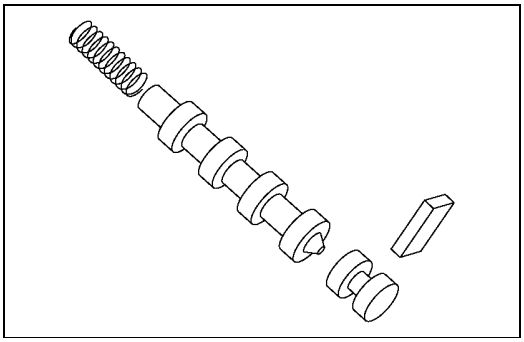
1. **Upper valve body**
2. **Plunger**
3. **Spring**
4. **Lock-up relay valve**
5. **Sleeve**

   Install the plunger and spring into the sleeve.

   Install the lock-up relay valve into the sleeve.

   Install the sleeve with the plunger, spring and lock-up relay valve into the bore.
6. **Retainer**

   Install the retainer.



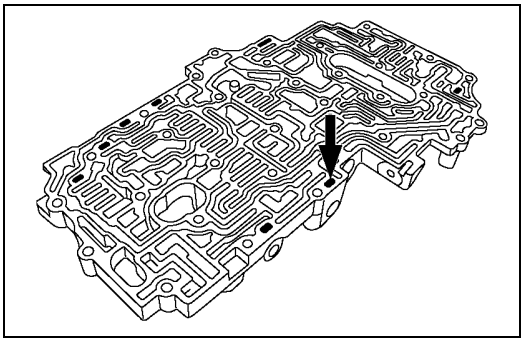
243R200064

7. **Spring**
8. **3-4 shift valve**
9. **Plug**

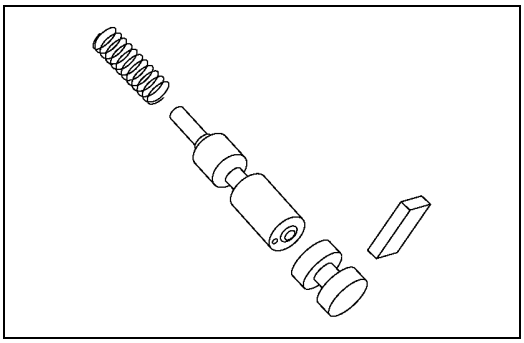
   Install the spring, 3-4 shift valve and plug into the bore.

10. **Retainer**

    Install the retainer by pushing in the plug.



243R200072



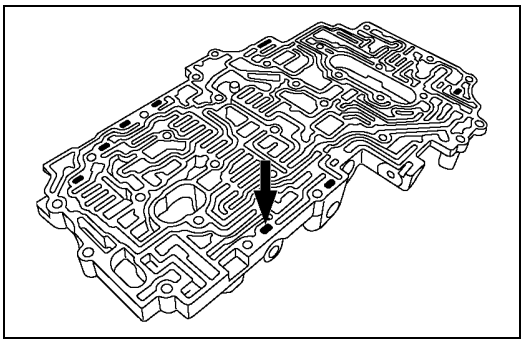
243R200063

11. **Spring**
12. **Secondary regulator valve**
13. **Plug**

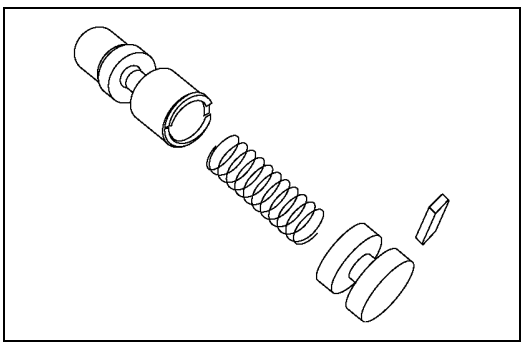
    Install the spring, second coast modulator valve and plug into the bore.

14. **Retainer**

    Install the retainer by pushing in the plug.



243R200073



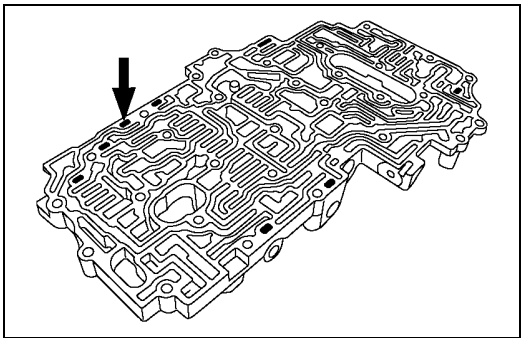
243R200060

15. **Reverse control valve**
16. **Spring**
17. **Plug**

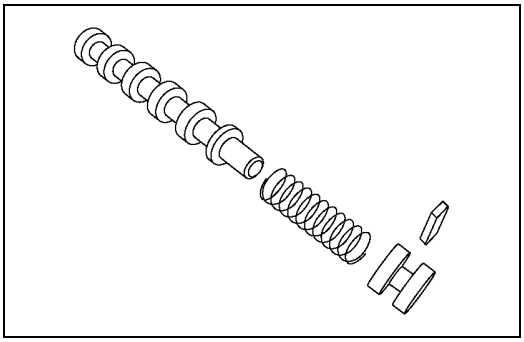
    Install the reverse control valve, spring and plug into the bore.

18. **Retainer**

    Install the retainer by pushing in the plug.



243R200068



243R200058

19. 2-3 shift valve

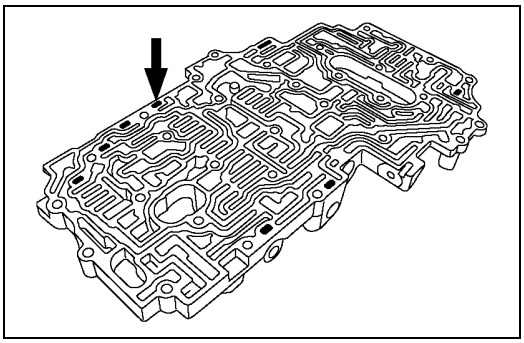
20. Spring

21. Plug

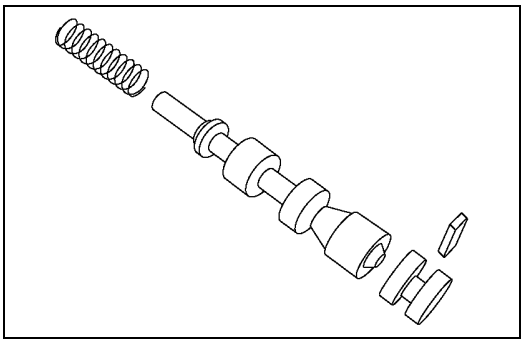
Install the 2-3 valve, spring and plug into the bore.

22. Retainer

Install the retainer by pushing in the plug.



243R200069



243R200056

23. Spring

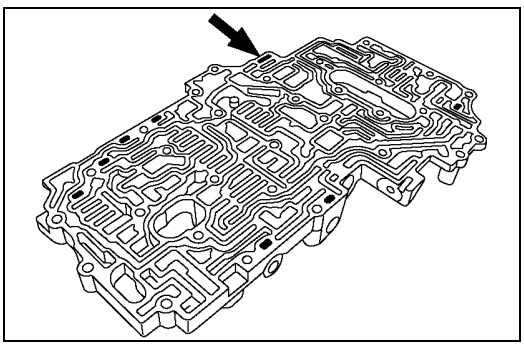
24. Secondary regulator valve

25. Plug

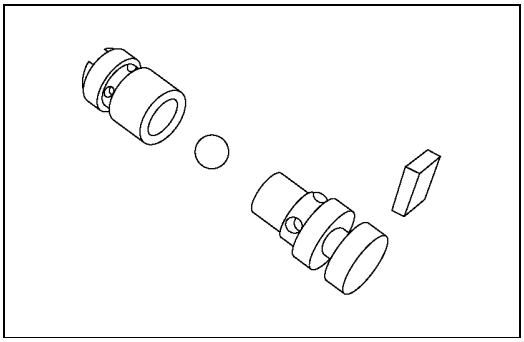
Install the spring, secondary regulator valve and plug into the bore.

