ISUZU
JR403-E

INDEX

AUTOMATIC TRANSMISSION SERVICE GROUP
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INTRODUCTION
ISUZU JR403-E
"ELECTROMATIC"

Updated
April, 2004

The JR403-E transmission, also known as the "Electromatic" by GM, is currently found in 1988 and up GMC Tiltmaster Trucks, Isuzu Trucks, Nissan Diesel Trucks, Mazda Trucks and Mitsubishi Trucks. This fully electronic controlled transmission is similar in design to the RE4R01A found in Nissan Pathfinders, 240SX and 300SX vehicles, but on a much larger scale. This manual contains information and procedures for assembly/disassembly, diagnosing electrical problems, and was compiled from GMC and ISUZU factory repair manuals.

The JR403-E transmission is fully electronic controlled, consisting of shift solenoids, a line pressure solenoid, a converter clutch solenoid, a overrun clutch solenoid and a fluid temperature sensor. There is built into the vehicles a self diagnostic procedure to aid in diagnosing electrical concerns and is also included in this manual.

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SELF DIAGNOSIS AND CODE RETRIEVAL

1988 VEHICLES: The instrument panel ECONOMY light functions as a pattern monitor lamp during self diagnosis (See Figure 1). Turn the ignition to the "ON" position (The Economy Switch can be in either the ECONOMY or NORMAL mode). The pattern monitor lamp will begin to blink rapidly indicating that an electrical problem does exist. If there were no problems detected, the light will

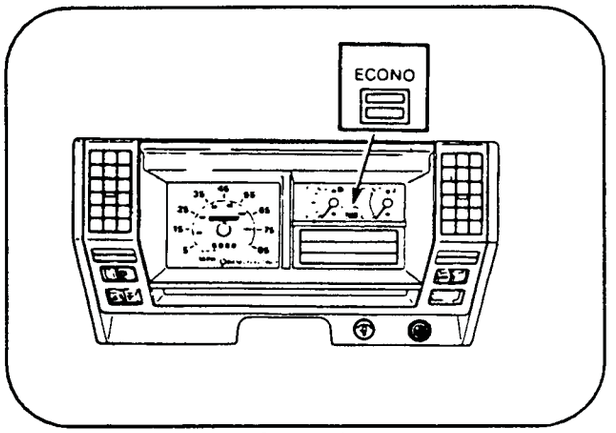


Figure 1

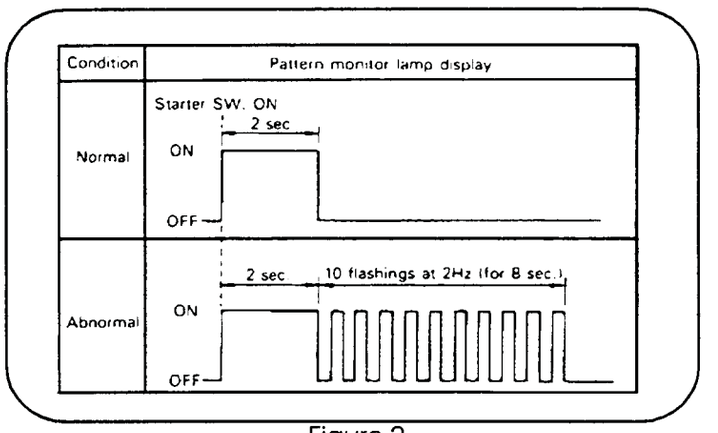


Figure 2

Retrieving Codes: If the pattern monitor lamp (economy indicator light), flashes to indicate that an electrical problem has been detected, follow the self diagnosis steps in Figure 3 to obtain the

1. TURN THE IGNITION OFF.
2. PLACE THE SELECTOR LEVER INTO THE "D" POSITION.
3. PLACE THE ECONOMY DRIVE SWITCH TO THE "NORMAL" POSITION.
4. TURN THE IGNITION SWITCH TO THE "ON" POSITION.
5. PLACE THE SELECTOR INTO THE "2" RANGE.
6. PLACE THE ECONOMY DRIVE SWITCH TO THE "ECONOMY" POSITION.
7. PLACE THE SELECTOR LEVER INTO THE "1" RANGE.
8. PLACE THE ECONOMY DRIVE SWITCH TO THE "NORMAL" POSITION.
9. DEPRESS THE ACCELERATOR PEDAL TO THE FLOOR AND RELEASE.

Figure 3

After performing the "Self Diagnostic Input Steps", the indicator light will flash for 2 seconds as a bulb check. The light will then begin to blink indicating the status of each component by the time difference in the light blinking "ON" and "OFF" . In other words, the first blink after the 2 second flash is a check on the Vehicle Speed Sensor on the transmission. If there was a problem detected here, the light would stay lit for 6/10 of a second. If no problem was detected, the light would have stayed lit for only 1/10 of a second. The illustration shown in Figure 4 shows an example of "Shift Solenoid A" as being a problem. The 4th blinking light is a check the Shift Solenoid A circuit and since a problem was detected here, the 4th blinking light stayed lit longer than the rest.

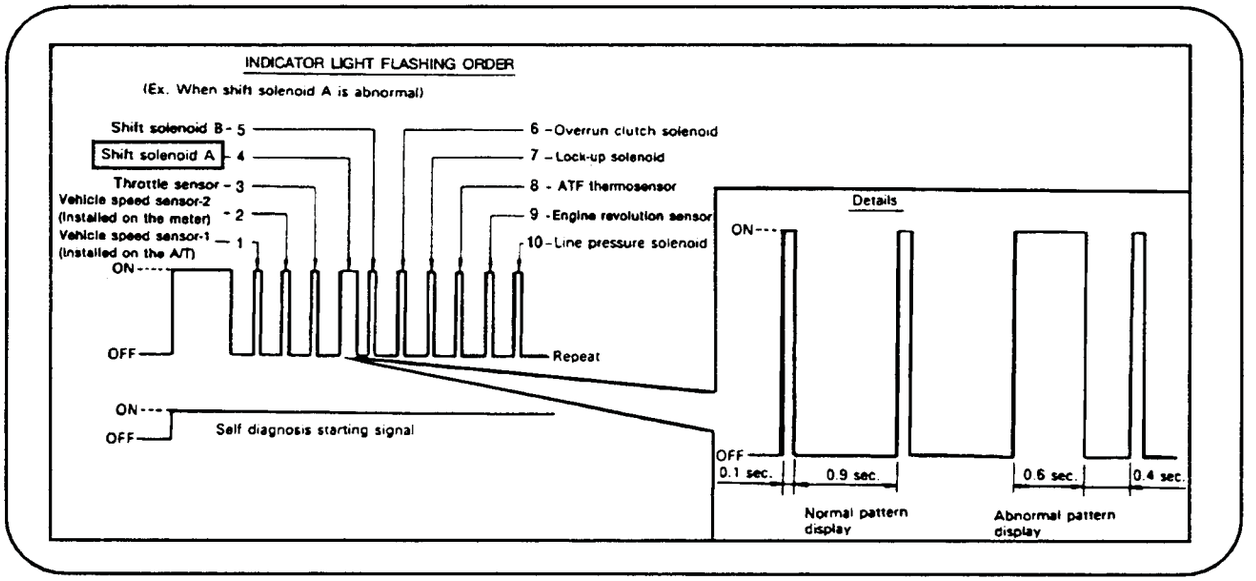


Figure 4

There are a total of 10 flashes with each flash representing a specific circuit. Refer to Figure 5 below for the flashing order and probable trouble.

No.	Component	Probable Trouble
1	Vehicle speed sensor-1	Sensor installed to the A/T open circuit
2	Vehicle speed sensor-2	Sensor installed to the meter open circuit
3	Throttle sensor	Open or short circuit
4	Shift solenoid A	Open or short circuit
5	Shift solenoid B	
6	Overrun clutch solenoid	
7	Lock-up solenoid	
8	ATF thermosensor	ATF thermosensor or battery power source open circuit
9	Engine-revolution sensor	Open circuit
10	Line pressure solenoid	Open or short circuit

Figure 5

1989 and 1990 vehicles: The 1989 vehicles inform and provide codes in the same manner as the 1988 vehicles. The only difference is in the operation of the Economy Drive Indicator Display. On 1988 vehicles if a code is present, when the key is turned to the "ON" position, the ECONOMY light will have a continuous flash irregardless of whether the button is in the ECONOMY MODE or NORMAL MODE. If no codes are present the light will come ON for two seconds and go out irregardless of what position the switch is in. On 1989 and 1990 vehicles, if NO codes are present and the switch is in the NORMAL MODE, the ECONOMY will come on for two seconds and go out. If the switch is placed in the ECONOMY MODE and NO codes is present, the ECONOMY light will come on and stay on. If codes ARE present, the ECONOMY light will have a continuous flash irregardless of what position the ECONOMY switch is in (Refer to Figure 6 Below). The Code retrieval method is the same as 1988 vehicles. Refer to figures 3, 4 and 5 to obtain and determine codes.

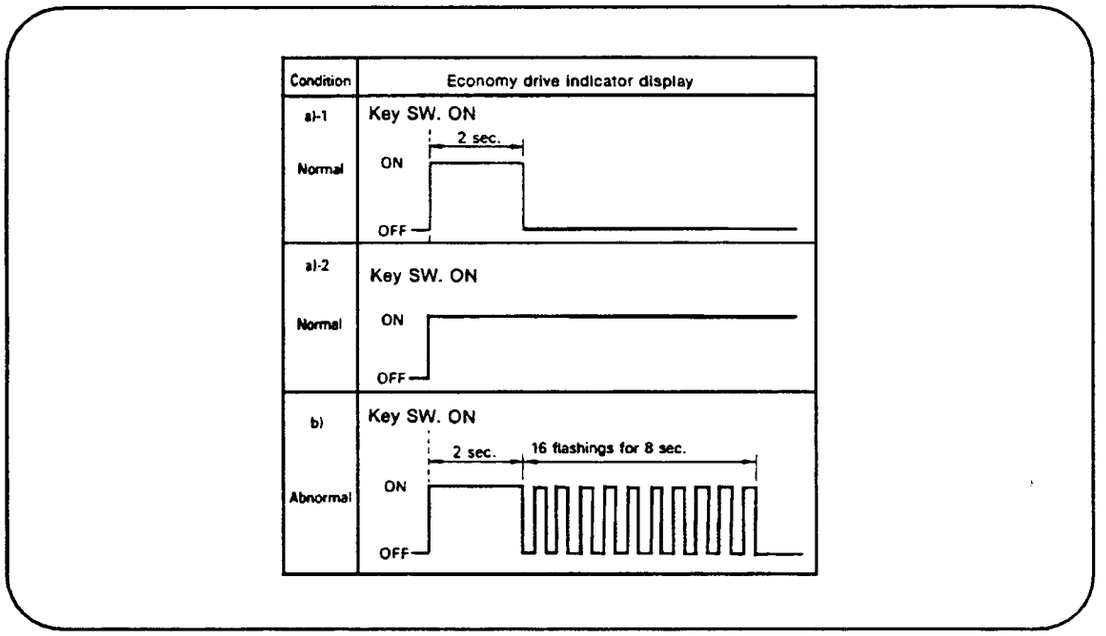


Figure 6

1991 to 1993 vehicles: The "Economy Drive Indicator Light" serves as a "Pattern Monitor Lamp" during self diagnosis as explained and shown in Figure 1. The "Economy Light" will blink a steady pattern when the ignition switch is turned to the "ON" position and an electrical problem has been detected as explained and shown in Figure 6.

Retrieving Codes: The trouble codes stored in the computers memory can be retrieved by jumping two leads in a diagnostic connector. 1991 vehicles have this diagnostic connector located behind the glove box as shown in Figure 7. 1992 and 1993 vehicles have this connector located under the brake and clutch fluid tank as shown in Figure 8. This connector is white in color and has a yellow wire with a black tracer and a solid black wire in the connector. When these two leads are connected together, the ECONOMY light will flash a TWO DIGIT code and repeat the code three times (See Figure 9). If there is more than 1 code stored in the computers memory, the lowest code number will be displayed first. Each code is displayed 3 times in a row before the next code comes up. Refer to Figure 10 for the list of TWO DIGIT codes for 1991 to 1993 vehicles.

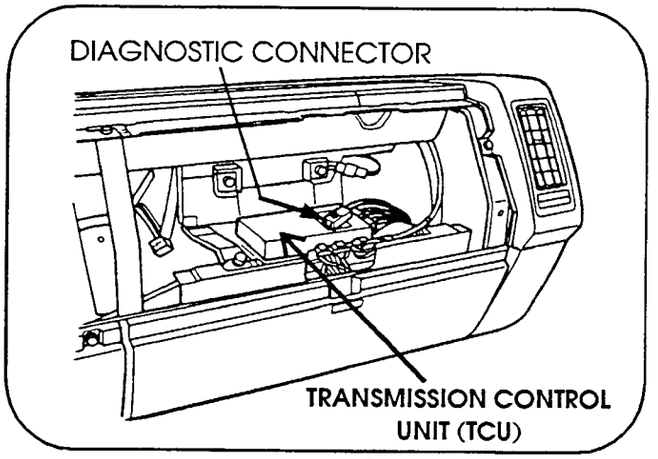


Figure 7
1991 Diagnostic connector location

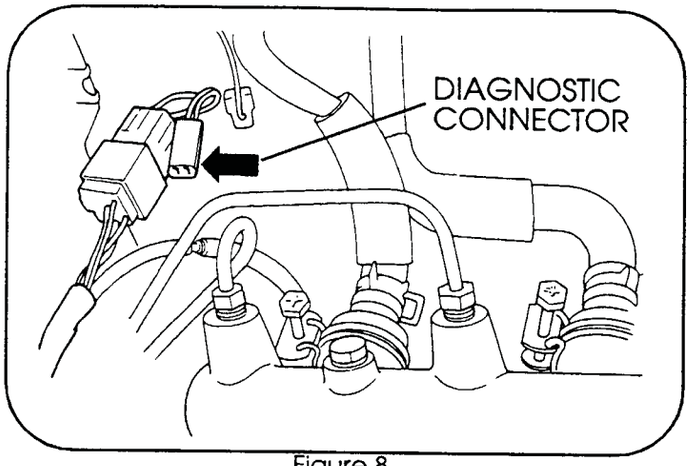


Figure 8
1992 and 1993 Diagnostic connector location

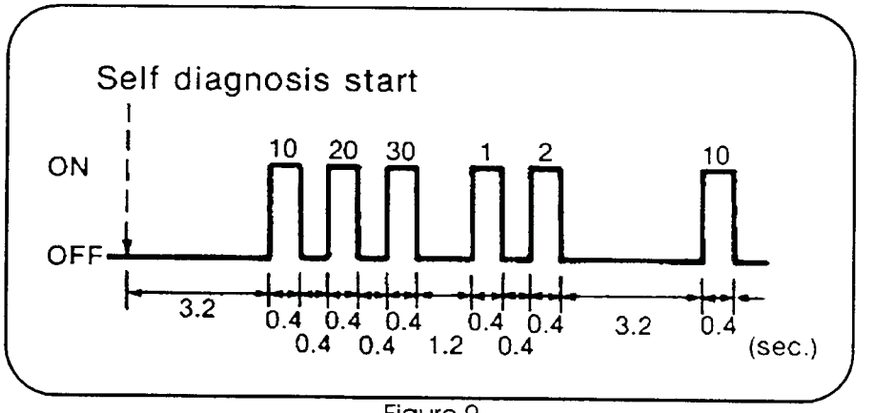


Figure 9
Trouble Code "32"

CODE No.	DIAGNOSIS ITEM	DIAGNOSED CONTENT
11	Vehicle speed sensor "1"	Vehicle speed sensor 1 circuit open or shorted
24	Vehicle speed sensor "2"	Vehicle speed sensor 2 circuit open or shorted
13	Engine revolution sensor	Engine revolution sensor circuit open or shorted
15	ATF thermosensor or battery back-up voltage	ATF thermosensor or battery back-up voltage circuit open or shorted
21	Throttle sensor	Throttle sensor circuit open or shorted
31	Shift solenoid A	Solenoid circuit open or shorted
32	Shift solenoid B	
33	Over-run clutch solenoid	
34	Lock-up duty solenoid	
35	Line pressure duty solenoid	

Figure 10
Trouble Code Chart for 1991-1993 Vehicles

ERASING CODES

To erase codes, simply remove the Number 11 fuse (See Figure 11) or disconnect the positive battery cable for approximately 10 seconds. The fuse box is located under the glove box.

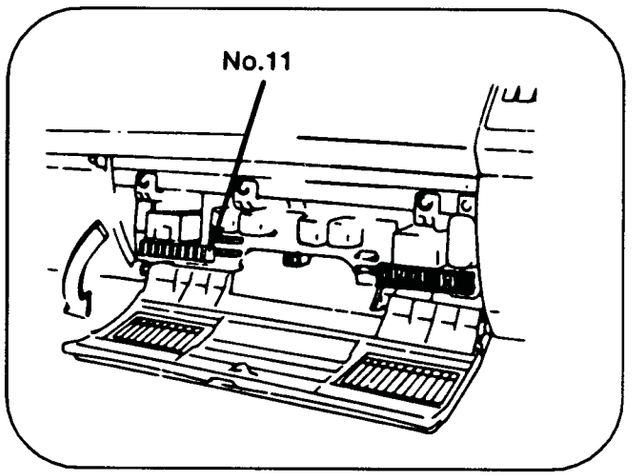


Figure 11

ELECTRICAL COMPONENT CHECK

IDLE SWITCH

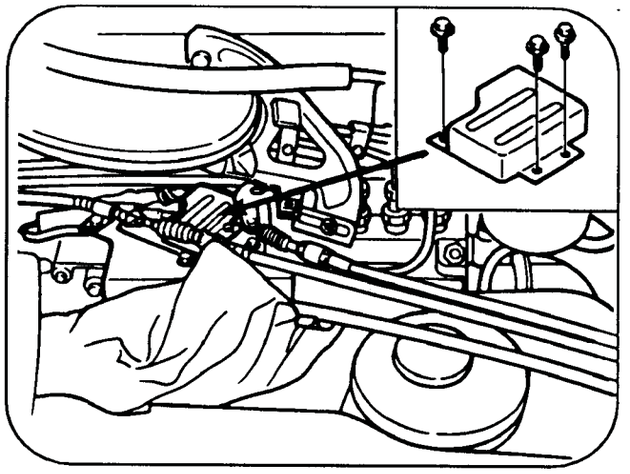


Figure 12

The IDLE SWITCH is attached to the injection pump and has a three bolt cover on it to protect it from dust (See Figure 12). Pin 14 at the computer sends battery voltage to both the THROTTLE SWITCH and the IDLE SWITCH. The IDLE SWITCH is a normally closed switch and when the switch is closed, it completes a ground circuit to pin 4 at the computer. To check the IDLE SWITCH for proper operation, remove the 3 bolt cover and unplug the two wire connector going to the switch and cross the connector on the switch side with an ohm meter.

When the Control Lever Cam is .004" from the Idle Set Bolt, the switch should show continuity. When the Control Lever Cam is .010" from the Idle Set Switch, the switch should read open (See Figure 13). Adjust or replace switch if necessary.

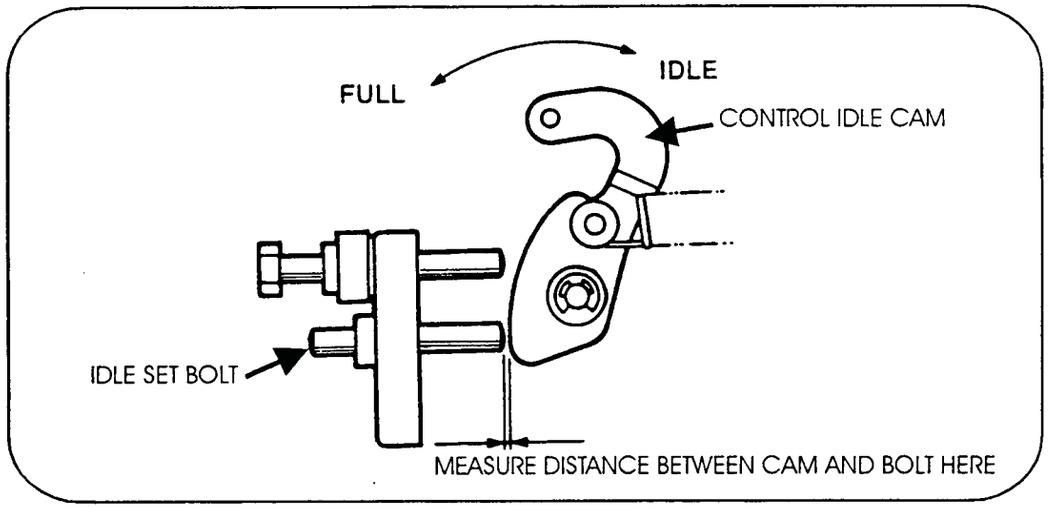


Figure 13

KICKDOWN SWITCH

The Kickdown Switch is a normally open switch and closes when the accelerator pedal is depressed approximately 1.38 ". A clicking sound can be heard if the switch is operating. The Kickdown switch can be checked with an ohm meter by placing the positive lead to the blade of the switch and the negative lead to a ground. With the accelerator pedal released, the switch should read open. With the accelerator pedal depressed approximately 1.38" of travel, the switch should read closed (See Figure 14).

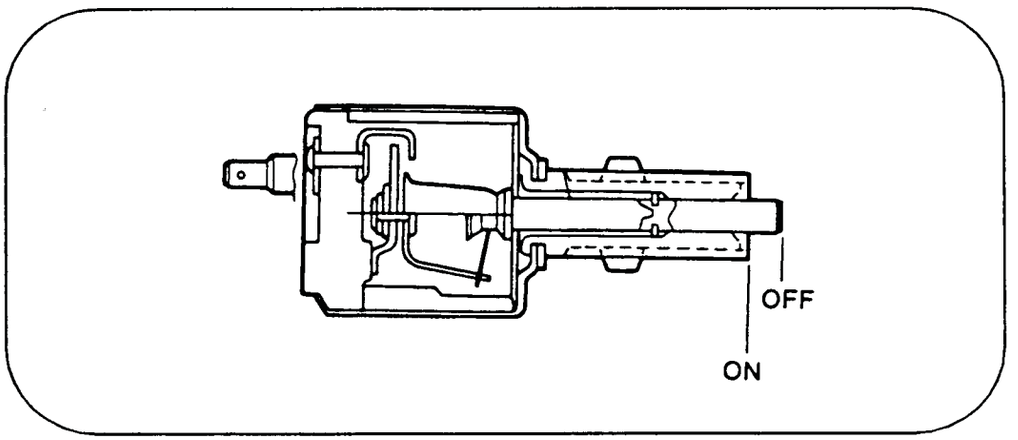


Figure 14

THROTTLE POSITION SWITCH AND SENSOR

The Throttle Position Sensor and Throttle Position Switch is located in one assembly (See Figure 15). The Throttle Position Switch is a normally open switch and closes when the accelerator pedal has reached a full throttle position. To check the switch, unplug the connector and cross the two pins on the switch side of the connector with an ohm meter. The switch should read open and close when the accelerator pedal has reached wide open throttle.

The throttle position sensor is fed with 5 volts from pin #10 at the computer. The sensor then sends voltage that is proportional to throttle opening back to the computer at pin #11. When the throttle is closed, approximately 4.5 volts is sent to the computer. As the throttle opens, the voltage decreases in proportion to throttle opening. When wide open throttle has been reached, approximately .5 volts is sent to the computer.

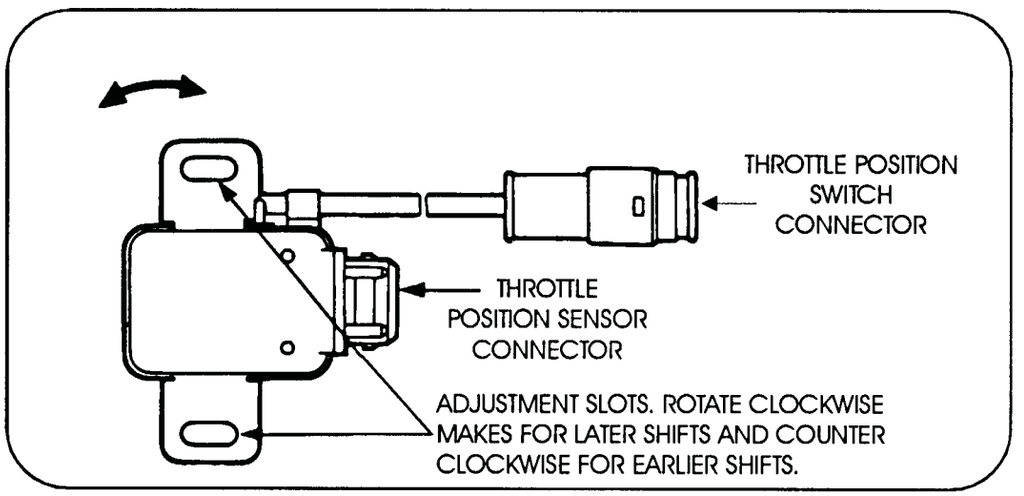


Figure 15

Figure 16 is a view of the pins in the TPS. The top pin is where the TPS receives the 5 volts sent by the computer. The bottom pin is a ground going to pin #15 at the computer. The middle pin is used by the sensor to send voltage proportional to throttle opening back to the computer. To check the TPS, keep the wires connected to the sensor. Turn the ignition ON and have the engine OFF. Carefully back probe the middle wire with the positive lead of a volt meter and place the negative lead to a ground. At closed throttle, the meter should read approximately 4.5 volts. As the throttle is opened, the voltage should drop smoothly to .5 volts when wide open throttle is reached.

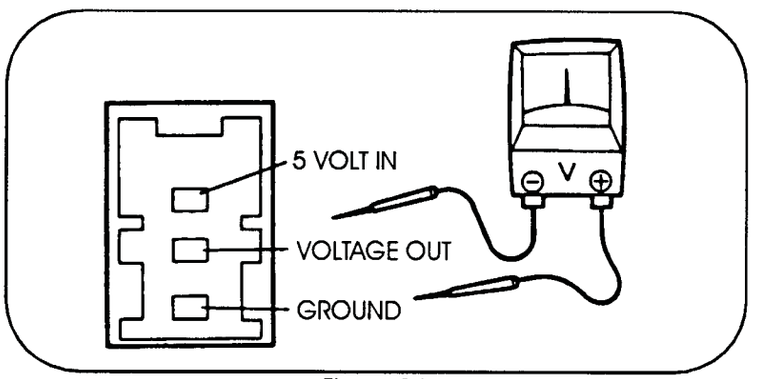


Figure 16

INHIBITOR SWITCH AND SOLENOIDS

Both the Inhibitor Switch and the Transmissions internal Solenoids can be checked for proper resistance through the external Harness connector as shown in Figure 17. The Inhibitor Switch Connectors are BLACK in color and the Solenoid Connector is BROWN in color.

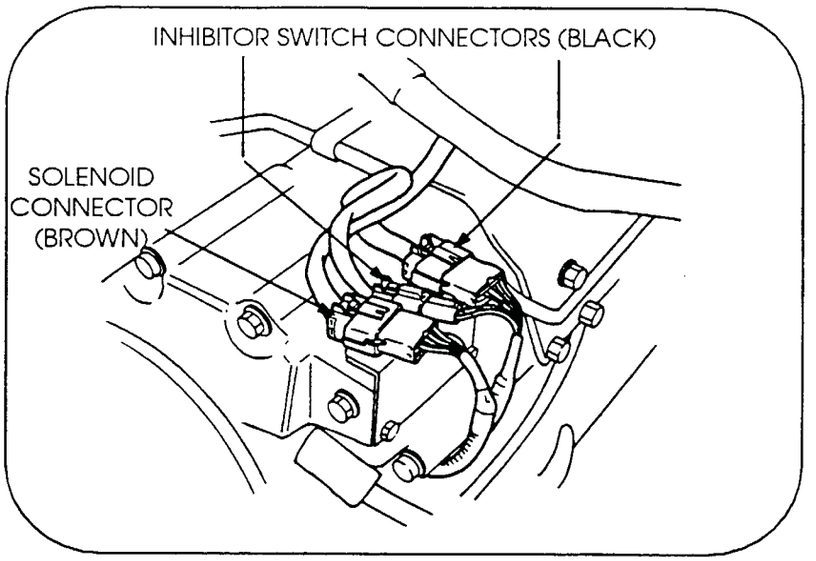


Figure 17

INHIBITOR SWITCH

To check the Inhibitor Switch, simply check for continuity through out the different shift lever positions as shown in Figure 18.

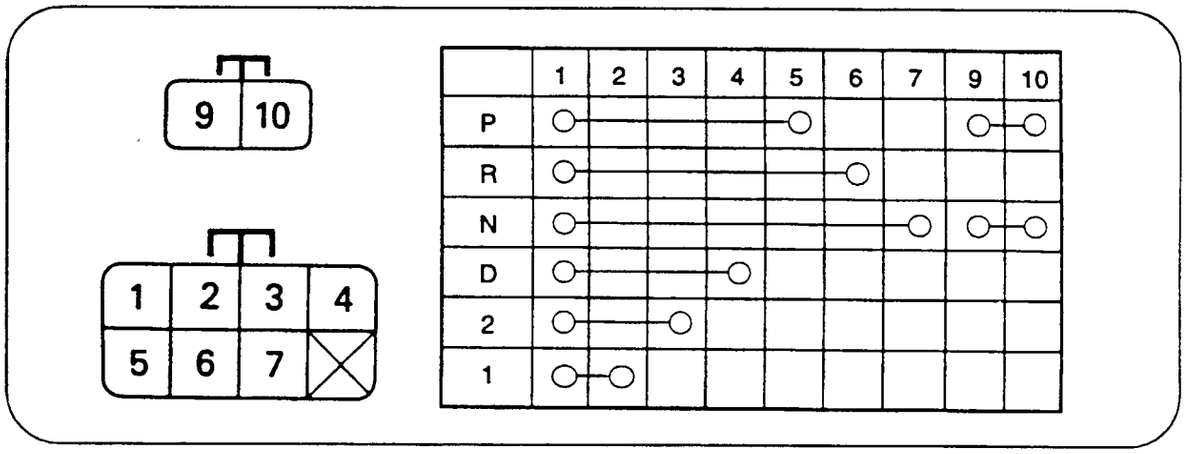


Figure 18

If the Inhibitor Switch Check reveals that the switch is out of range, adjust the switch by placing the selector lever in neutral. Align the switch by inserting a .15 inch diameter pin through the select lever and the inhibitor switch alignment hole as shown in Figure 19. Check the switch again using figure 18. If the switch fails the test after adjustment, replace the switch.

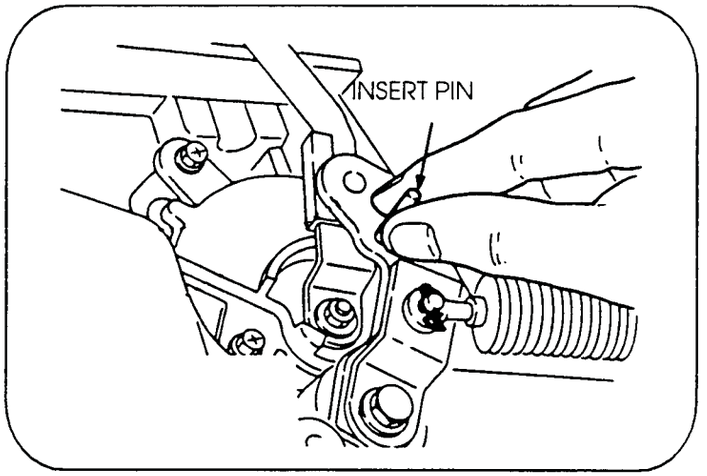


Figure 19

SOLENOID CHECK

Using an ohm meter, measure the resistance between the following connector terminals and ground as shown in Figure 20. Refer to Figure 21 for the proper values. Always keep in mind that you are only checking the solenoids for proper resistance, this test will not reveal solenoids that have a mechanical failure. If the unit had excessive metal damage or overheating, the solenoids should be replaced.

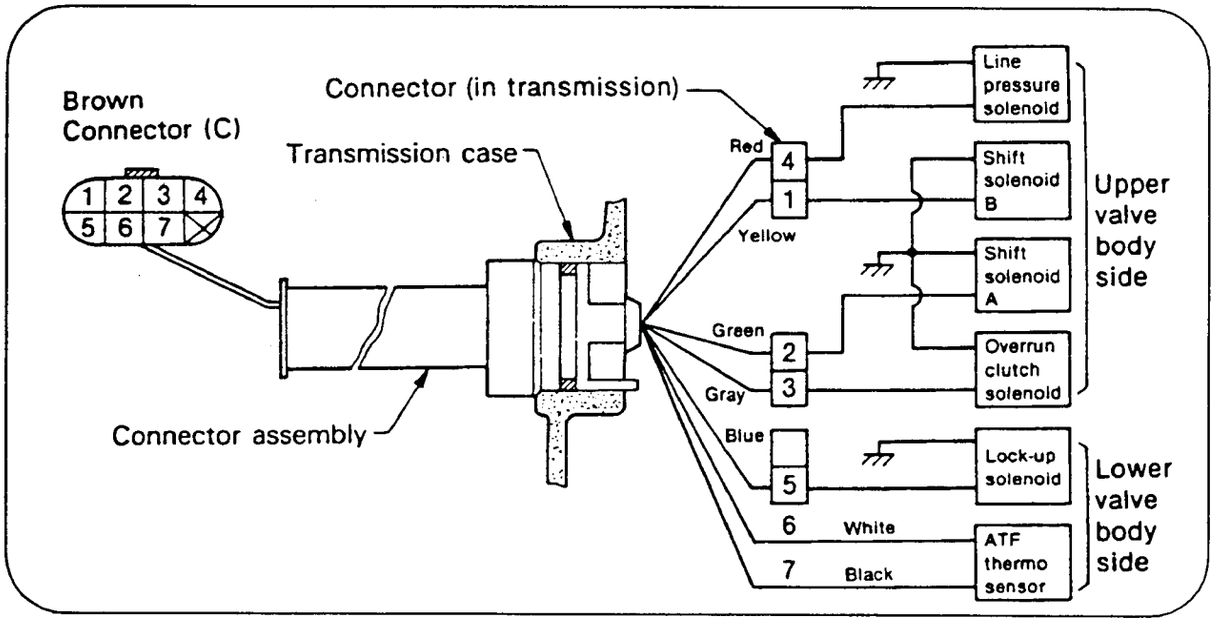
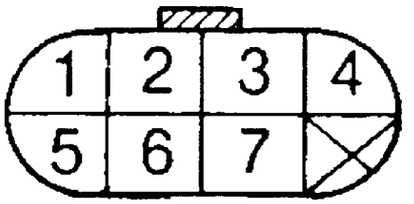


Figure 20

Solenoid	Terminal No.	Resistance (Ω)
Shift solenoid B	1	20 ~ 40
Shift solenoid A	2	
Overrun clutch solenoid	3	
Line pressure solenoid	4	2.5 ~ 5.0
Lockup solenoid	5	10 ~ 20
ATF thermosensor	6 ~ 7	2,500 approx. (at 20°C/68°F)
		300 approx. (at 80°C/176°F)



GEAR	SOLENOID A	SOLENOID B	LOCK-UP SOLENOID	OVERRUN SOLENOID	PRESSURE SOLENOID
1st	ON	ON	OFF	ACTIVATES UPON VARIOUS THRROTTLE OPENINGS	PULSE MODULATION CONTROLLED BY COMPUTER
2nd	OFF	ON	OFF		
3rd	OFF	OFF	OFF		
4th	ON	OFF	ON	OFF	

Figure 21

VEHICLE SPEED SENSORS

The illustration shown in Figure 22 is the Vehicle Speed Sensor #1. This sensor should measure 504 to 616 OHMS. Figure 23 shows the vehicle Speed Sensor #2 built into the speedometer head. This sensor can be checked by going to the Transmission Control Module (TCM) by placing the positive lead of an ohm meter to pin cavity 24 and the negative lead to a ground. Disconnect the speedo cable by the transmission and turn the cable by hand. If the ohm meter deflects repeatedly from open to close, the sensor is good.

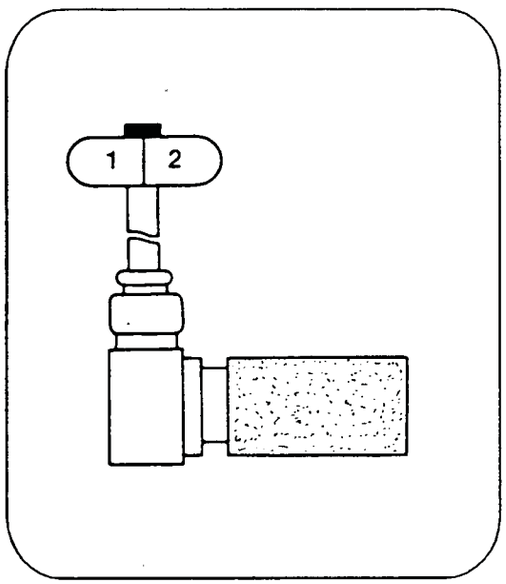


Figure 22
VEHICLE SPEED SENSOR #1

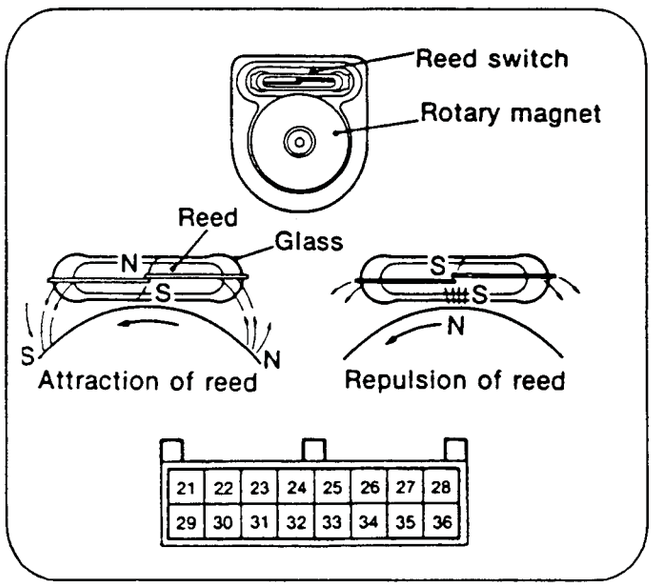


Figure 23
VEHICLE SPEED SENSOR #2

ENGINE REVOLUTION SENSOR

The Engine Revolution Sensor location is shown in Figure 24 below. This sensor should measure 2100 to 2500 ohms a approximately 77 F.

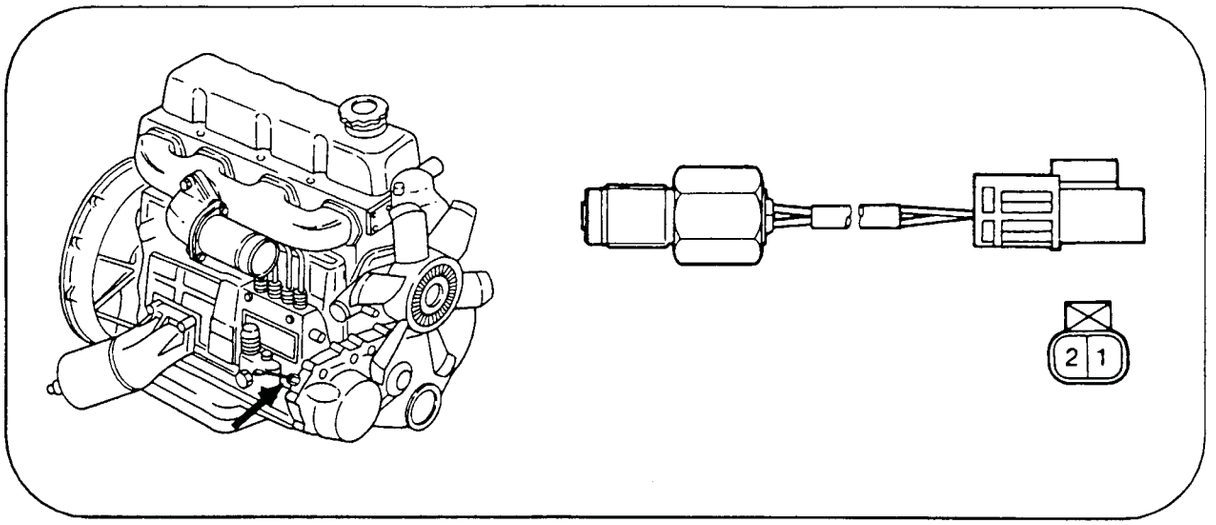


Figure 24

DROPPING RESISTOR

The dropping resistor is in a parallel circuit to the pressure control solenoid. Its purpose is to modify line pressure in relationship to engine temperature. This resistor can be checked with an OHM meter and should measure 11 to 15 ohms resistance. Refer to figure 25 for the location of the dropping resistor.

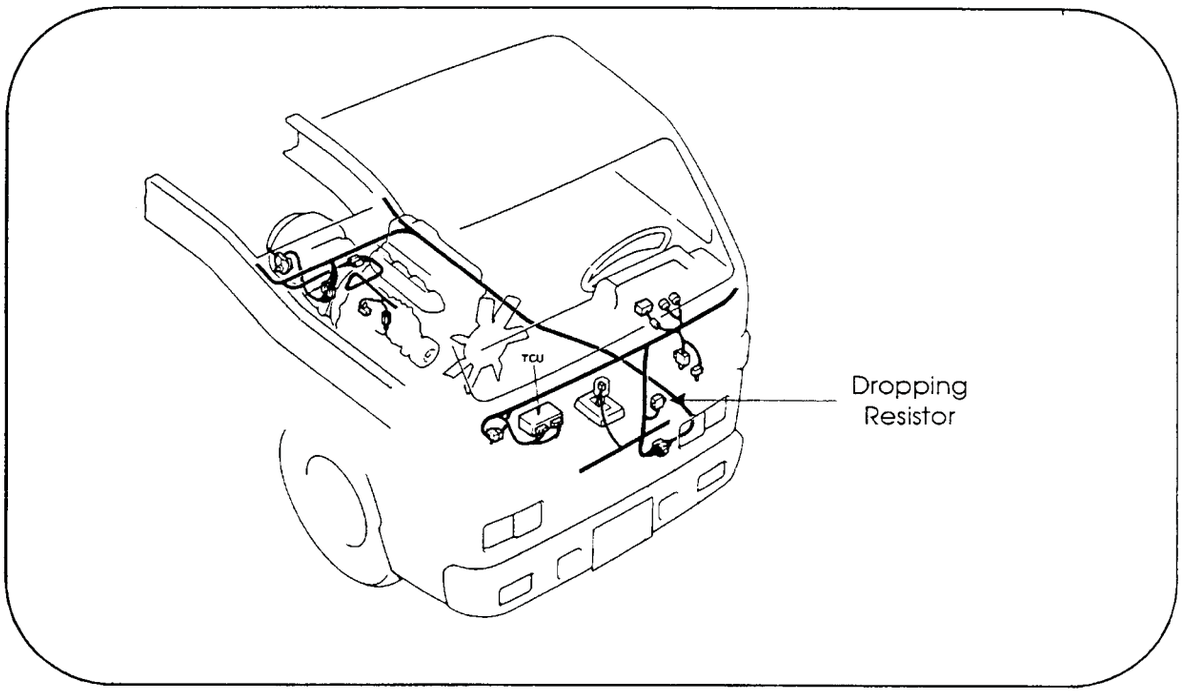
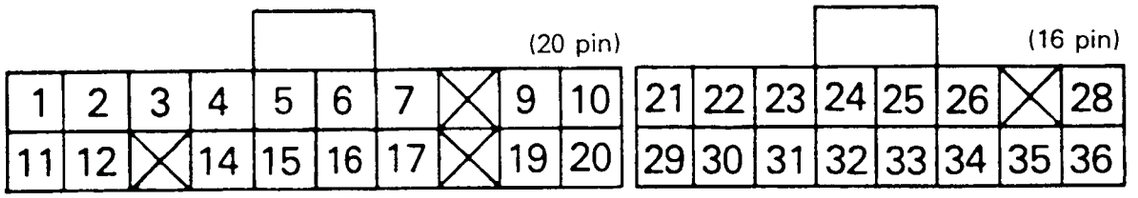


Figure 25

TRANSMISSION CONTROL UNIT PIN LAYOUT AND CHECKS



Pin No.	Function
1.	2 range switch
2.	1 range switch
3.	Exhaust brake signal
4.	Idle switch
5.	Diagnosis terminal
6.	Overdrive switch
7.	Kick-down switch
8.	—
9.	Economy drive switch
10.	Throttle sensor voltage (5V out)
11.	Throttle sensor
12.	ATF Thermosensor
13.	—
14.	Idle switch voltage
15.	Throttle sensor ground
16.	Vehicle speed sensor 1
17.	Full throttle switch
18.	—

Pin No.	Function
19.	Nutral range switch
20.	D range switch
21.	Overrun clutch solenoid
22.	Lock-up duty solenoid
23.	Economy drive indicator
24.	Vehicle speed sensor 2
25.	Engine revolution sensor
26.	Reverse range switch
27.	—
28.	Battery back-up voltage
29.	Battery voltage
30.	Battery voltage
31.	Ground
32.	Ground
33.	Duty solenoid (Dropping register)
34.	Duty solenoid (Line pressure)
35.	Shift solenoid A
36.	Shift solenoid B

Figure 26

Figure 26 is a view of the harness connector going into the Transmission Control Unit (TCU) from the wire side of the coonector Figure 27 shows the proper method in doing circuit checks at the TCU. Refer to the following pages for individual circuit checks and specifications.