26. Retainer

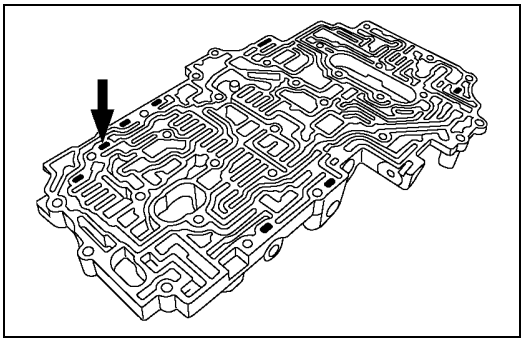
Install the retainer by pushing in the plug.



243R200070



243R200062



243R200067

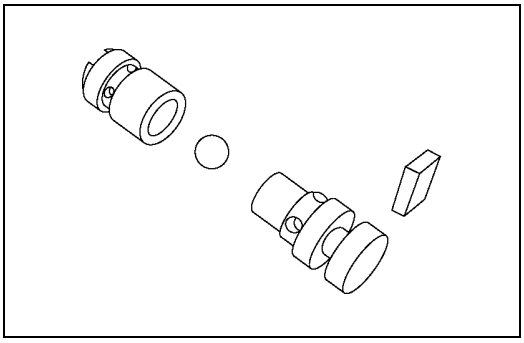
27. Check valve NO.1

28. Ball

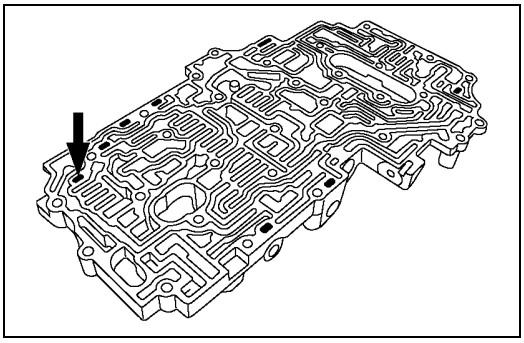
29. Check valve NO.2

Install the check valve NO.1, ball and check valve NO.2 to valve body.

30. Retainer



243R200062



243R200066

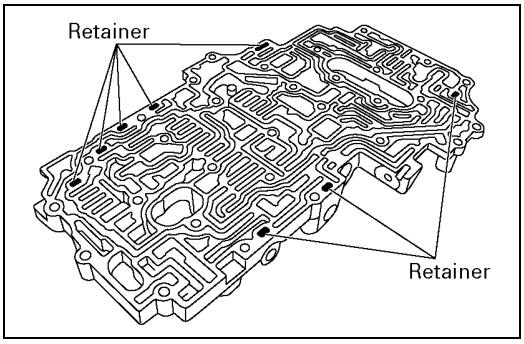
31. Check valve NO.1

32. Ball

33. Check valve NO.2

Install the check valve NO.1, ball and check valve NO.2 to the valve body.

34. Retainer

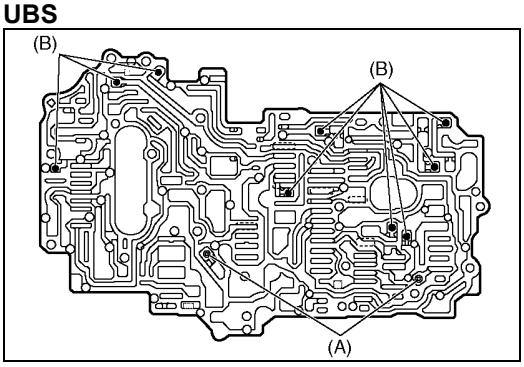


243R200054

NOTE:

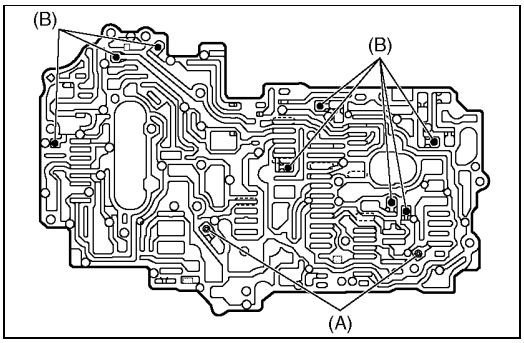
Make sure eight retainers are installed correctly

UBS



243R200053

TFR/S



243L200001

35. Check ball

Install the two types of check balls to the valve body.

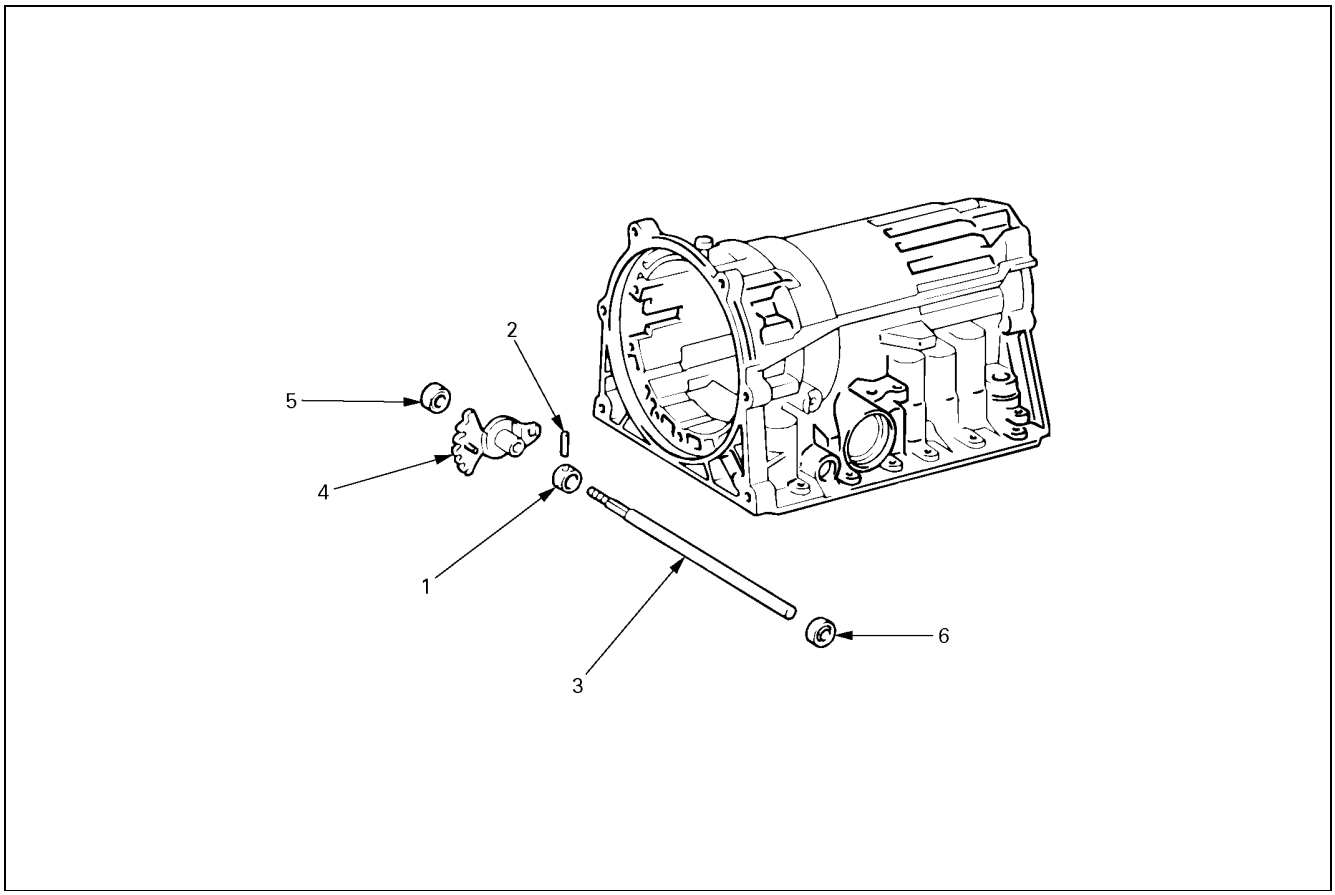
Number of check ball : UBS – 11

TFR/S – 10

Check ball	Diameter
(A) Rubber ball	5.535 mm (0.2179 in)
(B) Rubber ball	6.35 mm (0.2500 in)

TRANSMISSION CASE

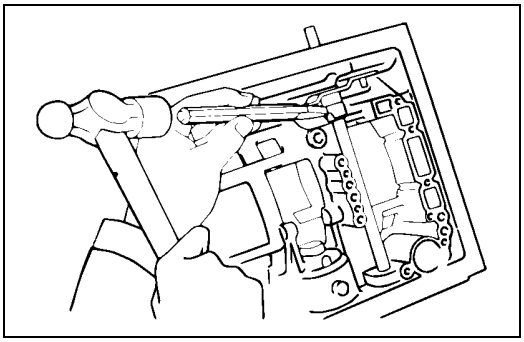
DISASSEMBLY



249RY00001

Disassembly steps

1. Spacer
2. Pin
3. Manual valve lever shaft
4. Manual valve lever
5. Oil seal
6. Oil seal

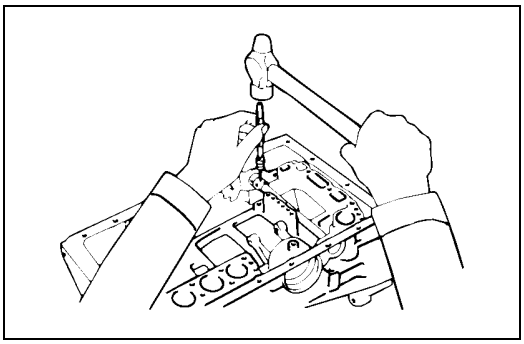


249RY00002

Disassembly steps

1. **Spacer**

   Using a chisel, cut off the spacer and remove it from the shaft.



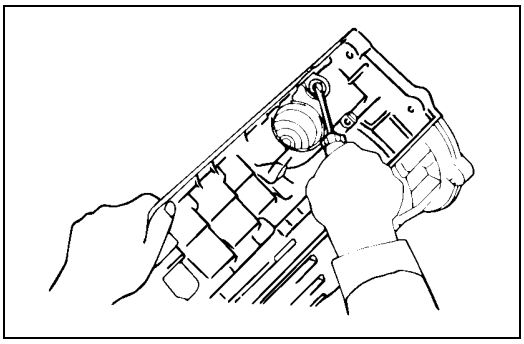
249RY00003

2. **Pin**

   Using a punch, drive out the pin.

3. **Manual valve lever shaft**
4. **Manual valve lever**

   Pull the manual valve lever shaft out through the case by the threads.

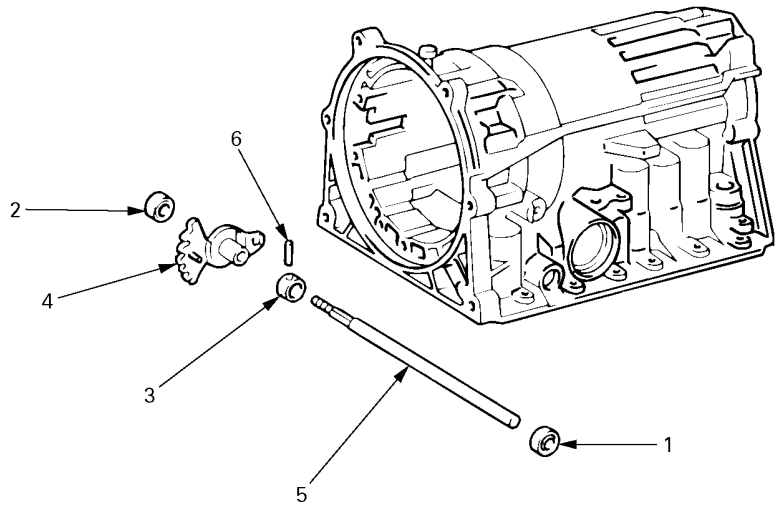


249RY00004

5. **Oil seal**
6. **Oil seal**

   Using a screwdriver, remove the oil seal.

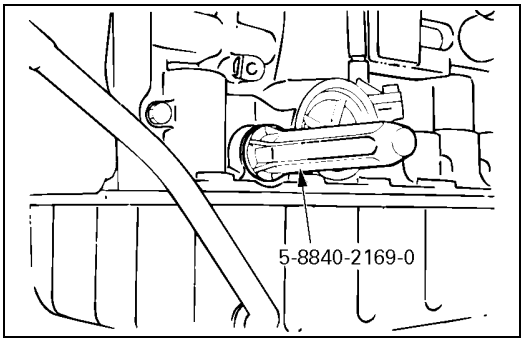
REASSEMBLY



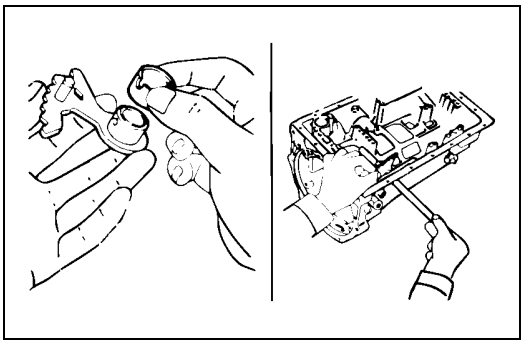
249RX00001

Reassembly steps

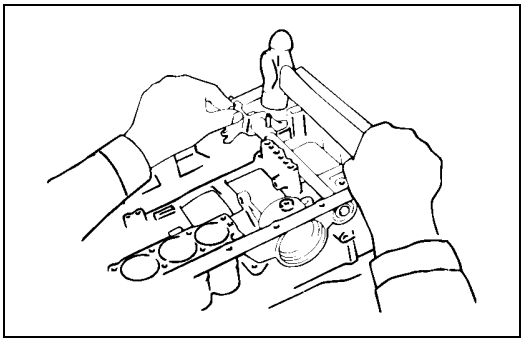
1. Oil seal
2. Oil seal
3. Spacer
4. Manual valve lever
5. Manual valve lever shaft
6. Pin



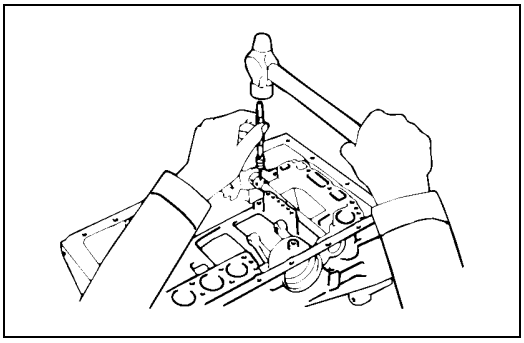
240RY00021



249RY00005



249RY00006



249RY00003

Reassembly steps

1. **Oil seal**
2. **Oil seal**

   Coat a new oil seal lip with multi purpose grease.