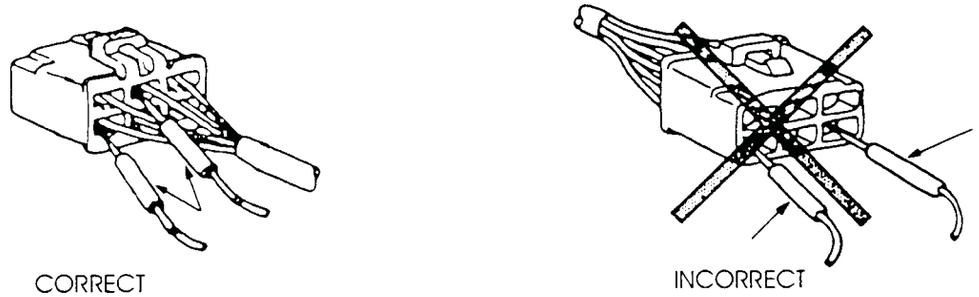


Figure 27

ATCU Terminal No.		Standard Voltage	Inspection Procedure	Signal Type	Signal Name
Tester (−)	Tester (+)				
(31) or (32)	(29)	12—15	Key switch "ON"	Source	Battery voltage
	(30)	12—15	Key switch "ON"	Source	Battery voltage
	(28)	12—15		Source	Battery back-up
(15)	(10)	4.5—5.5		Source	Throttle sensor
(31) or (32)	(26)	12—15	Selector "R" range	Input	"R" range switch
		Less than 1.0	Selector all ranges except "R"	Input	"R" range switch
	(19)	12—15	Selector "N" or "P" range	Input	"N" range switch
		Less than 1.0	Selector all ranges except "N" and "P"	Input	"N" range switch
	(20)	12—15	Selector "D" range	Input	"D" range switch
		Less than 1.0	Selector all ranges except "D"	Input	"D" range switch
	(1)	12—15	Selector "2" range	Input	"2" range switch
		Less than 1.0	Selector all ranges except "2"	Input	"2" range switch
	(2)	12—15	Selector "1" range	Input	"1" range switch
		Less than 1.0	Selector all ranges except "1"	Input	"1" range switch
	(3)	12—15	Exhaust brake switch "ON"	Input	Exhaust brake signal
		Less than 1.0	Exhaust brake switch "OFF"	Input	Exhaust brake signal
	(4)	8—15	Accelerator pedal released	Input	Idle switch
		Less than 1.0	Accelerator pedal depressed	Input	Idle switch
	(17)	8—15	Accelerator pedal more than 1/2 depressed	Input	Full throttle switch
		Less than 1.0	Accelerator pedal released	Input	Full throttle switch
	(6)	12—15	Overdrive switch "ON"	Input	Overdrive switch
		Less than 1.0	Overdrive switch "OFF"	Input	Overdrive switch
	(7)	3—8	Accelerator pedal released	Input	Kick-down switch
		Less than 1.0	Accelerator pedal fully depressed	Input	Kick-down switch
	(9)	3—8	Economy drive switch in "NORMAL" position	Input	Economy drive switch
		Less than 1.0 Throttle full position	Economy drive switch in "ECONOMY" position	Input	Economy drive switch
	(24)	1—5 (Intermittent AC)	Vehicle moved at slowest possible speed at least one meter	Input	Vehicle speed sensor-2
	(5)	3—8	Self diagnosis OFF	Input	Diagnosis terminal
		Less than 1.0	Self diagnosis ON	Input	Diagnosis terminal
(15)	(11)	4.0—4.9 (Fully closed) 0.1—1.8 (Fully opened)	Measure the throttle valve voltage at two positions	Input	Throttle sensor
	(12)	1.8 (ATF temp. approx. 10°C (50°F)) 1.1 (ATF temp. approx. 40°C (104°F))	Measure the throttle valve voltage at each specified termperature	Input	ATF thermosensor

Figure 28

ATCU Terminal No.		Standard Votage	Inspection Procedure	Signal Type	Signal Name
Tester (−)	Tester (+)				
(15)	(16)	More than 1(AC) (Vehicle speed 15 mph (24 km/h))	Measure the vehicle speed sensor-1 voltage at vehicle stop and 15 mph (24 km/h)	Input	Vehicle speed sensor-1
		0 (Vehicle stopped)		Input	Vehicle speed sensor-1
	(25)	More than 1	Check at an engine speed of approximately 2,000 rpm	Input	Engine revolution sensor
(31) or (32)	(23)	12—25	Economy drive switch in "NORMAL" position	Input	Economy drive indicator
		Less than 1.0	Economy drive switch in "ECONOMY" position	Input	Economy drive indicator
	(14)	8—15	Key switch "ON"	Output	Idle switch Full throttle switch
	(35)	12—15	Driving at "D1" and "D4" (Solenoid "ON")	Output	Shift solenoid "A"
		Less than 1.0	Driving at "D2" and "D3" (Solenoid "OFF")	Output	Shift solenoid "A"
	(36)	12—25	Driving at "D1" and "D2" (Solenoid "ON")	Output	Shift solenoid "B"
		Less than 1.0	Driving at "D3" and "D4" (Solenoid "OFF")	Output	Shift solenoid "B"
	(21)	12—15	Overrun clutch solenoid "ON", ("D" range, at vehicle stop).	Output	Overrun clutch solenoid
		Less than 1.0	Overrun clutch solenoid "OFF", ("D" range, vehicle speed 25 mph (40 km/h))	Output	Overrun clutch solenoid
	(33)	5—14	Engine warmed up and stopped, throttle valve fully closed, key switch "ON"	Output	Dropping resistor
		Less than 0.5	Engine warmed up and stopped, throttle valve fully opened, key switch "ON"	Output	Dropping resistor
	(34)	1.5—2.5	Engine warmed up and stopped, throttle valve fully closed, key switch "ON"	Output	Line pressure solenoid
		Less than 0.5	Engine warmed up and stopped, throttle valve fully opened, key switch "ON"	Output	Line pressure solenoid
	(22)	8—15	Lock-up "ON"	Output	Lock-up solenoid
		Less than 1.0	Lock-up "OFF"	Output	Lock-up solenoid

Figure 29

CIRCUIT DIAGRAM

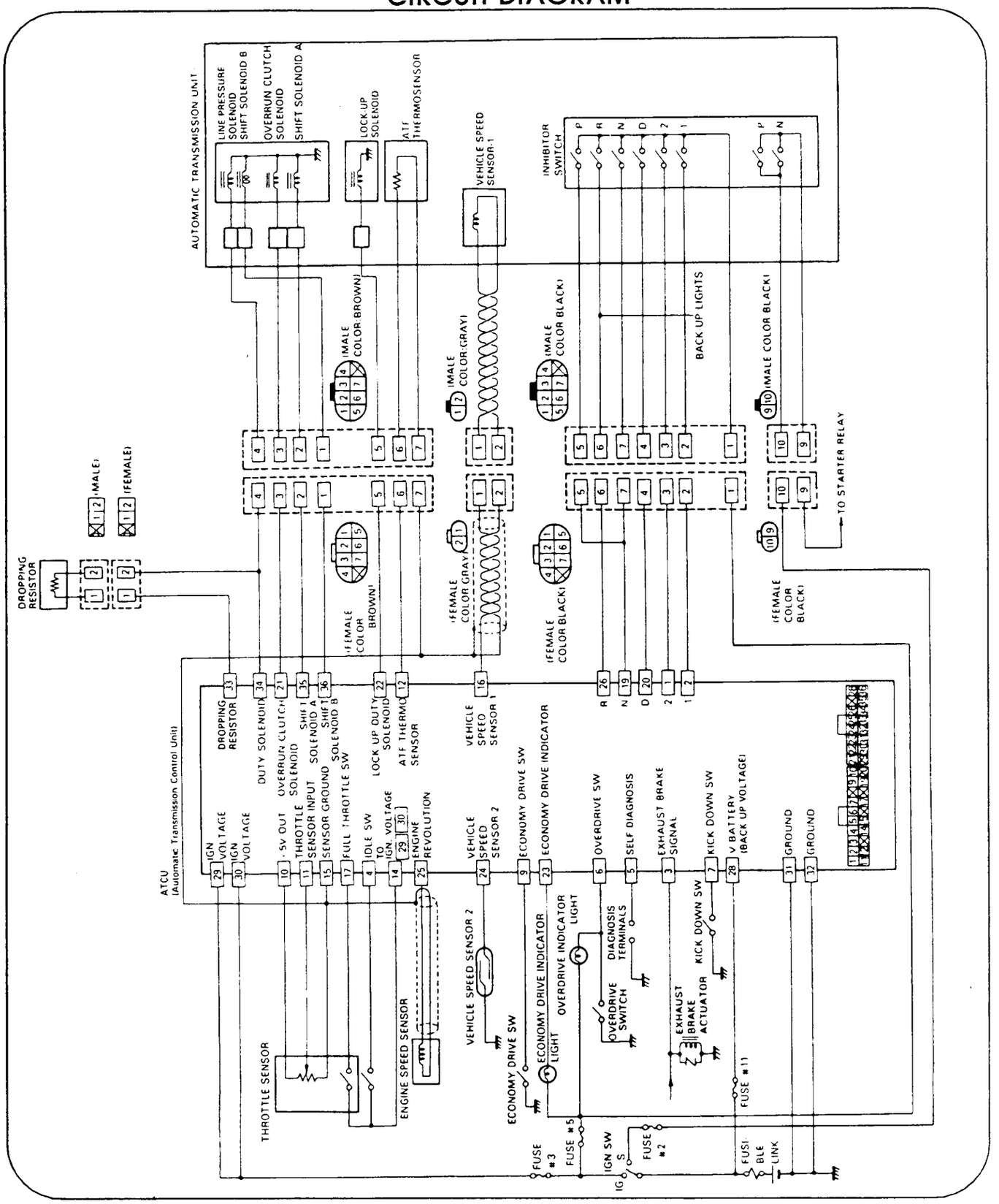
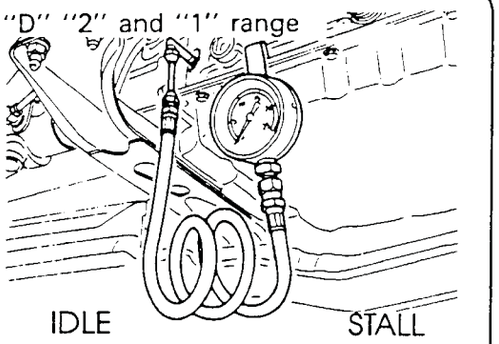


Figure 30

LINE PRESSURE TEST

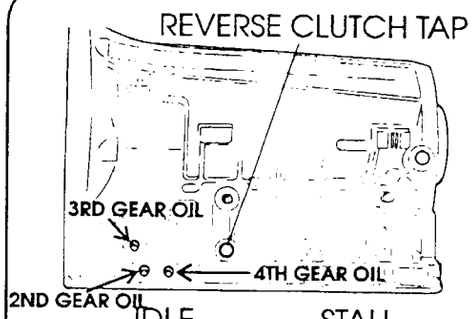
1988 VEHICLES: To check main line pressure in the "D", "2" and "1" range, connect a 300 pound pressure gauge to the FORWARD CLUTCH TAP located on the passenger side of the transmission near the back of the case. Refer to Figure 1 for tap locations and pressure specifications. To check main line pressure in REVERSE, connect a 300 pound pressure to the reverse clutch tap located on the drivers side of the transmission. Refer to Figure 2 for tap location and pressure specifications.



62-69 psi 128-140 psi

Caution: Be sure to place chocks at the front and rear of each tire and press firmly on the brake when doing a stall test.

Figure 1



96-103 PSI 202-214 PSI

Caution: Be sure to place chocks at the front and rear of each tire and press firmly on the brake when doing a stall test.

Figure 2

1989-1993 Vehicles: A main line pressure tap is located between the bellhousing and pan as shown in Figure 3. Both the DRIVE and REVERSE ranges can be checked at this pressure tap. Attach a 300 pound pressure gauge to the tap as shown in Figure $ and refer to the following chart for pressure specifications.

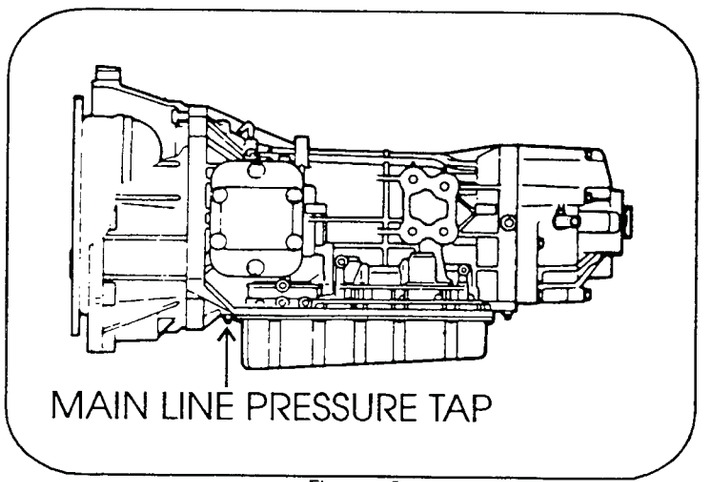


Figure 3

LINE PRESSURE TEST CONTINUED

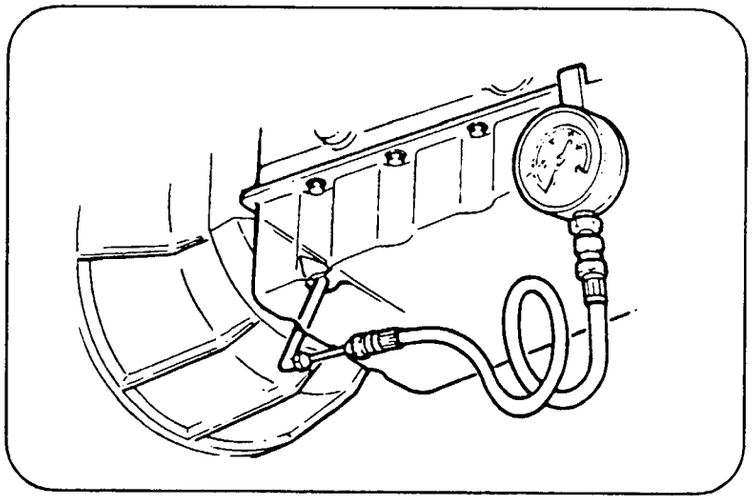


Figure 4

1989 - 1991 VEHICLES

RANGE	ENGINE SPEED	
	IDLING	WIED OPEN THROTTLE
D, 2, 1	42 - 68 PSI	113 - 139 PSI
R	68 - 103 PSI	170 - 213 PSI

1992 - 1993 VEHICLES

RANGE	ENGINE SPEED	
	IDLING	WIED OPEN THROTTLE
D, 2, 1	42 - 66 PSI	133 - 159 PSI
R	68 - 91 PSI	177 - 220 PSI

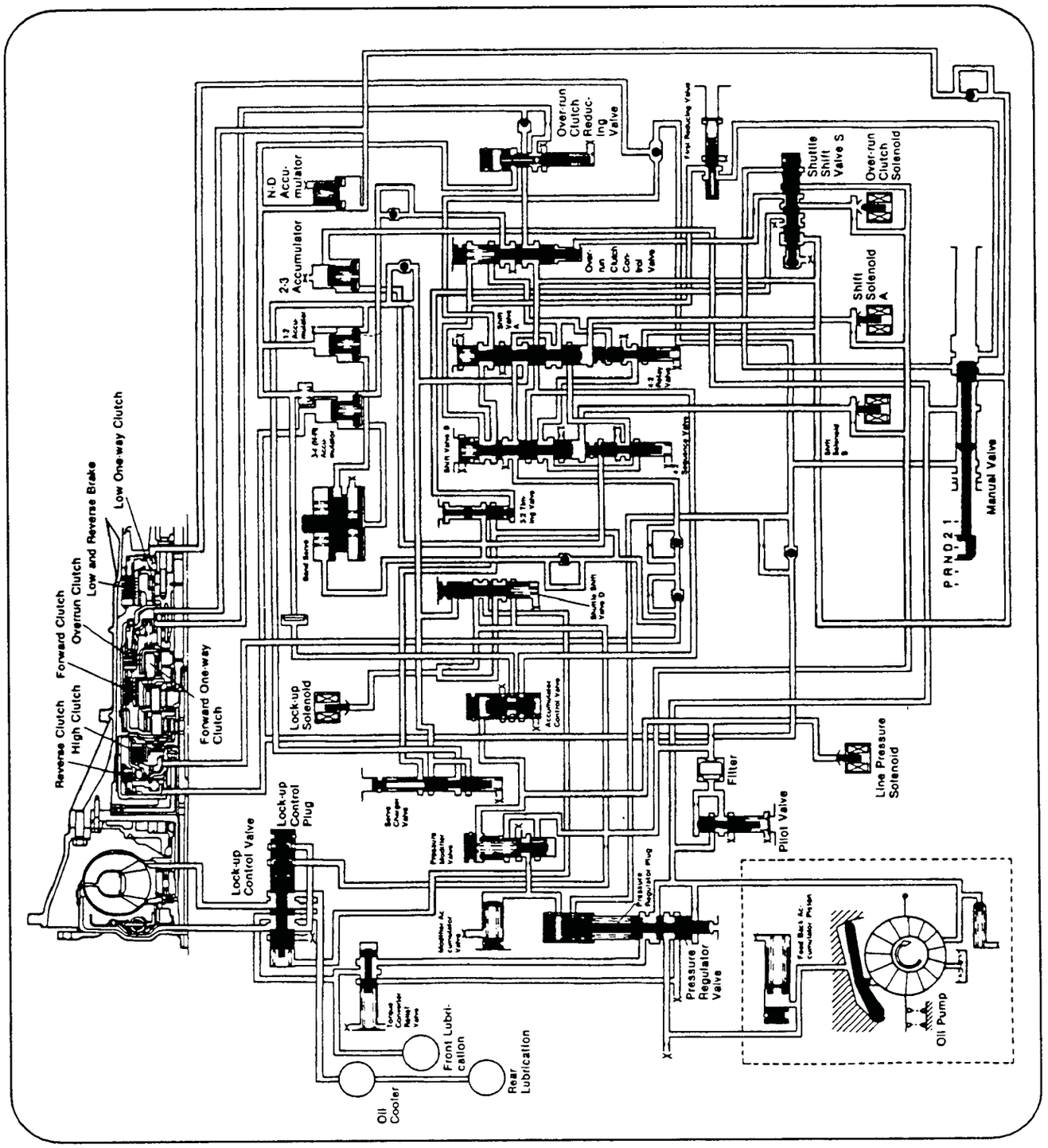

Low One-way Clutch
Low and Reverse Brake
Forward Clutch
Overrun Clutch
Reverse Clutch
High Clutch
Forward One-way Clutch
Lock-up Solenoid
Lock-up Control Valve
Lock-up Control Plug
Oil Cooler
Front Lubrication
Rear Lubrication
Pressure Regulator Valve
Oil Pump
Filter
Pilot Valve
Line Pressure Solenoid
Manual Valve
P R N D 2 1
Shift Solenoid A
Shuttle Shift Valve S
Over-run Clutch Solenoid
Over-run Clutch Reducing Valve
N-D Accumulator
2-3 Accumulator

Figure 5

COMPONENT APPLICATION CHART

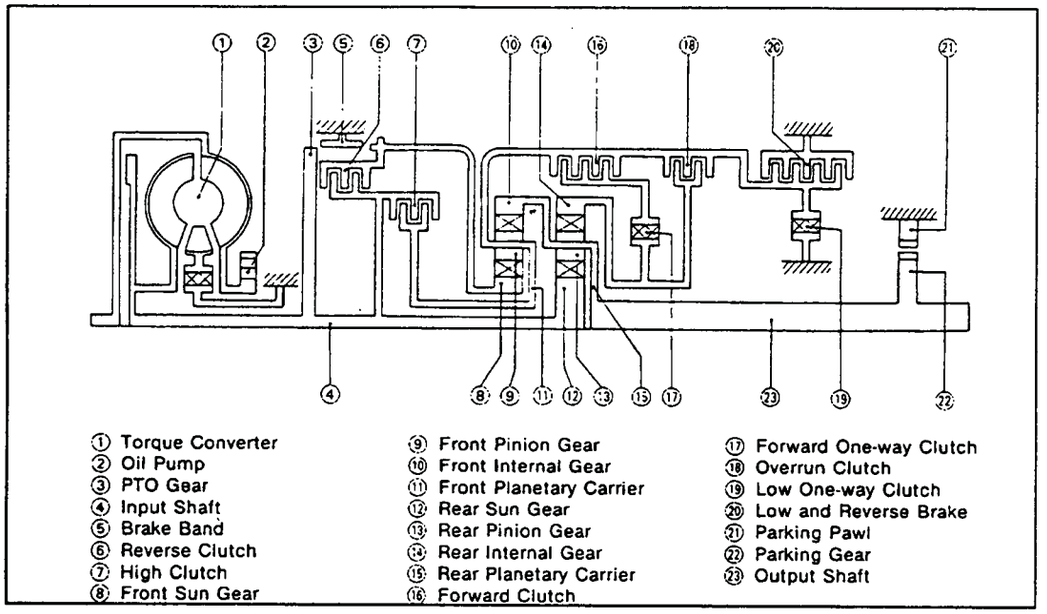


Figure 1

Shift position		R/C	H/C	F/C	O/C	Band servo: 2nd gear locked	Band servo: 3rd gear released	Band servo: 4th gear locked	F/O.C	L/O.C	L&R/B	Remarks
P												Parking
R		○									○	Reverse
N												Neutral
D	1st			○	◉				●	●		Automatic shift control 1↔2↔3↔4
	2nd			○	◉	○			●			
	3rd		○	○	○	*1 ⊗	⊗		●			
	4th		○	⊗		*2 ⊗	⊗	○				
2	1st			○	○				●	●		Automatic shift control 1↔2↔3↔4
	2nd			○	○	○			●			
	3rd		○	○	○	*1 ⊗	⊗		●			
	4th		○	⊗		*2 ⊗	⊗	○				
1	1st			○	○				●		○	Fixed at 1st speed 1←2
	2nd			○	○	○			●			

*1 Pressure acts on both 2nd gear lock and 3rd gear release sides of the band servo piston, but the brake band is not compressed because the release side area is larger.
*2 The brake band is compressed because pressure acts on 4th gear lock side condition *2 above.
○—Engaged
◉—Engaged above preset vehicle speed.
●—Operative when accelerating.
⊗—Engaged but does not contribute to power transmission.

Component name	Symbol	Function
Reverse clutch	R/C	Connects the input shaft to the front sun gear.
High clutch	H/C	Connects the input shaft to the front planetary carrier.
Forward clutch	F/C	Connects the front planetary carrier to the forward one-way clutch.
Overrun clutch	O/C	Connects the front planetary carrier to the rear internal gear.
Brake band	B/B	Locks the front sun gear.
Forward one-way clutch	F/O.C	Allows the rear internal gear to *turn forward with the front carrier and the low one-way clutch outer race but not in the opposite direction.
Low one-way clutch	L/O.C	Allows the front planetary carrier to *turn forward but not in the opposite direction.
Low and reverse brake	L&R/B	Locks the front planetary carrier.

DISASSEMBLY AND INSPECTION OF MAJOR COMPONENT

Place the automatic transmission on the holding fixture (Figure 2)

Fit the automatic transmission correctly to the special transmission holding fixture.
Holding Fixture : J-38369
Holding Fixture Base: J-3289-20

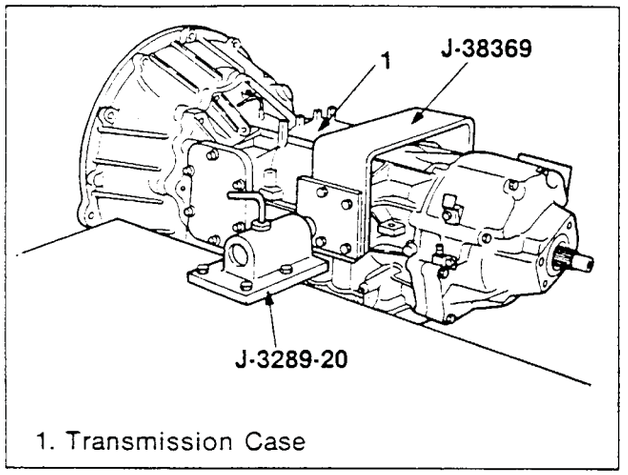


Figure 2. Transmission Holding Fixture

Remove or Disconnect

CAUTION: The torque converter is very heavy (24 kg /53 lb approx.) and must be handled carefully. Place an oil pan underneath as automatic transmission fluid (ATF) will spill when the torque converter is removed.

1. Empty ATF from the torque converter, with its rear side facing down.
2. Free harnesses from clips.

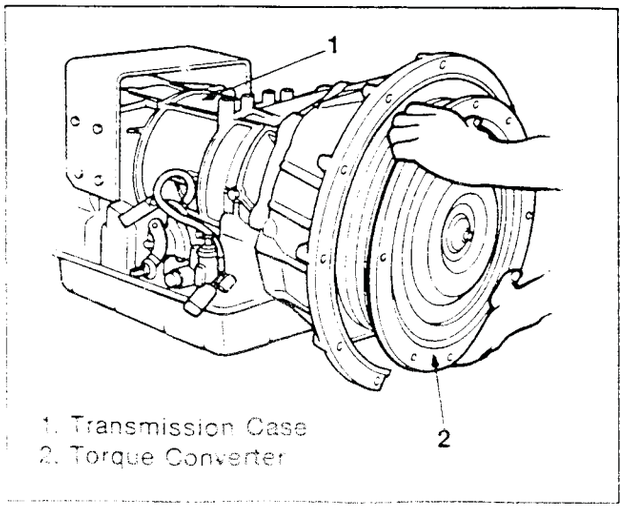


Figure 3. Torque Converter Removal

Oil Pan (Figure 4)

1. Remove the drain plug and drain ATF.
2. Rotate the automatic transmission so that the oil pan faces top.
3. Remove oil pan fixing bolts, and then the oil pan.
4. Rotate the automatic transmission so that oil pan opening faces down, and empty ATF.

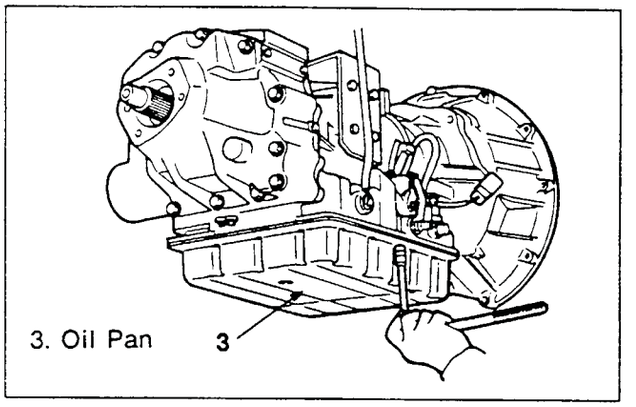


Figure 4. Oil Pan Removal

Oil Strainer (Figure 5)

1. Rotate the automatic transmission so the oil pan opening faces the top and, remove oil strainer bolts (4 pcs), and then the oil strainer.
2. Remove the O-ring.

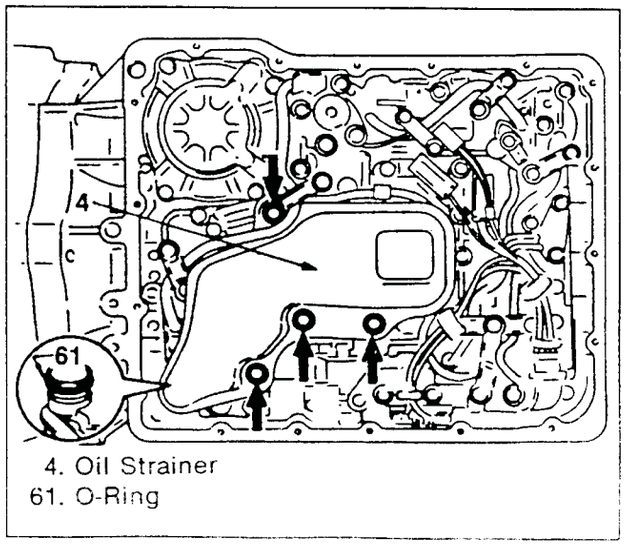
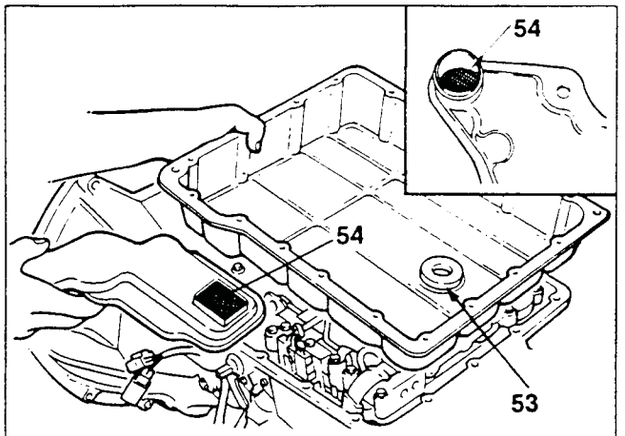


Figure 5. Oil Strainer Removal

Inspect (Figure 6)

Check the oil pan bottom and the oil strainer mesh for foreign substances (facing of clutches and metal flakes, etc.). If excess foreign substances are found, replace the torque converter and the oil strainer. Identify the cause and repair.

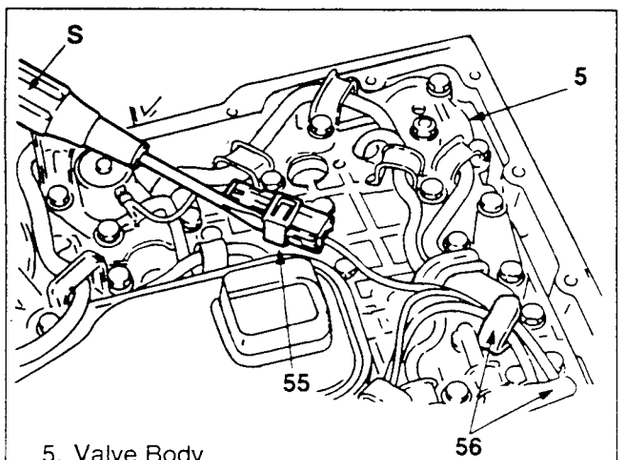


53. Magnet
54. Mesh

Figure 6. Oil Pan Inspection

Harness Connector (Figure 7)

1. Remove connector brackets (2 pcs) using a screwdriver, etc., and disconnect connectors.
2. Free wring from clips.

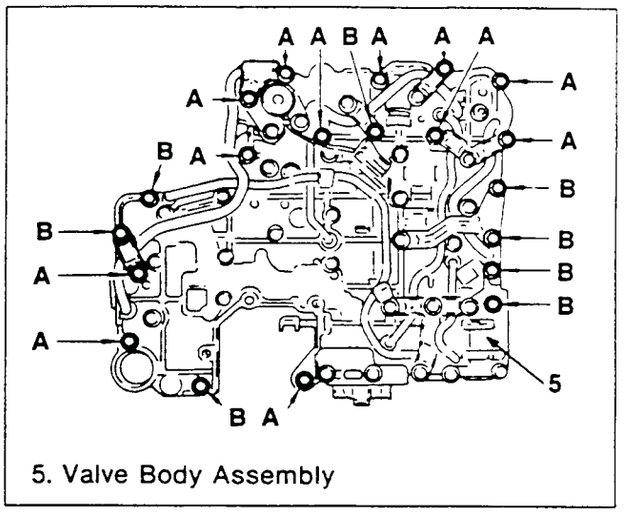


5. Valve Body
55. Bracket
56. Clip
S. Screwdriver

Figure 7. Connector Bracket Removal (1)

Valve Body Assembly (Figures 8, 9 and 10)

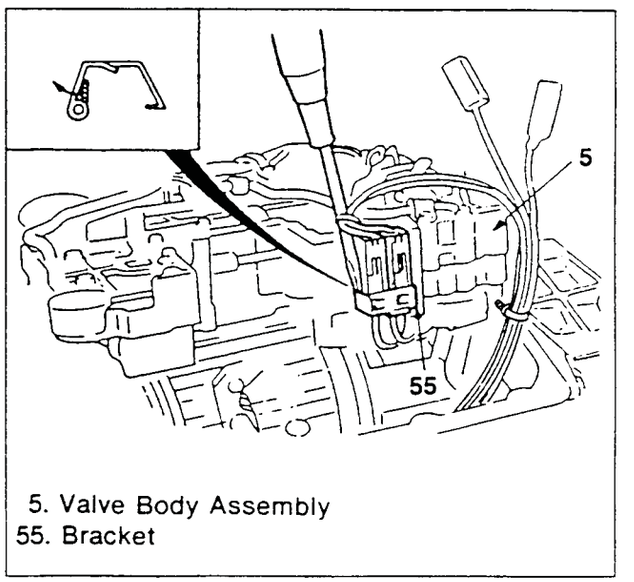
1. Remove bolts.
   (A) : Shank length 37 mm (1.46 in) 12 pcs
   (B) : Shank length 50 mm (1.97 in) 8 pcs



5. Valve Body Assembly

Figure 8. Valve Body Bolts Location

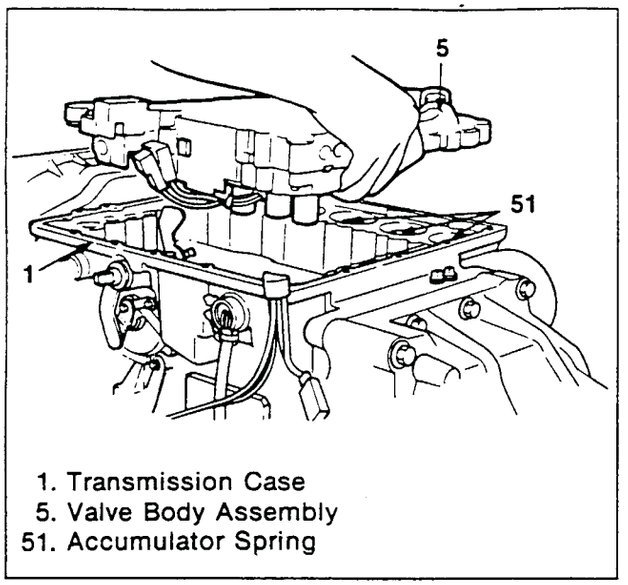
2. Remove connector bracket using a screwdriver, etc., and disconnect connectors (figure 9).



5. Valve Body Assembly
55. Bracket

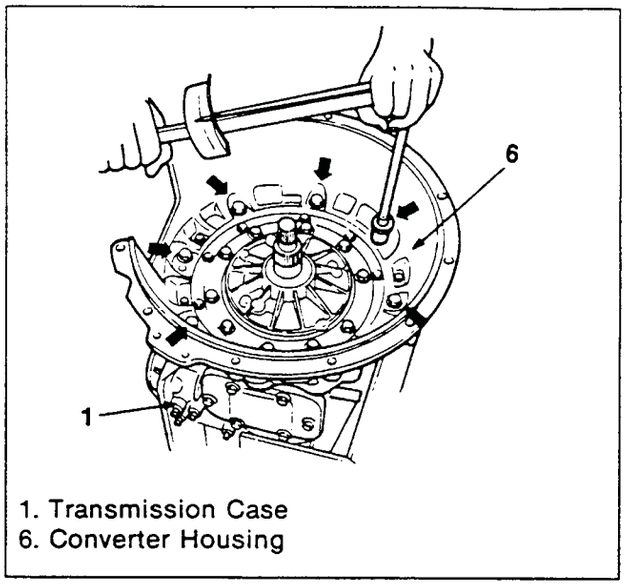
Figure 9. Connector Bracket Removal (2)

3. Remove the valve body assembly from the case (figure 10).
4. Remove springs (3 pcs) from the accumulators (figure 10).
5. Remove the LP filter from the case (figure 10a).



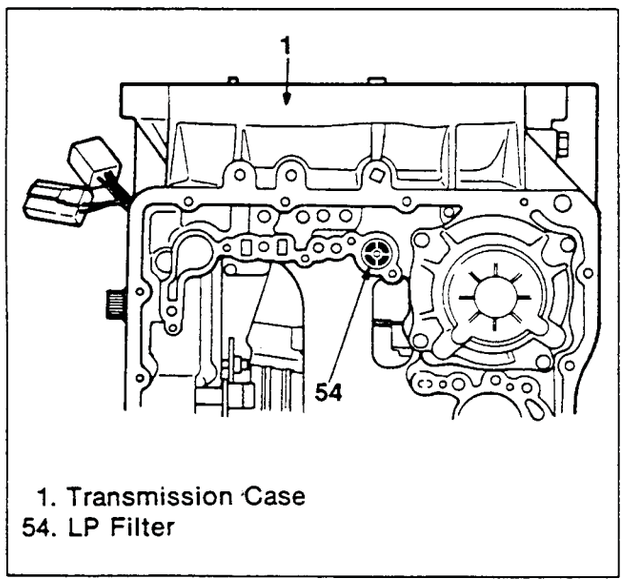
1. Transmission Case
5. Valve Body Assembly
51. Accumulator Spring

Figure 10. Valve Body Removal



1. Transmission Case
6. Converter Housing

Figure 11. Converter Housing Removal



1. Transmission Case
54. LP Filter

Figure 10a. LP Filter Removal

Inspect

Check the LP filter mesh for foreign substances and damage.

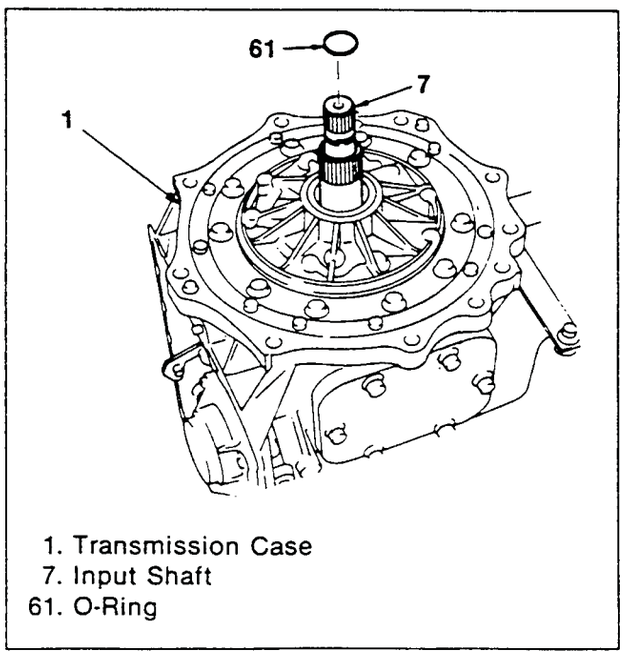
Converter Housing (Figure 11)

Rotate automatic transmission so that input side faces upward, remove bolts (8 pcs) and the housing.

NOTICE: Do not reuse the converter housing bolts.

O-Ring (Figure 12)

Remove the O-ring from the input shaft.



1. Transmission Case
7. Input Shaft
61. O-Ring

Figure 12. Input Shaft O-ring Removal

Oil Pump (Figures 13, 14 and 15)

1. Remove two of the oil pump housing bolts from the oil pump (figure 13).

NOTICE: Do not reuse the oil pump housing bolts.

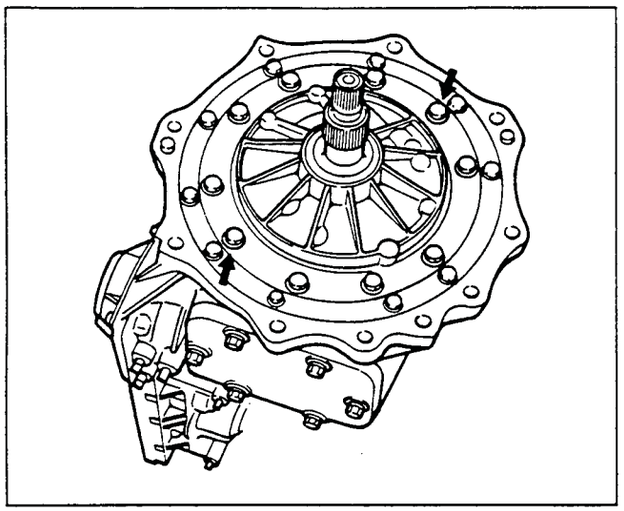


Figure 13. Oil Pump Removal (1)

2. Remove bolts (10 pcs) around the oil pump retainer (figure 14).

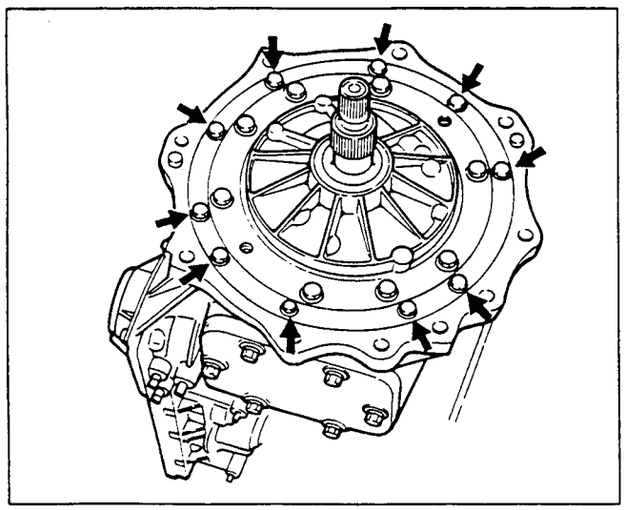


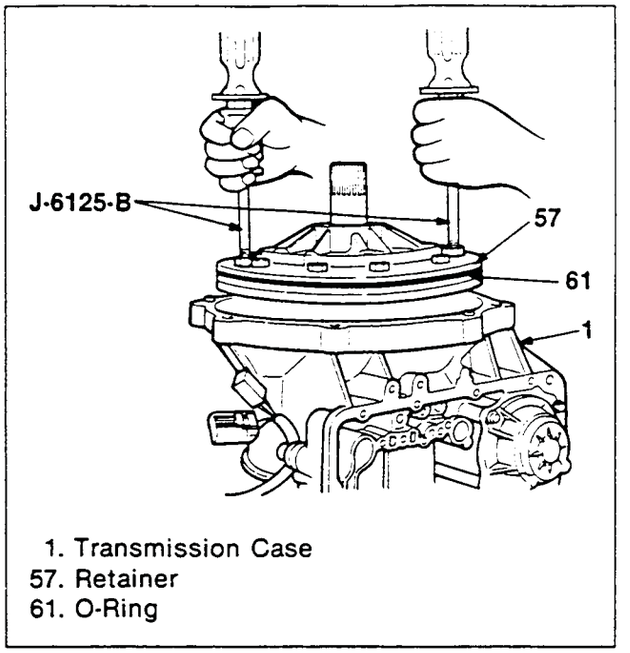
Figure 14. Oil Pump Removal (2)

3. Remove the oil pump assembly from the case using two slide hammers as an oil pump puller (special tool) (figure 15).
   Slide Hammer: J-6125-B

Important

- Screw in the puller thread through the oil pump thread completely.
  Otherwise, the female thread of the oil pump may be damaged.

4. Remove the retainer and O-ring.

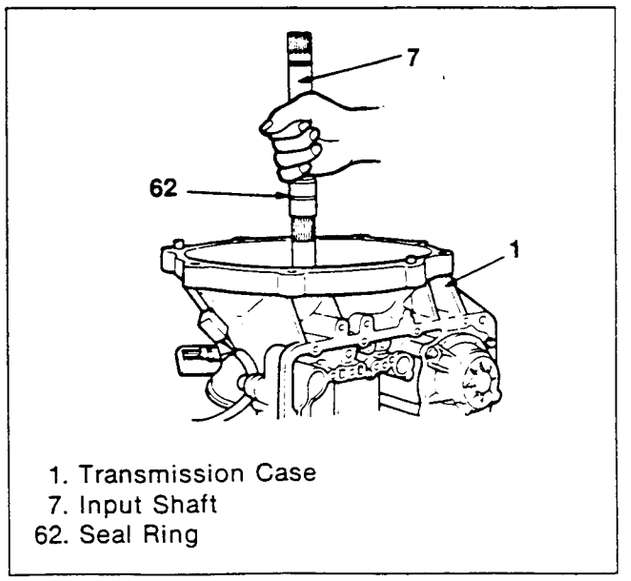


1. Transmission Case
57. Retainer
61. O-Ring

Figure 15. Oil Pump Removal (3)

Input Shaft (Figure 16)

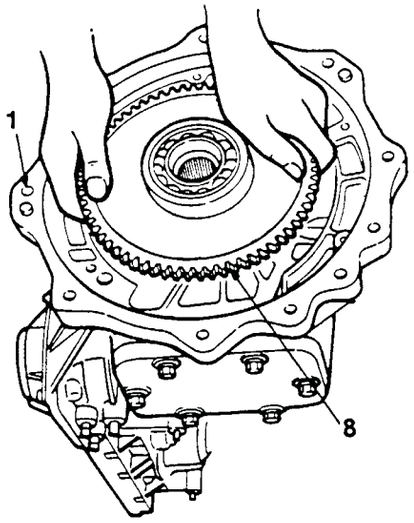
1. Remove the input shaft.
2. Remove the seal ring from the input shaft.
3. Remove the oil pump gasket.



1. Transmission Case
7. Input Shaft
62. Seal Ring

Figure 16. Input Shaft Removal

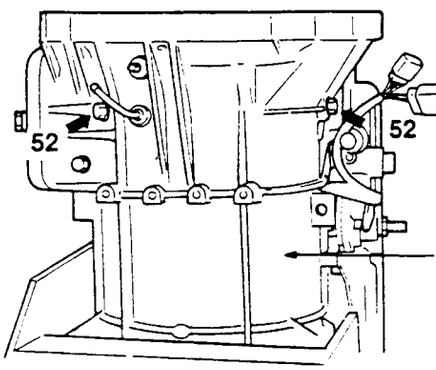
Power Take Off (PTO) Gear (Figure 17)
Remove the PTO gear.



1. Transmission Case
8. PTO Gear

Figure 17. PTO Gear Removal

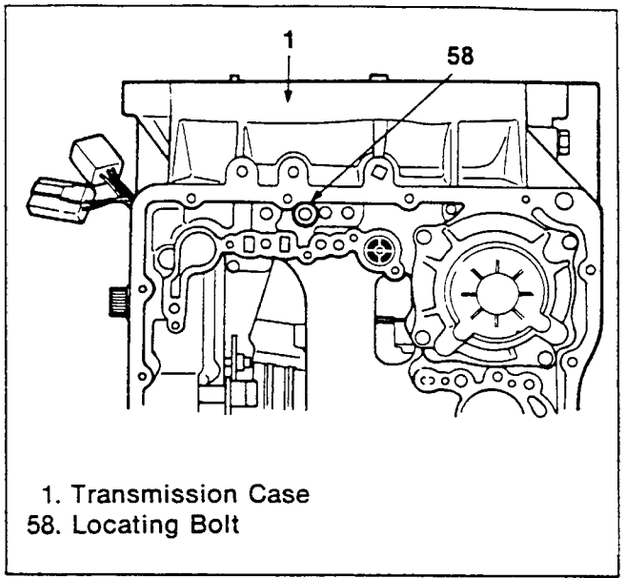
Drum Support (Figures 18, 19, 20, 21 and 22)
1. Remove bolts (2 pcs) from the drum Support (figure 18).



1. Transmission Case
52. Support Bolt

Figure 18. Drum Support Bolt Removal

2. Remove the drum support locating bolt using a hexagonal wrench (figure 19).



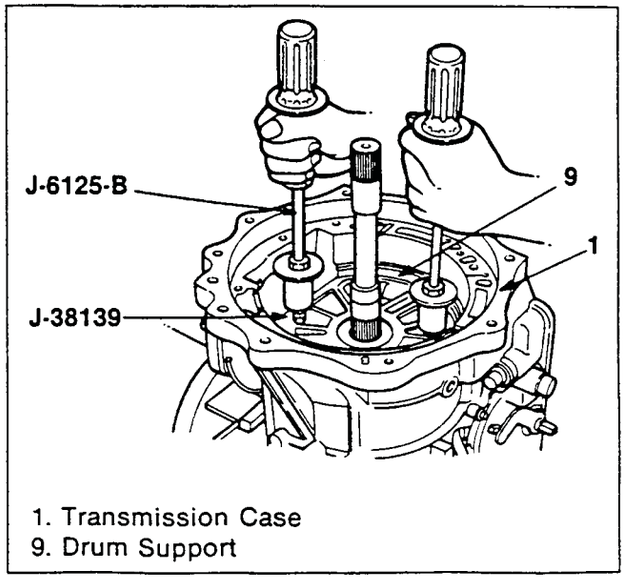
1. Transmission Case
58. Locating Bolt

Figure 19. Locating Bolt Removal

3. Remove the drum support from the case using a sliding hammer and adapter (special tool) (figure 20).
   Sliding Hammer : J-6125-B
   Sliding Hammer Adapter : J-38139

Important

- Pull the drum support up vertically using the special tool and using the input shaft as a guide.

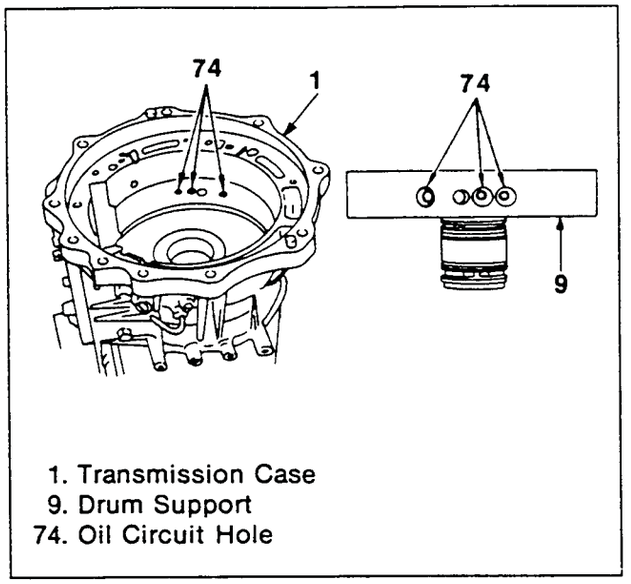


1. Transmission Case
9. Drum Support

Figure 20. Drum Support Removal

4. Blow compressed air over circuit holes in the case to remove seal flakes (figure 21).

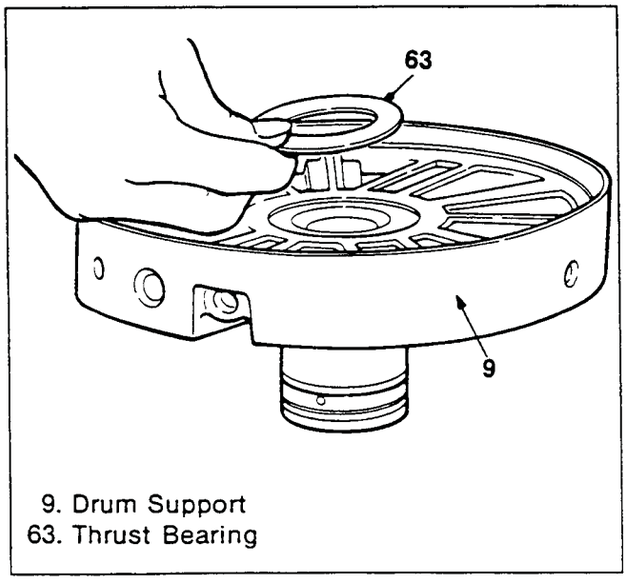
NOTICE: Make sure flakes do not fall inside the automatic transmission.



1. Transmission Case
9. Drum Support
74. Oil Circuit Hole

Figure 21. Seal Flakes Removal

5. Remove the thrust bearing from the drum support (figure 22).
6. Remove the thrust washer, and the thrust bearing (figure 23).

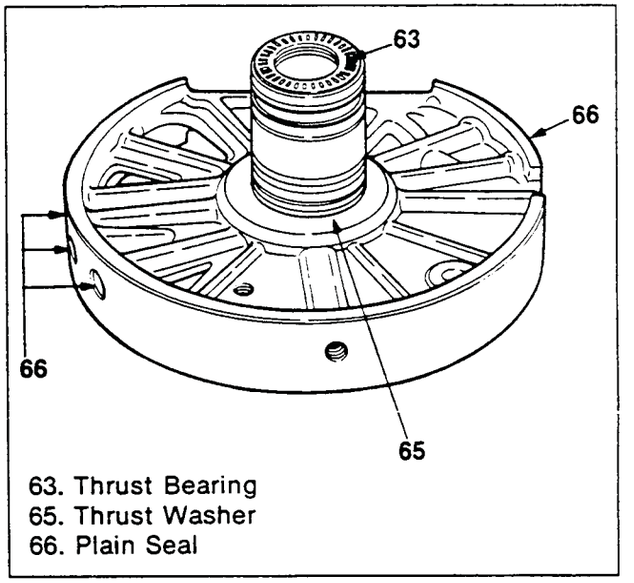


9. Drum Support
63. Thrust Bearing

Figure 22. Thrust Bearing Removal

Inspect (Figure 23)

1. Inspect the thrust bearing for damage.
2. Inspect the hydraulic circuit along the case bore and around the drum support for presence of any foreign substances. Plain seals (4 pcs) around the drum support must be renewed.

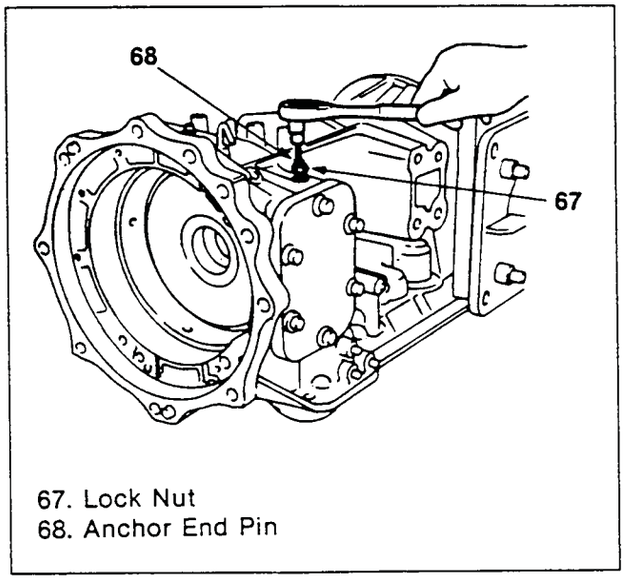


63. Thrust Bearing
65. Thrust Washer
66. Plain Seal

Figure 23. Drum Support Inspection

Brake Band (Figures 24 and 25)

1. With the oil pan section facing down, loosen the anchor end pin lock nut, and untighten the anchor end pin 3 to 4 turns (figure 24).



67. Lock Nut
68. Anchor End Pin

Figure 24. Brake Band Removal (1)

2. Remove the brake band carefully so that the band strut is not dropped (figure 25).
3. Hold the brake band in a circular shape with a fabricated clip (figure 25).
4. Remove the anchor end pin.

NOTICE: Do not reuse the anchor end pin.

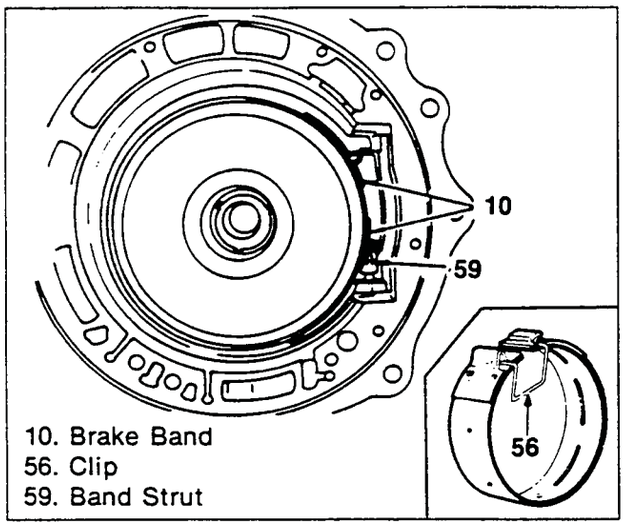


Figure 25. Brake Band Removal (2)

Clutch Pack (Figure 26)

1. Rotate automatic transmission so that input side faces upward.
2. Remove the reverse clutch and the high clutch.
3. Separate the high clutch from the reverse clutch, and remove the front bearing race from the high clutch.

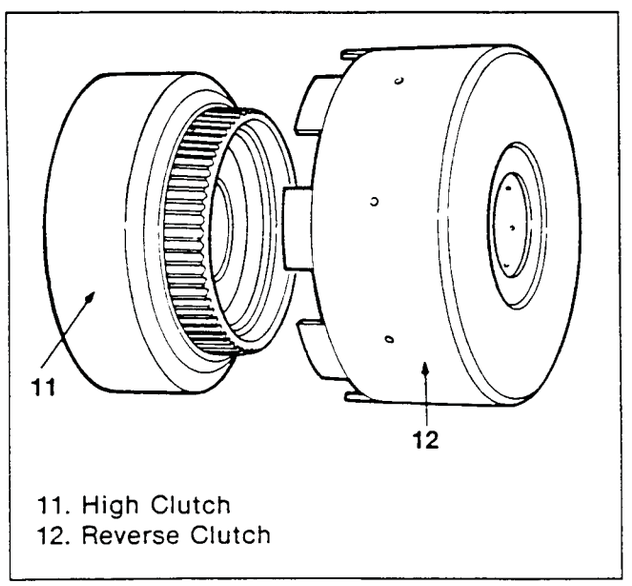


Figure 26. Clutch Pack Removal

Inspect (Figure 27)

Inspect the bearing race for damage and unusual wear.

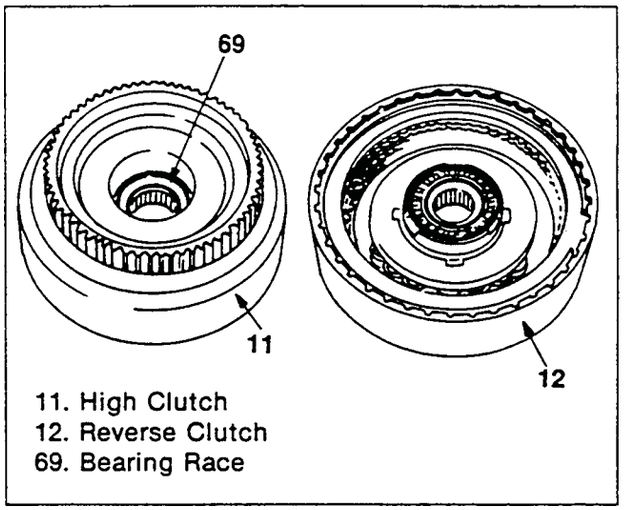


Figure 27. Bearing Race Location

Front Sun Gear (Figures 28 and 29)

1. Remove the high clutch hub and the front sun gear (figure 28).
2. Remove thrust bearings (3 pcs) (figure 29).

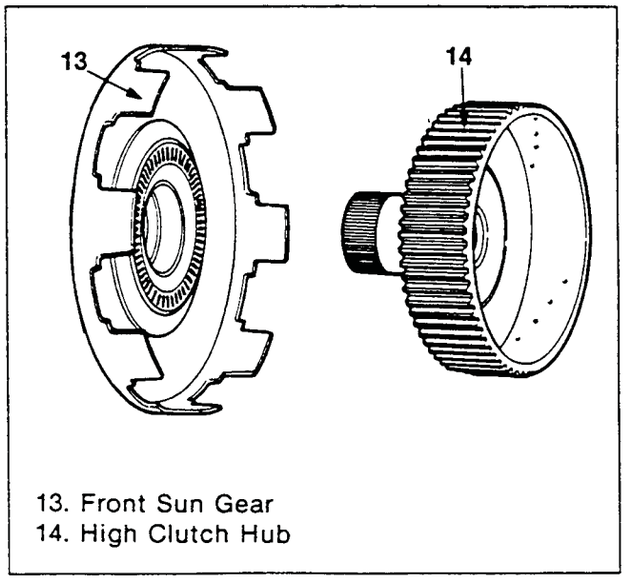
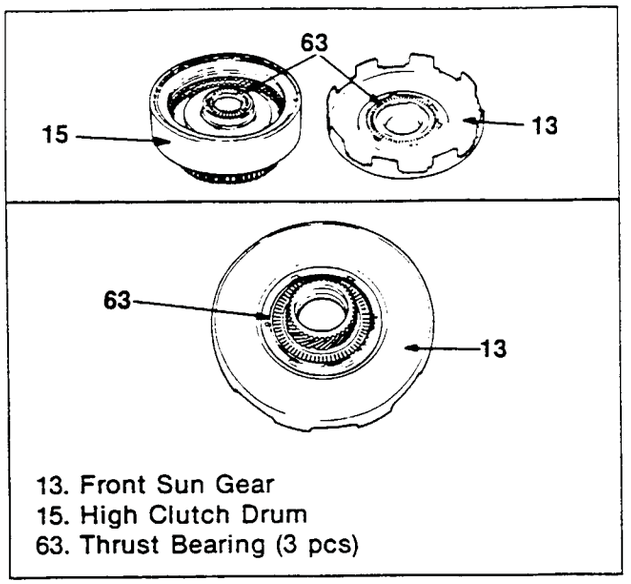


Figure 28. Front Sun Gear Removal

Inspect (Figure 29)

Inspect each bearing for damage.



13. Front Sun Gear
15. High Clutch Drum
63. Thrust Bearing (3 pcs)

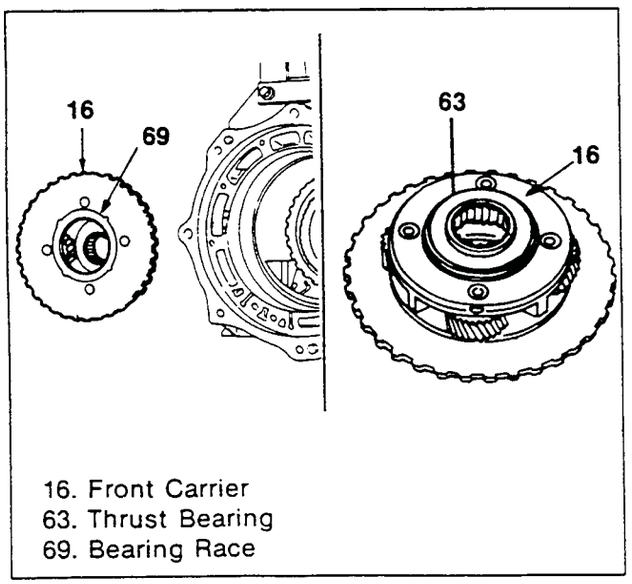
Figure 29. Thrust Bearing Inspection

Front Carrier (Figure 30)

1. Remove the front carrier.
2. Remove the bearing race and thrust bearing from the front carrier.

Inspect (Figure 30)

Inspect the bearing race, thrust bearing and front carrier for damage.



16. Front Carrier
63. Thrust Bearing
69. Bearing Race

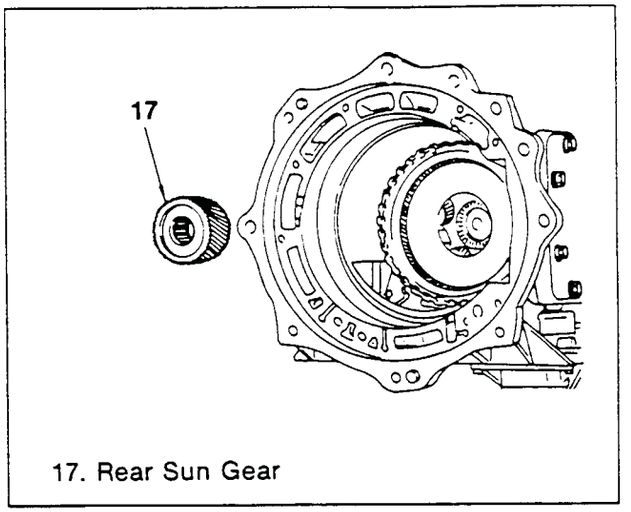
Figure 30. Front Carrier Inspection

Rear Sun Gear (Figure 31)

Remove the rear sun gear.

Inspect (Figure 31)

Inspect the rear sun gear for damage.



17. Rear Sun Gear

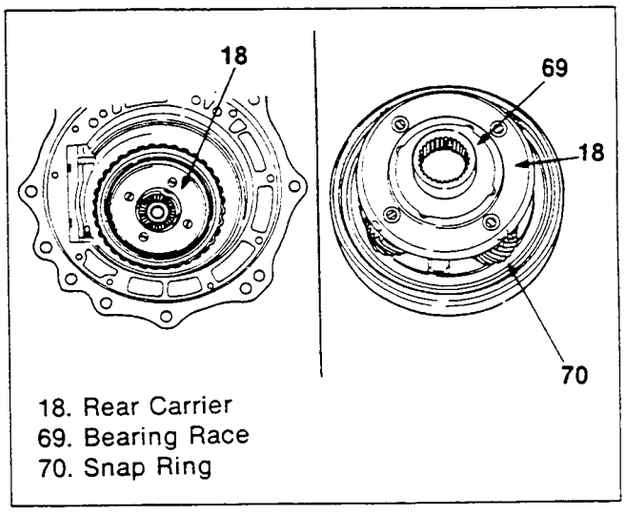
Figure 31. Rear Sun Gear Removal

Rear Carrier (Figure 32)

1. Remove the rear carrier.
2. Remove the snap ring using a flat-end screwdriver, and remove the front internal gear.
3. Remove the bearing race.

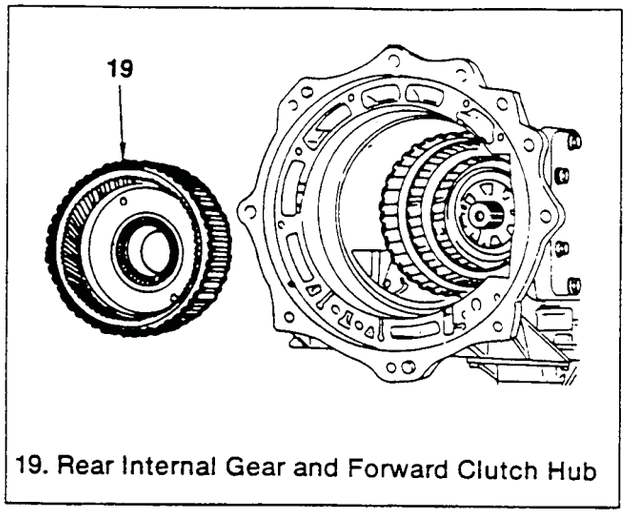
Inspect (Figure 32)

Inspect the bearing race, spline teeth surface, etc., for damage.



18. Rear Carrier
69. Bearing Race
70. Snap Ring

Figure 32. Rear Carrier Removal

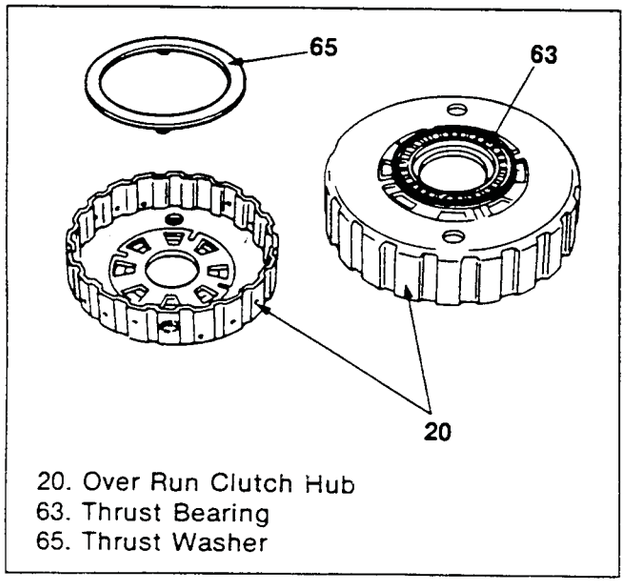


19. Rear Internal Gear and Forward Clutch Hub

Figure 33. Rear Internal Gear and Forward Clutch Hub Removal

Forward Clutch Hub and Overrun Clutch Hub (Figure 33)

1. Remove the forward clutch hub and the overrun clutch hub as a unit.
2. Separate the overrun clutch hub from the forward clutch hub.
3. Remove the thrust bearing from the forward clutch hub.
4. Remove the thrust bearing and thrust washer from the overrun clutch hub (figures 34 and 35).

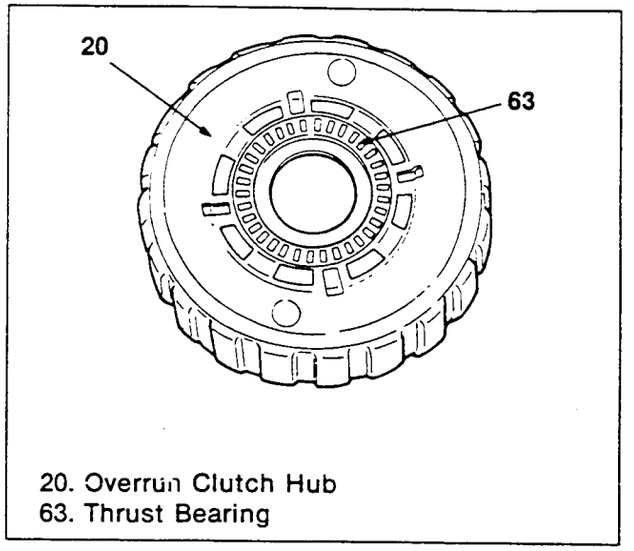


20. Over Run Clutch Hub
63. Thrust Bearing
65. Thrust Washer

Figure 34. Thrust Washer Removal

Inspect (Figure 34)

Inspect the bearing, washer and other parts for damage.



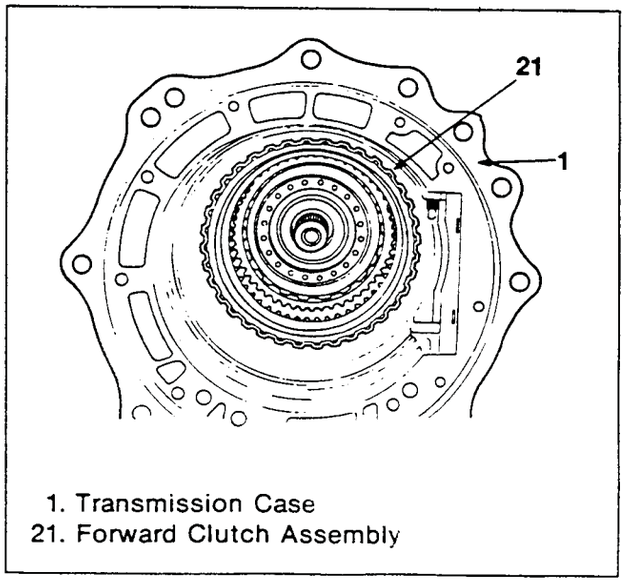
20. Overrun Clutch Hub
63. Thrust Bearing

Figure 35. Thrust Bearing Inspection

Forward Clutch Assembly (Figure 36)

Pull the forward clutch assembly upward while rotating it clockwise.

CAUTION: The forward clutch assembly is heavy. Support it firmly when removing it.

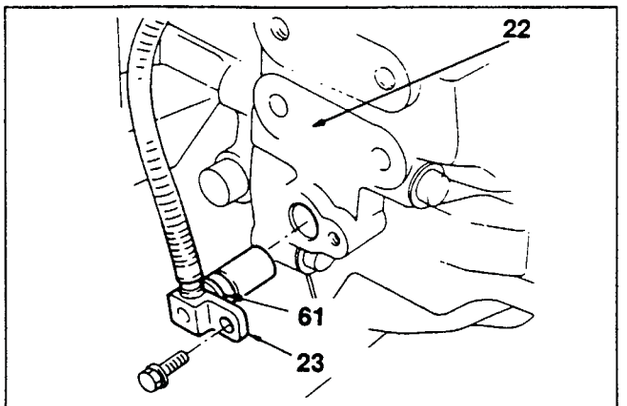


1. Transmission Case
21. Forward Clutch Assembly

Figure 36. Forward Clutch Assembly Removal

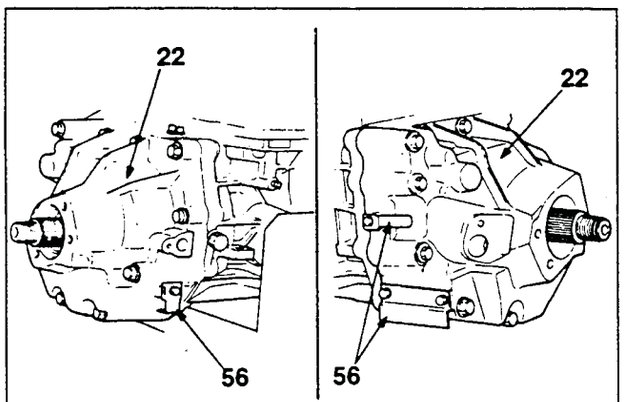
Rear Cover (Figures 37, 38, 39, 40 and 41)

1. Remove the bolt, and then the vehicle speed sensor (figure 37).
2. Remove the O-ring (figure 37).



22. Rear cover
23. Vehicle Speed Sensor
61. O-Ring

Figure 37. Vehicle Speed Sensor Removal



22. Rear Cover
56. Clips

Figure 38. Rear Cover Clip Removal

3. Remove clips (3 pcs) (figure 38).
4. Remove the rear cover fitting bolts (figure 39).

NOTICE: Do not reuse the rear cover fitting bolts.

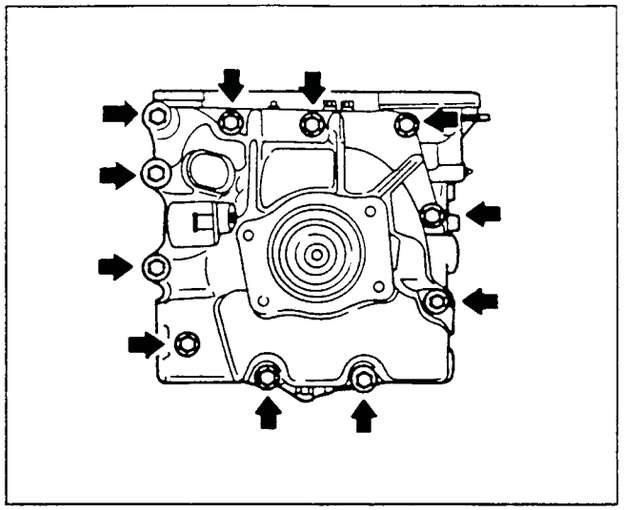
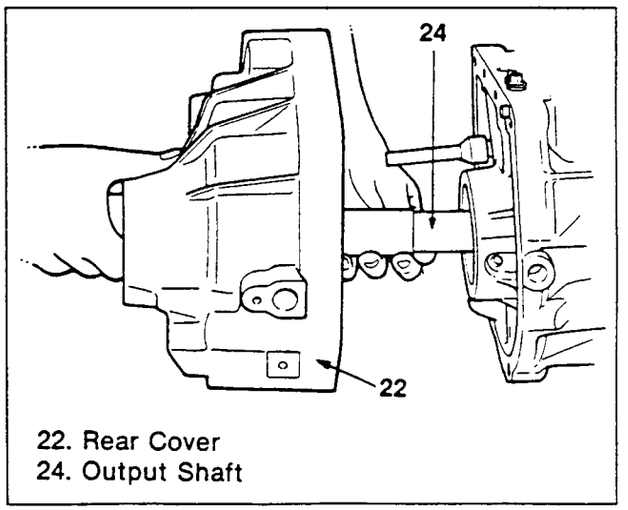


Figure 39. Rear Cover Fitting Bolt Removal

5. Remove the rear cover and the output shaft as a unit (figure 40).



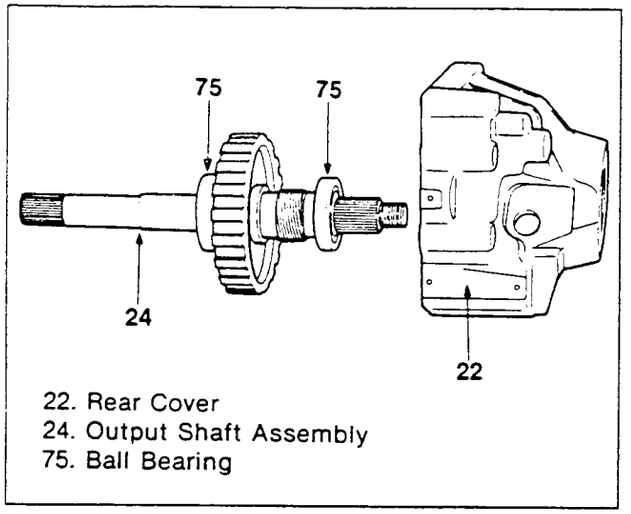
22. Rear Cover
24. Output Shaft

Figure 40. Rear cover and Output Shaft Assembly Removal (1)

6. Separate the output shaft assembly from the rear cover (figure 41).
7. Remove the gasket.
8. Remove the rear cover oil seal using a flat-end screwdriver.

Inspect (Figure 41)

Check the ball bearing for smooth operation.

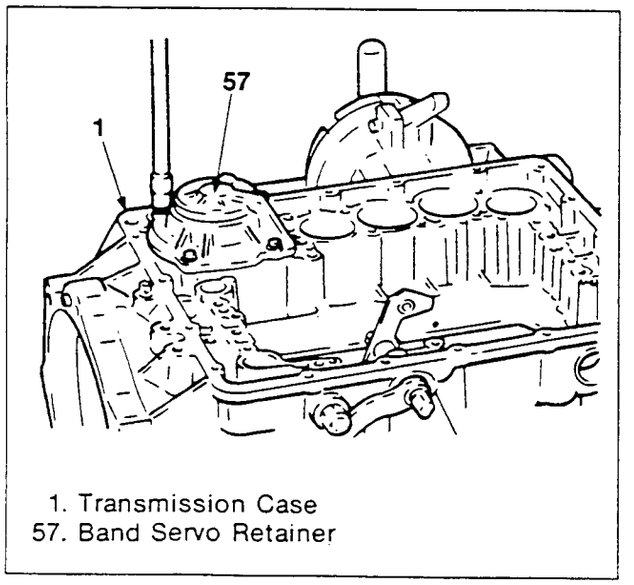


22. Rear Cover
24. Output Shaft Assembly
75. Ball Bearing

Figure 41. Rear Cover and Output Shaft Assembly Removal (2)

Band Servo (Figures 42, 43 and 44)

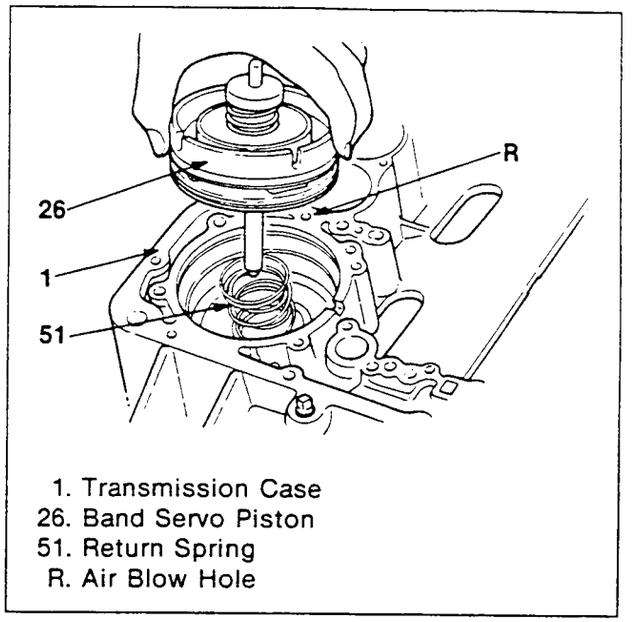
1. Remove the bolts, and the retainer (figure 42).
2. Remove the gasket.



1. Transmission Case
57. Band Servo Retainer

Figure 42. Band Servo Retainer Removal

3. Blow compressed air (294 kPa/42 psi or less) into oil hole to remove band servo piston (figure 43).
4. Remove return springs (2 pcs).



1. Transmission Case
26. Band Servo Piston
51. Return Spring
R. Air Blow Hole

Figure 43. Band Servo Removal

Accumulator (Figure 44)

1. Blow compressed air (294 kP/42 psi or less) into oil holes to remove pistons.

CAUTION: Direct only a small amount of air at a time. If you direct too much air at once, the piston could fly out.

Piston mark	A	B	C	D
Oil hole mark	a	b	c	d

2. Remove the O-ring from each piston.

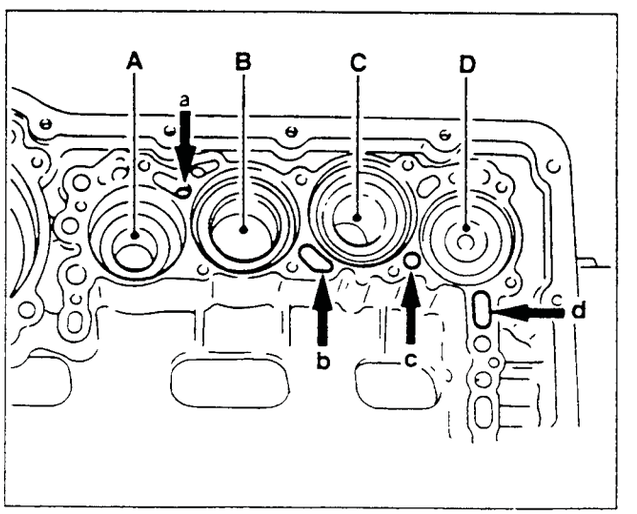
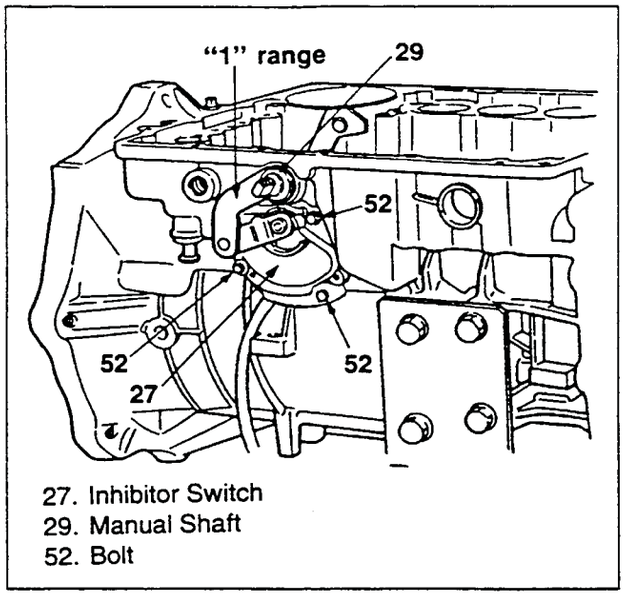


Figure 44. Piston and Oil Hole Mark

Inhibitor Switch (Figure 45)

1. Place the manual shaft in the 1 range.
2. Remove bolts (3 pcs), and then remove the inhibitor switch (figure 45).

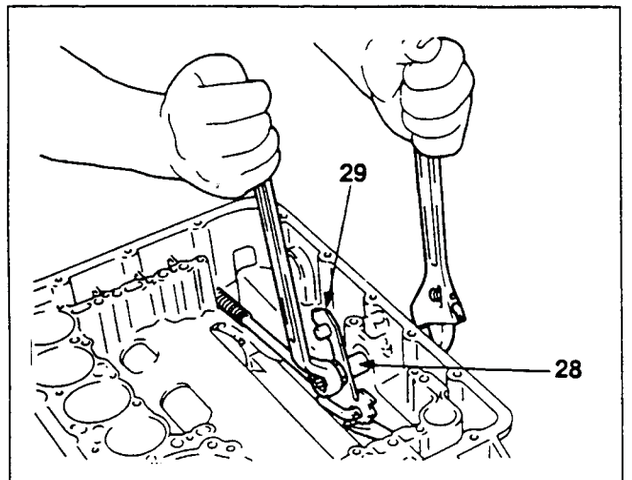


27. Inhibitor Switch
29. Manual Shaft
52. Bolt

Figure 45. Inhibitor Switch Removal

Manual Plate (Figures 46 and 47)

1. Secure the manual shaft with an adjustable wrench placed on the flat area and remove the lock nut of the manual plate (figure 46).



28. Manual Plate
29. Manual Shaft

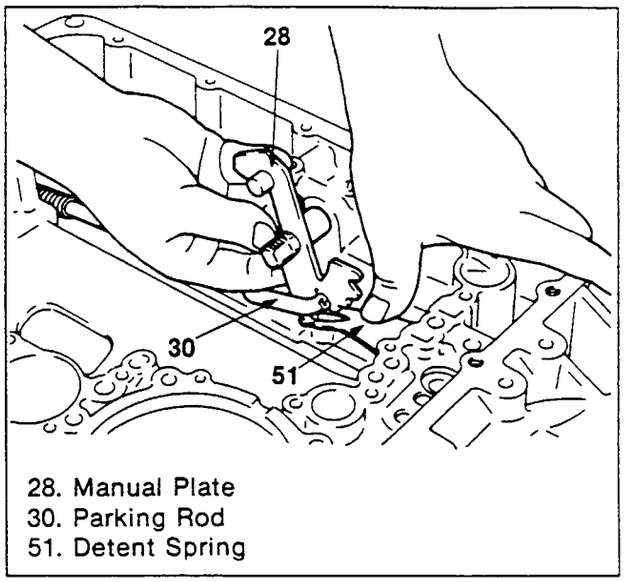
Figure 46. Manual Plate Removal (1)

2. While depressing the detent spring, remove the manual plate and the parking rod as a unit (figure 47).

Important

- Only depress the detent spring slightly.

3. Separate the parking rod from the manual plate.



28. Manual Plate
30. Parking Rod
51. Detent Spring

Figure 47. Manual Plate Removal (2)

Manual Shaft (Figures 48 and 49)

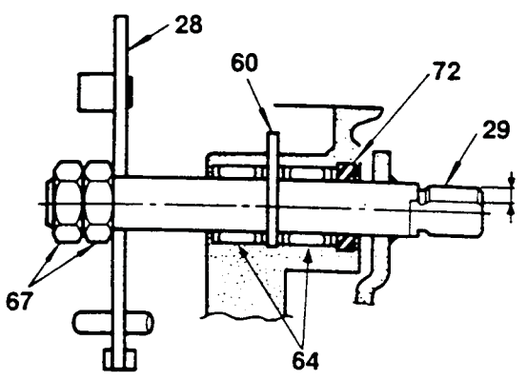
Important

- Do not remove If no fault is apparent.

1. Pull out the spring pin using pliers.

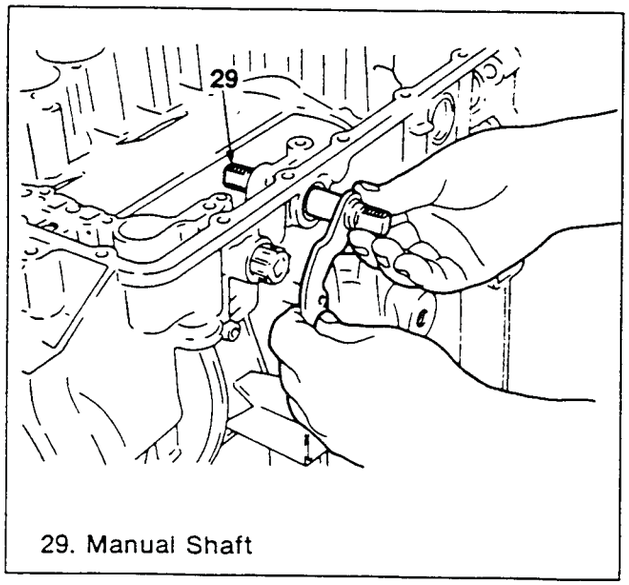
NOTICE: The removed spring pin discard.