   Using special tool, drive in the oil seal.

   Oil seal installer : 5-8840-2169-0 (J-37232-2)

3. **Spacer**
4. **Manual valve lever**

   Assemble a new spacer to the manual valve lever.
5. **Manual valve lever shaft**

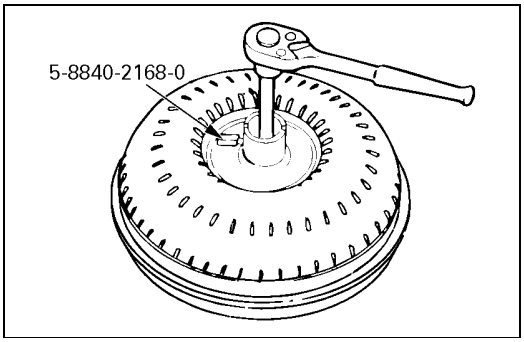
   Install the manual valve lever shaft to the transmission case through the manual valve lever by the threads.

6. **Pin**

   Drive in the pin with the slot at a right angle to the shaft.

   Match the spacer hole to the lever staking hollow and stake the spacer to the lever.

   Make sure the manual valve lever shaft turns smoothly.



241RY00018

TORQUE CONVERTER
INSPECTION AND REPAIR

Insert special tool in end of torque converter.

Insert a turning tool into the inner race of the one-way clutch.

One-way clutch testing tool : 5-8840-2168-0
(J-35467)

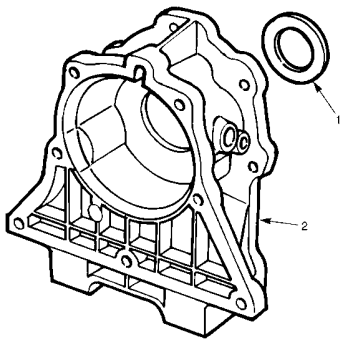
Insert the stopper so that it fits in the notch of the converter hub and outer race of the one-way clutch.

One-way clutch test

The clutch should lock when turned counterclockwise, and rotate freely and smoothly clockwise. Less than 25 kg·cm (22 lb·in) of torque should be required to rotate the clutch clockwise. If necessary, clean the converter and retest the clutch. Replace the converter if the clutch still fails the test.

ADAPTER HOUSING (4×4)

DISASSEMBLY



241R200005

Disassembly steps

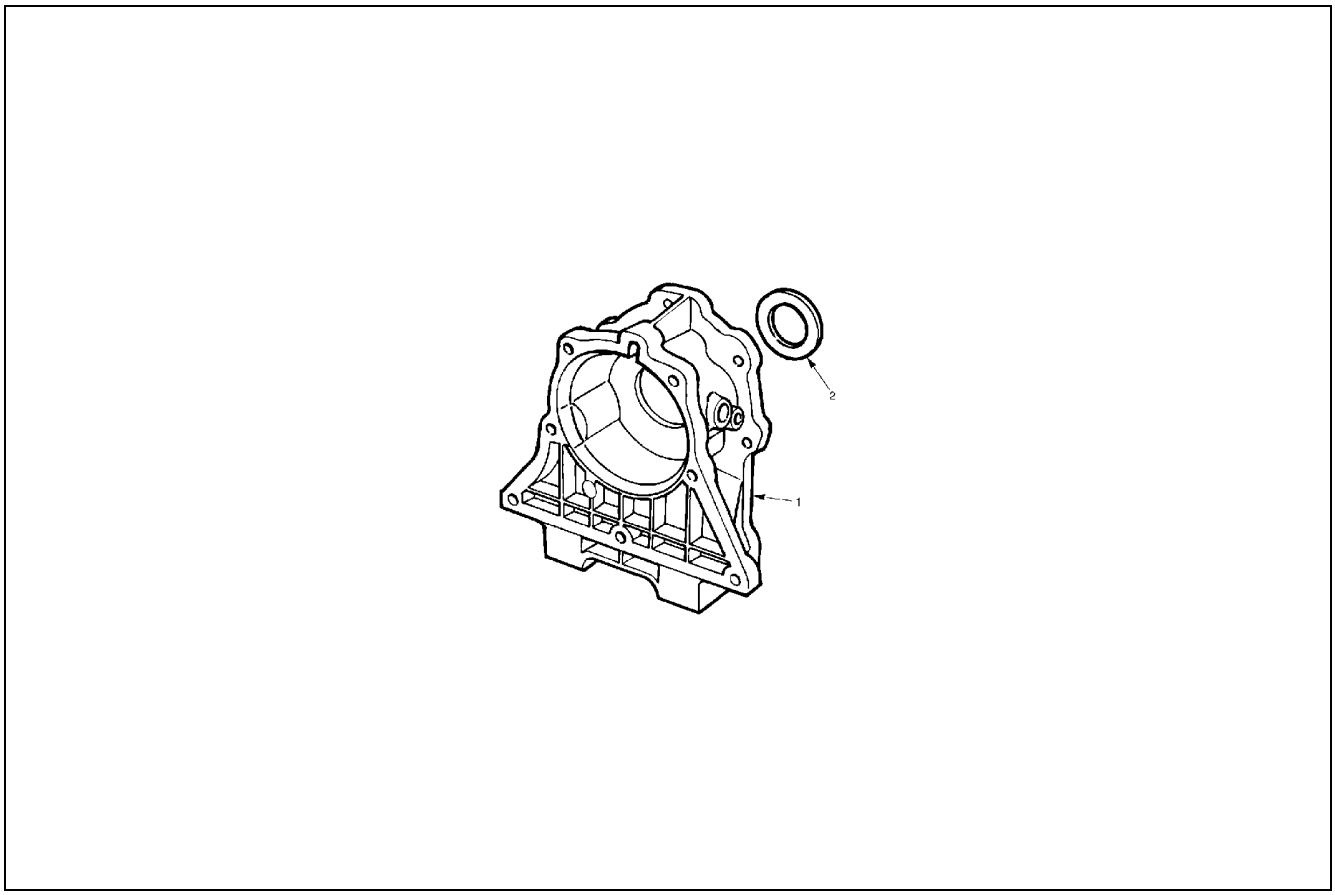
1. Oil seal
2. Adapter housing

Disassembly steps

1. **Oil seal**
2. **Adapter housing**

   Using a screwdriver, remove the oil seal.