2. Pull out the manual shaft (figure 49).



28. Manual Plate
29. Manual Shaft
60. Spring Pin
64. Needle Bearing
67. Lock Nut
72. Oil Seal

Figure 48. Manual Shaft Removal (1)

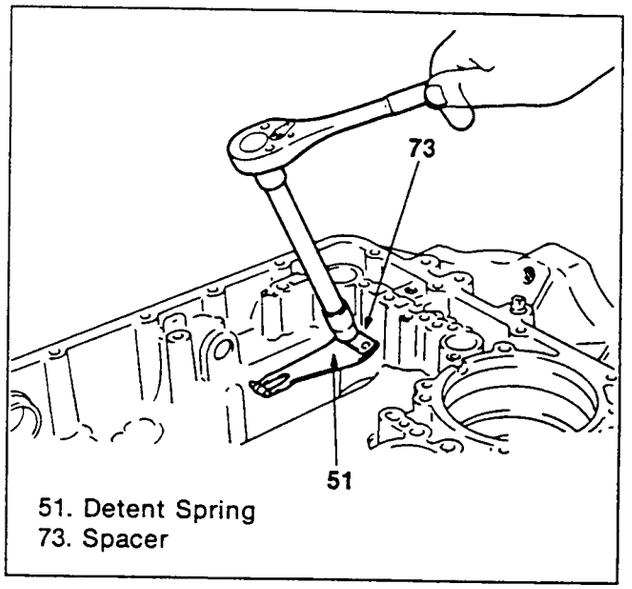


29. Manual Shaft

Figure 49. Manual Shaft Removal (2)

Detent Spring (Figure 50)

Remove the bolt, the spacer and the detent spring.



51. Detent Spring
73. Spacer

Figure 50. Detent Spring Removal

Oil Seal (Figure 51)

Remove the oil seal using a flat-end screwdriver.

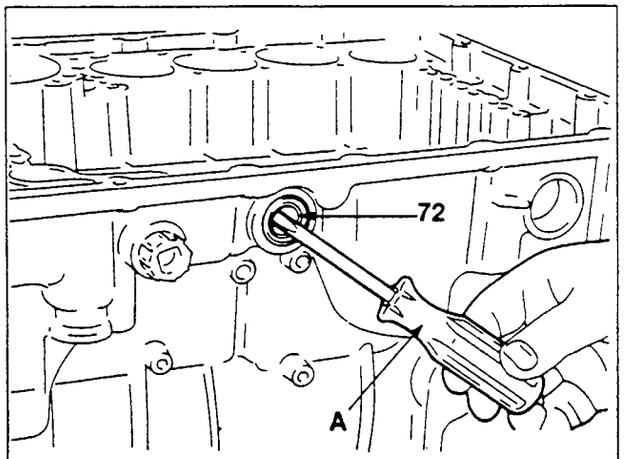
Important

- Do not damage the sealing seat of the case with the screwdriver.

Inspect (Figure 48)

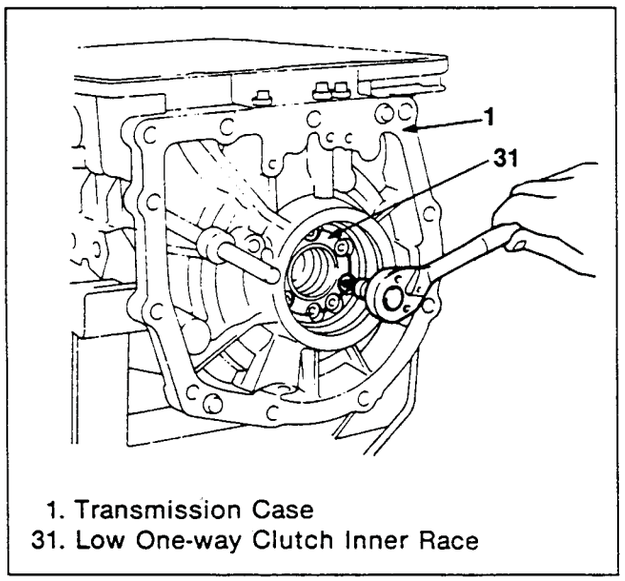
Inspect needle bearings (2 pcs) for damage and adhesion of foreign substances.

NOTICE: The needle bearing of the manual shaft is fitted to the transmission under a very strict torque control and cannot thus cannot be replaced separately. Therefore, when the needle bearing is found to be faulty, the entire transmission case assembly must be replaced.



72. Oil Seal
A. Screwdriver

Figure 51. Manual Shaft Oil Seal Removal



1. Transmission Case
31. Low One-way Clutch Inner Race

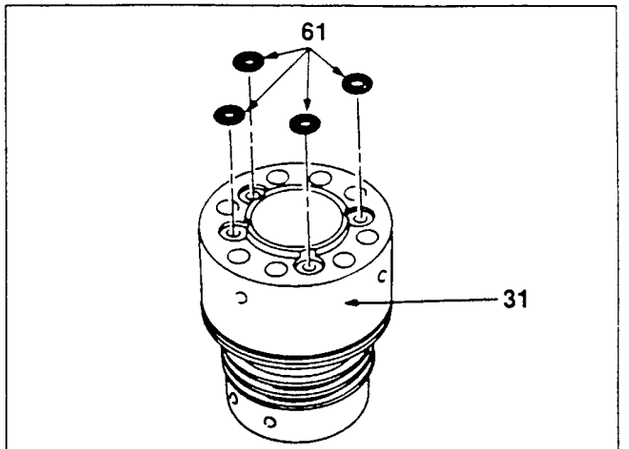
Figure 52. Low One-way Clutch Inner Race Bolt Removal

Low One-way Clutch Inner Race (Figures 52 and 53)

1. Remove the hexagonal bolts (8 pcs) and separate the inner race from the case (figure 52).

   NOTICE: Do not reuse the clutch inner race bolts.

2. Remove the O-rings (4 pcs) (figure 53).
3. Remove the thrust bearing (figure 54).

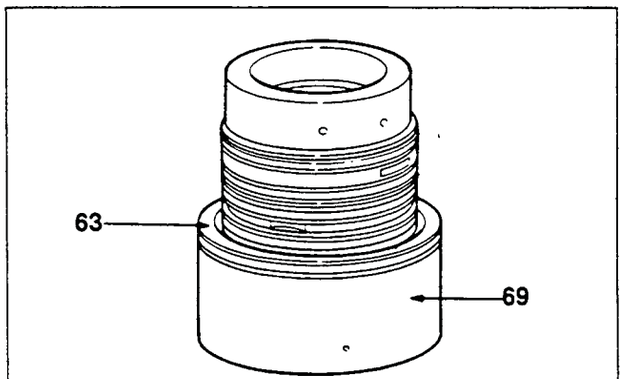


31. Low One-way Clutch Inner Race
61. O-Ring

Figure 53. Low One-way Cluctch Inner Race O-ring Removal

Inspect (Figure 54)

Inspect the inner race and the bearing for damage and unusual wear on the sliding surfaces.



63. Thrust Bearing
69. Inner Race

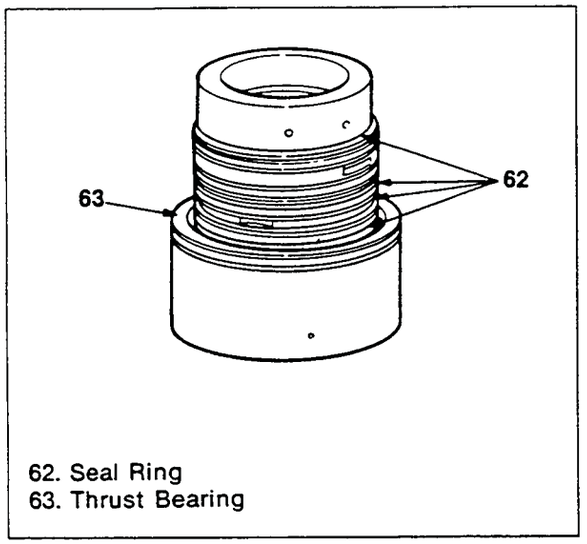
Figure 54. Low One-way Clutch Inner Race Inspection

Seal Ring (Figure 55)

Remove seal rings (4 pcs) from the low one way clutch inner race.

Inspect (Figure 55)

Inspect parts for damage and unusual wear in seal ring grooves.



62. Seal Ring
63. Thrust Bearing

Figure 55. Low One-way Clutch Inner Race Seal Ring and Thrust Bearing Removal

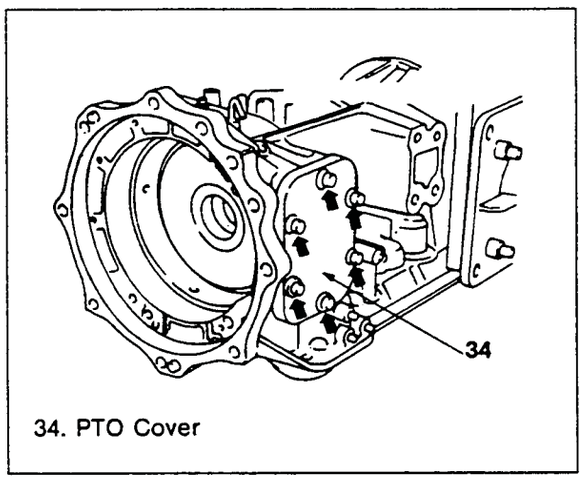
Power Take Off (PTO) Cover (Figure 56)

Remove bolts (6 pcs), and then remove the PTO cover and gasket.

NOTICE: Do not reuse the PTO cover bolts.

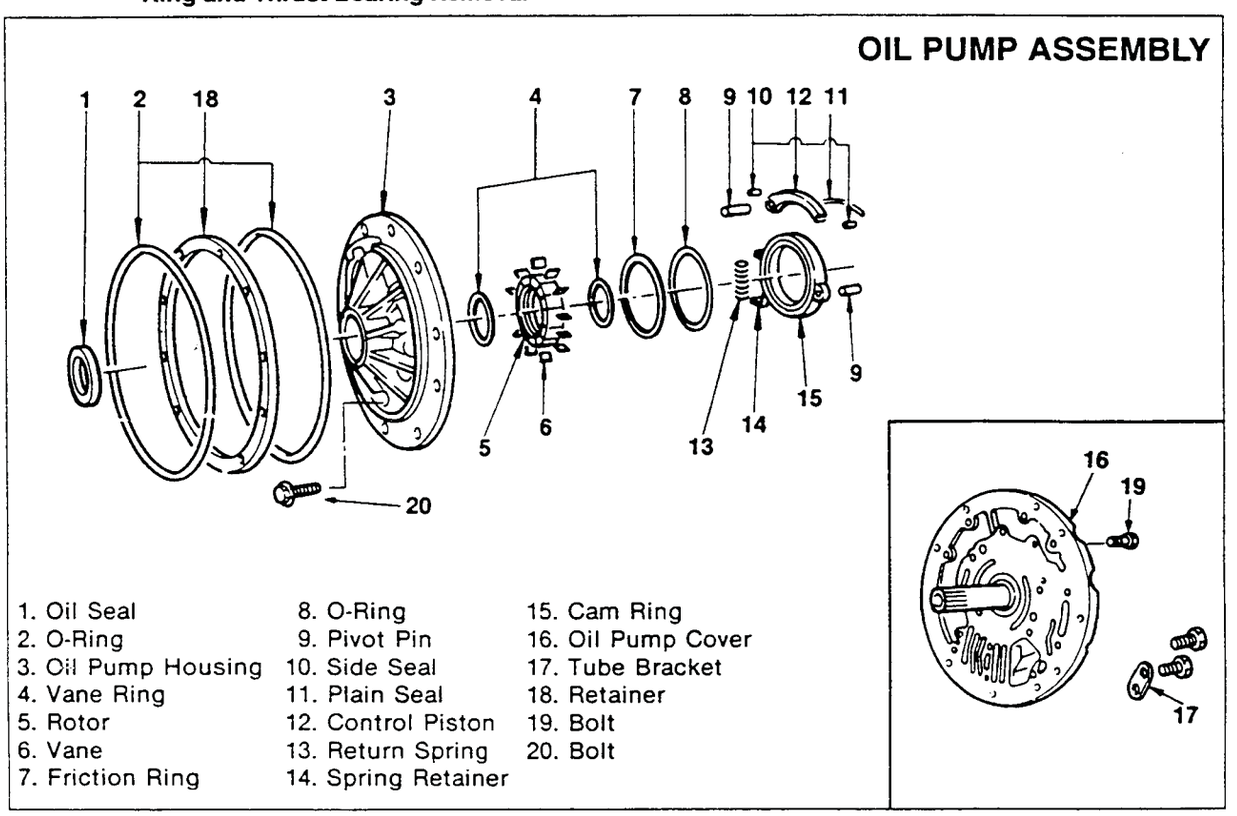
Important

- Do not remove the PTO cover unless oil leak or other problems are present.



34. PTO Cover

Figure 56. PTO Cover Removal



1. Oil Seal
2. O-Ring
3. Oil Pump Housing
4. Vane Ring
5. Rotor
6. Vane
7. Friction Ring
8. O-Ring
9. Pivot Pin
10. Side Seal
11. Plain Seal
12. Control Piston
13. Return Spring
14. Spring Retainer
15. Cam Ring
16. Oil Pump Cover
17. Tube Bracket
18. Retainer
19. Bolt
20. Bolt

Figure 57. Oil Pump Assembly

DISASSEMBLY, REASSEMBLY AND INSPECTION OF MINOR COMPONENT

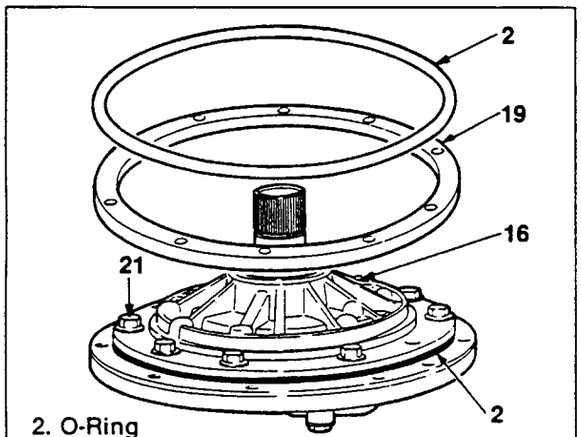
Disassemble

Oil Pump Cover (Figures 58, 59 and 60)

1. Remove the retainer and the O-rings.
2. Remove bolts (8 pcs) from the housing (figure 58).

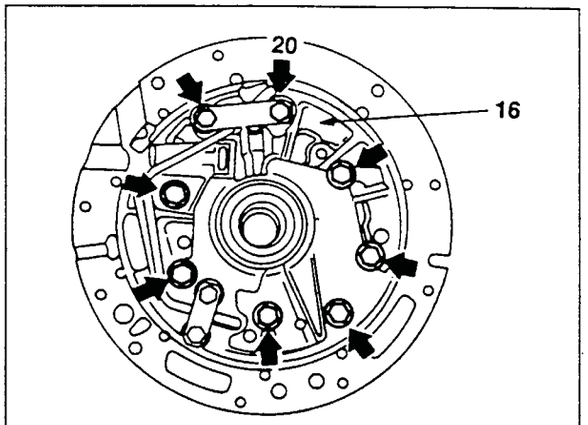
   NOTICE: Do not reuse the oil pump housing bolts.

3. Place the oil pump housing on a wooden block, etc., and remove bolts (8 pcs) from the cover (figure 59).
4. Pull up the cover and remove it.
5. Remove the vane ring, vane and rotor (figure 60).



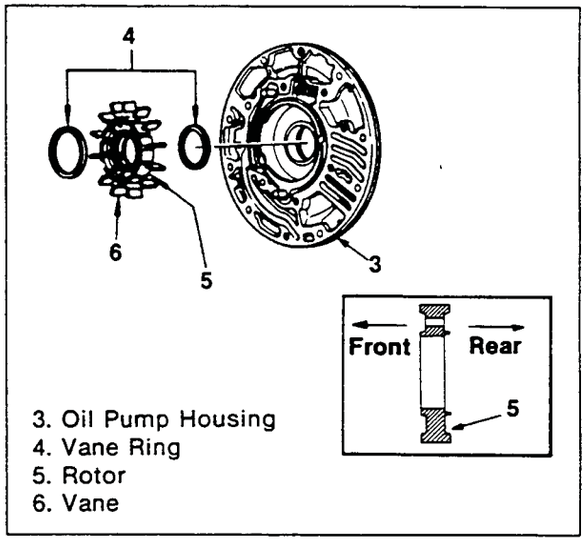
2. O-Ring
16. Oil Pump Cover
19. Retainer
21. Bolt

Figure 58. Oil Pump Cover Removal (1)



16. Oil Pump Cover
20. Bolt

Figure 59. Oil Pump Cover Removal (2)

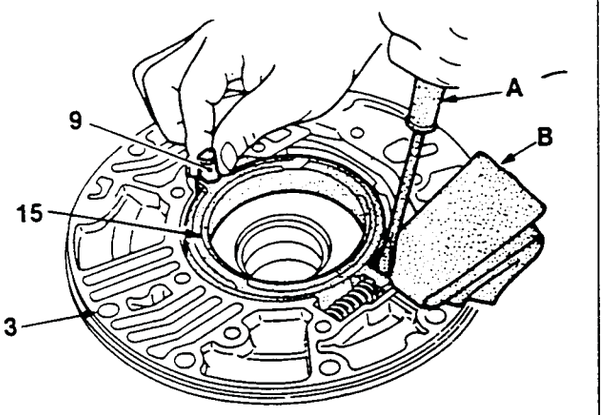


3. Oil Pump Housing
4. Vane Ring
5. Rotor
6. Vane

Figure 60. Vane Ring, Vane and Rotor Removal

Pivot Pin (Figure 61)

Pushing the cam ring with a flat-end screw-driver, pull out the pivot pin.



3. Oil Pump Housing
9. Pivot Pin
15. Cam Ring
A. Screwdriver
B. Paper Towel

Figure 61. Pivot Pin Removal

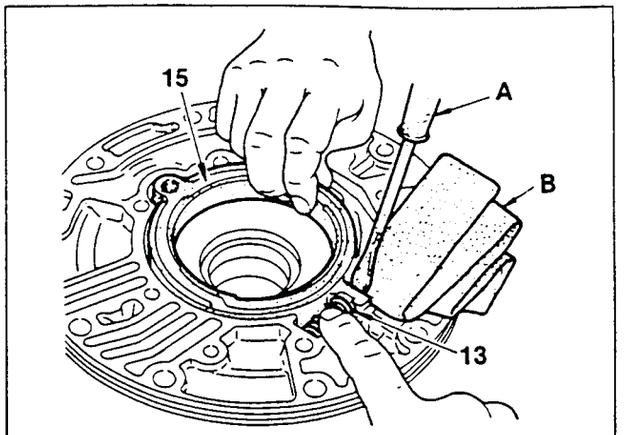
Return Spring and Cam Ring (Figure 62)

1. Pull out the spring and the retainer using a flat-end screwdriver.

Important

- Insert thick paper towel between the screwdriver and the housing to prevent the housing corner from being damaged.

2. Remove the cam ring.

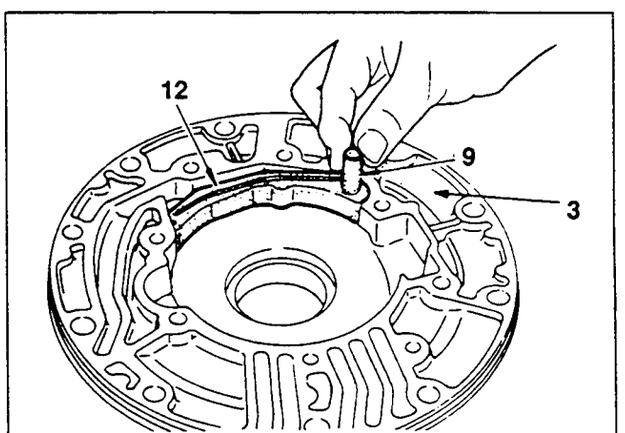


13. Return Spring
15. Cam Ring
A. Screwdriver
B. Paper Towel

Figure 62. Return Spring and Cam Ring Removal

Control Piston (Figure 63)

1. Remove the pivot pin.
2. Remove the control piston.



3. Oil Pump Housing
9. Pivot Pin
12. Control Piston

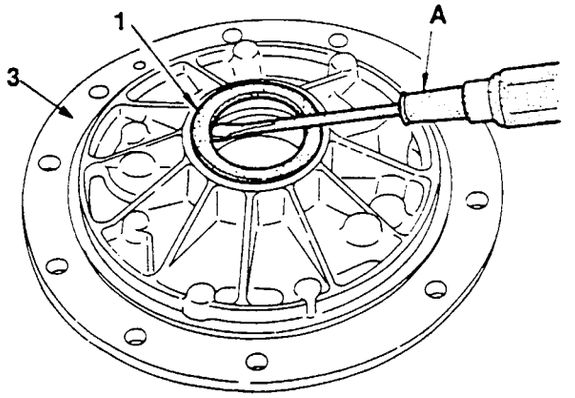
Figure 63. Control Piston Removal

Oil Seal (Figure 64)

Remove the oil seal using a flat-end screw-driver.

Important

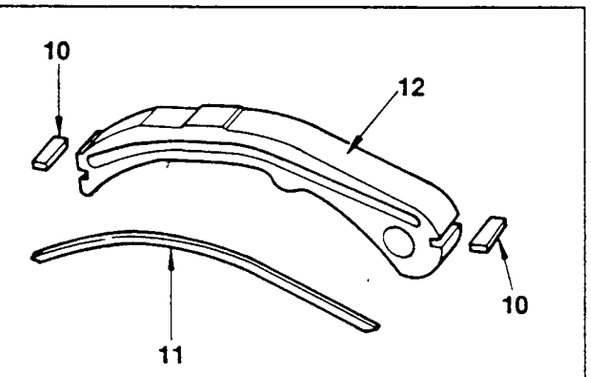
- Do not damage the sealing seat of the housing with the screwdriver.



1. Oil Seal
3. Oil Pump Housing
A. Screwdriver

Figure 64. Oil Pump Oil Seal Removal

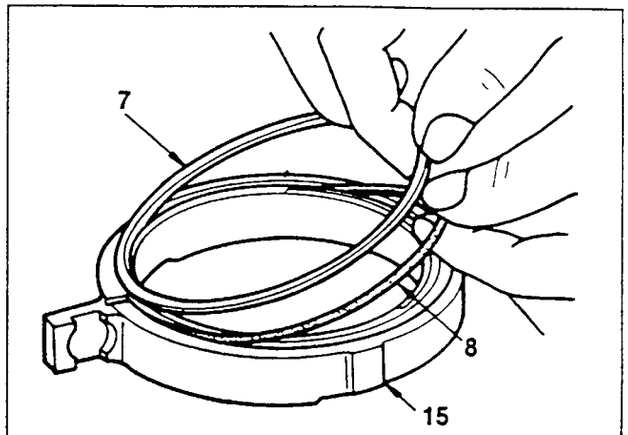
Inspect (Figures 65, 66, 67 and 68)



10. Side Seal
11. Plain Seal
12. Control Piston

Figure 65. Oil Pump Inspection (1)

1. Inspect the oil pump cover, rotor, cam ring, vanes, control piston, etc., for damage and unusual wear.
2. Inspect the control piston for damage and unusual wear (figure 65).
3. Inspect the friction ring of the cam ring for damage and unusual wear (figure 66).



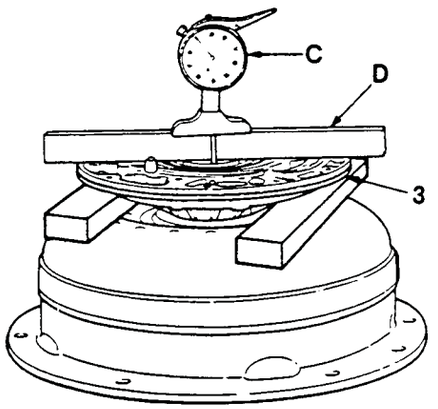
7. Friction Ring
8. O-Ring
15. Cam Ring

Figure 66. Oil Pump Inspection (2)

4. Measure the side clearance (figures 67 and 68).
   - Using a dial depth gage, measure clearance from the oil pump housing end surface to the cam ring, rotor, vanes and control piston respectively.

Important

- Remove the friction ring and O-ring from the cam ring, and remove side seals, the plain seal and return spring from the control piston before measuring clearance.



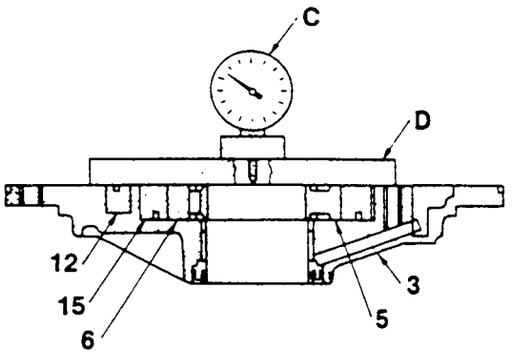
3. Oil Pump Housing
C. Dial Gage
D. Span (180 mm / 7 in)

Figure 67. Side Clearance Measurement (1)

- If the measured clearance is greater than the limit shown below, the oil pump must be replaced as an assembly or as a set (housing, cam ring, rotor, vanes, and control piston).

Side Clearance

	Standard (mm/in)	Limit (mm/in)
Cam ring	0.01 – 0.024/ 0.0004 – 0.0009	0.030 / 0.0012
Rotor	0.03 – 0.044/ 0.0012 – 0.0017	0.050 / 0.0019
Vane	0.03 – 0.044/ 0.0012 – 0.0017	0.050 / 0.0019
Control piston	0.03 – 0.044/ 0.0012 – 0.0017	0.050 / 0.0019



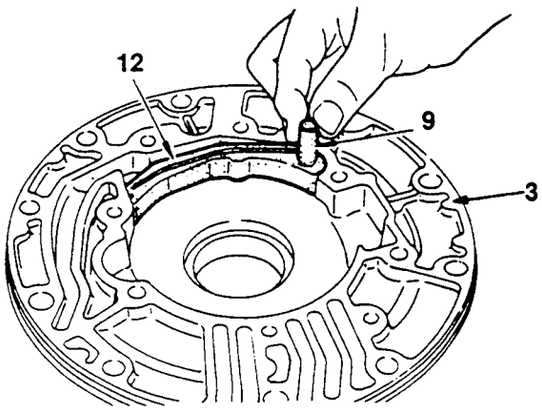
3. Oil Pump Housing
5. Rotor
6. Vane
12. Control Piston
15. Cam Ring
C. Dial Gage
D. Span (180 mm / 7 in)

Figure 68. Side Clearance Measurement (2)

Assemble

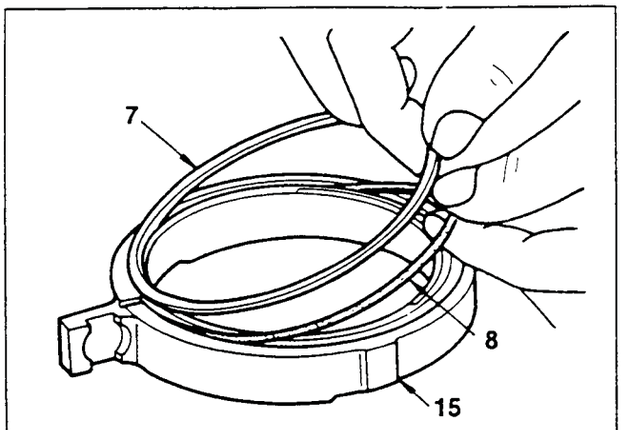
Control Piston (Figure 69)

1. Apply vaseline to the new side seal (2 pcs) and new plain seal and then install them on the control piston.
2. Install the control piston.
3. Install the pivot pin.



3. Oil Pump Housing
9. Pivot Pin
12. Control Piston

Figure 69. Control Piston Installation

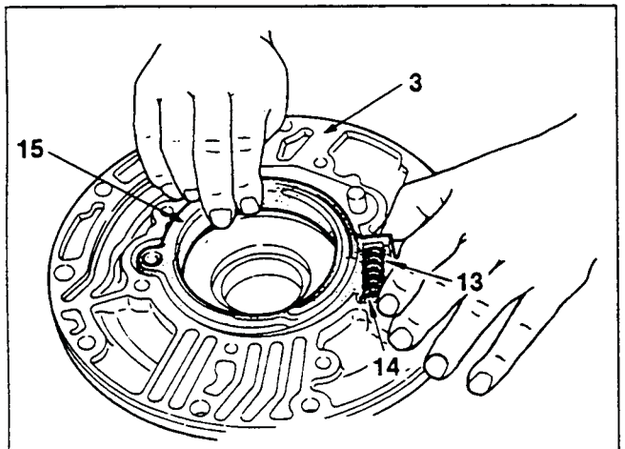


7. Friction Ring (Apply Vaseline)
8. O-Ring (Apply Vaseline)
15. Cam Ring

Figure 70. Cam Ring Installation (1)

Cam Ring (Figures 71 and 72)

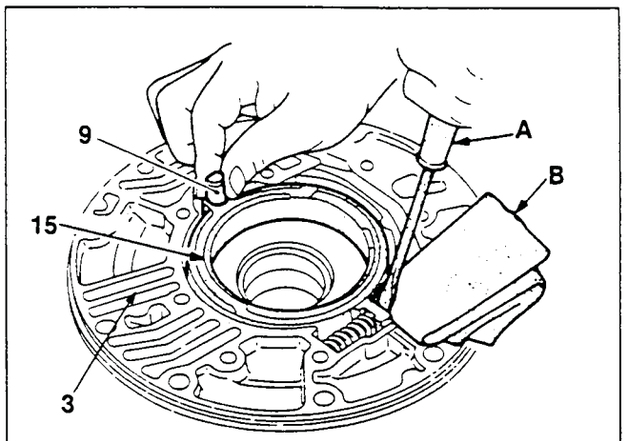
1. Apply vaseline to the O-ring (new) and friction ring and then assemble them on the cam ring (figure 70).
2. Assemble the return spring and spring retainer to the cam ring and, pushing the spring with your finger, install the cam ring in the housing (figure 71).



3. Oil Pump Housing
13. Return Spring
14. Spring Retainer
15. Cam Ring

Figure 71. Cam Ring Installation (2)

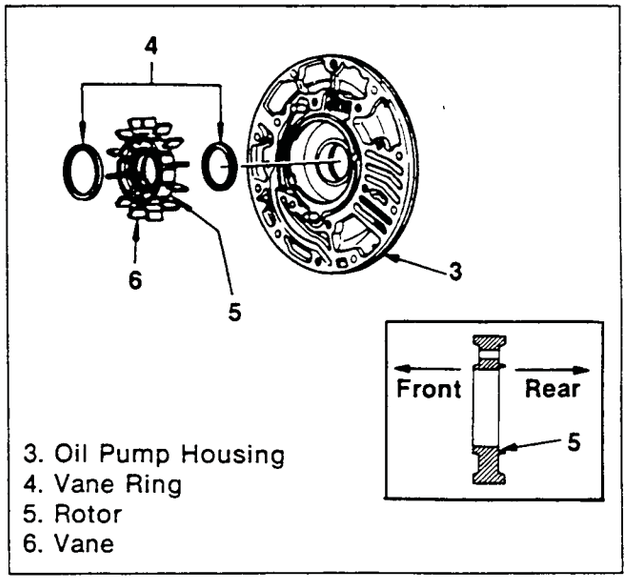
3. Pressing the cam ring with a flat-end screwdriver, install the pivot pin (figure 72).



3. Oil Pump Housing
9. Pivot Pin
15. Cam Ring
A. Screwdriver
B. Paper Towel

Figure 72. Pivot Pin Installation

Rotor, Vane and Vane Ring (Figure 73)



3. Oil Pump Housing
4. Vane Ring
5. Rotor
6. Vane

Figure 73. Rotor, Vane and Vane Ring Installation

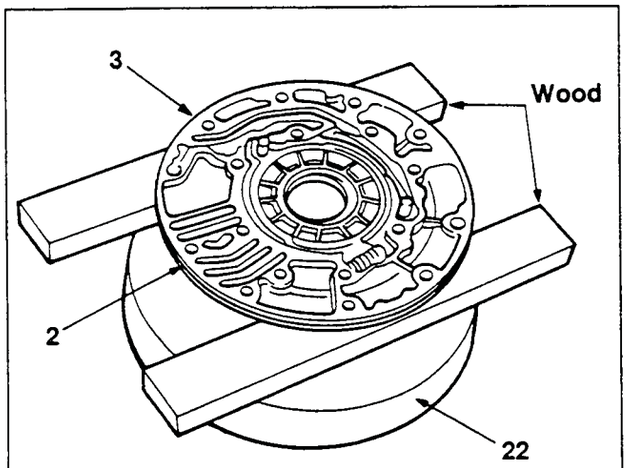
1. Assemble the vane ring to the oil pump housing.
2. Install the rotor.
3. Install the vane ring on the rotor, and install the vanes.

Important

- The rotor must be placed in a particular direction (figure 73).

Oil Pump Cover (Figures 74, 75, 76 and 77)

1. Place the oil pump housing on the wooden pieces inserted over the torque converter whose drive sleeve is inserted to the oil pump rotor. Apply automatic transmission fluid to around the oil pump housing then install the new O-ring (figure 74).



2. O-Ring
3. Oil Pump Housing
22. Torque Converter

Figure 74. Oil Pump Cover Installation (1)

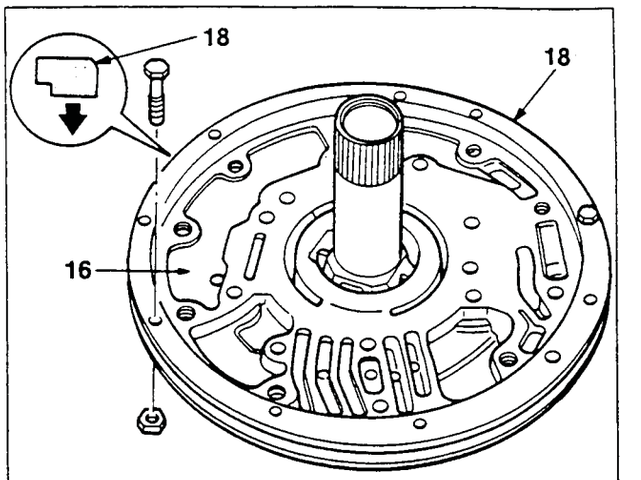
2. Place the retainer to the oil pump cover with being located by hold portion, then install tentatively with two fixing bolts.

Important

- Be careful to place the retainer for correct direction (figure 75).

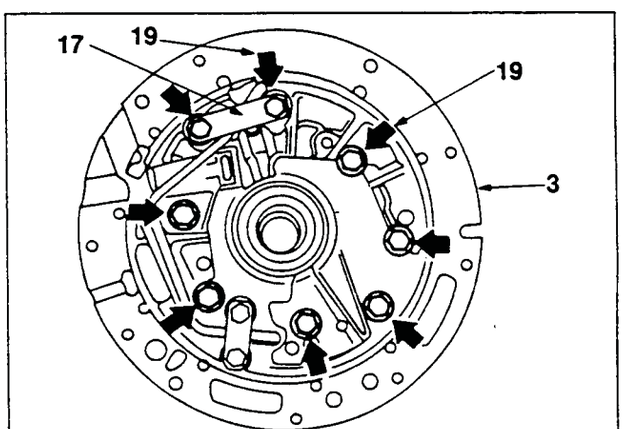
3. Install the oil pump cover to the oil pump housing with locating pin matched (figure 76).

NOTICE: Put the housing and the cover together by hand, and check if the cover is assembled correctly. If it is fitted incorrectly, it will cause rattling. In that case, remove the cover, check inside and correct it as necessary. Never tighten bolts unless you are very certain that the cover is fitted correctly. When it is tightened, the internal parts may be broken if it is fitted incorrectly.



16. Oil Pump Cover
18. Retainer

Figure 75. Oil Pump Cover Installation (2)



3. Oil Pump Housing
17. Tube Bracket
19. Oil Pump Cover Bolt

Figure 76. Oil Pump Cover Installation (3)

4. Tighten cover side bolts (8 pcs) together with the tube bracket (figure 76).

Important

- Tighten bolts evenly in a cross pattern sequence.

Tighten

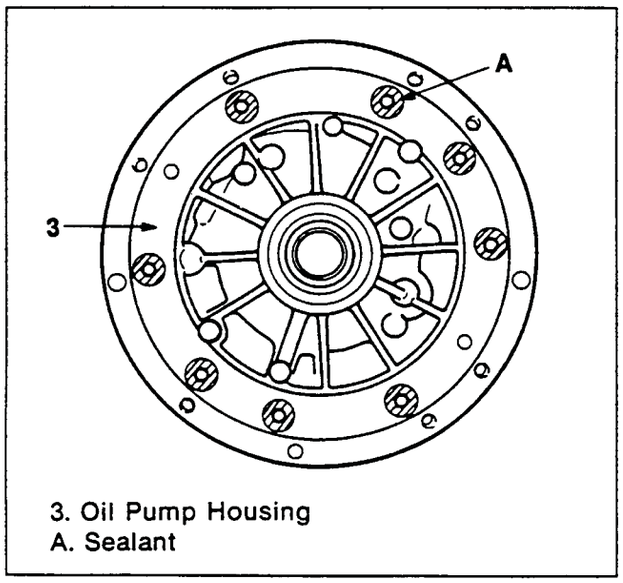
- Oil pump cover bolts (19) 19 N·m (14 lb·ft)

5. Apply sealant (Three Bond 1215 or equivalent) on the bolt seat of each of the housing side bolts (8 pcs, excluding the two bolts for setting the oil pump puller).
6. Tighten bolts evenly in a cross pattern sequence (figures 77 and 78).

NOTICE: Do not reuse the oil pump housing bolts.

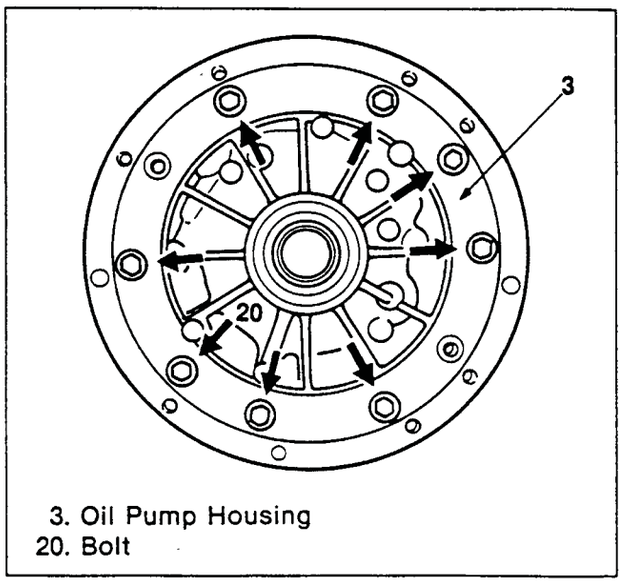
Tighten

- Oil pump housing bolts (21)
  57 N·m (42 lb·ft)



3. Oil Pump Housing
A. Sealant

Figure 77. Oil Pump Cover Installation (4)



3. Oil Pump Housing
20. Bolt

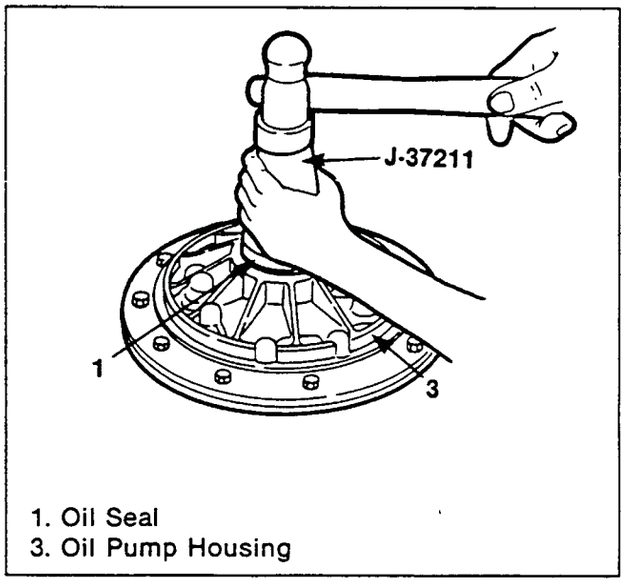
Figure 78. Oil Pump Cover Installation (5)

Oil Seal (Figure 79)

1. Apply automatic transmission fluid outside the oil seal (new) and the sealing seat of the oil pump housing.
2. Drive in the oil seal using an installer (special tool).
   Front Oil Seal Installer: J-37211

Important

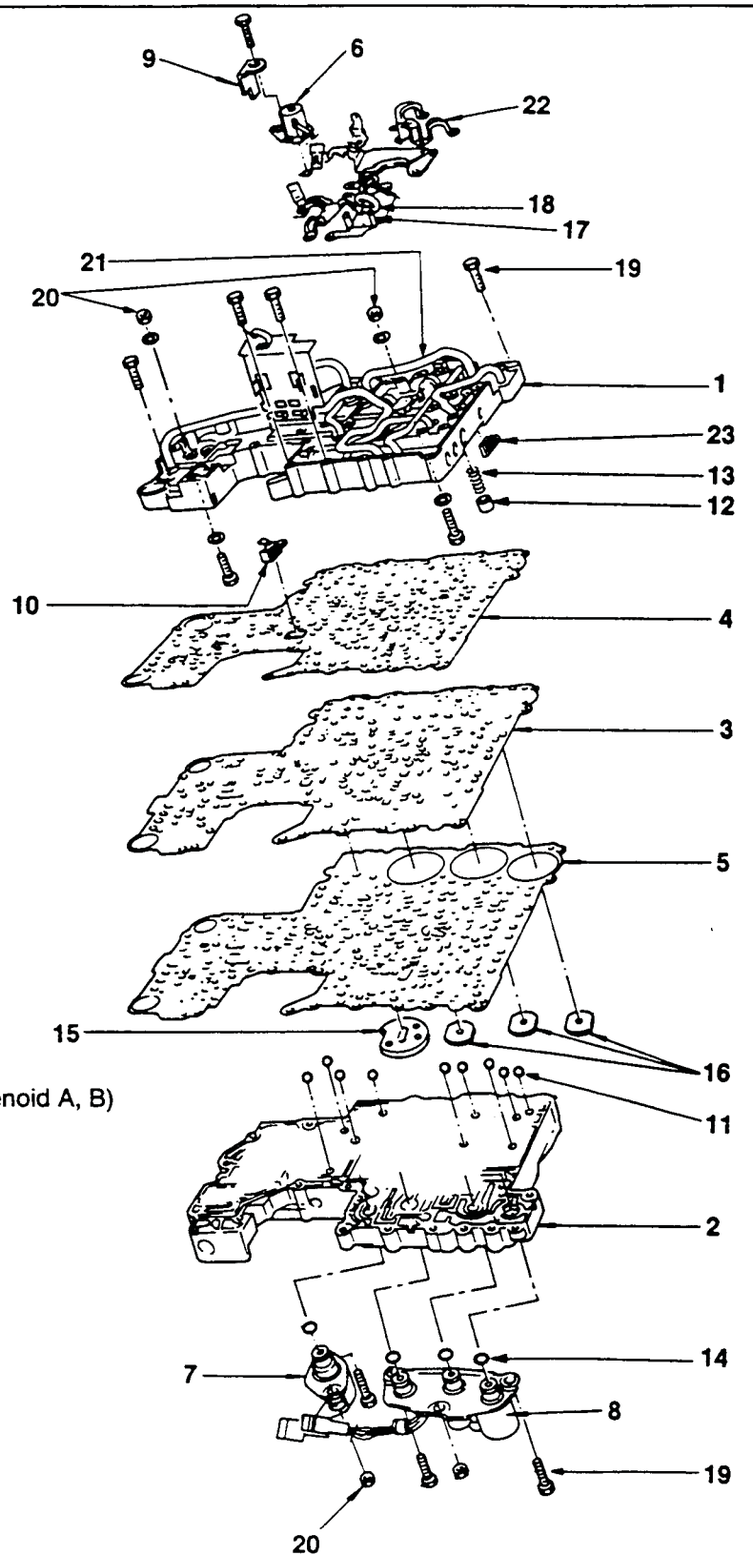
- Place paper towel underneath first to prevent the portion of the housing that contacts the cover from being damaged.
  Make sure that the oil seal is driven completely to the surface level of the housing.



1. Oil Seal
3. Oil Pump Housing

Figure 79. Oil Pump Oil Seal Installation

VALVE BODY ASSEMBLY



1. Lower Valve Body
2. Upper Valve Body
3. Separator Plate
4. Lower Valve Body Gasket
5. Upper Valve Body Gasket
6. Lock-up Solenoid
7. Line Pressure Solenoid
8. Three Combined Solenoids
   (Overrun Clutch Solenoid, Shift Solenoid A, B)
9. Lock Washer
10. Pilot Filter
11. Steel Ball
12. Orifice Check Valve
13. Orifice Check Valve Spring
14. O-Ring
15. Side Plate
16. Support Plate
17. Connector Bracket
18. Harness Clip
19. Bolt
20. Nut
21. Connector Tube
22. Tube Bracket
23. Accum Filter

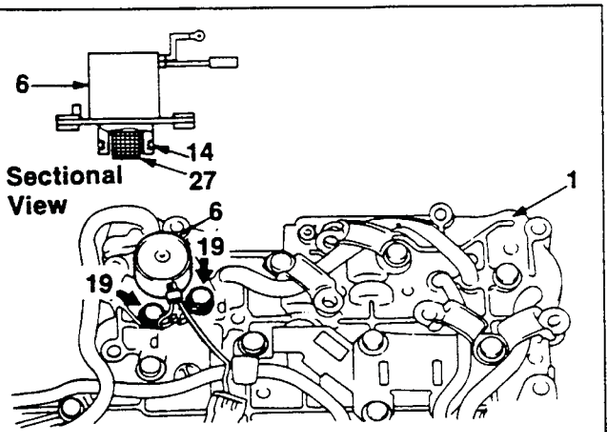
ATF: Automatic Transmission Fluid

Figure 80. Valve Body Assembly

Disassemble

Lock-up Solenoid (Figure 81)

1. Loosen bolts (2 pcs), and remove the lock-up solenoid from the lower valve body.
2. Remove the O-ring from the solenoid.

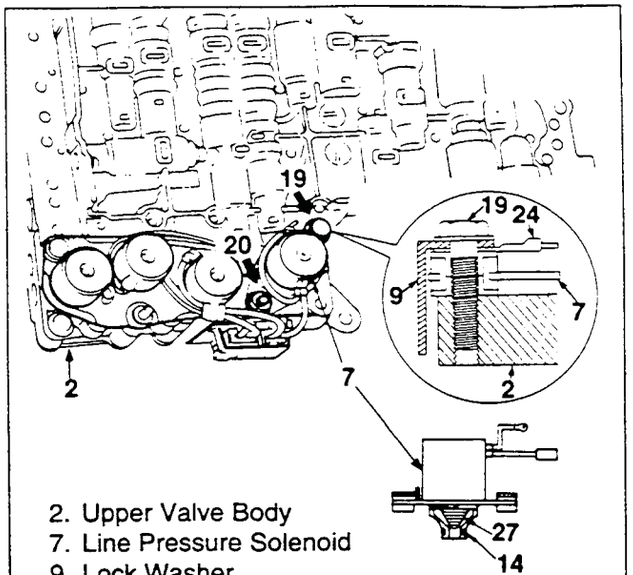


1. Lower Valve Body
6. Lock-up Solenoid
14. O-Ring
19. Bolt
27. Oil Filter

Figure 81. Lock-up Solenoid Removal

Line Pressure Solenoid (Figure 82)

1. Loosen the bolt and nut, and remove the lock washer, grounding terminal and the line pressure solenoid from the upper valve body.
2. Remove the O-ring from the solenoid.

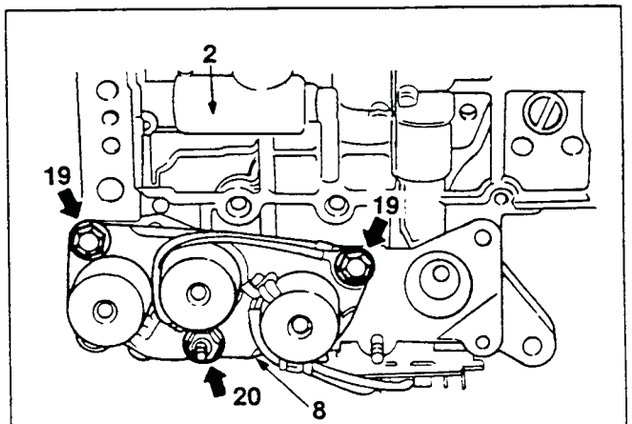


2. Upper Valve Body
7. Line Pressure Solenoid
9. Lock Washer
14. O-Ring
19. Bolt
20. Nut
24. Ground Terminal
27. Oil Filter

Figure 82. Line Pressure Solenoid Removal

Three Combined Solenoids (Overrun Clutch Solenoid, Shift Solenoid A, B) (Figure 83)

1. Loosen bolts (2 pcs) and a nut, and remove the three combined solenoids from the upper valve body.
2. Remove the O-ring from the solenoids.



2. Upper Valve Body
8. Three Combined Solenoid
19. Bolt
20. Nut

Figure 83. Three Combined Solenoid Removal

Upper and Lower Valve Body
(Figures 84 and 85)

1. With the upper valve body facing down, loosen the bolts and nuts (figure 84), and remove the lower valve body, separator plate and valve body gaskets as a unit from the upper valve body.

Important

- The lower valve body contains the orifice check valve, orifice check spring and pilot filter. When you separate the lower valve body from the upper valve body, remove it together with the separator plate and separate gaskets so that other contents do not fall. Make certain that the steel balls do not drop out from the upper valve body.

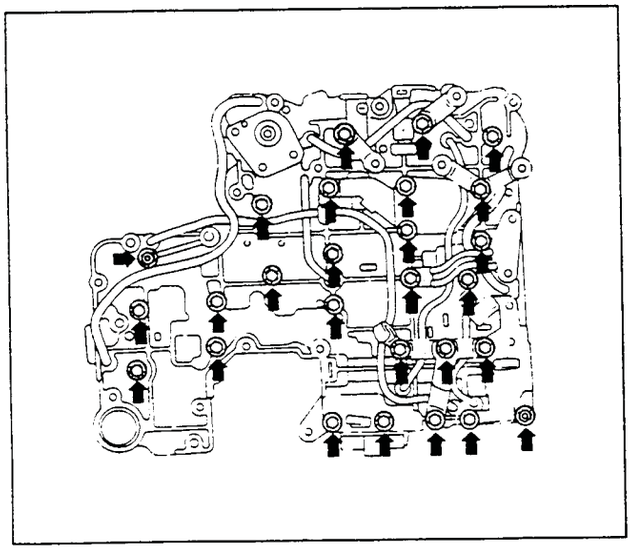
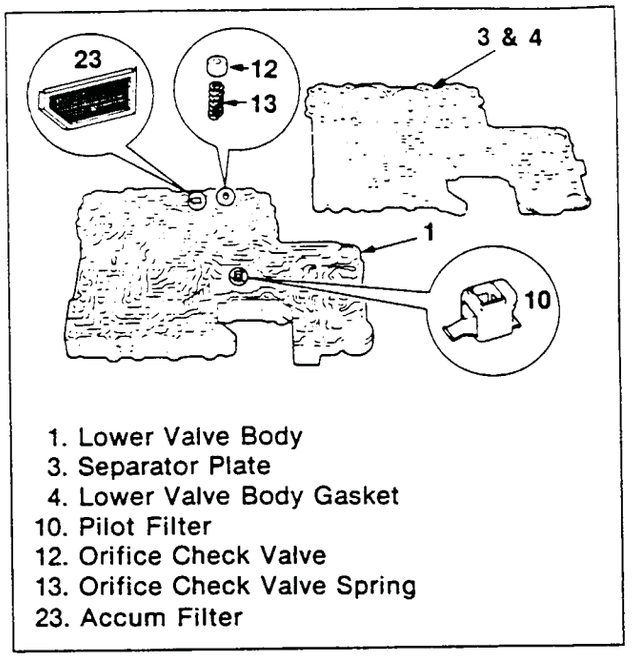


Figure 84. Upper and Lower Valve Body Removal

2. With the lower valve body facing down, remove the valve body gaskets and separator plate.
3. Remove the pilot filter, orifice check valve and orifice check valve spring (figure 85).

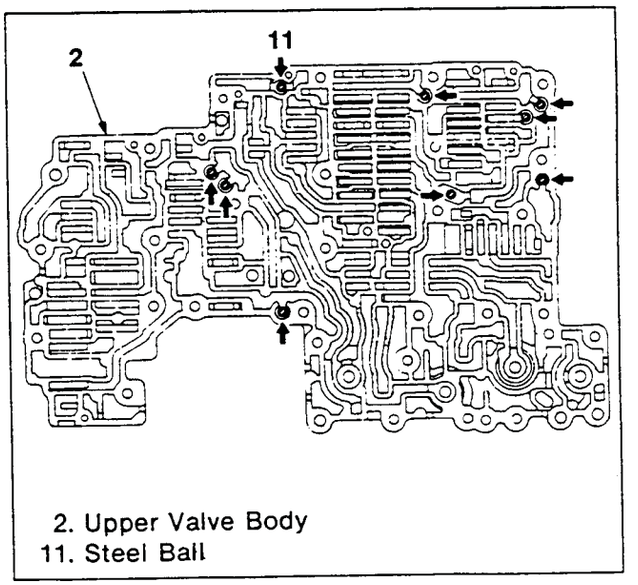
NOTICE: Do not lose or damage the pilot filter, orifice check valve and orifice check spring.



1. Lower Valve Body
3. Separator Plate
4. Lower Valve Body Gasket
10. Pilot Filter
12. Orifice Check Valve
13. Orifice Check Valve Spring
23. Accum Filter

Figure 85. Orifice and Pilot Filter Removal

Inspect



2. Upper Valve Body
11. Steel Ball

Figure 86. Steel Ball Location

Upper Valve Body (Figure 86)

1. Inspect the surfaces of the upper valve body where the steel balls (9 pcs) are contained, and then remove the balls.

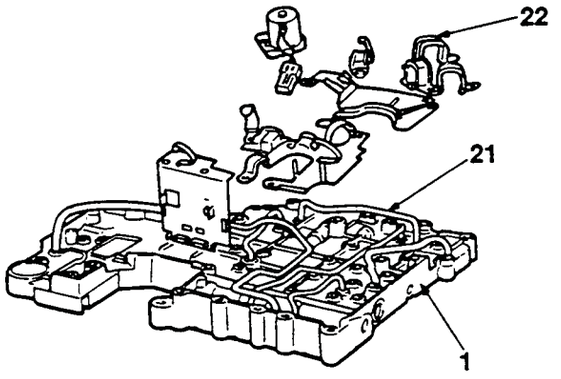
Important

- Do not lose any of the steel balls.

2. Inspect the hydraulic circuit for damage or foreign substances.

Lower Valve Body (Figure 87)

1. Inspect the hydraulic circuit for damage or foreign substances.
2. Inspect the connector tube and tube bracket for damage and deformation.

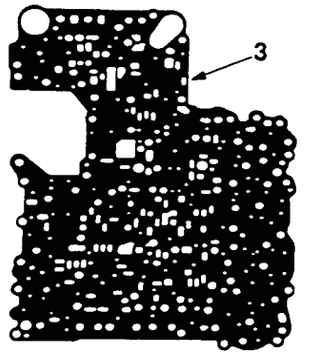


1. Lower Valve Body
21. Connector Tube
22. Tube Bracket

Figure 87. Lower Valve Body Inspection

Separator Plate (Figure 88)

1. Inspect the hydraulic circuit in the separator plate for damage and foreign substances.

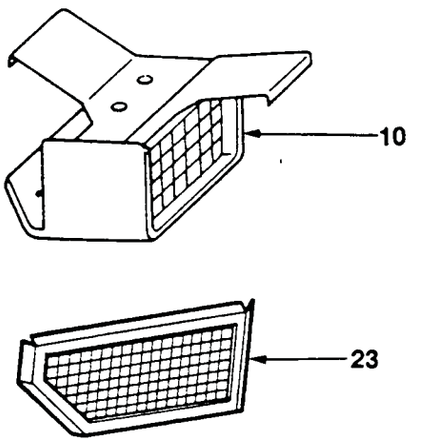


3. Separator

Figure 88. Separator Plate Inspection

Pilot Fiter, Accum Filer and Orifece (Figure 89)

1. Inspect the pilot filter and accum filter for damage and clogging.
2. Inspect the orifice check valve and orifice check valve spring for damage.



10. Pilot Filter
23. Accum Filter

Figure 89. Pilot Filter Inspection

Solenoid (Figures 90 and 91)

1. Check resistance across the lock-up solenoid and line pressure solenoid terminals using a circuit tester (figure 90).

Standard values

Item / Solenoid name	Terminals	Resistance (Ω)
Line pressure solenoid	No. 4 - Ground	2.5 – 5
Lock-up solenoid	No. 5 - Ground	10 – 20

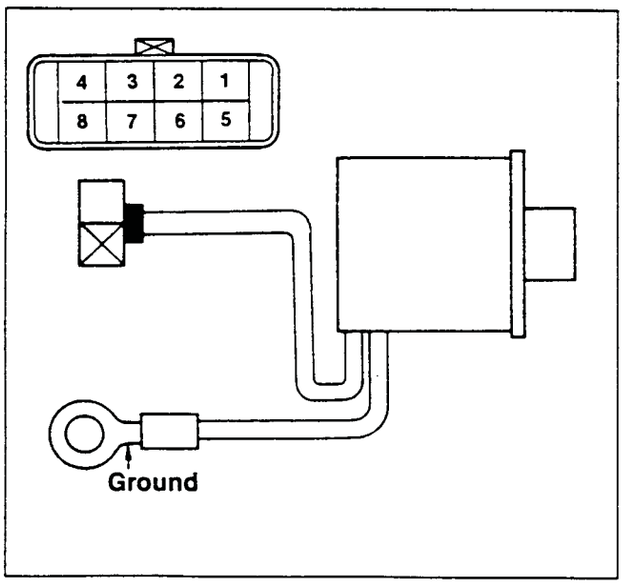


Figure 90. Lock-up Solenoid and Line Pressure Solenoid Resistance Check

2. Inspect O-rings for damage and filters for clogging.
3. Check resistance across the three combined solenoid (overrun clutch solenoid, shift solenoid A, B) terminals using a circuit tester (figure 91).

Standard values

Item / Solenoid name	Terminals	Resistance (Ω)
Shift solenoid A	No. 2 - Ground	20 – 40
Shift solenoid B	No. 1 - Ground	20 – 40
Overrun clutch Solenoid	No. 3 - Ground	20 – 40

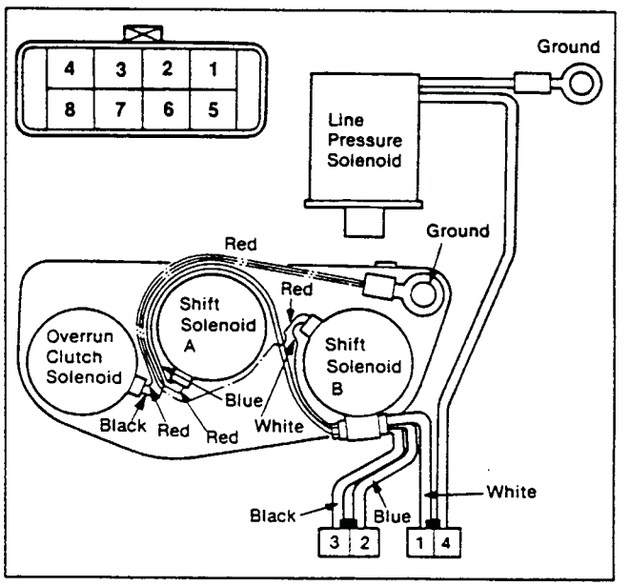


Figure 91. Three Combined Solenoid Resistance Check

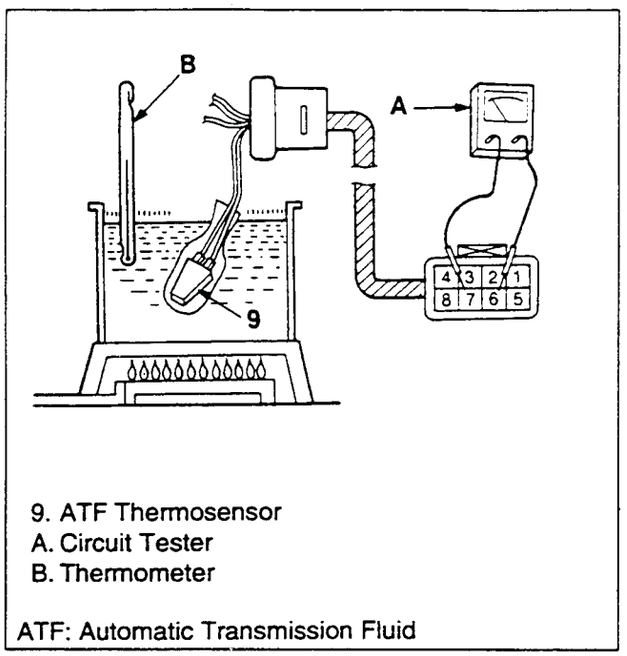
4. Inspect O-rings for damage and filters for clogging.

Automatic Transmission Fluid (ATF) Thermosensor (Figure 92)

Put the ATF thermosensor into the ATF and check resistance across terminals, as you change the oil temperature.

Standard values

Temperature (°C/°F)	Resistance (Ω)
20/68	2,500 approx.
80/176	300 approx.



9. ATF Thermosensor
A. Circuit Tester
B. Thermometer

ATF: Automatic Transmission Fluid

Figure 92. ATF Thermosensor Inspection

Assemble

Steel Balls

1. With the hydraulic circuit of the upper valve body facing up, assemble steel balls (9 pcs) in the positions shown.

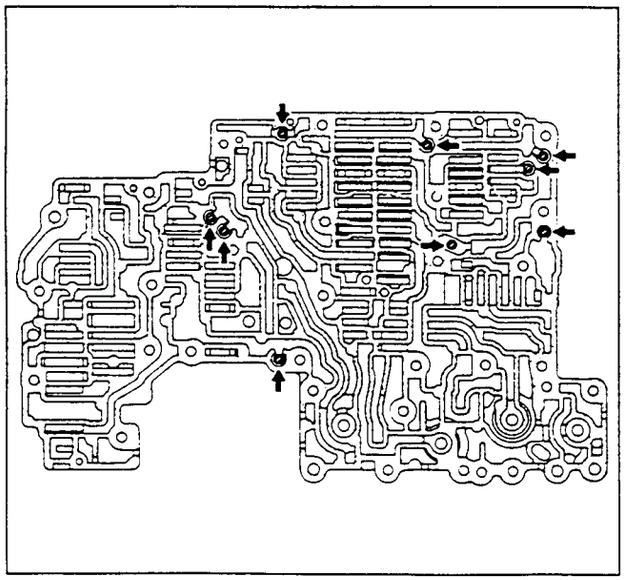


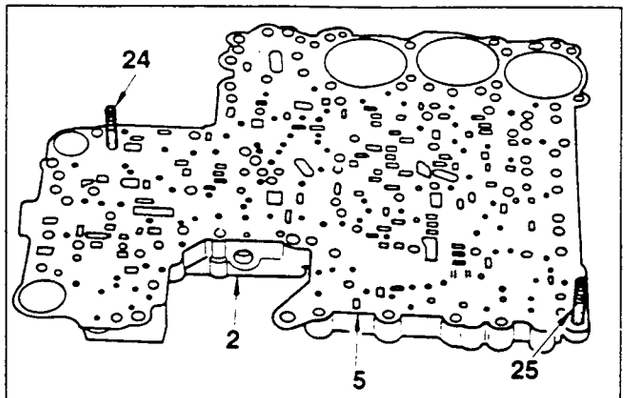
Figure 93. Steel Ball Contained Portion

Upper Valve Body Gasket (Figure 94)

1. Put locating bolts (2 pcs) through the upper valve body from below, and install the new upper valve body gasket along bolt holes.

Important

- Do not confuse the lower valve body gasket with the upper valve body gasket. Put locating bolts in correct positions.

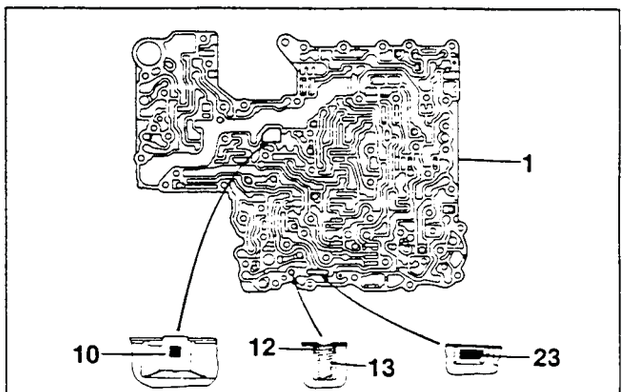


2. Upper Valve Body
5. Upper Valve Body Gasket
24. Locating Bolt (Long)
25. Locating Bolt (Short)

Figure 94. Upper Separate Gasket Installation

Lower Valve Body Gasket (Figures 95 and 96)

1. With the hydraulic circuit of the lower valve body facing up, install the orifice check valve spring, orifice check valve and the pilot filter.



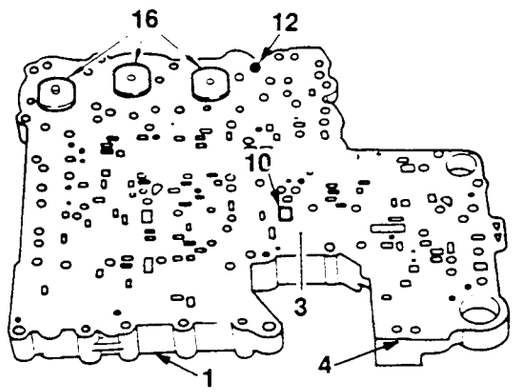
1. Lower Valve Body
10. Pilot Filter
12. Orifice Check Valve
13. Orifice Check Valve Spring
23. Accum Filter

Figure 95. Orifice and Filters Installation

2. Put the lower valve body gasket (new) and separator plate aligned with bolt holes, attach the support plates (3 pcs) and assemble them temporarily (figure 96).

Important

- Be sure that the orifice check valve is not positioned askew and that the spring is not deformed. Be sure that the pilot filter is installed correctly. When the support plates is installed with bolts, be sure that the tube bracket is also installed. Tighten bolts only temporarily so that the orifice check valve is not pushed out of position.



1. Lower Valve Body
3. Separator Plate
4. Lower Valve Body Gasket
10. Pilot Filter
12. Orifice
16. Support Plate

Figure 96. Lower Valve Body Installation

Lower and Upper Valve Body (Figure 97)

1. Install the lower and upper valve bodies aligning the bolt holes with each others, and fix them with the nuts for locating bolts X and Y.
2. Install bolts of the specified nominal length and the tube bracket.
3. Tighten bolts to the specified torque.

Tighten

- Valve body bolts 8 N·m (69 lb·in)

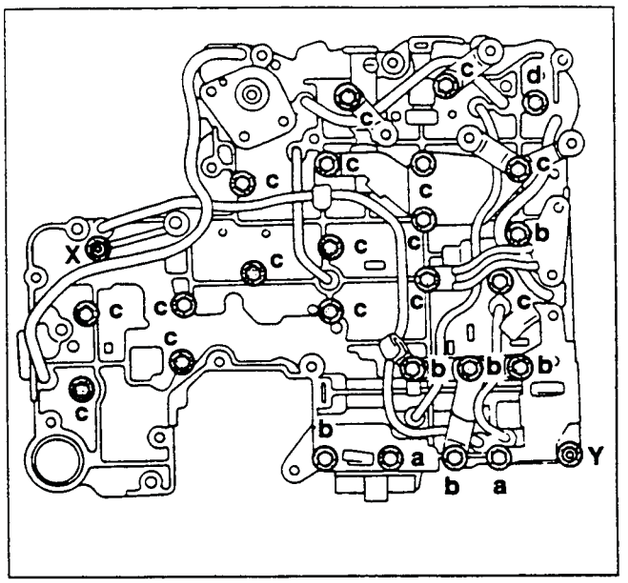


Figure 97. Bolt Tightening Location

Nominal length and quantity of valve body bolts

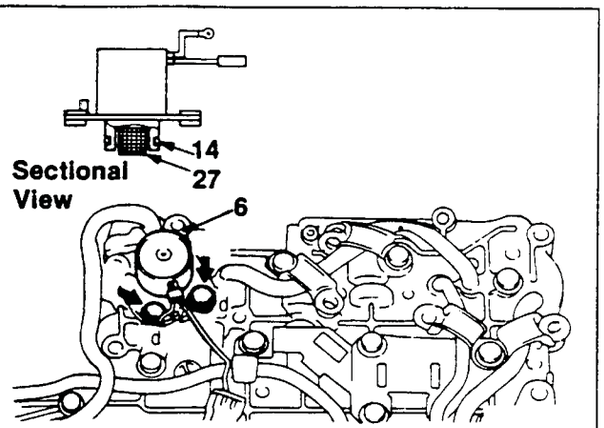
	Length (mm/in)	Quantity
a	70 / 2.8	2
b	50 / 2.0	6
c	33 / 1.3	16
d	27 / 1.1	1
X	55 / 2.2	1
Y	45 / 1.8	1

Lock-Up Solenoid (Figure 98)

Assemble the lock-up solenoid and side plate to the lower valve body, and tighten them to the specified tightening torque.

Tighten

- Lock-up solenoid 12 N·m (104 lb·in)



6. Lock-up Solenoid
14. O-Ring
27. Oil-Filter

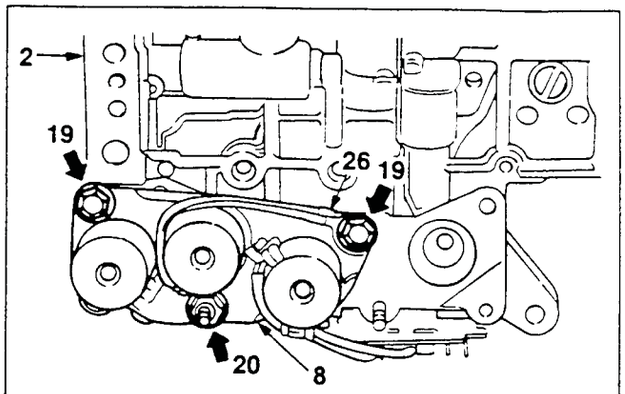
Figure 98. Lock-up Solenoid Installation

Three Combined Solenoids (Overrun Clutch Solenoid, Shift Solenoid A, B) (Figure 99)

1. Install the three combined solenoids to the upper valve body.
2. Attach the body grounding terminal at the position shown (figure 99), and tighten the bolt and nut at the specified torque.

Tighten

- Three Combined solenoids 8 N·m (69 lb·in)



2. Upper Valve Body
8. Three Combined Solenoid
19. Bolt
20. Nut
26. Body Grounding Terminal

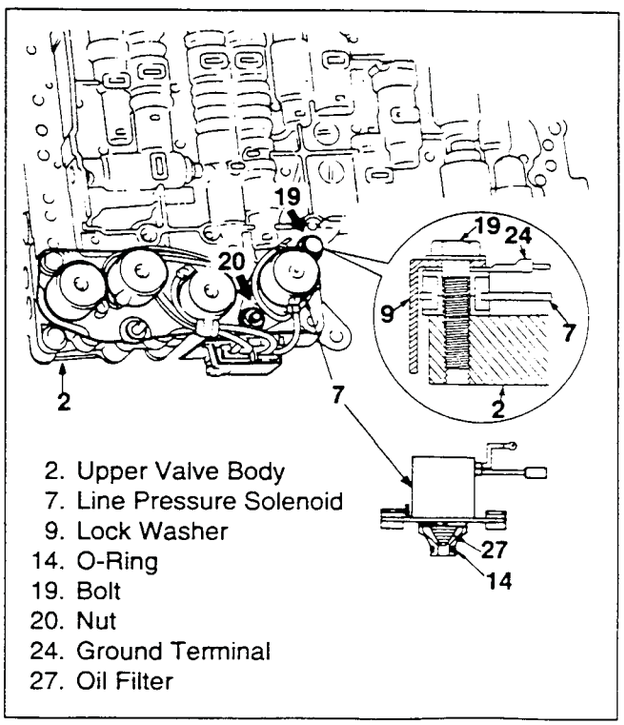
Figure 99. Three Combined Solenoid and Body Grounding Terminal Installation

Line Pressure Solenoid (Figure 100)

1. Install the line pressure solenoid on the upper valve body.
2. Attach the body grounding terminal and the lock washer at the position shown (figure 100) and tighten the bolt and nut at the specified torque.

Tighten

- Line pressure solenoid 8 N·m(69 lb·in)

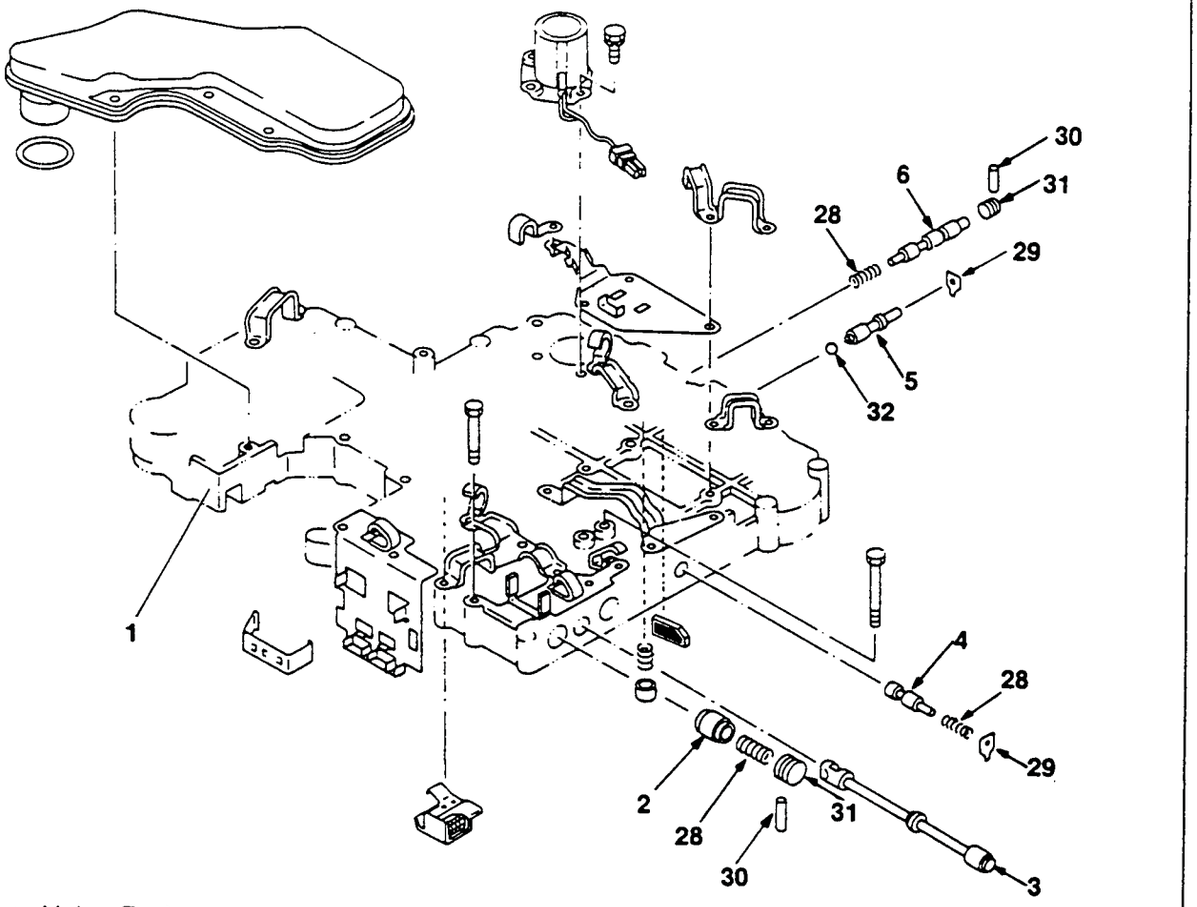


2. Upper Valve Body
7. Line Pressure Solenoid
9. Lock Washer
14. O-Ring
19. Bolt
20. Nut
24. Ground Terminal
27. Oil Filter

Figure 100. Line Pressure Solenoid Installation

CONTROL VALVE

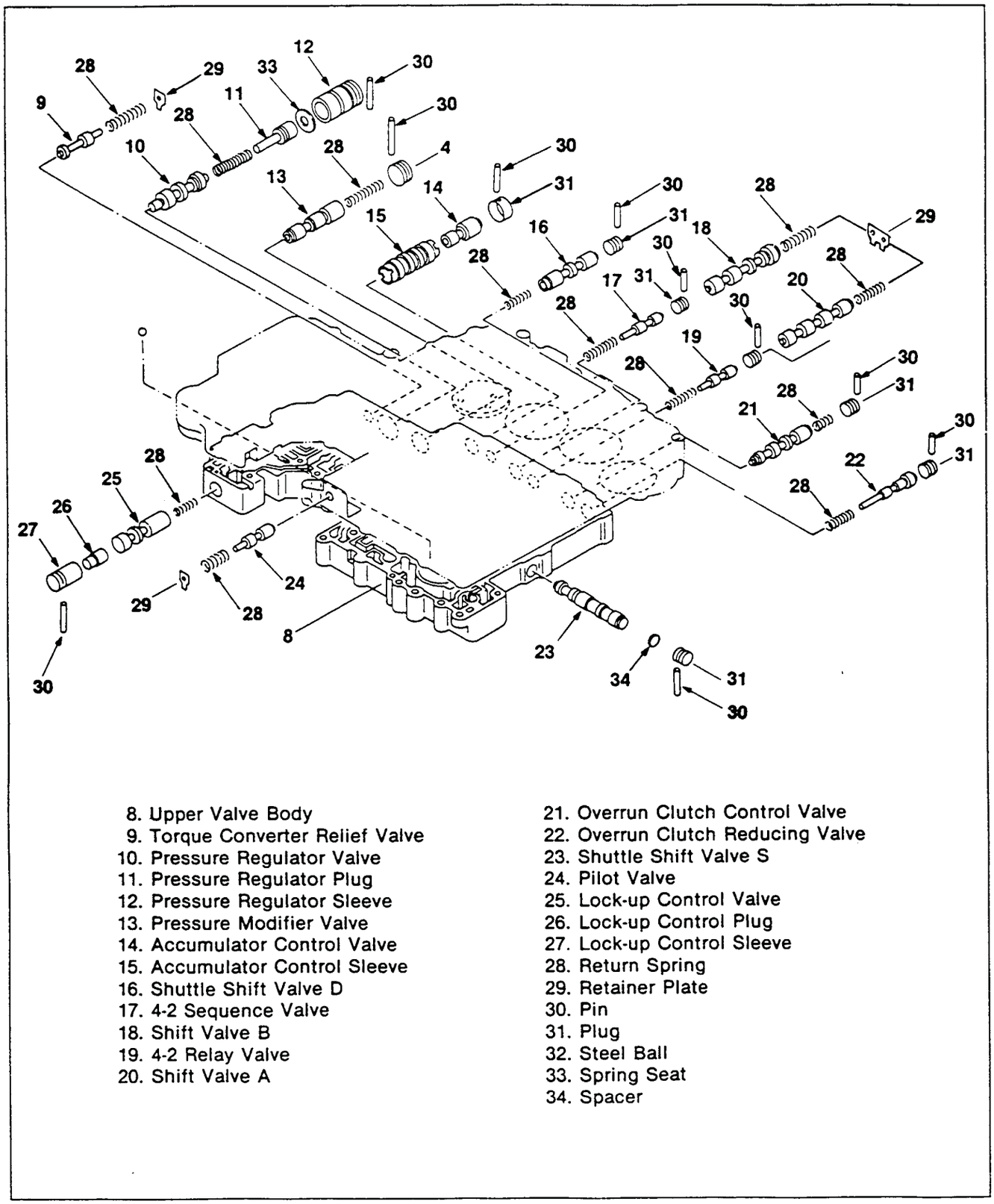
Lower Body



1. Lower Valve Body
2. Modifier Accumulator Valve
3. Manual Valve
4. 1st Reducing Valve
5. 3-2 Timing Valve
6. Servo Charger Valve
28. Return Spring
29. Retainer Plate
30. Pin
31. Plug
32. Steel Ball

Figure 101. Lower Body Assembly

Upper Body



8. Upper Valve Body
9. Torque Converter Relief Valve
10. Pressure Regulator Valve
11. Pressure Regulator Plug
12. Pressure Regulator Sleeve
13. Pressure Modifier Valve
14. Accumulator Control Valve
15. Accumulator Control Sleeve
16. Shuttle Shift Valve D
17. 4-2 Sequence Valve
18. Shift Valve B
19. 4-2 Relay Valve
20. Shift Valve A
21. Overrun Clutch Control Valve
22. Overrun Clutch Reducing Valve
23. Shuttle Shift Valve S
24. Pilot Valve
25. Lock-up Control Valve
26. Lock-up Control Plug
27. Lock-up Control Sleeve
28. Return Spring
29. Retainer Plate
30. Pin
31. Plug
32. Steel Ball
33. Spring Seat
34. Spacer

Figure 102. Upper Body Assembly

Disassemble

CAUTION:
The valve body assembly must be replaced in any of the following conditions.

- **The automatic transmission is heavily contaminated by metal and wear chips. Examples: Severely seized clutch, unusual wear or scoring of gears, bushings, etc.**
- **Stuck valve**

To check a valve function, operate the valve as assembled without separating it from the body. Operate the valve carefully so that you do not touch the valve edge (figure 103).

Important

- Only the accumulator control valve cannot be checked as assembled. It must be disassembled to check its function.

CAUTION:
If automatic transmission fluid (ATF) is dirty, the valve body needs to be cleaned in the following manner.

- **The spool valve may not be removed (but the accumulator control valve must be removed).**
- **Do not put parts in a cleaning machine. Place them in a clean solvent and clean them by hand.**
- **After cleaning, air dry to remove solvent from them.**
- **Pour ATF over the circuit so that the valve spool is lubricated.**
- **Check operation of each valve.**

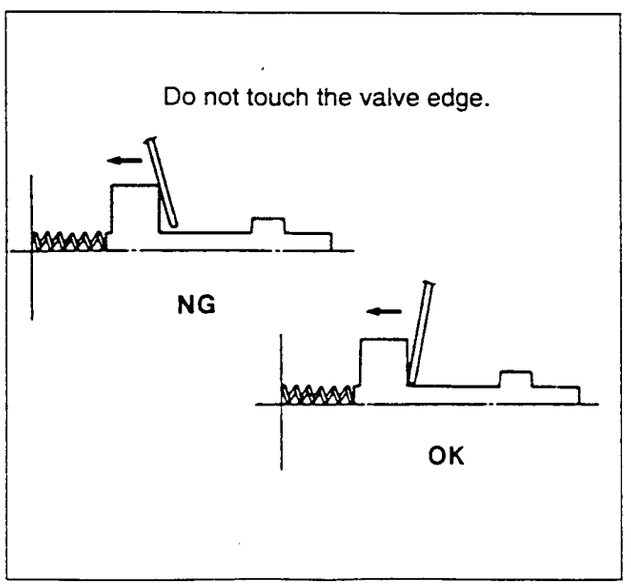


Figure 103. Valve Operation Check

Important

1. Do not reuse dropped parts.
2. Prior to installation, apply ATF to valves, valve holes, springs and plugs.
3. When installing, note the direction of valves, sleeves, and plugs.
4. If valves, sleeves, and plugs are in the normal condition, they should settle down to their original place while sliding in with their own weights.
5. Before installation, check valves, sleeves, plugs for burrs, dents and other abnormal conditions.

Control Valve Combined with Pin (Figures 104, 105, 106, 107 and 108)

1. Control valves are secured by 12 pins and 6 retainer plates (figure 104).
   Follow the steps listed below: for removal.

CAUTION: Do not a use magnet for holding parts, this will avoid parts from being magnetization.

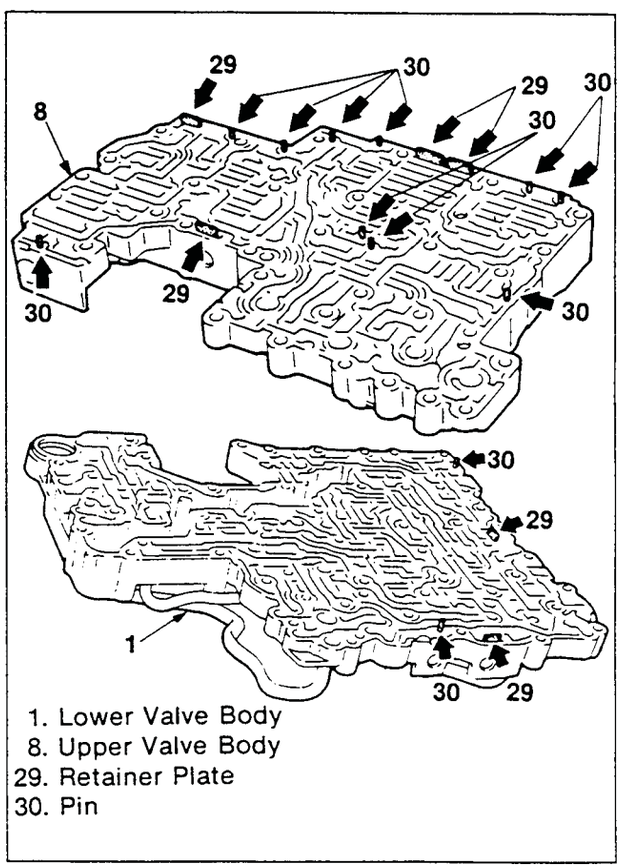
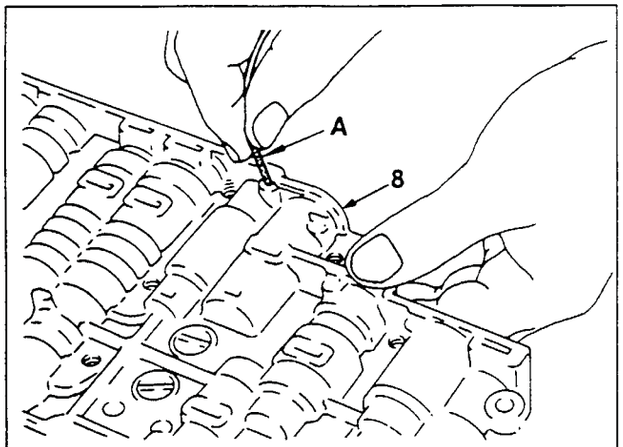


Figure 104. Retainer Plate and Pin Location



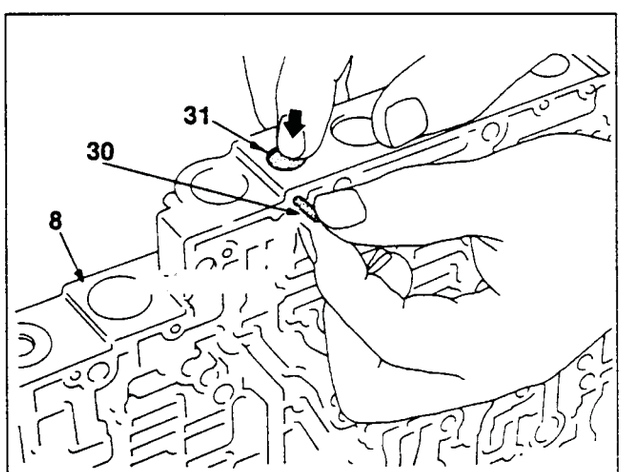
8. Upper Valve Body
A. Wire

Figure 105. Pin Removal (1)

2. Push pin out with some fine wire (figure 105).
3. Pull pin out while pushing plug and sleeve with fingers (figure 106).

Important

- Remove the plug gently to avoid the inside parts from jumping out.



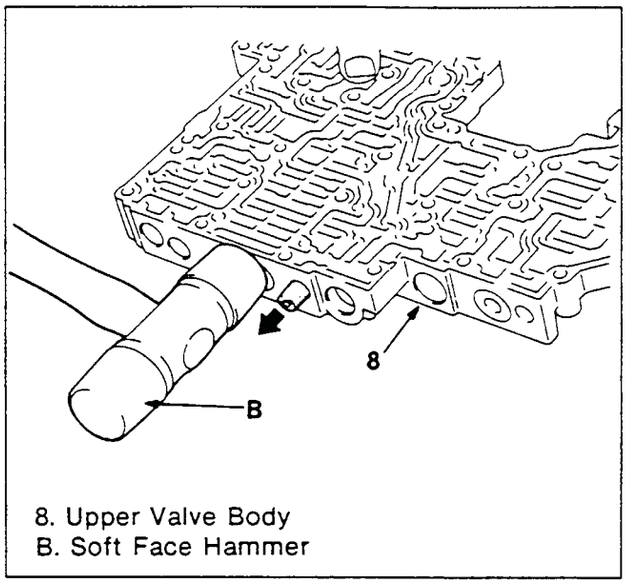
8. Upper Valve Body
30. Pin
31. Plug

Figure 106. Pin Removal (2)

4. With valve located hole facing down, remove the inside parts.
   If valve cannot be removed easily, hold the valve hole facing down and tap around the valve body side slightly with soft face hammer (figure 107).

Important

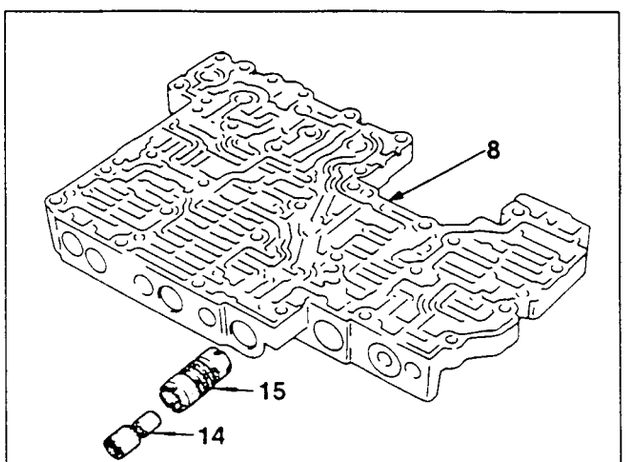
- Do not damage the inside parts by dropping them down.