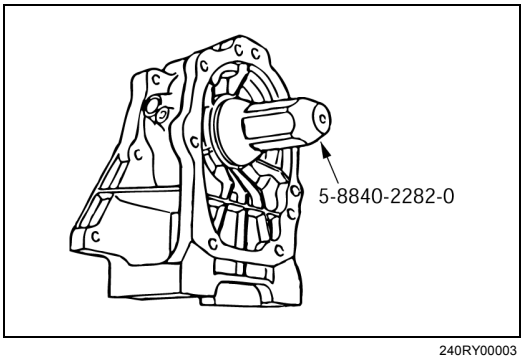
REASSEMBLY



241R200006

Reassembly steps

1. Adapter housing
2. Oil seal



240RY00003

Reassembly steps

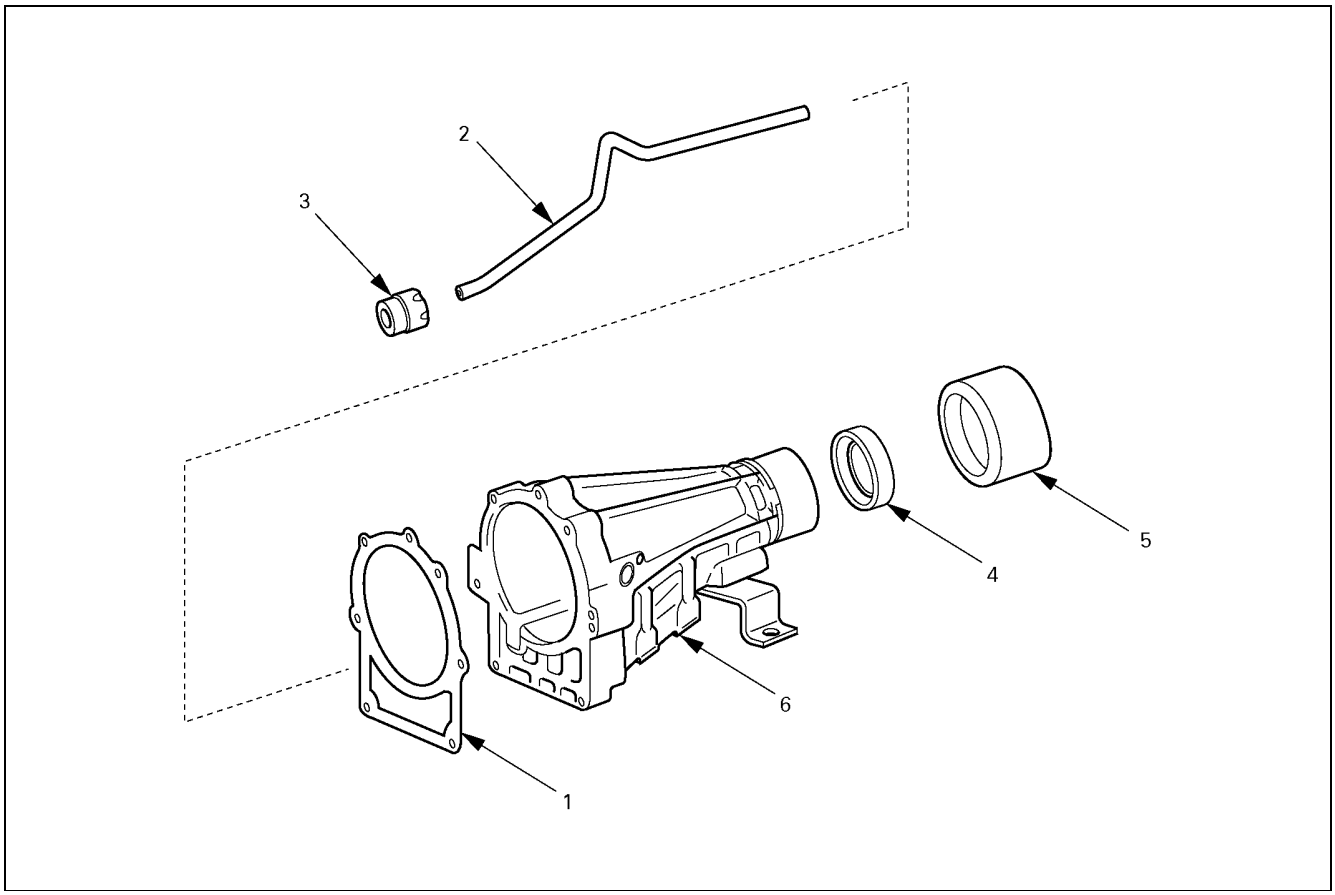
1. **Adapter housing**
2. **Oil seal**

   Using oil seal installer, install the new oil seal to the adapter housing.

   Oil seal installer : 5-8840-2282-0

EXTENSION HOUSING (4×2)

DISASSEMBLY



241R200007

Disassembly steps

1. Gasket
2. Tube
3. Tube packing
4. Oil seal
5. Dust deflector
6. Extension housing

Disassembly steps

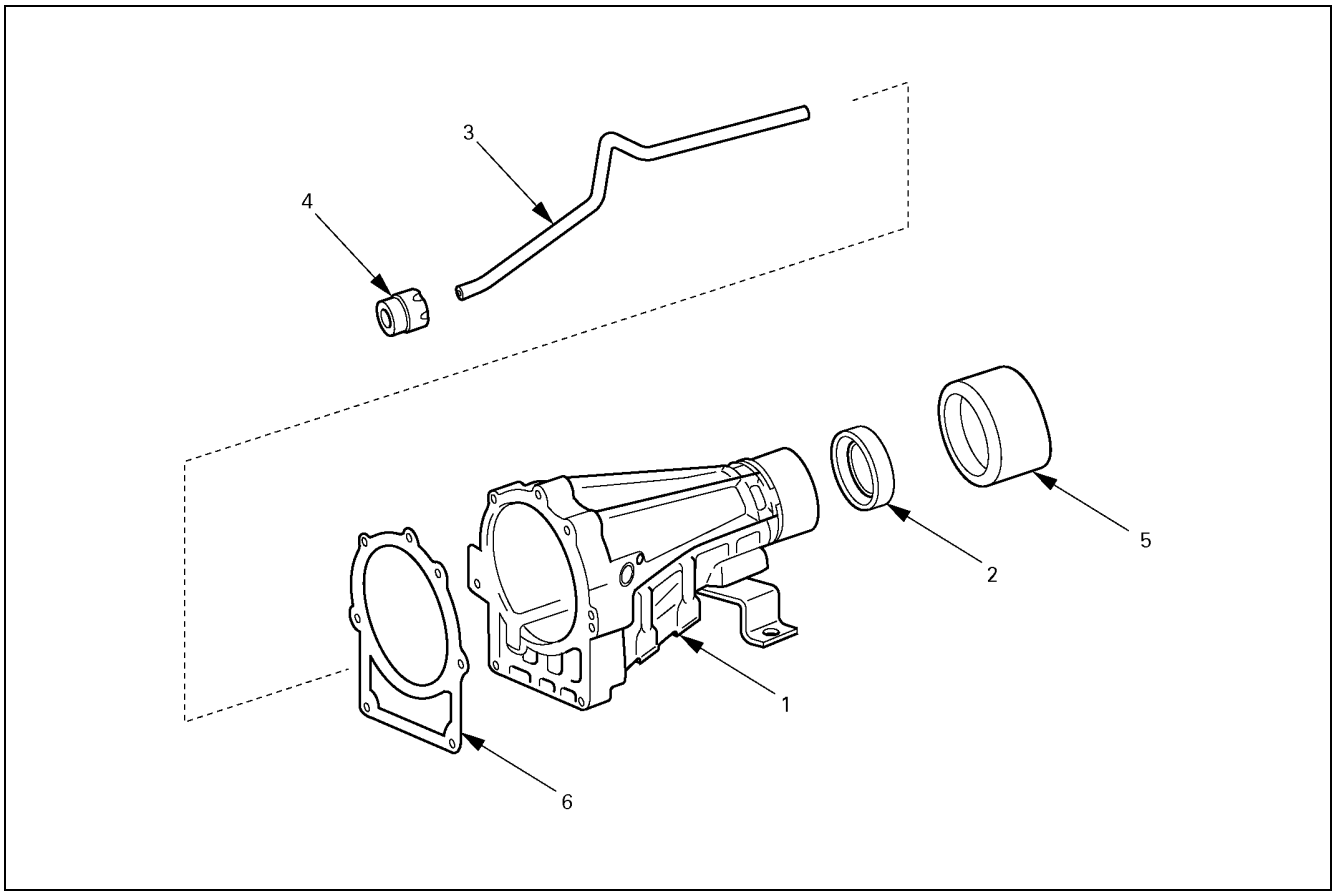
1. **Gasket**
2. **Tube**
3. **Tube packing**
4. **Oil seal**

   Using a screwdriver, remove the oil seal.