8. Upper Valve Body
B. Soft Face Hammer

Figure 107. Upper Valve Body Inside Part Removal (1)

5. When removing the lock-up control valve and accumulator control valve. pull out the plug and sleeve as a unit, then separate them (figure 108).

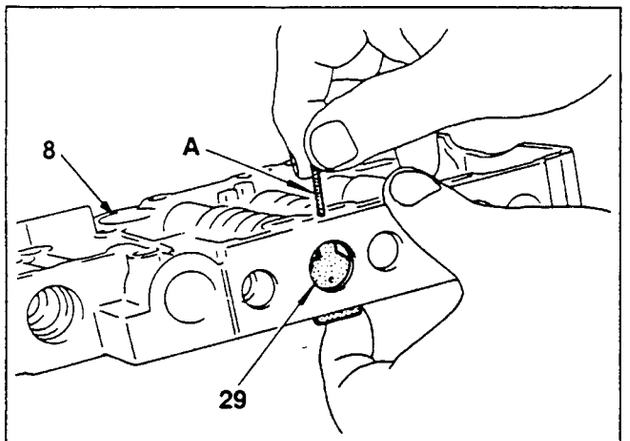


8. Upper Valve Body
14. Accumulator Control Valve
15. Accumulator Control Sleeve

Figure 108. Upper Valve Body Inside Part Removal (2)

Control Valve Combined with Retainer Plate (Figures 109, 110 and 111)

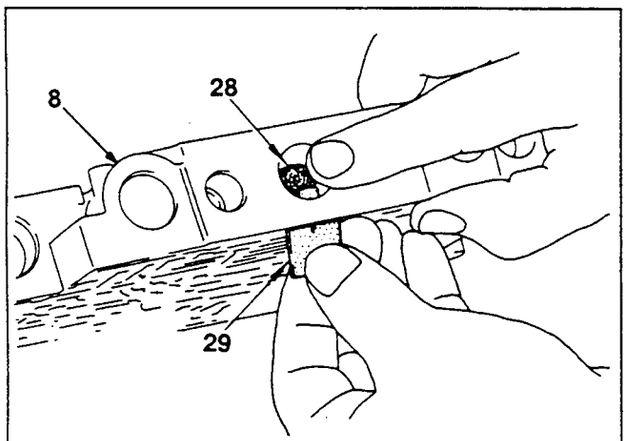
1. Push retainer plate out with some fine wire (figure 109).



8. Upper Valve Body
29. Retainer Plate
A. Wire

Figure 109. Retainer Plate Removal (1)

2. Remove retainer plate (total 4 pcs) while holding the inside parts with your fingers to prevent parts from popping out (figure 110).



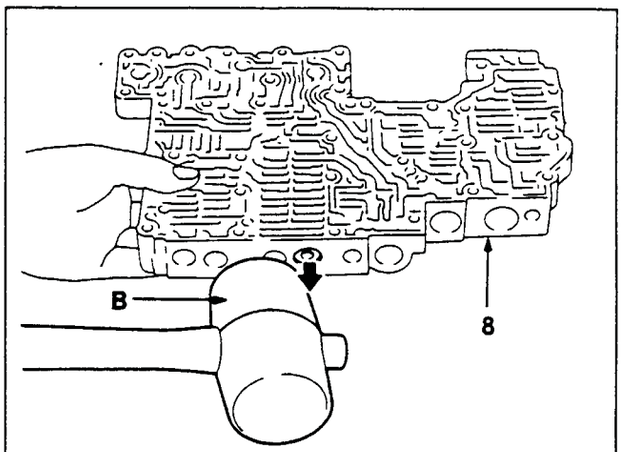
8. Upper Valve Body
28. Return Spring
29. Retainer Plate

Figure 110. Retainer Plate Removal (2)

3. With the valve locating hole facing down, remove the inside parts. If valve cannot be removed easily, hold the valve hole facing down and tap around the valve body side slightly with a soft face hammer (figure 111).

Important

- Do not damage the inside parts by dropping them down.



8. Upper Valve Body
B. Soft Face Hammer

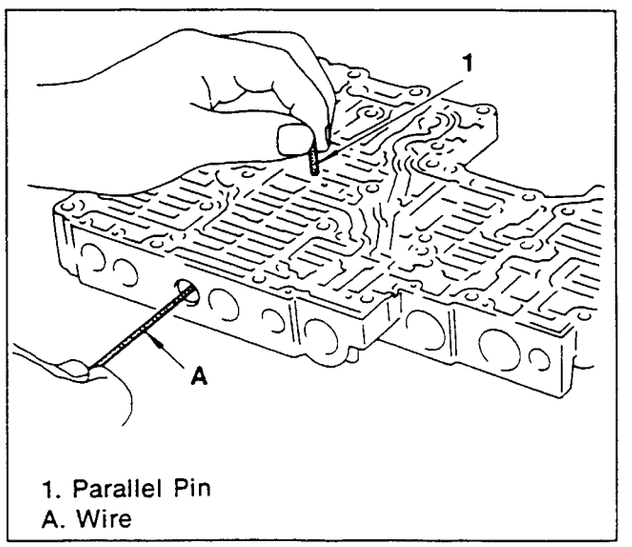
Figure 111. Upper Valve Body Inside Parts Removal

4-2 Sequence Valve and 4-2 Relay Valve (Figure 112)

The 4-2 sequence valve and the 4-2 relay valve are set up in the upper valve body mid-area and if they cannot be removed easily, push them out gently with some fine wire.

Important

- Do not scratch valve sliding surface with wire.



1. Parallel Pin
A. Wire

Figure 112. 4-2 Sequence Valve and 4-2 Relay Valve Removal

Valve Spring Dimension

Check the spring dimensions (figure 113). If damage, deformation and other abnormal conditions are detected, replace the spring.

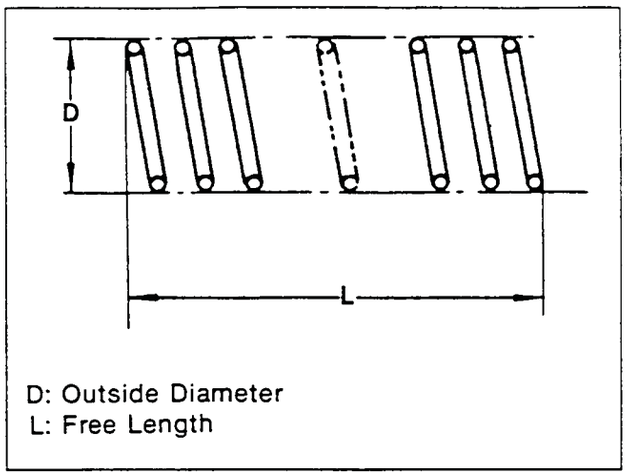
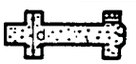
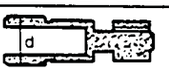
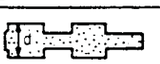
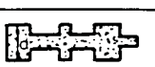


Figure 113. Spring Dimension

Parts Name / Standard Dimension		Free Length (L) (mm/in)	Outside Diameter (D) (mm /in)
2	Modifier Accumulator Valve Spring	29.5–31.5 / 1.16–1.24	9.8 / 0.386
4	1st Reducing Valve Spring	26.0–28.0 / 1.02–1.10	6.8 / 0.268
6	Servo Charger Valve Spring	32.0–34.0 / 1.26–1.34	6.5 / 0.256
9	Torque Converter Relief Valve Spring	37.0–39.0 / 1.46–1.54	9.0 / 0.354
10	Pressure Regulator Valve Spring	30.5–32.5 / 1.20–1.28	13.5 / 0.531
13	Pressure Modifier Valve Spring	30.9–32.9 / 1.22–1.30	6.8 / 0.268
16	Shuttle Shift Valve D Spring	25.5–27.5 / 1.00–1.08	6.0 / 0.236
17	4-2 Sequence Valve Spring	28.1–30.1 / 1.11–1.19	6.95 / 0.274
18	Shift Valve B Spring	24.0–26.0 / 0.94–1.02	7.0 / 0.276
19	4-2 Relay Valve Spring	28.1–30.1 / 1.11–1.19	6.95 / 0.274
20	Shift Valve A Spring	24.0–26.0 / 0.94–1.02	7.0 / 0.276
21	Overrun Clutch Control Valve Spring	22.6–24.6 / 0.89–0.97	7.0 / 0.276
22	Overrun Clutch Reducing Valve Spring	31.7–33.7 / 1.25–1.33	7.1 / 0.280
24	Pilot Valve Spring	24.7–26.7 / 0.97–1.05	9.1 / 0.358
25	Lock-up Control Valve Spring	17.5–19.5 / 0.69–0.77	13.0 / 0.512

Control Valve Dimension

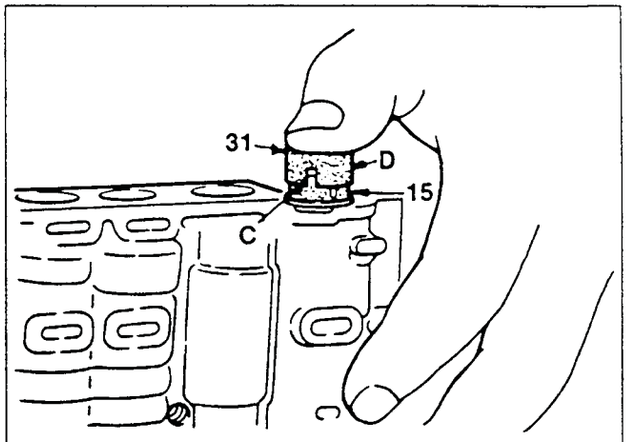
Inspect the sliding surface of control valves, sleeves and plugs.
If any damage is found, replace it.

Parts Name / Standard Dimension		Outside Diameter (d) (mm/in)	Lenght (mm/in)	Figure
2	Modifier Accumulator Valve	14.0 / 0.55	19.5 / 0.77	
4	1st Reducing Valve	8.0 / 0.31	37.5 / 1.48	
5	3-2 Timing Valve	8.0 / 0.31	37.5 / 1.48	
6	Servo Charger Valve	8.0 / 0.31	66.0 / 2.60	
9	Torque Converter Relief Valve	10.0 / 0.39	37.5 / 1.48	
10	Pressure Regulator Valve	15.0 / 0.59	53.0 / 2.09	
13	Pressure Modifier Valve	14.0 / 0.55	43.5 / 1.71	
14	Accumulator Control Valve	12.0 / 0.47	31.5 / 1.24	
15	Shuttle Shift Valve D	10.0 / 0.39	48.0 / 1.89	
17	4-2 Sequence Valve	8.0 / 0.31	38.5 / 1.52	
18	Shift Valve B	12.0 / 0.47	68.5 / 2.70	
19	4-2 Relay Valve	8.0 / 0.31	38.5 / 1.52	
20	Shift Valve A	12.0 / 0.47	75.0 / 2.95	
21	Overrun Clutch Control Valve	12.0 / 0.47	63.5 / 2.50	
22	Overrun Clutch Reducing Valve	13.0 / 0.51	55.5 / 2.19	
24	Pilot Valve	10.0 / 0.39	38.5 / 1.52	
25	Lock-up Control Valve	14.3 / 0.56	49.5 / 1.95	

Assemble

To install, follow the removal step in the reverse order, noting the following points.

1. In case of install of accumulator control valve, apply automatic transmission fluid (ATF) on the valve and install it in the sleeve.
2. Apply ATF on the sleeve assembly and install it in the body.
3. Install the spring.
4. Install the plug in such a way that the projection on the sleeve fits in the slit in the plug (figure 114).
5. Install the pin into the retaining plug.



15. Accumulator Control Sleeve
31. Plug
C. Slit
D. Pin Groove

Figure 114. Valve Body Valve Installation

Diagnosis

PROBLEM	VEHICLE CONDITION	POSSIBLE CAUSE
Shift shock	Always	Pressure regulator valve, pilot valve, pressure modifier valve
	At up-shifting (especially from 1 to 2)	Accumulator control valve and servo charger valve, in addition to three valves above
	At down-shifting from 3 to 2	3 → 2 timing valve in addition to 3 common valves
	At down-shifting from 4 to 2	4 → 2 sequence valve and 4 → 2 relay valve in addition to 3 common valves
	At coasting (especially from 2 to 1 in L Range)	1st reducing valve and overrun clutch reducing valve in addition to 3 common valves
No up-shifting	Always	Shift valve A, Shift valve B, shuttle shift valve S
Slippage	Always	Pressure regulator valve, pilot valve, pressure modifier valve, accumulator cotrol valve
Engine starting	When driving in D range	Shuttle shift valve D, lock-up control valve

Important

- Other valves which are not mentioned above must be checked for operation also.

CLUTCH ASSEMBLY AND LOW AND REVERSE BRAKE

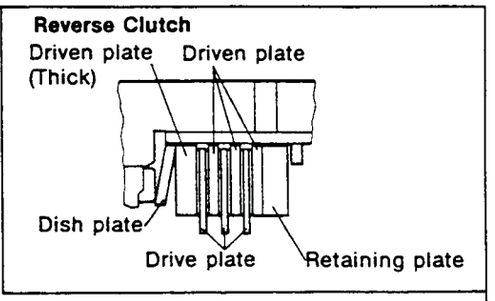
THE SPECIFICATION OF CLUTCH AND BRAKE

Plate and spring numbers for each clutch and brake.

Part Name	Clutch (Brake)				
	Reverse	High	Forward	Over-run	Low & reverse
Dish plate	1	—	1	1	1
Drive plate	3	7	8	5	8
Driven plate	3	7	10	5	8
Retaining plate	1	1	1	1	1
Return spring	16	16	20 (Common)		16

REVERSE CLUTCH

1. Reverse Clutch Drum
2. Clutch Piston
3. D-Ring
4. Lip Seal
5. Spring Retainer
6. Snap Ring
7. Return Spring
8. Dish Plate
9. Driven Plate
10. Drive Plate
11. Retaining Plate
12. Snap Ring



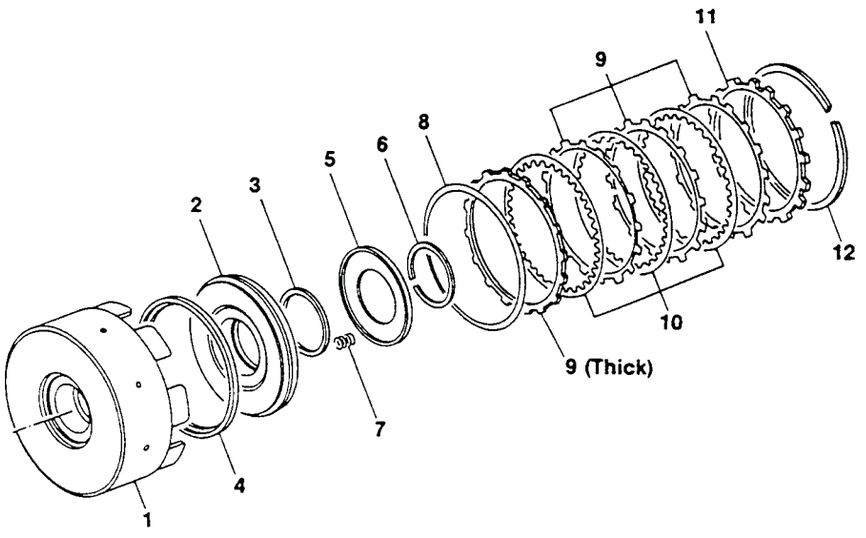
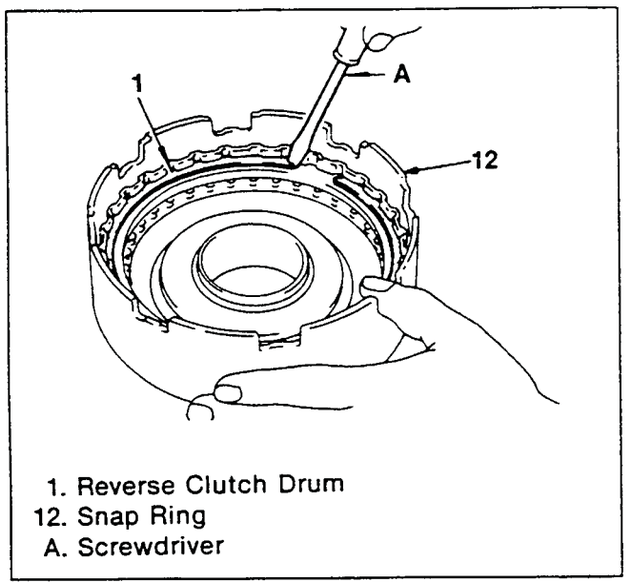


Figure 115. Reverse Clutch Assembly

Disassemble

Clutch Plate (Figure 116)

1. Remove the snap ring with a flat-end screwdriver.
2. Remove the retaining plates, drive plates, driven plates and dish plate.

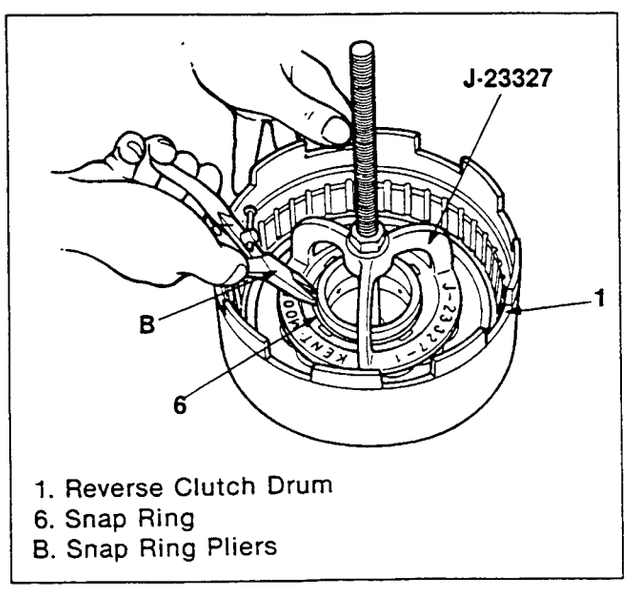


1. Reverse Clutch Drum
12. Snap Ring
A. Screwdriver

Figure 116. Clutch Plate Removal

Return Spring (Figure 117)

1. Remove the snap ring from the clutch drum using a spring compressor (special tool). Spring Compressor: J-23327
2. Remove the spring compressor, spring retainer and return springs.



1. Reverse Clutch Drum
6. Snap Ring
B. Snap Ring Pliers

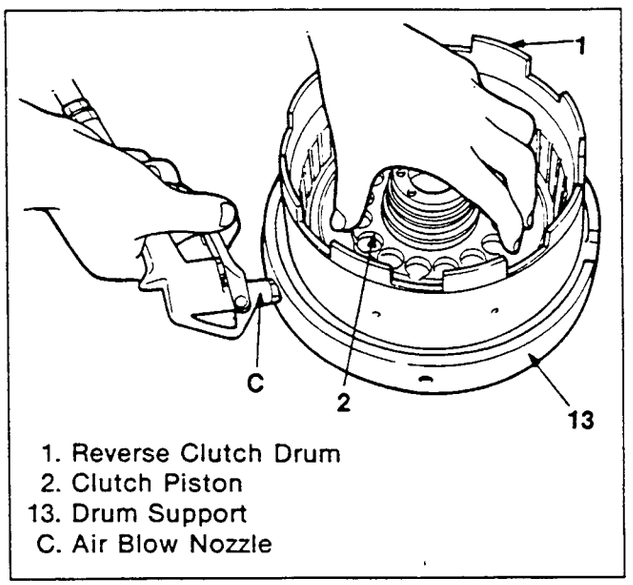
Figure 117. Return Spring Removal

Piston (Figure 118)

1. Attach the reverse clutch drum to the drum support and, while depressing the piston by hand. blow compressed air to the oil hole a little at a time to remove the piston.

Important

- The piston will not come out if it is slanted. Direct only a small amount of air at a time and support the piston by hand so that it is not slanted.

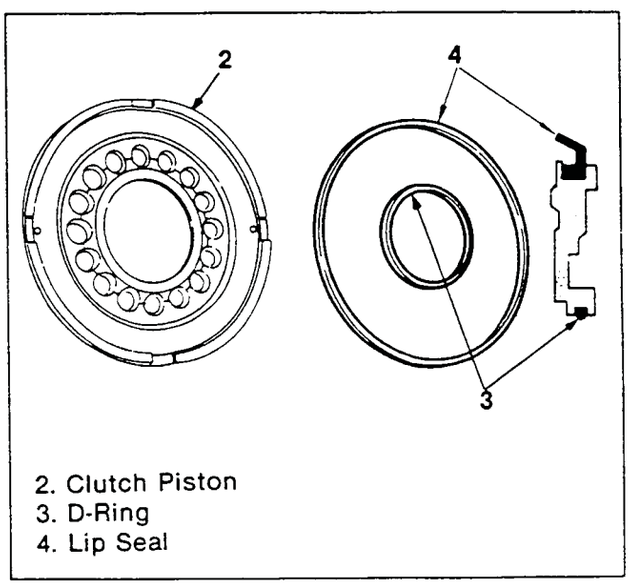


1. Reverse Clutch Drum
2. Clutch Piston
13. Drum Support
C. Air Blow Nozzle

Figure 118. Clutch Piston Removal

D-Ring and Lip Seal (Figure 119)

1. Remove the D-ring and lip seal from the piston.



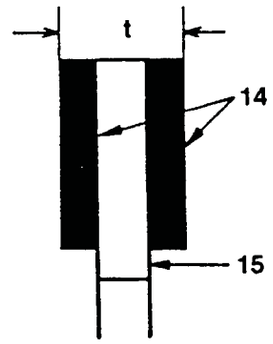
2. Clutch Piston
3. D-Ring
4. Lip Seal

Figure 119. D-Ring and Lip Seal Removal

Inspect

1. If one of the plates are burned, all plates should be replaced. If they are not burned, measure the thickness of each Drive Plate.
   If any one of the plates is out of specification, all plates must be replaced (figure 120).

   Thickness
   Standard: 2.0 mm (0.078 in)
   Limit : 1.92 mm (0.076 in)
   • Any burnt part must be replaced.



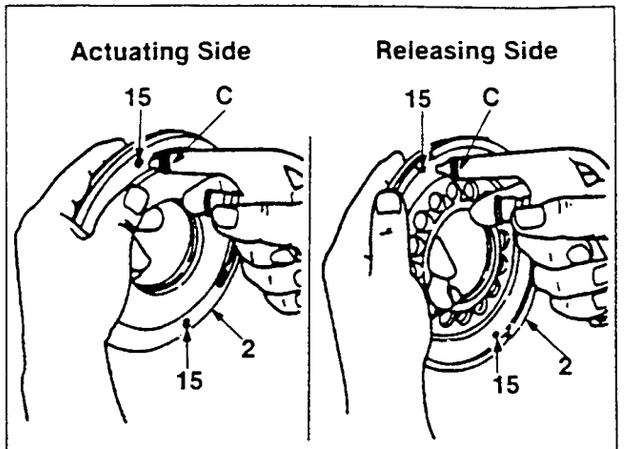
14. Facing
15. Core Plate
t. Thickness

Figure 120. Drive Plate Facing Check

2. Inspect the snap ring, return springs and spring retainer for damage, deformation and fatigue. Replace them as necessary.

   Return spring free length
   36.2 – 38.2 mm (1.43 – 1.50 in)

3. Check the piston check ball function.
   • Blow 294 – 392 kPa (42 – 56 psi) air to the check ball from both the actuating and releasing sides and check movement with finger (figure 121).
   Actuating side: Must be sealed completely without air leakage.
   Releasing side: Air must penetrate freely.



2. Clutch Piston
15. Check Ball
C. Air Blow Nozzle

Figure 121. Check Ball Function Inspection

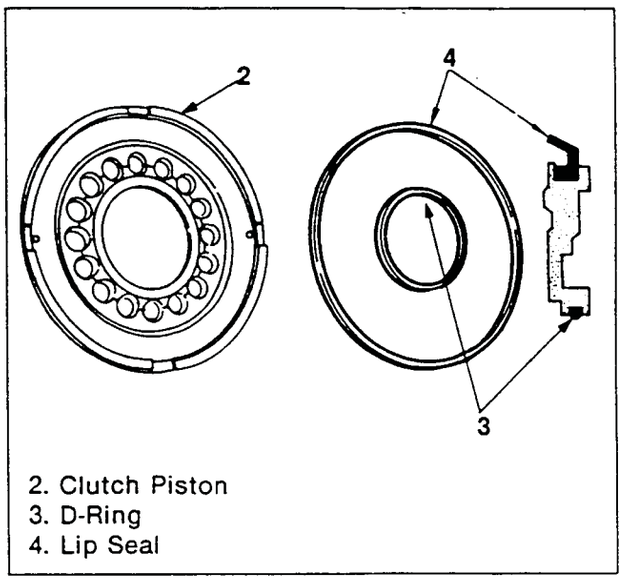
Assemble

D-Ring and Lip Seal (Figure 122)

1. Apply automatic transmission fluid on the new D-ring and new lip seal, and assemble them to the piston.

Important

• Place the lip seal in the correct direction (figure 122).



2. Clutch Piston
3. D-Ring
4. Lip Seal

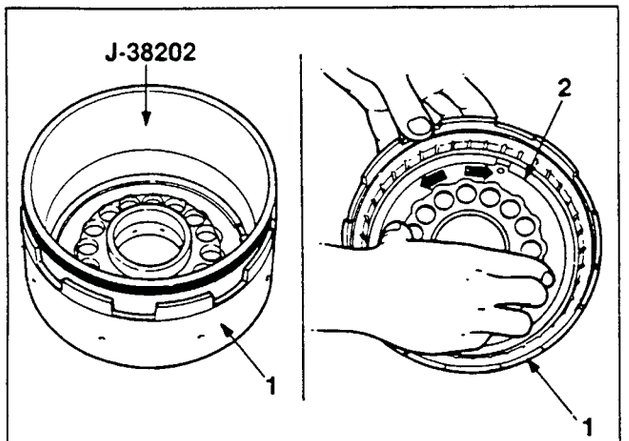
Figure 122. D-Ring and Lip Seal Installation

Piston (Figure 123)

1. Apply automatic transmission fluid inside the drum and on the D-ring and lip seal. Assemble the piston on the drum using a piston installing guide (special tool).
   Reverse Clutch Piston Guide: J-38202
2. Insert the piston while turning it by hand. After it is put in place, check if it can be turned smoothly by hand (figure 123).

Important

- The piston will not move smoothly when turned by hand if the lip seal is rolled up. Install a new lip seal and test again.

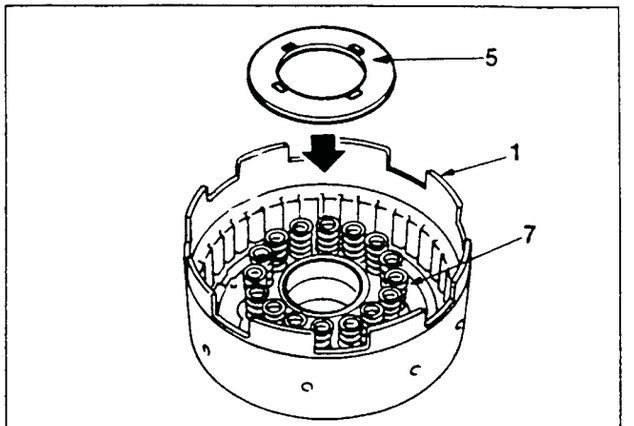


1. Reverse Clutch Drum
2. Clutch Piston

Figure 123. Clutch Piston Installation

Return Spring (Figures 124 and 125)

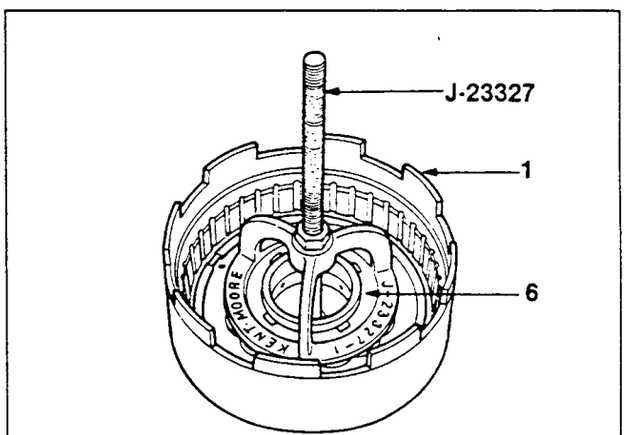
1. Install the return springs and spring retainer (figure 124).



1. Reverse Clutch Drum
5. Spring Retainer
7. Return Spring

Figure 124. Return Spring Installation (1)

2. While compressing the return spring using special tool against spring retainer, install the snap ring with snap ring plier(figure 125).
   Spring Compressor: J-23327
3. Using a flat-end screwdriver, check if the snap ring is accurately installed in the groove in the drum.

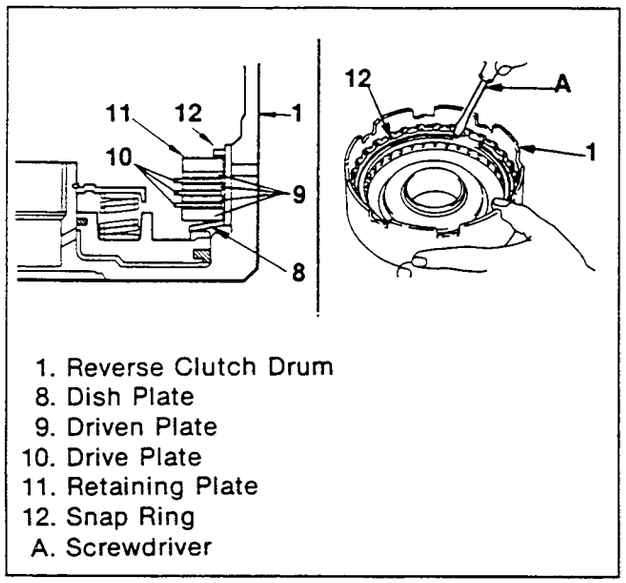


1. Reverse Clutch Drum
6. Snap Ring

Figure 125. Return Spring Installation (2)

Clutch Plate (Figure 126)

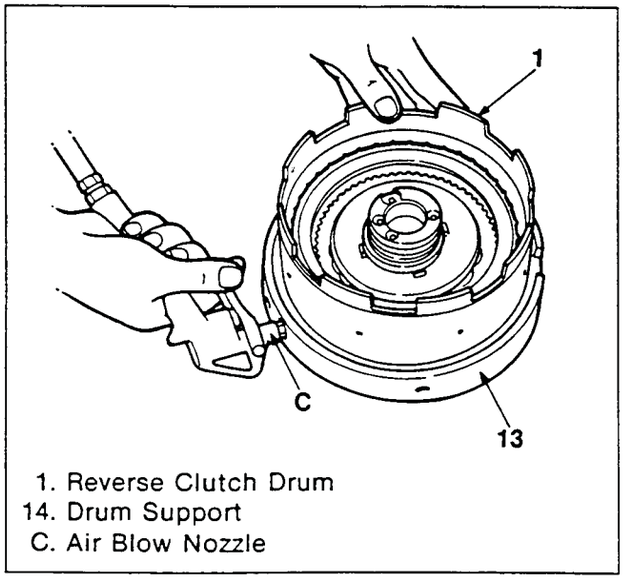
1. Install the dish plate, driven plates, drive plates and retaining plates.
2. Install the snap ring.



1. Reverse Clutch Drum
8. Dish Plate
9. Driven Plate
10. Drive Plate
11. Retaining Plate
12. Snap Ring
A. Screwdriver

Figure 126. Clutch Plate Installation

3. After the clutch is assembled, install it in the drum support and blow air 294 – 392 kPa (42 – 56 psi) into the circuit hole to check the piston operation. (figure 127)
4. If the piston fails to operate or its stroke is not enough, remove the piston and correct.



1. Reverse Clutch Drum
14. Drum Support
C. Air Blow Nozzle

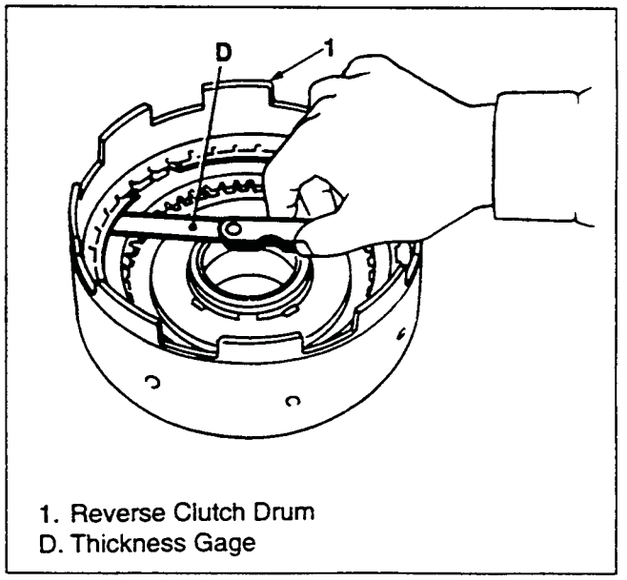
Figure 127. Reverse Clutch Operation Inspection

5. After operation check, measure the clearance from the retaining plate to the snap ring using a thickness gage. (figure 128)
6. If the clearance is beyond the limit, replace the drive plates, driven plates and dish plate, and choose the right retaining plate from the list below.
7. If the clearance is within the limit, choose the right retaining plate from the list to make the standard clearance.

Clearance

Standard: 0.5 – 0.8 mm (0.020 – 0.031 in)
Limit : 1.00 mm (0.039 in)

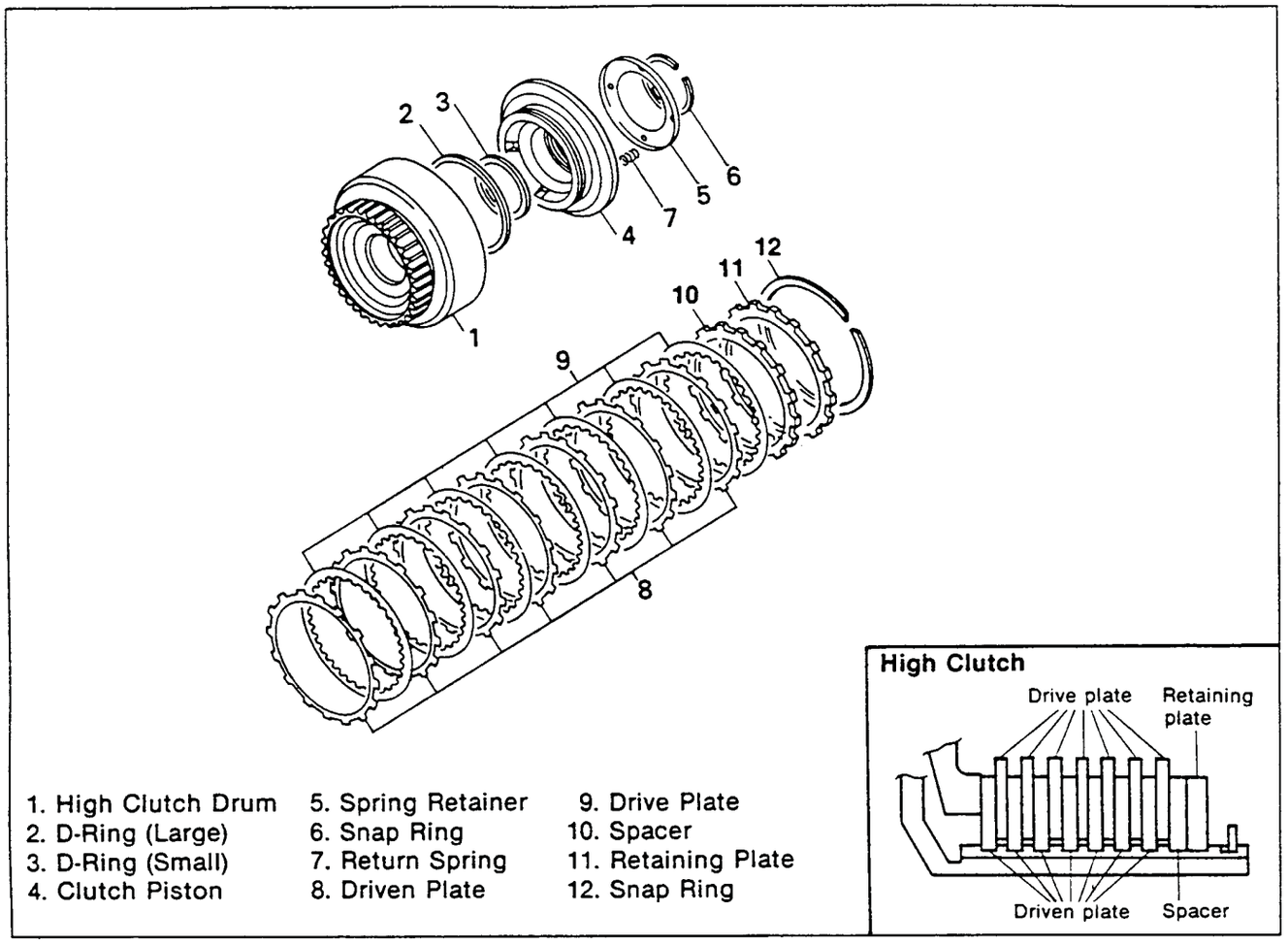
Thickness of Retainer Plate (mm / in)
4.4 / 0.173
4.6 / 0.181
4.8 / 0.189
5.0 / 0.197
5.2 / 0.205
5.4 / 0.213



1. Reverse Clutch Drum
D. Thickness Gage

Figure 128. Clearance Check

HIGH CLUTCH



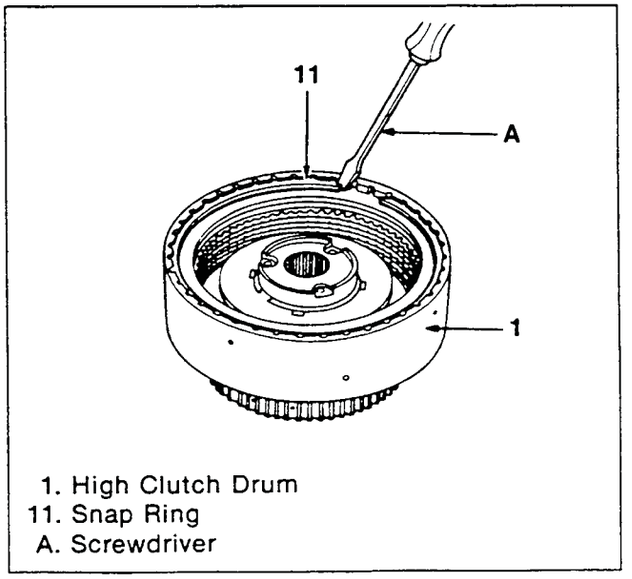
1. High Clutch Drum
2. D-Ring (Large)
3. D-Ring (Small)
4. Clutch Piston
5. Spring Retainer
6. Snap Ring
7. Return Spring
8. Driven Plate
9. Drive Plate
10. Spacer
11. Retaining Plate
12. Snap Ring

Figure 129. High Clutch Assembly

Disassemble

Clutch Plates (Figure 130)

1. Remove the snap ring with a flat blade screwdriver.
2. Remove the retaining plate, drive plates and driven plates.

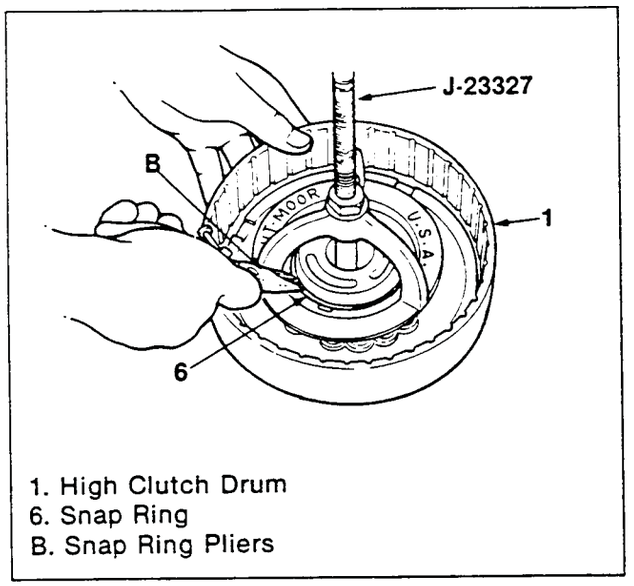


1. High Clutch Drum
11. Snap Ring
A. Screwdriver

Figure 130. Clutch Plate Removal

Return Spring (Figure 131)

1. Remove the snap ring of the spring retainer using a spring compressor (special tool). Spring Compressor: J-23327
2. Remove the spring compressor off and remove the spring retainer and the return springs.



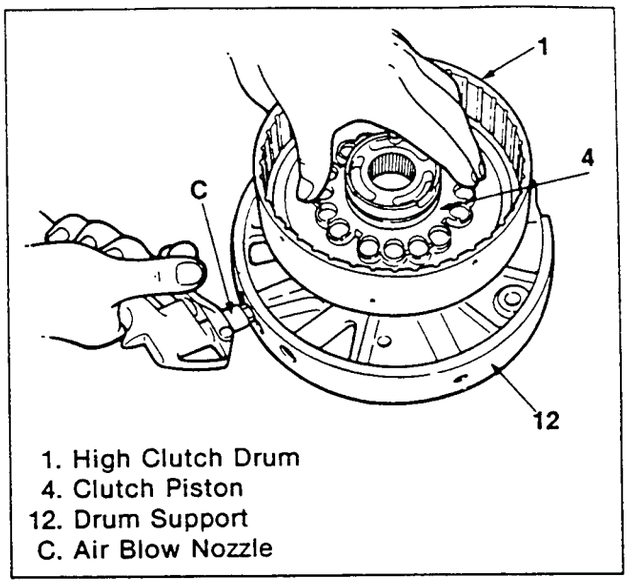
1. High Clutch Drum
6. Snap Ring
B. Snap Ring Pliers

Figure 131. Return Spring Removal

Piston (Figure 132)

Put the reverse clutch drum and the drum support together, blow air little by little into the oil hole, holding the piston with your hand, and remove the piston.

CAUTION: The piston cannot be removed if it is in a slanted position, so put your hand on the piston to prevent it from tilting.

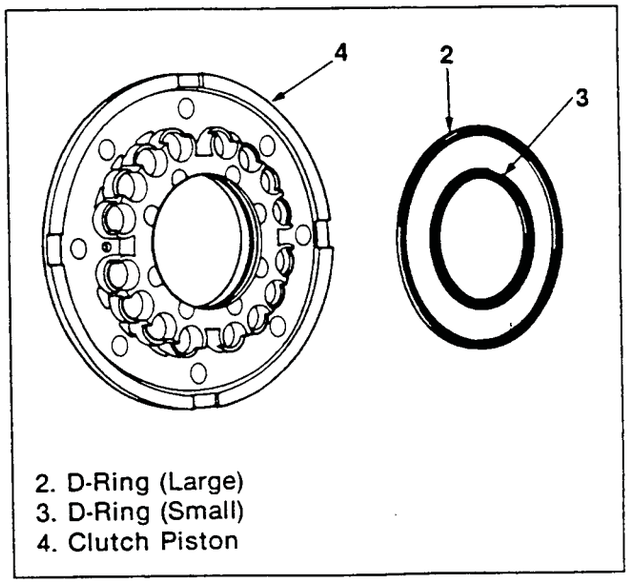


1. High Clutch Drum
4. Clutch Piston
12. Drum Support
C. Air Blow Nozzle

Figure 132. Clutch Piston Removal

D-Ring (Figure 133)

Remove two D-rings from the piston.



2. D-Ring (Large)
3. D-Ring (Small)
4. Clutch Piston

Figure 133. D-Ring Removal

Inspect (Figures 134 and 135)

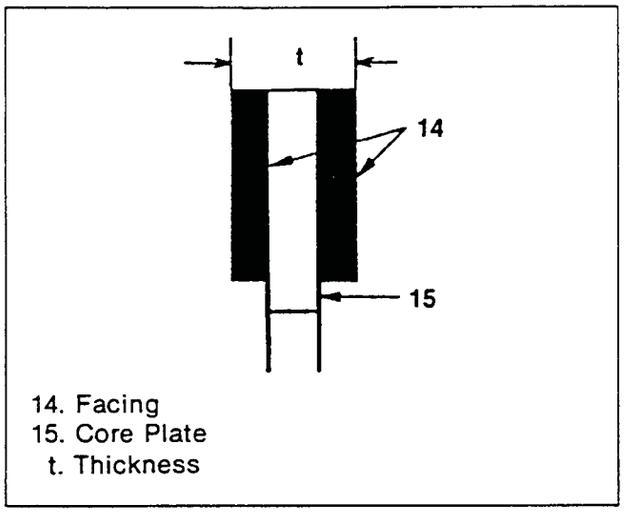
1. If one of the plates are burned, all plates should be replaced. If they are not burned, measure the thickness of each Drive Plate. If any one of the plates is out of specification, all plates must be replaced (figure 134).

Thickness

Standard: 1.6 mm (0.063 in)
Limit : 1.52 mm (0.060 in)

- Any burnt parts must be replaced.

2. Replace any damaged, distorted or weak snap ring, return springs or spring retainers.



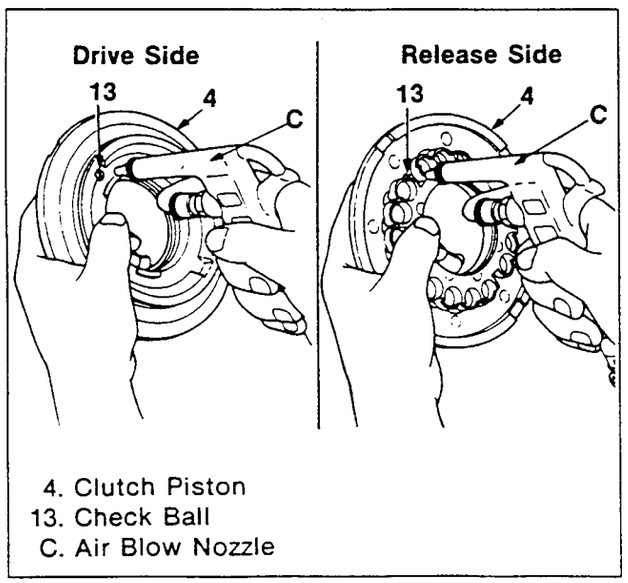
14. Facing
15. Core Plate
t. Thickness

Figure 134. Drive Plate Facing Check

Return spring free length
21.1 – 23.1 mm (0.83 – 0.91 in)

3. Check the piston check ball function.
   - Blow air 294 – 392 kPa (42 – 56 psi) to the check ball from both the drive and release sides and check movement by finger (figure 135).

   Drive side .....Must be sealed completely without air leakage.
   Release side.....Air must penetrate freely.

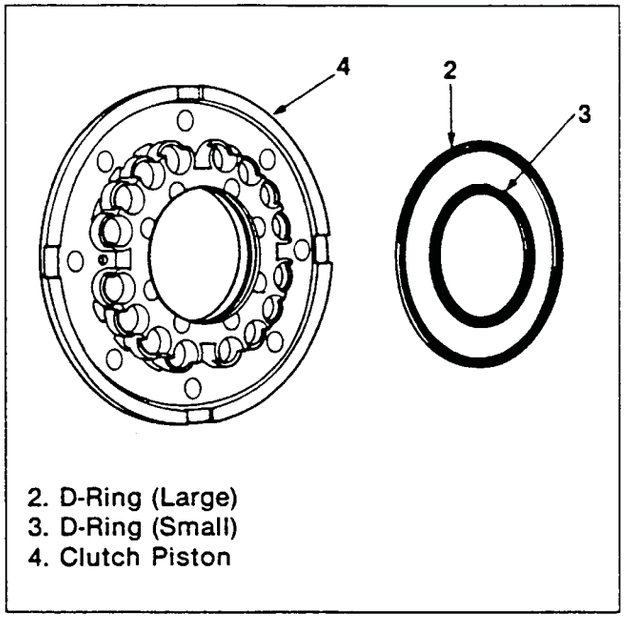


4. Clutch Piston
13. Check Ball
C. Air Blow Nozzle

Figure 135. Piston Check Ball Function Check

Assemble

D-Ring (Figure 136)
Apply automatic transmission fluid (ATF) to two new D-rings and internal them on the piston.

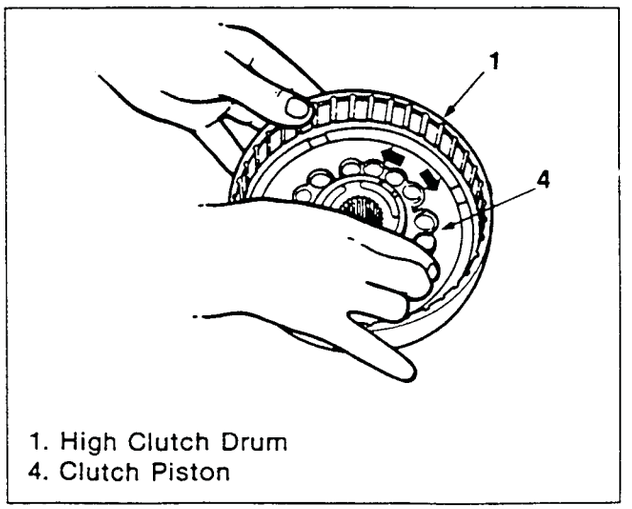


2. D-Ring (Large)
3. D-Ring (Small)
4. Clutch Piston

Figure 136. D-Ring Installation

Piston (Figure 137)
1. Apply ATF inside the drum and to the D-rings and install the piston into the drum.
2. When inserting the piston, turn it with your hand. After it is in the right position, make sure it turns by hand.

NOTICE: When you cannot turn the piston by hand, replace the D-rings, which might have cut deeply by the piston.

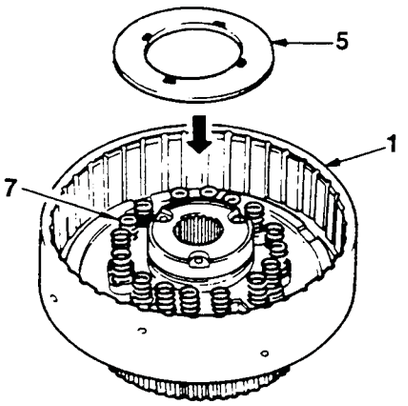


1. High Clutch Drum
4. Clutch Piston

Figure 137. Clutch Piston Installation

Return Spring (Figures 138 and 139)

1. Attach the return springs and the spring retainer in the designated position (figure 138).



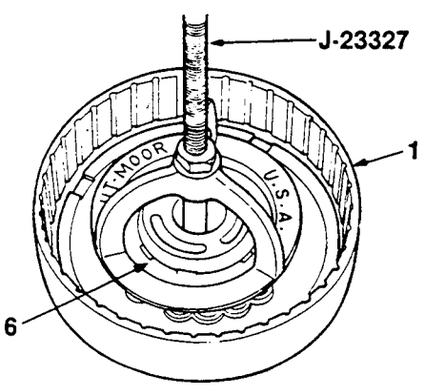
1. High Clutch Drum
5. Spring Retainer
7. Return Spring

Figure 138. Return Spring Installation (1)

2. Push down the retainer with a spring compressor and install the snap ring (figure 139).
   Spring Compressor: J-23327

Important

- Using a flat blade screwdriver, make sure the snap ring fits completely in the groove.

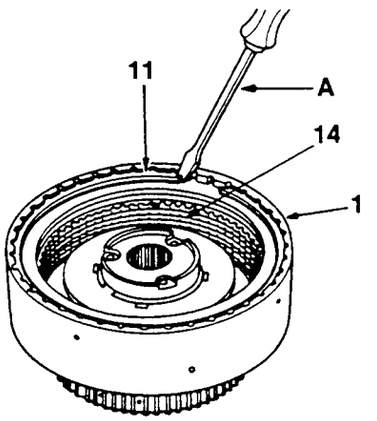


1. High clutch Drum
6. Snap Ring

Figure 139. Return Spring Installation (2)

Clutch Plate (Figure 140)

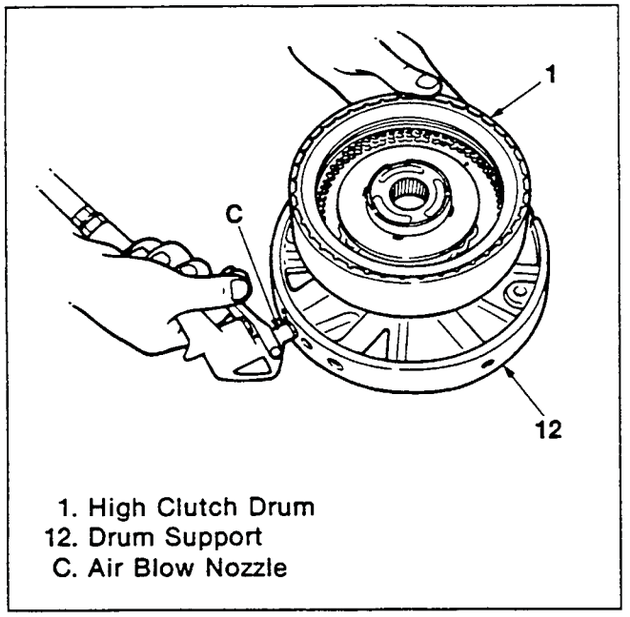
1. Attach the dish plate, driven plates, drive plates and retaining plate in the designated positions.
2. Install the snap ring.



1. High Clutch Drum
11. Snap Ring
14. Clutch
A. Screwdriver

Figure 140. Clutch Plate Installation

3. After assembly, put the drum and support clutch together, blow 294 – 392 kPa (42 – 56 psi) air into the oil hole and check its operation (figure 141).
4. If it doesn't operate or have enough stroke during operation, remove the piston and recheck.



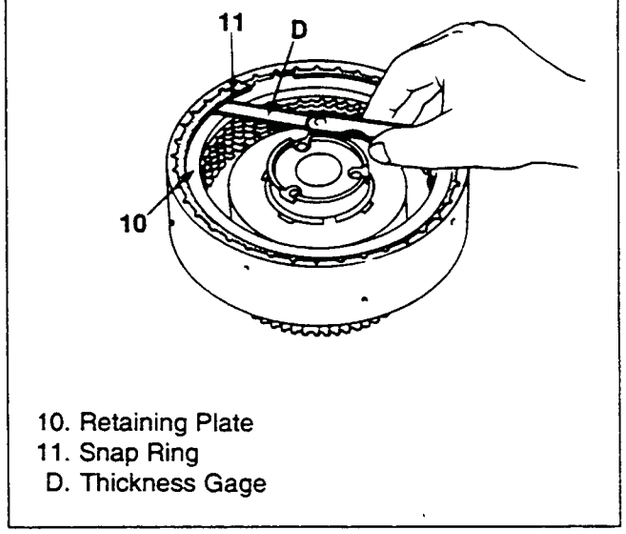
1. High Clutch Drum
12. Drum Support
C. Air Blow Nozzle

Figure 141. High Clutch Operation Inspection

5. After operation check, measure the clearance between the retaining plate and the snap ring with a thickness gage. (figure 142)
6. If the clearance is beyond the limit, replace the drive plates, driven plates and dish plate, and choose the right retaining plate from the list below.
7. If the clearance is within the limit, choose the right retaining plate from the list to make the standard clearance.

Clearance
Standard: 1.8 – 2.2 mm (0.071 – 0.087 in)
Limit : 2.40 mm (0.094 in)

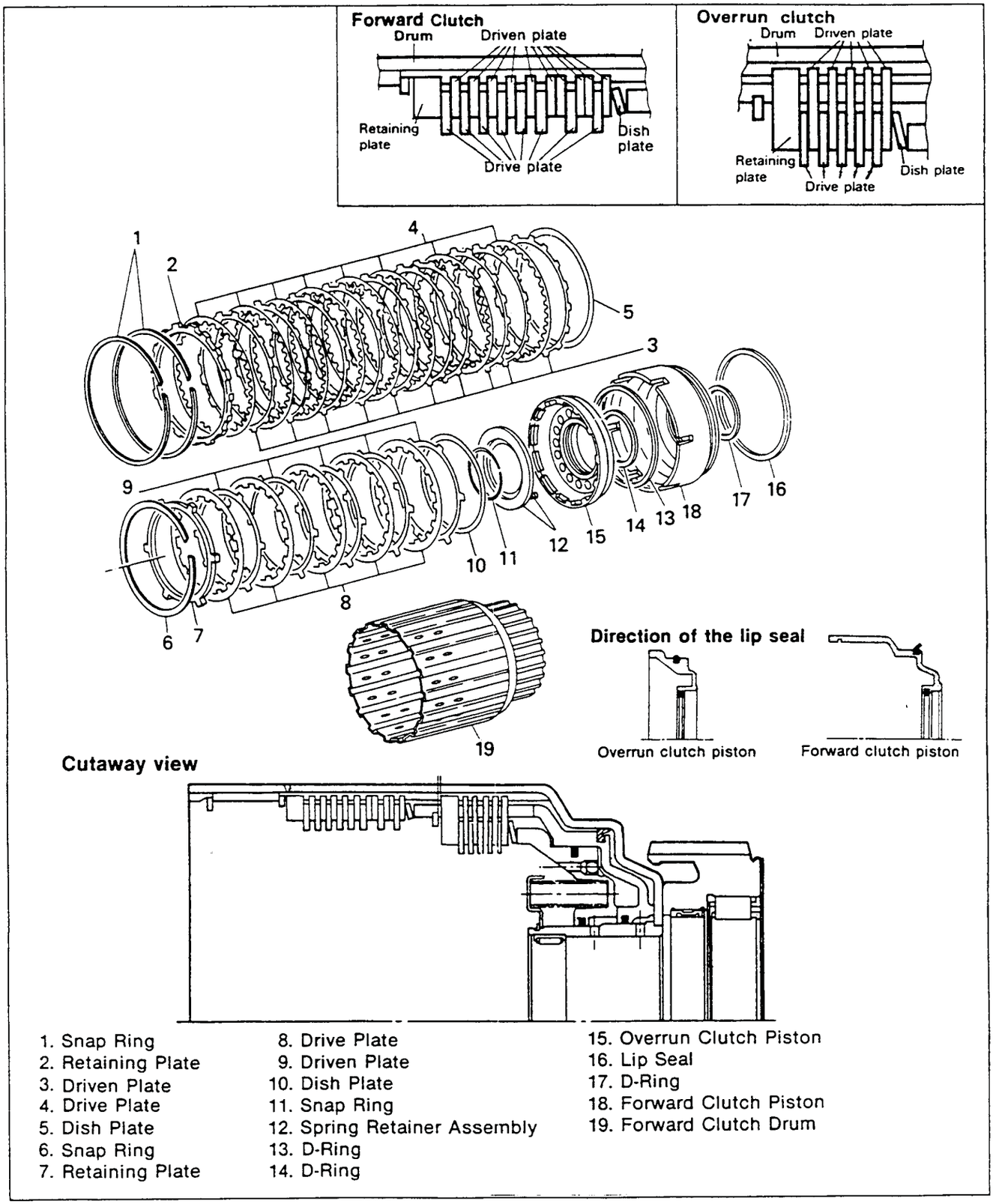
Thickness of Retainer Plate (mm / in)
4.0 / 0.157
4.2 / 0.165
4.4 / 0/173
4.6 / 0.181
4.8 / 0.189
5.0 / 0.197



10. Retaining Plate
11. Snap Ring
D. Thickness Gage

Figure 142. Clearance Check

FORWARD CLUTCH AND OVERRUN CLUTCH



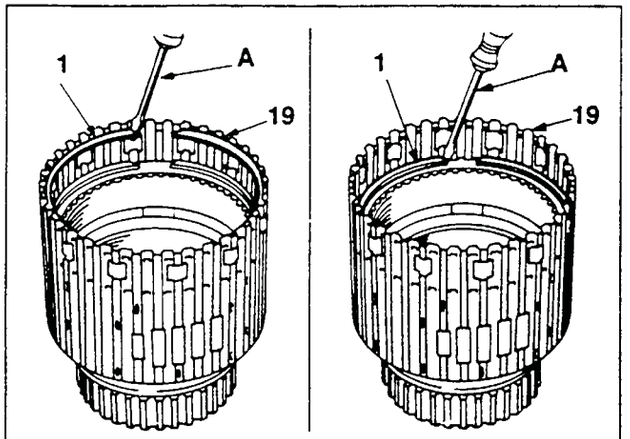
1. Snap Ring
2. Retaining Plate
3. Driven Plate
4. Drive Plate
5. Dish Plate
6. Snap Ring
7. Retaining Plate
8. Drive Plate
9. Driven Plate
10. Dish Plate
11. Snap Ring
12. Spring Retainer Assembly
13. D-Ring
14. D-Ring
15. Overrun Clutch Piston
16. Lip Seal
17. D-Ring
18. Forward Clutch Piston
19. Forward Clutch Drum

Figure 143. Forward Clutch Assembly

Disassemble

Forward Clutch Plate (Figure 144)

1. Remove the two snap rings.
2. Remove the retaining plate, driven plates, drive plates and dish plate from the forward clutch.

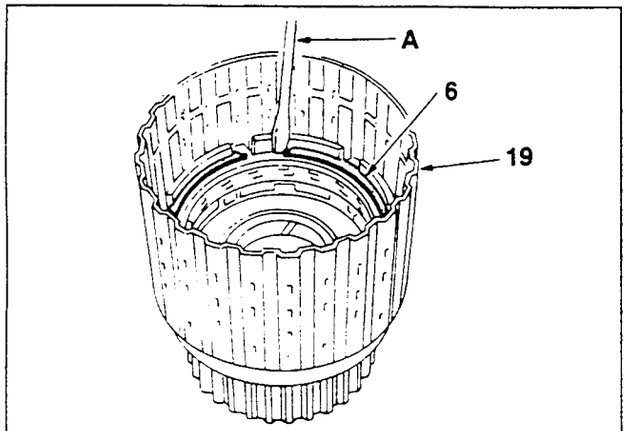


1. Snap Ring
19. Forward Clutch Drum
A. Screwdriver

Figure 144. Forward Clutch Plate Removal

Overrun Clutch Plate (Figure 145)

1. Remove the snap ring.
2. Remove the retaining plate, the driven plates, the drive plates and the dish plate from the overrun clutch.

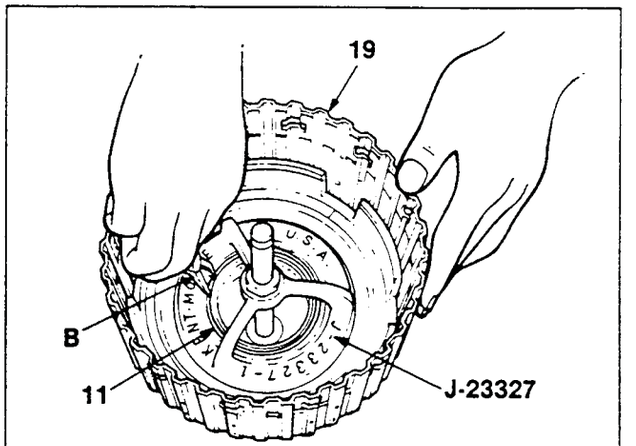


6. Snap Ring
19. Forward Clutch Drum
A. Screwdriver

Figure 145. Overrun Clutch Plate Removal

Return Spring (Figure 146)

1. Remove the return spring from the spring retainer using a spring compressor (special tool).
   Spring Compressor: J-23327
2. Take off the spring compressor and remove the spring retainer assembly.



11. Snap Ring
19. Forward Clutch Drum
B. Snap Ring Pliers

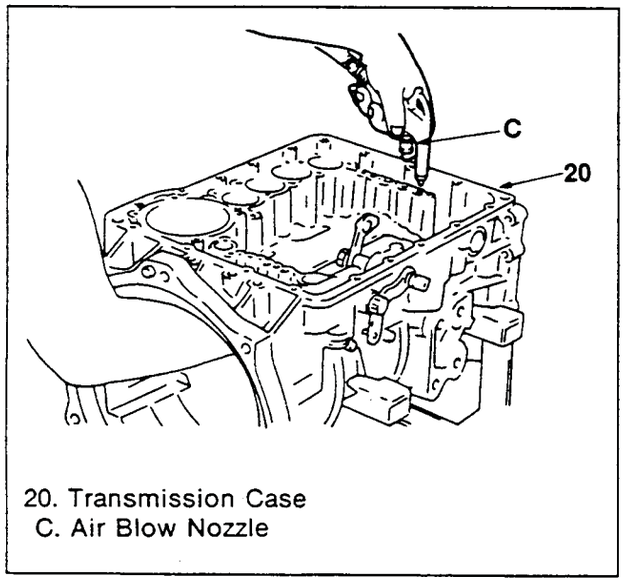
Figure 146. Return Spring Removal

Piston (Figures 147 and 148)

1. Put the forward clutch drum and the low one-way clutch inner race together, blow air little by little into the oil hole and remove the forward clutch piston and overrun clutch piston together (figure 147).

Important

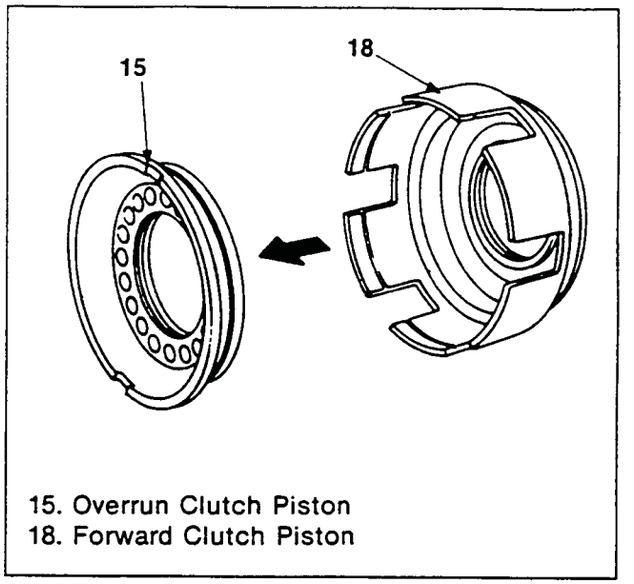
- When putting the drum and inner race together, the work may be easier if the plates of the low and reverse brake are removed in advance. When removing the pistons, support the piston with your hand to prevent them from tilting, and blow air to free the piston.



20. Transmission Case
C. Air Blow Nozzle

Figure 147. Clutch Piston Removal (1)

2. Remove the overrun clutch piston from the forward clutch piston (figure 148).

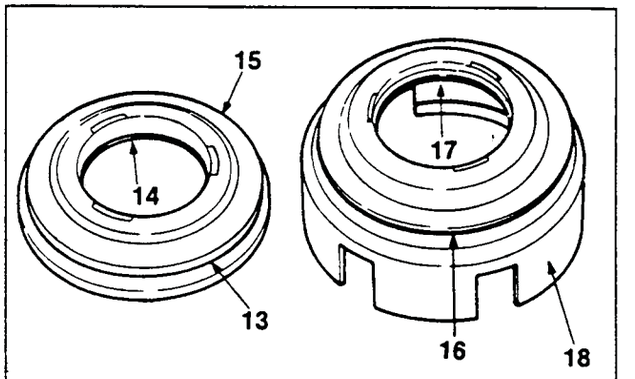


15. Overrun Clutch Piston
18. Forward Clutch Piston

Figure 148. Clutch Piston Removal (2)

D-Ring and Lip Seal (Figure 149)

1. Remove the D-ring and lip seal from the forward clutch piston.
2. Remove the D-ring and lip seal from the overrun clutch piston.



13. D-Ring
14. D-Ring
15. Overrun Clutch Piston
16. Lip Seal
17. D-Ring
18. Forward Clutch Piston

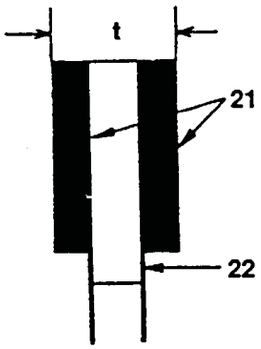
Figure 149. D-Ring and Lip Seal Removal

Inspect

Forward Clutch Plate (Figure 150)

If one of the plates are burned, all plates should be replaced.
If they are not burned, measure the thickness of each Drive Plate. If any one of the plates is out of specification, all plates must be replaced.

Thickness
Standard: 2.0 mm (0.079 in)
Limit : 1.92 mm (0.076 in)



21. Facing
22. Core Plate
t. Thickness

Overrun Clutch Plate (Figure 150)

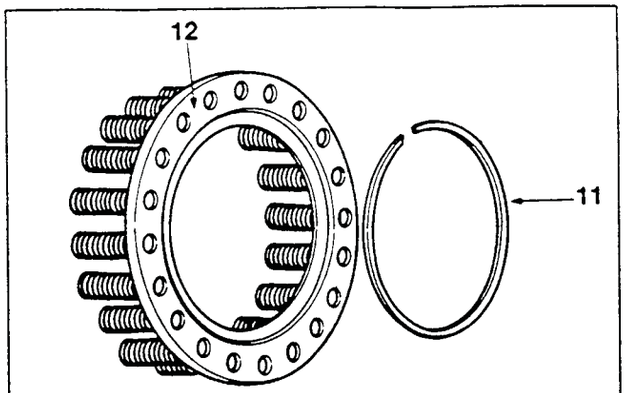
1. Check the drive plates and driven plates for burns and damage.
2. Measure the facing thickness of the drive plates and replace if it is less than the limit.

Thickness
Standard: 2.0 mm (0.079 in)
Limit : 1.92 mm (0.076 in)

Spring Retainer Assembly (Figure 151)

1. Check the spring retainer assembly for damage and tension.

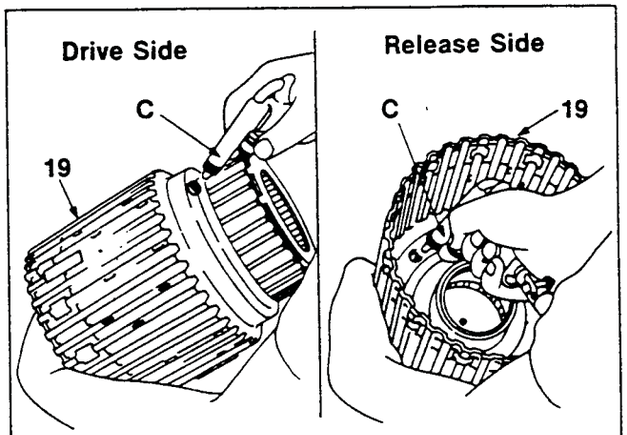
Return spring free length
35.8 – 37.8 mm (1.41 – 1.49 in)



11. Snap Ring
12. Spring Retainer Assembly

Drum Check Ball (Figure 152)

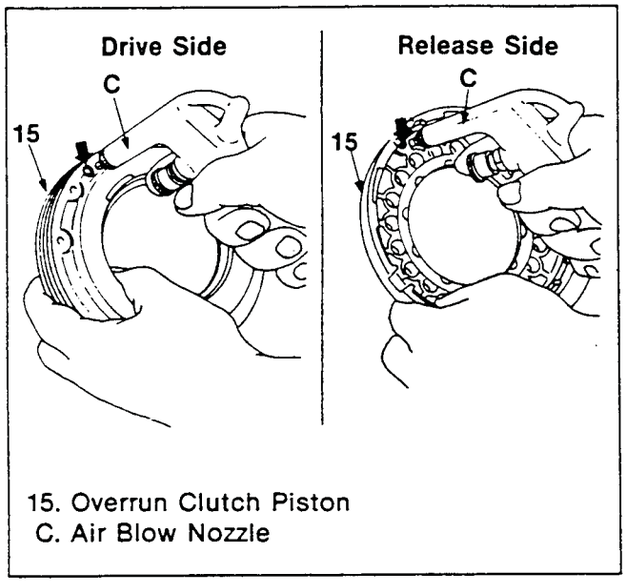
1. Blow 294 – 392 kPa (42 – 56 psi) air to the check ball from both the drive and release sides and check movement by finger.
   Drive side.....Must be sealed completely without air leakage.
   Release side.....Air must penetrate freely.



19. Forward Clutch Drum
C. Air Blow Nozzle

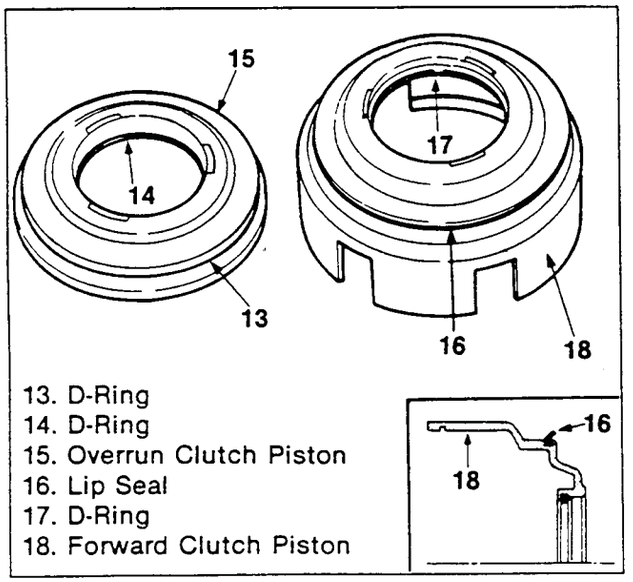
Piston Check Ball (Figure 153)

1. Blow 294 – 392 kPa (42 – 56 psi) air to the check ball from both the actuating and releasing sides and check movement by finger.
   Drive side.....Must be sealed completely without air leakage.
   Release side.....Air must penetrate freely.



15. Overrun Clutch Piston
C. Air Blow Nozzle

Figure 153. Piston Check Ball Check



13. D-Ring
14. D-Ring
15. Overrun Clutch Piston
16. Lip Seal
17. D-Ring
18. Forward Clutch Piston

Figure 154. D-Ring and Lip Seal Installation

Assemble

D-Ring and Lip Seal (Figure 154)

1. Apply automatic transmission fluid (ATF) to the new D-ring and new lip seal and install them in the forward clutch piston.
2. Apply ATF to the new D-rings and new lip seal and install them in the overrun clutch piston.

Important

- Be careful of the lip's direction (figure 154).

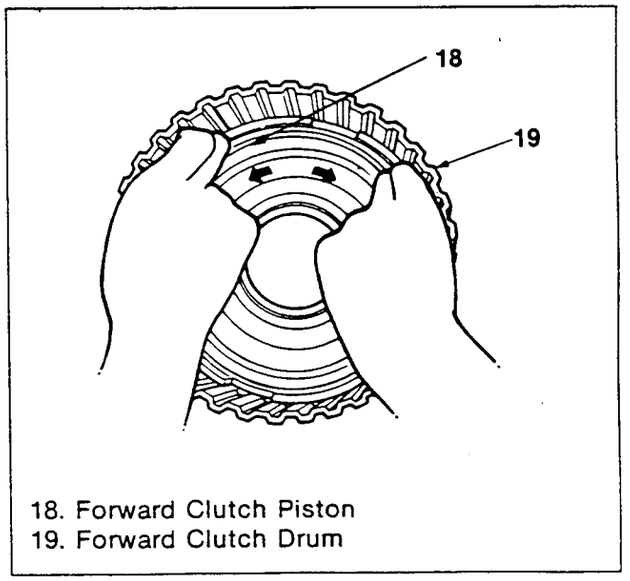
Forward Clutch Piston (Figures 155 and 156)

1. Apply ATF inside the drum and to the D-rings and lip seal, then install the piston in the drum.
2. When installing the piston, turn it with your hand, and after it is in the right position, make sure that it turns by hand (figure 155).

NOTICE: When you cannot turn the piston by hand, replace the lip seal, which might have cut deeply by the piston.

3. Place the piston's notch on the drum groove (the groove with the open oil hole) (figure 156).

NOTICE: Make sure the oil hole is open, otherwise it can cause a failure.



18. Forward Clutch Piston
19. Forward Clutch Drum

Figure 155. Forward Clutch Piston Installation (1)

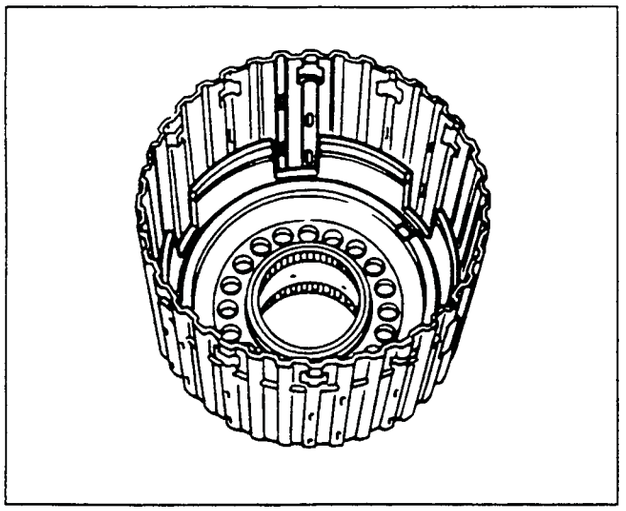
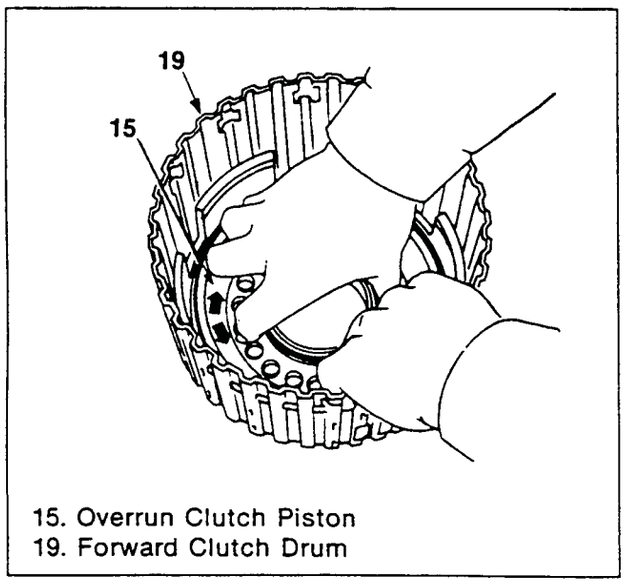


Figure 156. Forward Clutch Piston Installation (2)

Overrun Clutch Piston (Figure 157)

1. Apply automatic transmission fluid inside the drum and to the D-rings and lip seal, then put the overrun clutch piston and the forward clutch piston together.
2. When installing the piston, turn it with your hand, and when it is in the right position, make sure that it turns by hand (figure 157).

NOTICE: When you cannot turn the piston by hand, replace the lip seal, which might have cut deeply by the piston.



15. Overrun Clutch Piston
19. Forward Clutch Drum

Figure 157. Overrun Clutch Piston Installation

Spring Retainer Assembly (Figure 158)

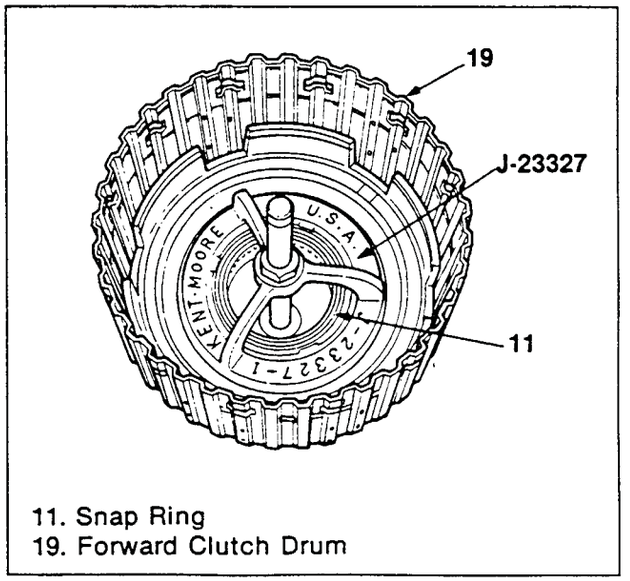
1. Put the spring retainer assembly and the overrun clutch piston together.

Important

- Make sure the springs are put into the spring holes of the piston completely.

2. Put the new snap ring on the spring retainer.
3. Push down the retainer with a spring compressor and install the snap ring (figure 158).
   Spring Compressor: J-23327

NOTICE: When fastening with the compressor, do not turn the retainer or the spring will be off position and distorted. Using a screwdriver, make sure the snap ring fits in the groove.



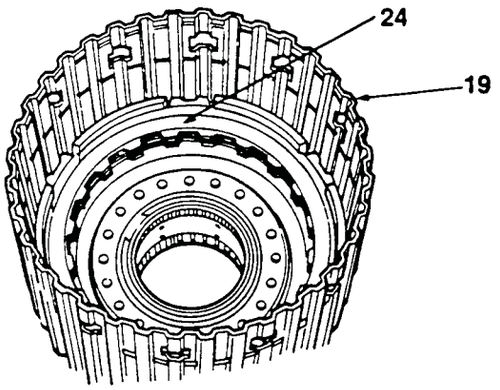
11. Snap Ring
19. Forward Clutch Drum

Figure 158. Spring Retainer Assembly Installation

Assemble

Overrun Clutch Plate (Figure 159)

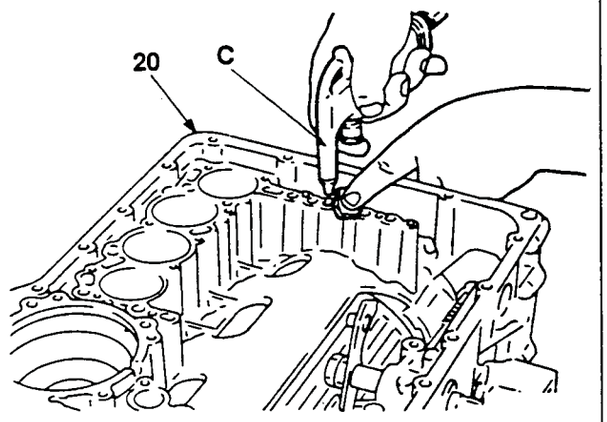
1. Install the dish plate, driven plates, drive plates and retaining plate in the designated positions.
2. Install the snap ring.



19. Forward Clutch Drum
24. Overrun Clutch Plate

Figure 159. Overrun Clutch Plate Installation

3. Put the forward clutch drum and the low one-way clutch inner race together.
4. Check the operation of the overrun clutch by blowing 294 – 392 kPa(42 – 56 psi) air into the oil hole (figure 160).
5. If it doesn't work or have enough stroke during operation, remove the piston and correct.



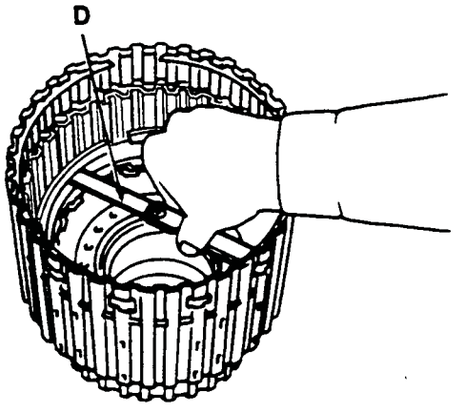
20. Transmission Case
C. Air Blow Nozzle

Figure 160. Overrun Clutch Operation Check

6. After the operation check, measure the clearance between the retaining plate and snap ring with a thickness gage (figure 161).
7. If the clearance is beyond the limit, replace the drive plates, driven plates and dish plate, and choose the right retaining plate from the list below.
8. If the clearance is within the limit, choose the right retaining plate from the list to make the standard clearance.

Clearance (Overrun clutch)
Standard: 1.0 – 1.4 mm (0.039 – 0.055 in)
Limit : 1.6 mm (0.063 in)

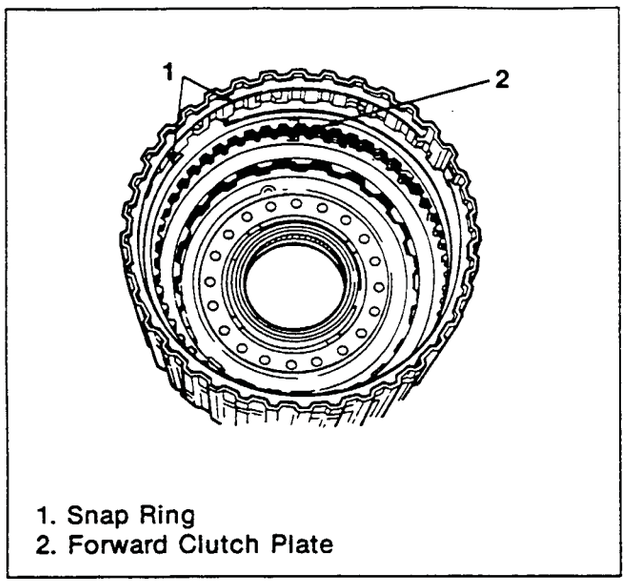
Thickness of Retainer Plate (mm / in)
4.0 / 0.157
4.2 / 0.165
4.4 / 0.173
4.6 / 0.181
4.8 / 0.189
5.0 / 0.197
5.2 / 0.205



D. Thickness Gage

Figure 161. Clearance Check

Forward Clutch Plate (Figure 162)
1. Install the dish plate, driven plates, drive plates and retaining plate in the designated positions.
2. Attach the two snap springs in the designated positions.



1. Snap Ring
2. Forward Clutch Plate

Figure 162. Forward Clutch Plate Installation

3. Put the forward clutch drum and the low one-way clutch inner race together.
4. Check the operation of the forward clutch by blowing 294 – 392 kPa(42 – 56 psi) air into the oil hole (figure 163).
5. If it doesn't work or have enough stroke during operation, remove the piston and recheck.

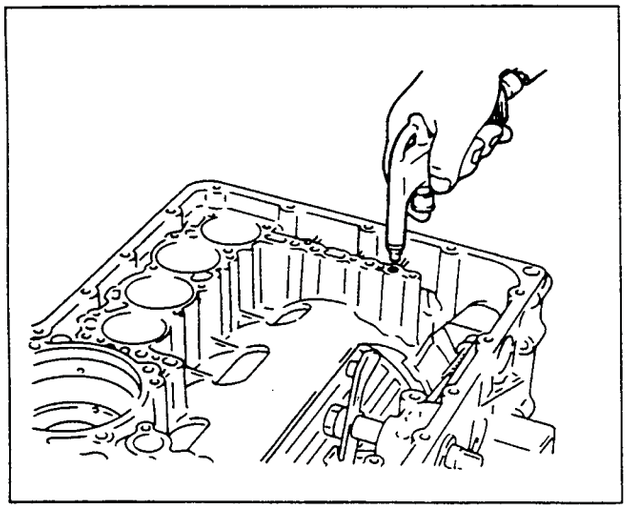
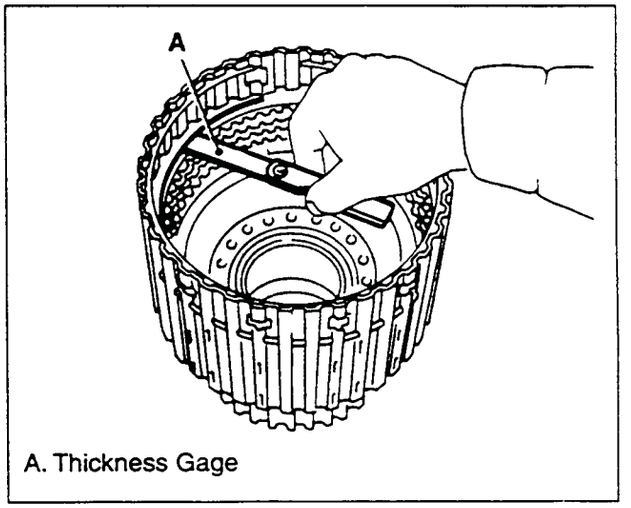


Figure 163. Forward Clutch Operation Check

6. After operation check, measure the clearance between the retaining plate of the forward clutch and the snap ring with a thickness gage (figure 164).
7. If the clearance is beyond the limit, replace the drive plates, driven plates and dish plate, and choose the right retaining plate from the list below.
8. If the clearance is within the limit, choose the right retaining plate from the list to make the standard clearance.