   NOTE:

   The oil seal can be removed without removing the dust deflector.
5. **Dust deflector**
6. **Extension housing**

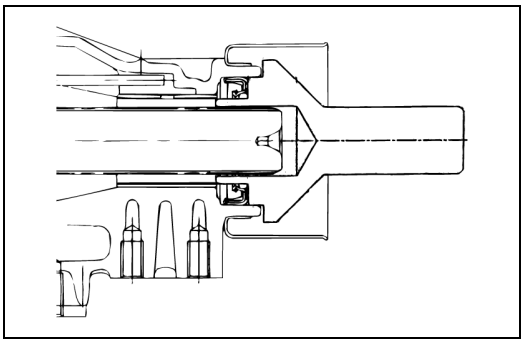
REASSEMBLY



241R200008

Reassembly steps

1. Extension housing
2. Oil seal
3. Tube
4. Tube packing
5. Dust deflector
6. Gasket



249L100005

Reassembly steps

1. **Extension housing**
2. **Oil seal**

   Using oil seal installer, install the new oil seal to the extension housing.

   Oil seal installer : 5-8840-2702-0

   NOTE:

   The oil seal can be installed without removing the dust deflector.
3. **Tube**
4. **Tube packing**
5. **Dust deflector**
6. **Gasket**

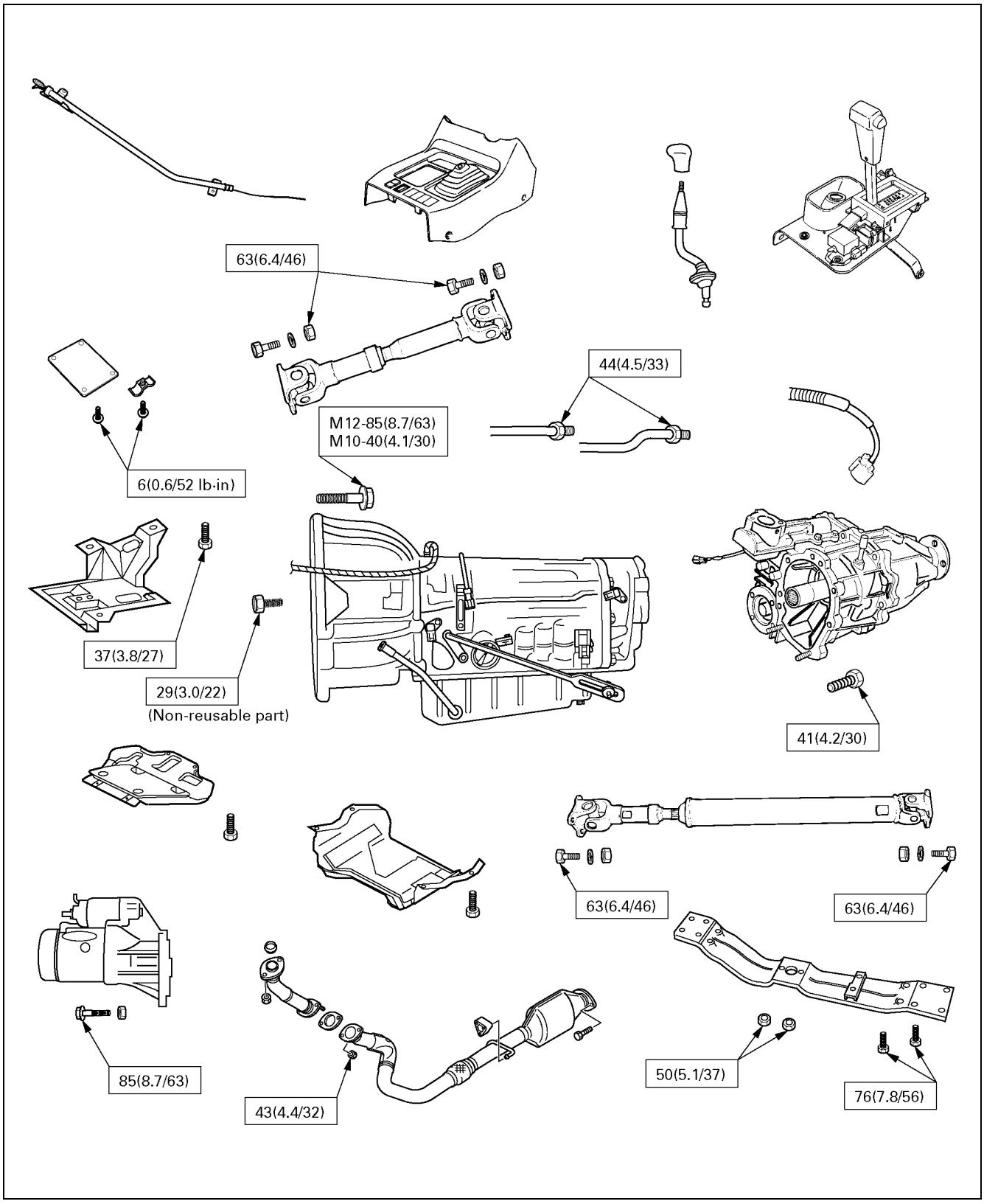
MAIN DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

				Remaks
Model			AW30-40LE	
Engine			'02 UBS － 4JX1-TC '02 TFR/S － 4JH1-TC '01 TFR － 4JH1-T	
Type			Electronic control planetary gear type	
			3-element 1-stage 2-phase type (with lock-up mechanism)	
Gear ratio		1st	2.804	
		2nd	1.532	
		3rd	1.000	
		4th (O/D)	0.705	
		Reverse	2.394	
Oil used		Name	BESCO ATF Ⅲ	
		Q'ty (l)	UBS and TFR/S － 8.7 '01 TFR － 8	
Torque converter			UBS 2450±150 TFR/S 2270±150 '01 TFR 2415±150	Stall speed (rpm)
Friction element	Forward clutch	C-1	UBS － 6, TFR/S － 5	Number of discs
	Direct clutch	C-2	UBS － 5, TFR/S － 4	
	OD direct clutch	C-0	2	
	Second coast brake	B-1	40 mm	Band width or Number of discs
	Second brake	B-2	5	Number of discs
	First and reverse brake	B-3	UBS － 7, TFR/S － 6	
	Overdrive brake	B-0	4	
Clutch	One-way clutch No.1	F-1	22	Number of sprage
	One-way clutch No.2	F-2	28	
	OD one-way clutch	F-0	24	
Planetary gear	Front planetary	Sun gear	42	Number of teeth
		Pinion gear	19	
		Ring gear	79	
	Rear planetary	Sun gear	33	
		Pinion gear	23	
		Ring gear	79	
	O/D planetary	Sun gear	33	
		Pinion gear	23	
		Ring gear	79	

TORQUE SPECIFICATIONS

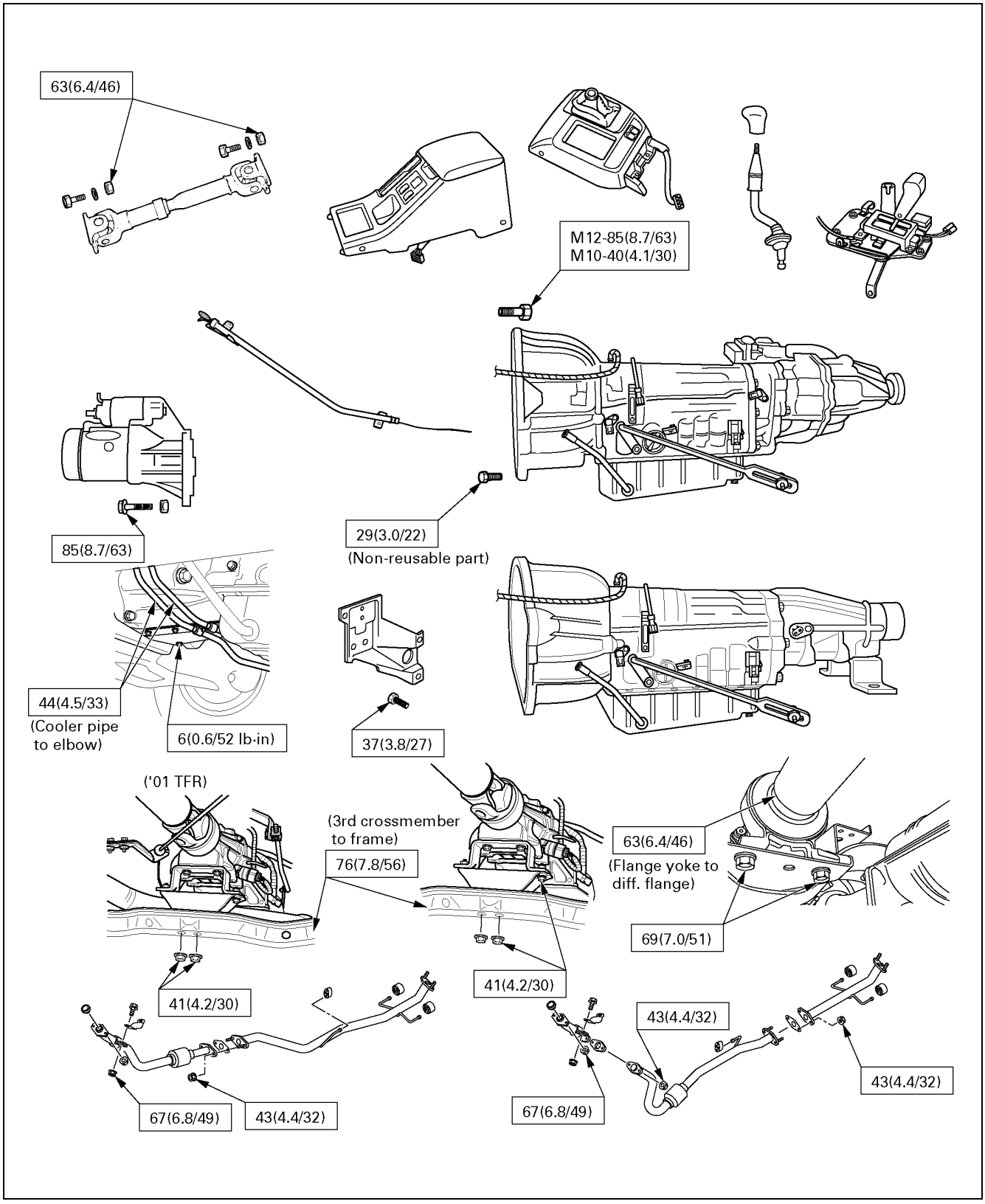
UBS **N·m (kg·m/lb·ft)**



E07R200015

TORQUE SPECIFICATIONS (Cont'd)

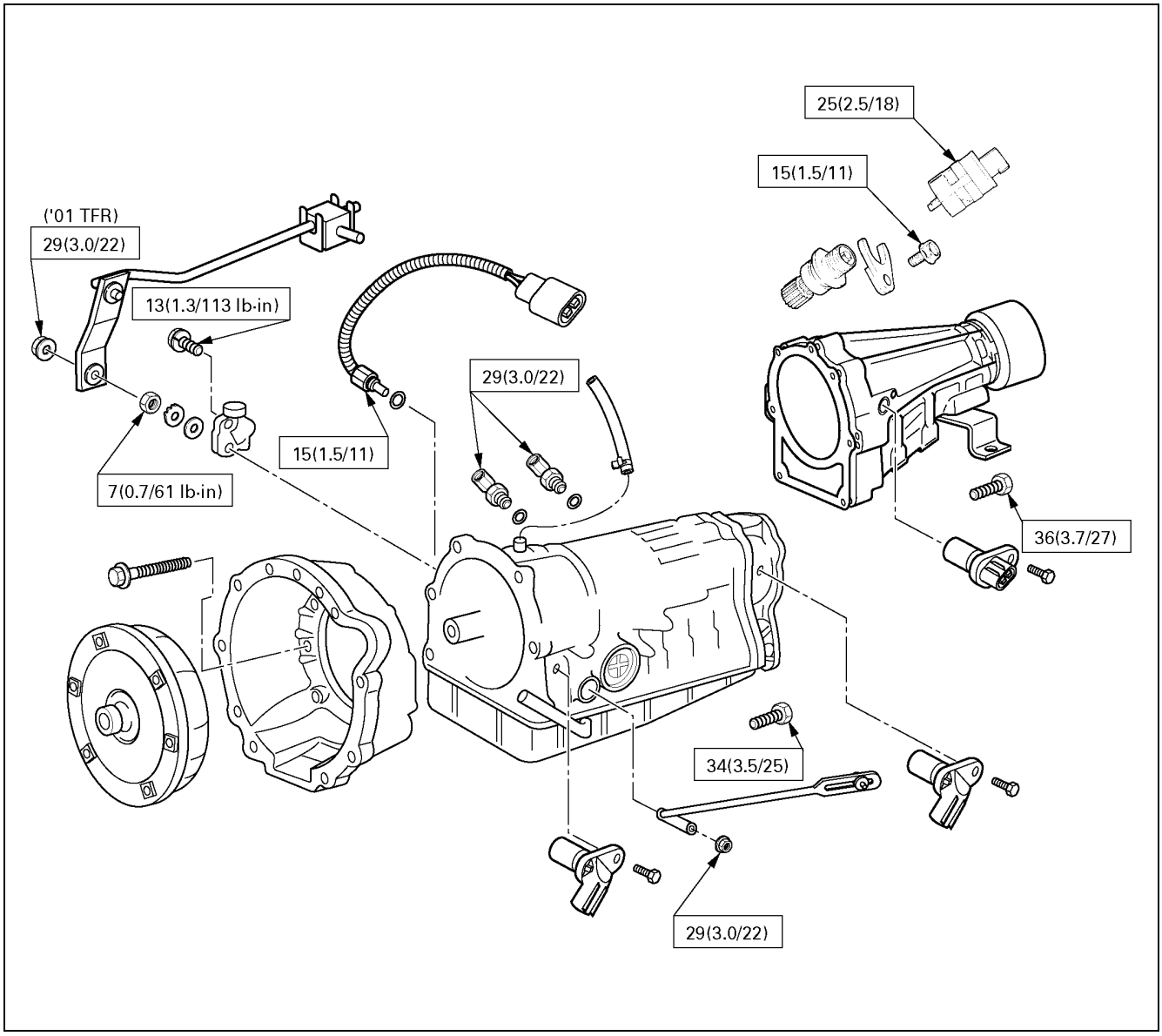
TFR/S **N·m (kg·m/lb·ft)**



E07L200005

TORQUE SPECIFICATIONS (Cont'd)

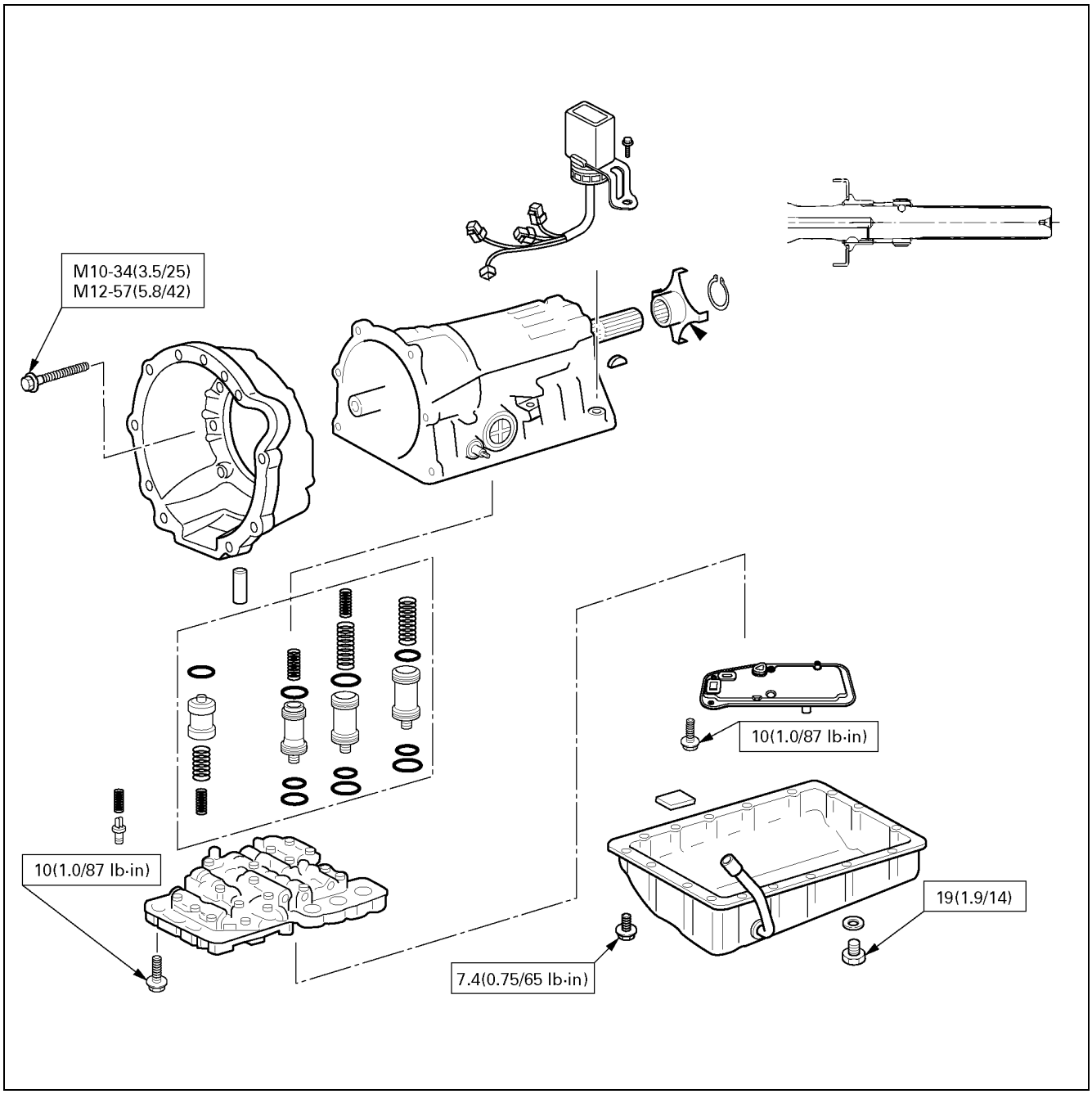
N·m (kg·m/lb·ft)



E07R200018

TORQUE SPECIFICATIONS (Cont'd)

N·m (kg·m/lb·ft)



E07R200020

SPECIAL TOOLS

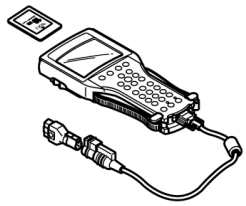
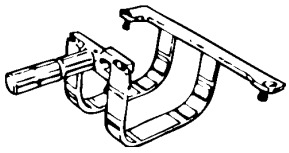
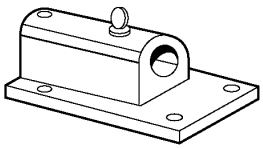
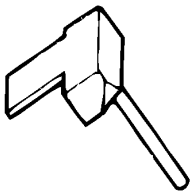
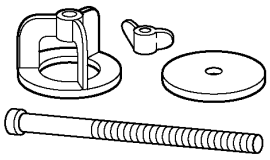
ILLUSTRATION	PART NO.	PART NAME
		Tech 2 scan tool
 5884000930	5-8840-0093-0	Oil pressure gauge
 901RY00018	5-8840-2152-0 (J-37227)	Holding fixture
 901RT096	5-8840-0003-0 (J-3289-20)	Holding fixture base
 901RY00019	5-8840-2153-0 (J-37228)	Oil pan seal cutter
 901RY00028	5-8840-0195-0 (J-23327-1)	Spring compressor

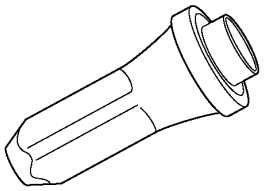
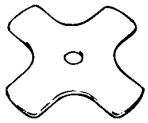
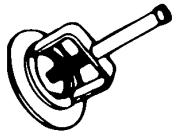
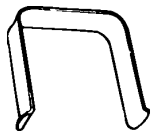
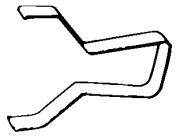
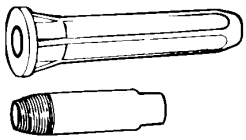
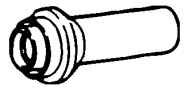
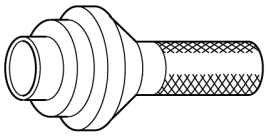
ILLUSTRATION	PART NO.	PART NAME
 901RY00020	5-8840-2256-0 (J-9617)	Oil seal installer; oil pump
 901RY00021	5-8840-2170-0 (J-37233)	Spring compressor; OD brake piston
 901RY00022	5-8840-0254-0 (J-25048)	Spring compressor
 901RY00023	5-8840-2173-0 (J-37236)	Reaction sleeve puller; first and reverse brake
 901RY00024	5-8840-2174-0 (J-37237)	Piston puller; first and reverse brake
 901RY00025	5-8840-2169-0 (J-37232-2)	Oil seal installer; manual valve shaft seal installer & remover
 901RY00026	5-8840-2168-0 (J-35467)	One-way clutch testing tool; torque converter

ILLUSTRATION	PART NO.	PART NAME
 901RY00027	5-8840-2282-0	Oil seal installer; adapter housing (4×4)
 5884027020	5-8840-2702-0	Oil seal installer; extension housing (4×2)

RVAW3-WE-0211F

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