Clearance (Forward clutch)
Standard : 0.45 – 0.85 mm (0.018 – 0.033 in)
Limit : 1.05 mm (0.041 in)

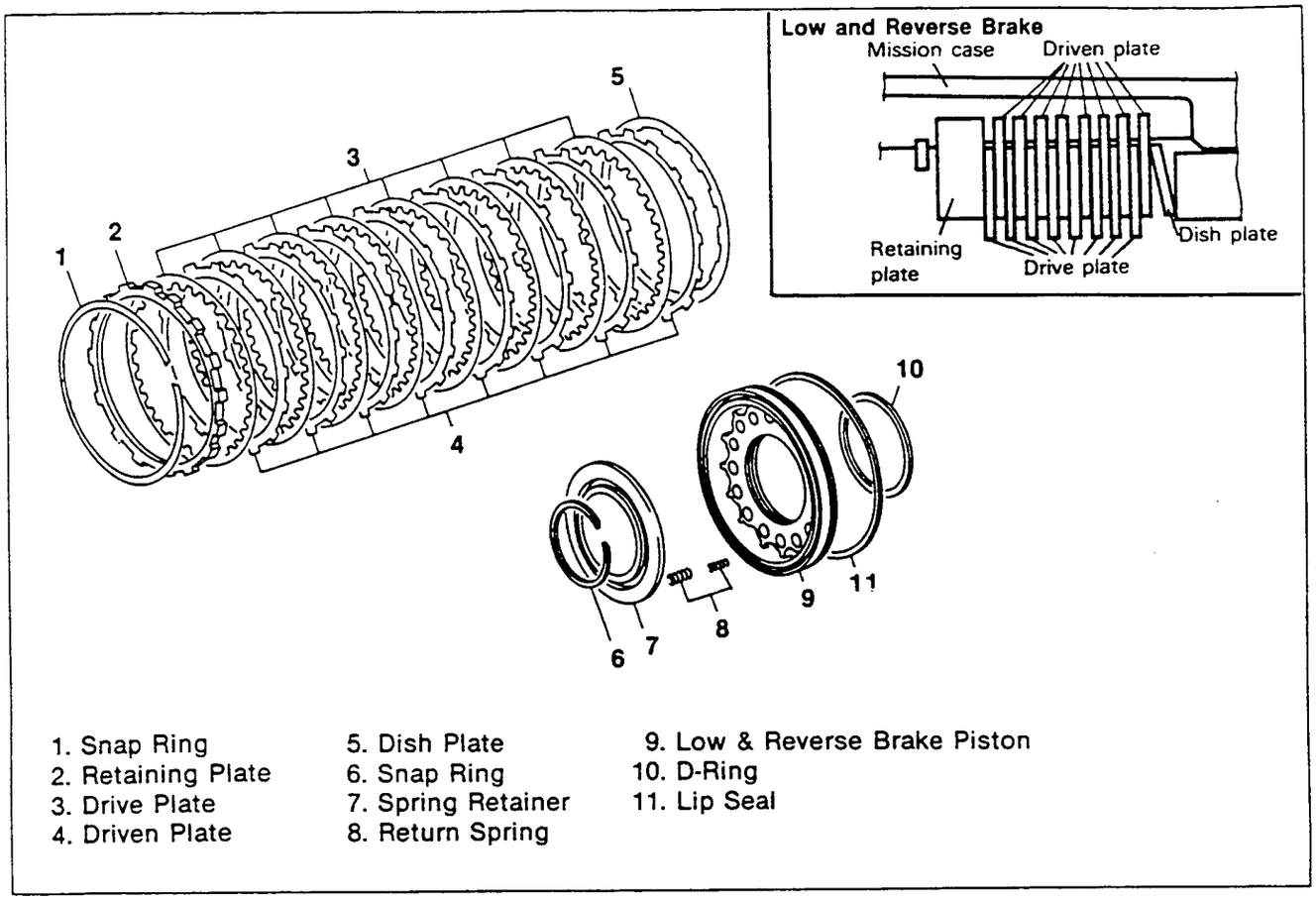
Thickness of Retainer Plate (mm / in)
4.2 / 0.165
4.4 / 0.173
4.6 / 0.181
4.8 / 0.189
5.0 / 0.197
5.2 / 0.205
5.4 / 0.213



A. Thickness Gage

Figure 164. Clearance Check

LOW AND REVERSE BRAKE



1. Snap Ring
2. Retaining Plate
3. Drive Plate
4. Driven Plate
5. Dish Plate
6. Snap Ring
7. Spring Retainer
8. Return Spring
9. Low & Reverse Brake Piston
10. D-Ring
11. Lip Seal

Figure 165. Low and Reverse Brake Assembly

Inspect

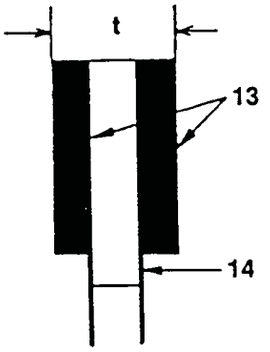
1. If one of the plates are burned, all plates should be replaced.
   If they are not burned, measure the thickness of each Drive Plate.
   If any one of the plates is out of specification, all plates must be replaced.

   Thickness (Figure 170)
   Standard: 1.6 mm (0.063 in)
   Limit : 1.52 mm (0.060 in)

   NOTICE: Replace Any burned parts.

2. Replace any damaged, distorted or worn snap ring, return springs or spring retainer.

   Return spring free length
   Outer: 17.8 – 19.8 mm (0.70 – 0.78 in)
   Inner : 14.7 – 16.7 mm (0.58 – 0.66 in)



13. Facing
14. Core Plate
t. Thickness

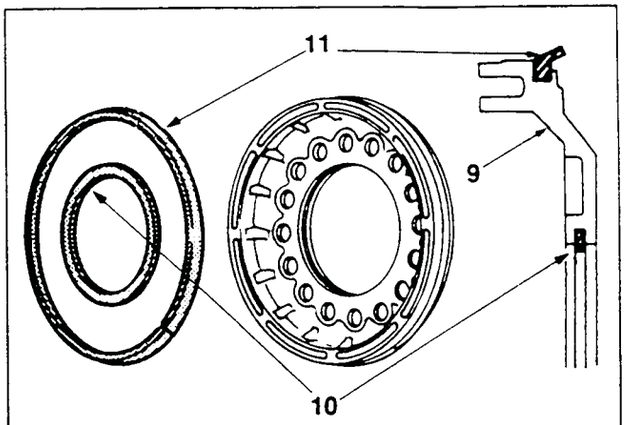
Figure 170. Drive Plate Facing Check

Assemble

D-Ring and Lip Seal (Figure 171)
Apply automatic transmission fluid (ATF) to the new D-ring and the new lip seal and attach them to the piston.

Important

- Be careful of the lip's direction.



9. Low & Reverse Brake Piston
10. D-Ring
11. Lip Seal

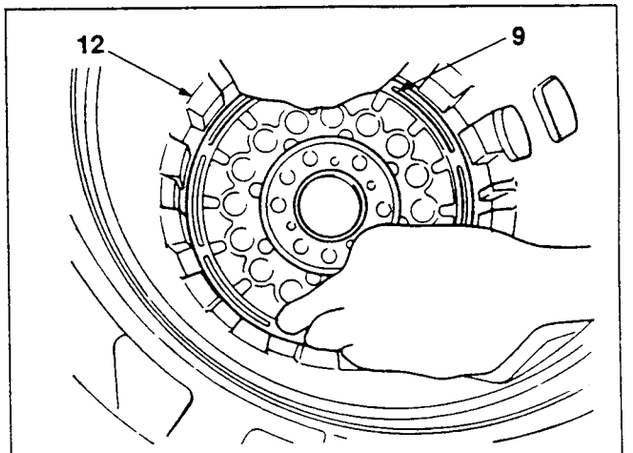
Figure 171. D-Ring and Lip Seal Installation

Piston (Figure 172)

1. Apply ATF inside the case and to the D-ring and the lip seal. Put the piston into the case.
2. When installing the piston, turn it with your hand, and after it is installed, make sure that it turns by hand.

Important

- When you cannot turn the piston by hand, replace the lip seal, which might have turned over, and try again.



9. Low and Reverse Brake Piston
12. Transmission Case

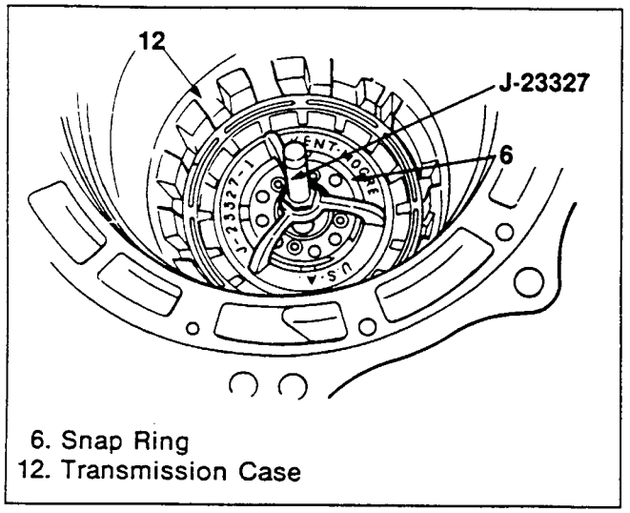
Figure 172. Low and Reverse Brake Piston Installation

Return Spring (Figure 173)

1. Install the return springs and spring retainer to the designated position.
2. Put the new snap ring on the spring retainer.
3. Push down the retainer with a spring compressor and install the snap ring (figure 173).
   Spring Compressor: J-23327

Important

- Using a flat end screwdriver, make sure the snap ring fits in the drum groove completely.



6. Snap Ring
12. Transmission Case

Figure 173. Return Spring Installation

Brake Plate (Figure 174)

1. Attach the dish plate, driven plates, drive plates and retaining plate to the designated positions.
2. Install the snap ring.

Important

- The driven plate is installed in a special position in the case groove.

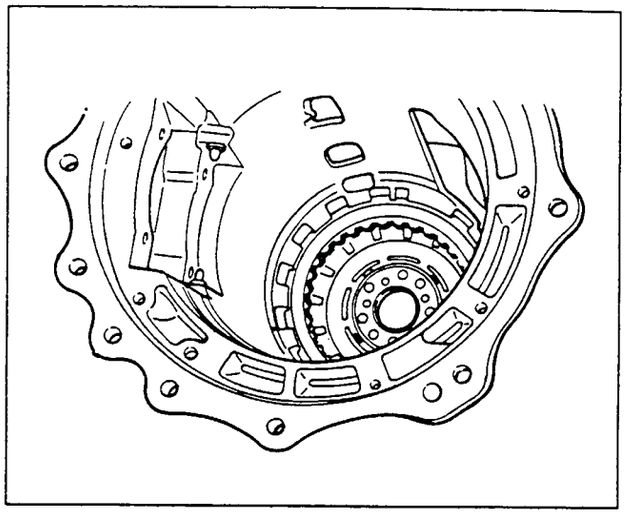
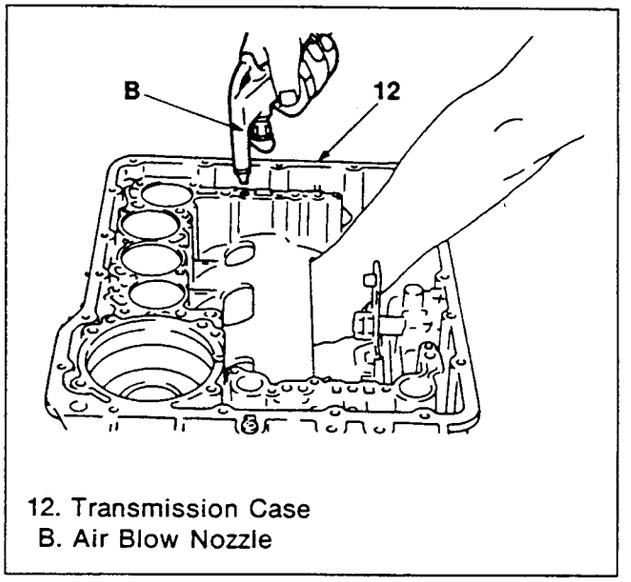


Figure 174. Brake Plate Installation

3. After assembly, blow 294 – 392 kPa (42 – 56 psi) air into the oil hole and check its operation (figure 175).
4. If it doesn't work or have enough stroke during operation, remove the piston and recheck.



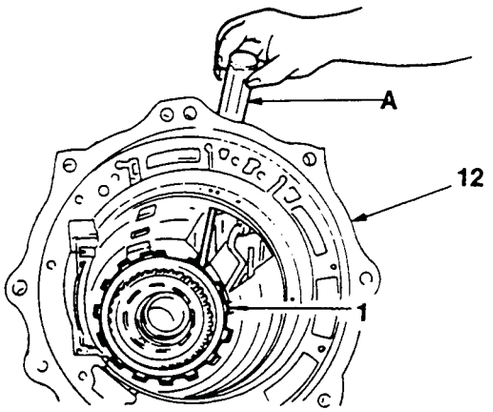
12. Transmission Case
B. Air Blow Nozzle

Figure 175. Low and Reverse Brake Operation Check

Disassemble

Brake Plate (Figure 166)

1. Remove the snap ring with a flat blade screwdriver.
2. Remove the retaining plate, drive plates, driven plates, and dish plate.

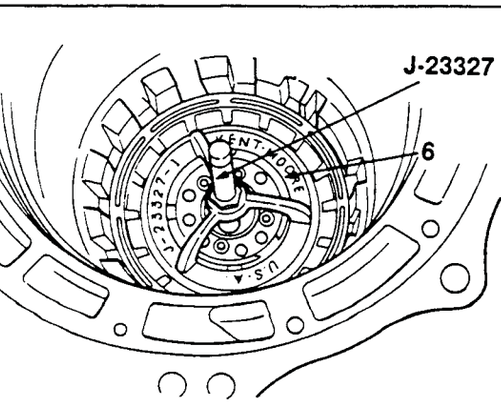


1. Snap Ring
12. Transmission Case
A. Screwdriver

Figure 166. Brake Plate Removal

Return Spring (Figure 167)

1. Remove the spring from the spring retainer using a spring compressor.
   Spring Compressor: J-23327
2. Take off the spring compressor, and then remove the spring retainer and the return springs.



6. Snap Ring

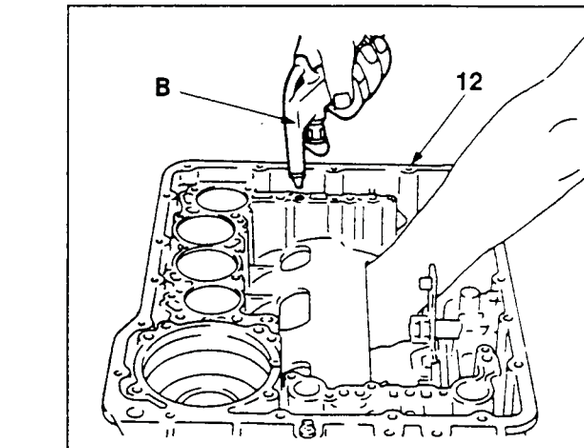
Figure 167. Return Spring Removal

Piston (Figure 168)

1. Support the piston with your hand and remove it, blowing air gradually into the oil hole.

Important

- Blow air into the hole little by little and support the piston with your hand so it doesn't tilt, which makes it hard to pull out.

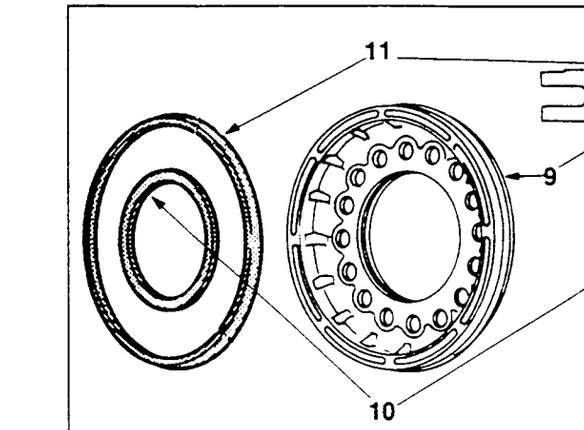


12. Transmission Case
B. Air Blow Nozzle

Figure 168. Brake Piston Removal

D-Ring and Lip Seal (Figure 169)

1. Remove the D-ring and the lip seal from the piston.



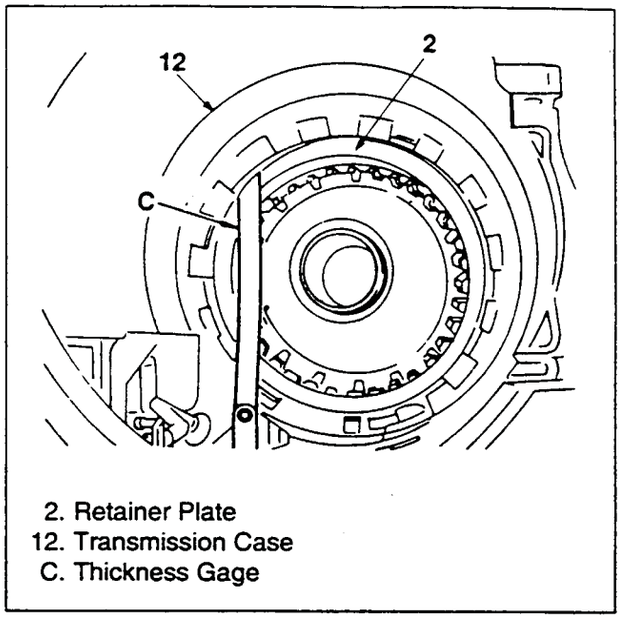
9. Low & Reverse Brake Piston
10. D-Ring
11. Lip Seal

Figure 169. D-Ring and Lip Seal Removal

5. After the operation check, measure the clearance between the retaining plate and snap ring with a thickness gage (figure 176).
6. If the clearance is beyond the limit, replace the drive plates, driven plates and dish plate,and choose the right retaining plate from the list below.
7. If the clearance is within the limit, choose the right retaining plate from the list to make the standard clearance.

Clearance
Standard: 1.1 – 1.5 mm (0.043 – 0.059 in)
Limit : 1.70 mm (0.067 in)

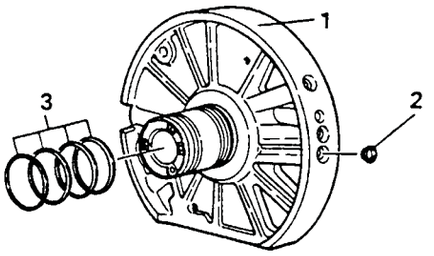
Thickness of Retainer Plate (mm / in)
4.4 / 0.173
4.6 / 0.181
4.8 / 0.189
5.0 / 0.197
5.2 / 0.205
5.4 / 0.213
5.6 / 0.220



2. Retainer Plate
12. Transmission Case
C. Thickness Gage

Figure 176. Clearance Check

DRUM SUPPORT ASSEMBLY



1. Drum Support
2. Plain Seal
3. Seal Ring

Figure 177. Drum Support Assembly

Disassemble

1. Remove four plain seals
2. Remove four seal rings

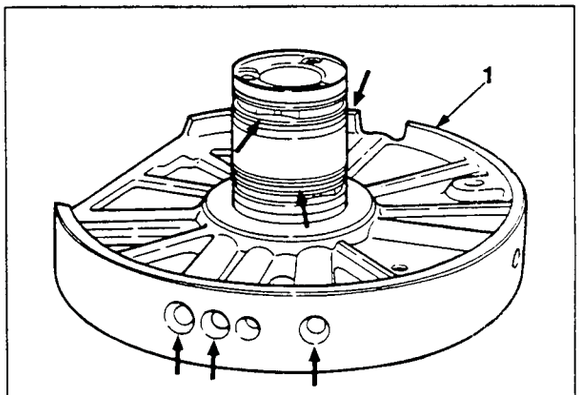
Inspect

1. Check for foreign material in the oil pressure circuit of the drum support.
2. Check for damage and wear on the drum support exterior and the seal ring surface.

Assemble

Plain Seal and Seal Ring (Figures 178 and 179)

1. Apply special grease (included in the repair kit) to the four new plain seals, and install them to the drum support (figure 178).

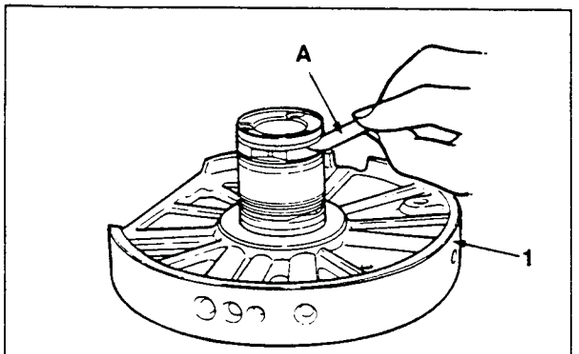


1. Drum Support

Figure 178. Plain Seal Installation

3. Measure the clearance between the seal ring and the groove with a thickness gauge (figure 180).
4. If the thickness is beyond the limit, replace the drum support.

Clearance
Standard: 0.10 – 0.25 mm (0.004 – 0.010 in)
Limit : 0.25 mm (0.010 in)

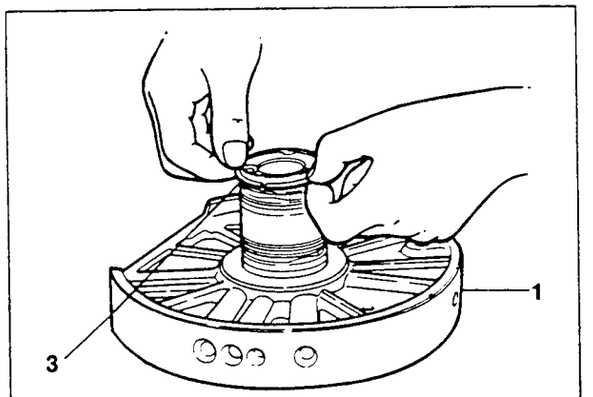


1. Drum Support
A. Thickness Gage

Figure 180. Clearance Check

High Clutch and Reverse Clutch (Figure 181)

1. Assemble the high clutch and reverse clutch and leave them assembled while the seal ring is being formed so that the seal ring will not spread out.



1. Drum Support
3. Seal Ring

Figure 179. Seal Ring Installation

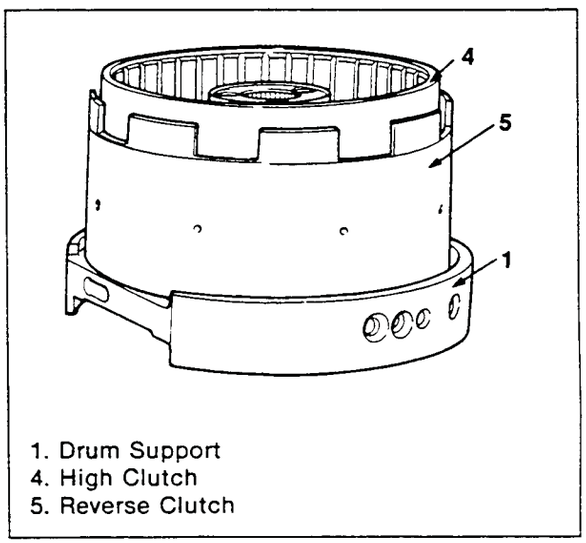
2. Apply Vaseline to new seal rings and attach them to the drum support (figure 179).

NOTICE: There are two kinds of seal rings – small: 50.0 mm (1.97 in) in diameter; large: 52.5 mm (2.07 in) in diameter. When attaching seal rings, do not spread the ring gap too much, or it will distort.

Important

- Be sure to install the flat washer, thrust bearing and bearing race when you assemble the clutches.

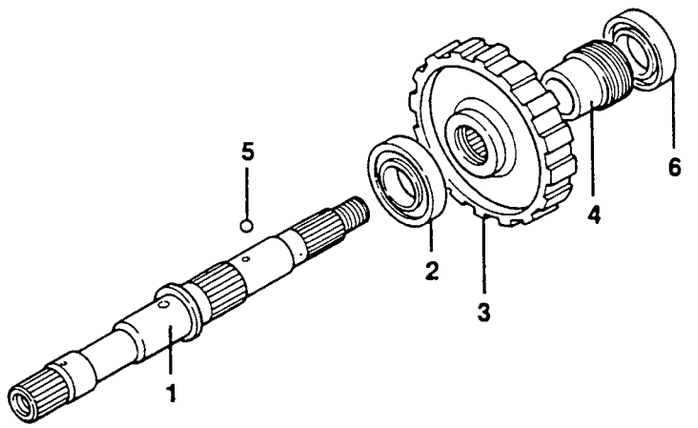
2. Cover the seal ring with a cellophane sheet or aluminum foil, and put thick paper around it and bind with rubber bands so it doesn't spread.



1. Drum Support
4. High Clutch
5. Reverse Clutch

Figure 181. High Clutch and Reverse Clutch

OUTPUT SHAFT ASSEMBLY



1. Output Shaft
2. Ball Bearing (Large)
3. Parking Gear
4. Speedometer Drive Gear
5. Steel Ball
6. Ball Bearing (Small)

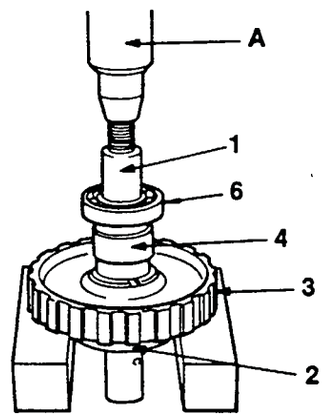
Figure 182. Output Shaft Assembly

Disassemble (Figures 183 and 184)

1. Remove the ball bearing (small), speedometer drive gear, steel ball and parking gear with a press (figure 183).

Important

- Do not disassemble if no fault is apparent.



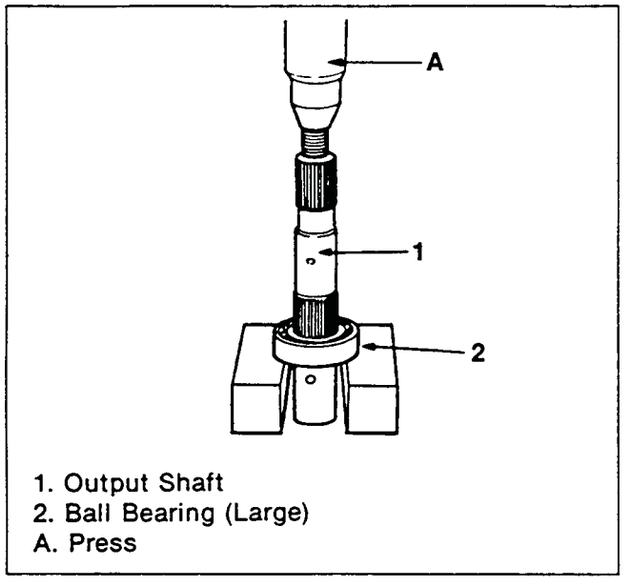
1. Output Shaft
2. Ball Bearing (Large)
3. Parking Gear
4. Speedometer Drive Gear
6. Ball Bearing (Small)
A. Press

Figure 183. Ball Bearing (Small), Speedometer Drive Gear and Parking Gear Removal

2. Remove the ball bearing (large) with a press (figure 184).

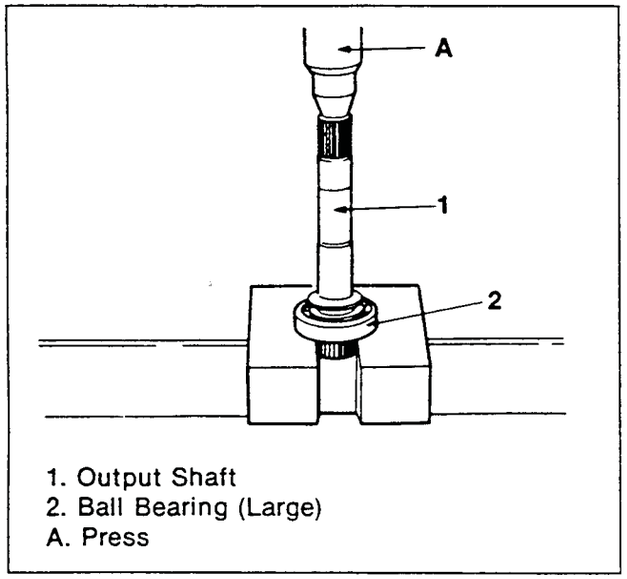
Inspect

Check the output shaft, parking gear and speedometer drive gear for damage.



1. Output Shaft
2. Ball Bearing (Large)
A. Press

Figure 184. Ball Bearing (Large) Removal



1. Output Shaft
2. Ball Bearing (Large)
A. Press

Figure 185. Ball Bearing (Large) Installation

Assemble (Figures 185, 186 and 187)

1. Install a new ball bearing (large) to the designated position (figure 185).

Important

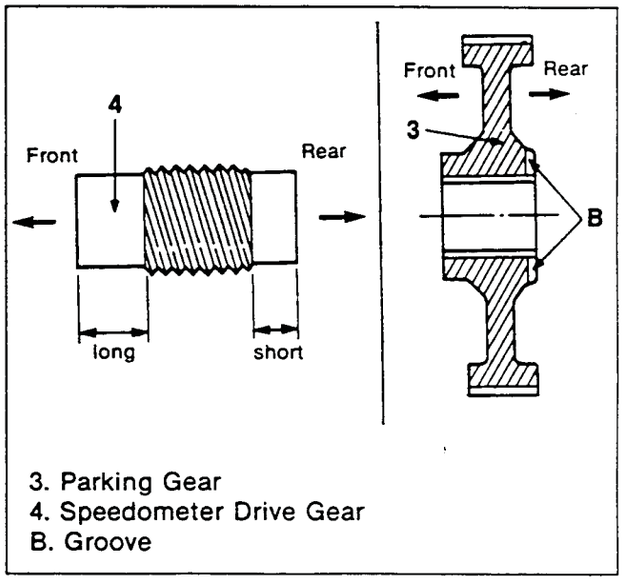
- Be sure to apply automatic transmission fluid on the shaft and internal surface of the bearing before press–fitting the ball bearing.

2. Attach the parking gear in the designated position.
3. Install the speedometer drive gear and the steel ball in the designated position.

Important

- Note correct direction of the speedometer drive gear and parking gear (figure 186).

NOTICE: Do not reuse the ball bearings.



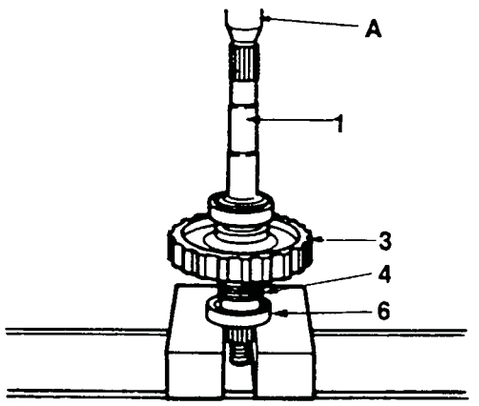
3. Parking Gear
4. Speedometer Drive Gear
B. Groove

Figure 186. Speedometer Drive Gear and Parking Gear Direction

4. Install a new ball bearing (small) (figure 187).

Important

- Be sure to apply automatic transmission fluid on the shaft and internal surface of the bearing before press–fitting the ball bearing.



1. Output Shaft
3. Parking Gear
4. Speedometer Drive Gear
6. Ball Bearing (Small)
A. Press

Figure 187. Ball Bearing (Small) Installation

PLANETARY CARRIER

Inspect (Figure 188)

Check the movement of the pinion gears of the front and rear planetary carrier assemblies. (It must turn easily.) Also check for damage on the gear teeth and anything that looks unusual.

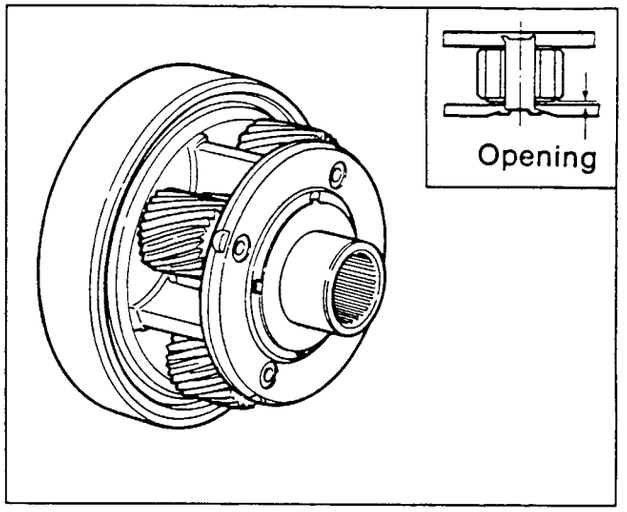
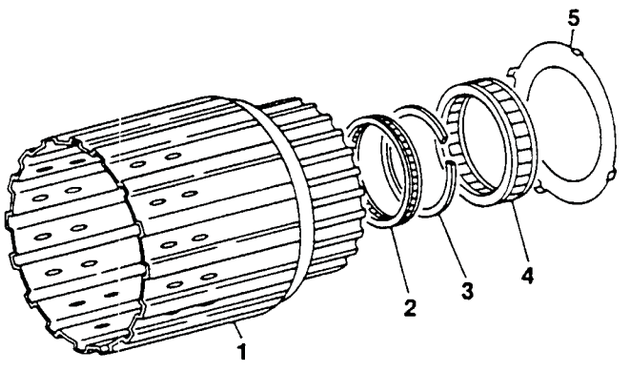


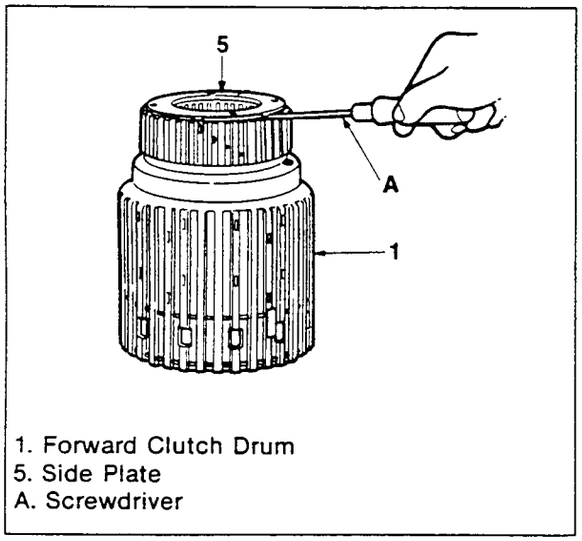
Figure 188. Planetary Carrier Check

FORWARD CLUTCH DRUM ASSEMBLY



1. Forward Clutch Drum
2. Needle Bearing
3. Snap Ring
4. Low One-way Clutch
5. Side Plate

Figure 189. Forward Clutch Drum Assembly

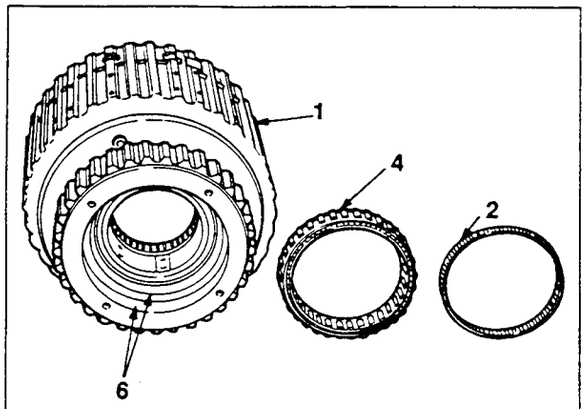


1. Forward Clutch Drum
5. Side Plate
A. Screwdriver

Figure 190. Side Plate Removal

1. Remove the side plate lugs off with a flat end screwdriver and remove the plate (figure 190).

Check for damage and wear on the contact surface, etc., of the low one-way clutch, the needle bearing and the forward clutch drum (figure 192).



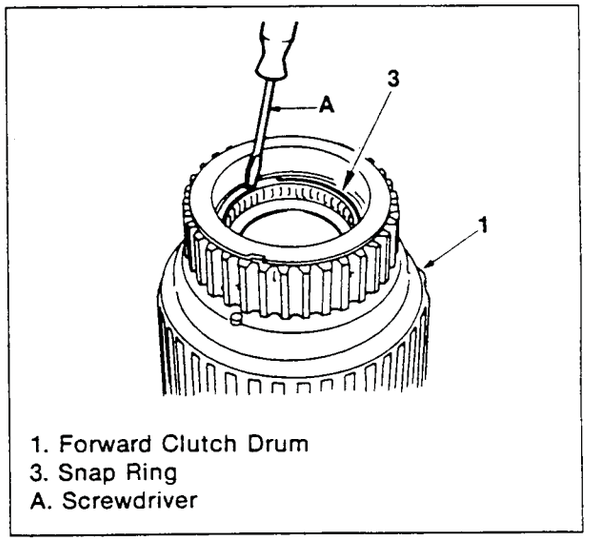
1. Forward Clutch Drum
2. Needle Bearing
4. Low One-way Clutch
6. Contact Surface

Figure 192. Forward Clutch Drum, Low One-way Clutch and Needle Bearing Check

1. Attach the large needle bearing, the snap ring and the low one-way clutch in the designated positions (figure 193).

Important

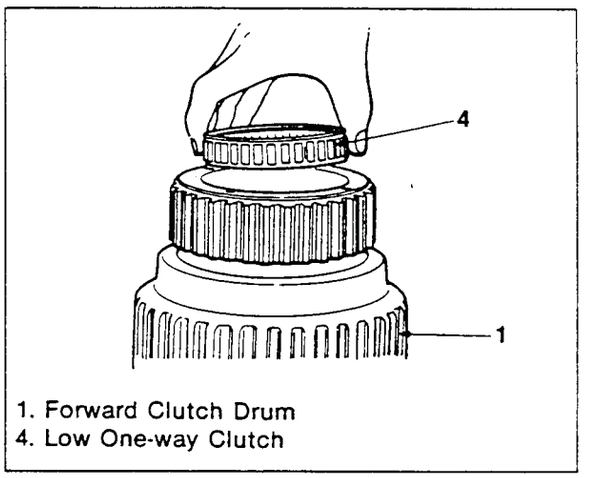
- Be careful about the low one-way clutch's installation position; flange side faces the rear.



1. Forward Clutch Drum
3. Snap Ring
A. Screwdriver

Figure 191. Low One-way Clutch and Snap Ring Removal

2. Remove the low one-way clutch, the snap ring and the large needle bearing (figure 191).



1. Forward Clutch Drum
4. Low One-way Clutch

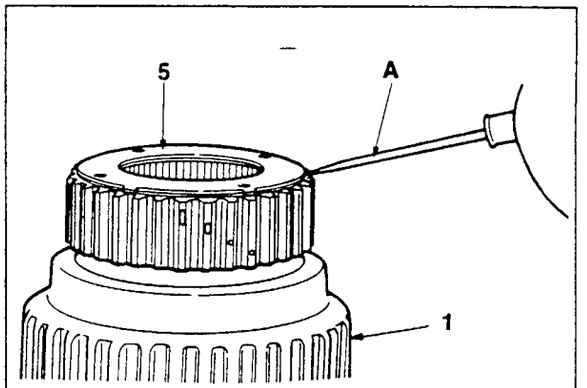
Figure 193. Needle Bearing (Large), Snap Ring and Low One-way Clutch Installation

2. Attach a new side plate by staking the lugs with a flat end screwdriver (figure 194).

Important

- Stake the lugs firmly at the four positions.

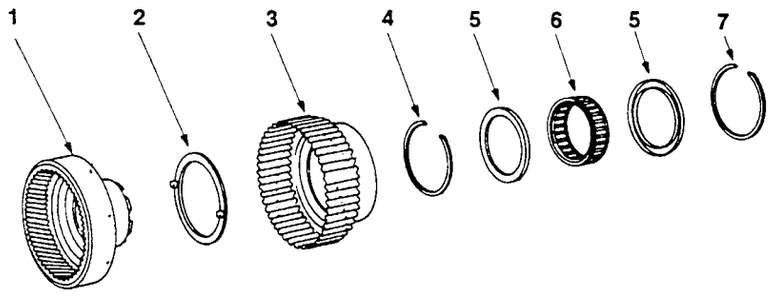
NOTICE: Do not reuse the side plate.



1. Forward One-way Clutch
5. Side Plate
A. Screwdriver

Figure 194. Side Plate Installation

FORWARD ONE-WAY CLUTCH OUTER RACE ASSEMBLY & REAR INTERNAL GEAR

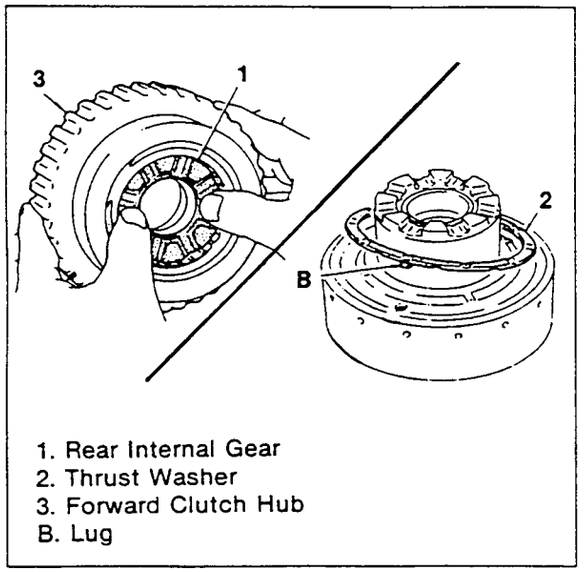


1. Rear Internal Gear
2. Thrust Washer
3. Forward One-way Clutch Outer Race
4. Snap Ring
5. Side Race
6. Forward One-way Clutch
7. Snap Ring

Figure 195. Forward One-way Clutch Outer Race Assembly and Rear Internal Gear

Disassemble (Figures 196 and 197)

1. Disassemble the rear internal gear and remove the thrust washer (figure 196).

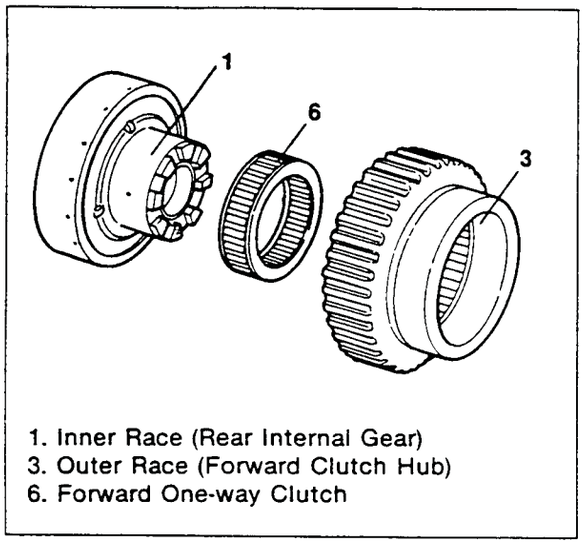


1. Rear Internal Gear
2. Thrust Washer
3. Forward Clutch Hub
B. Lug

Figure 196. Rear Internal Gear and Thrust Washer Removal

Inspect (Figure 198)

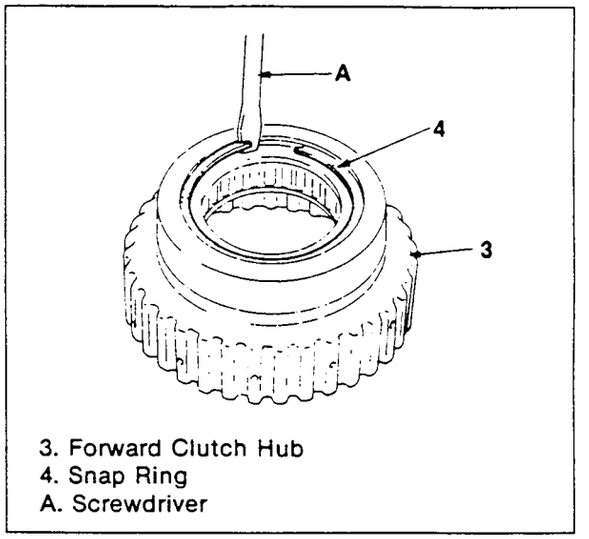
Check for damage or unusual wear on the forward one-way clutch, the inner and outer races, thrust washers and spline teeth.



1. Inner Race (Rear Internal Gear)
3. Outer Race (Forward Clutch Hub)
6. Forward One-way Clutch

Figure 198. Forward One-way Clutch Inspection

2. Remove the snap ring and remove the forward one-way clutch and the side race (figure 197).



3. Forward Clutch Hub
4. Snap Ring
A. Screwdriver

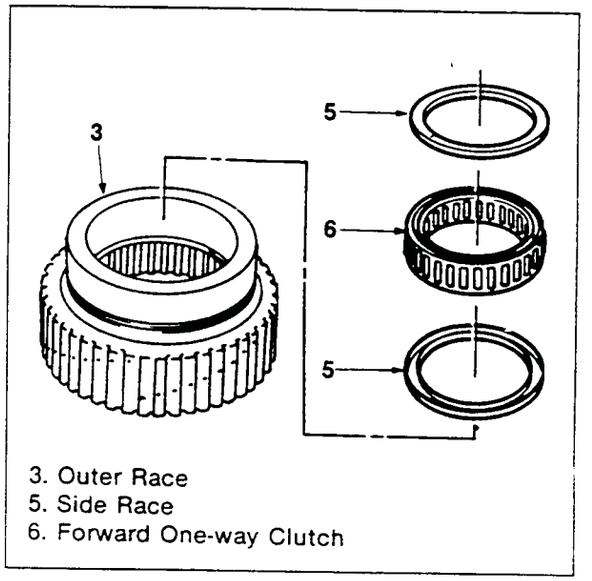
Figure 197. Snap Ring Removal

Assemble (Figure 199)

Attach the snap ring, the side race and the forward one-way clutch in the designated position.

Important

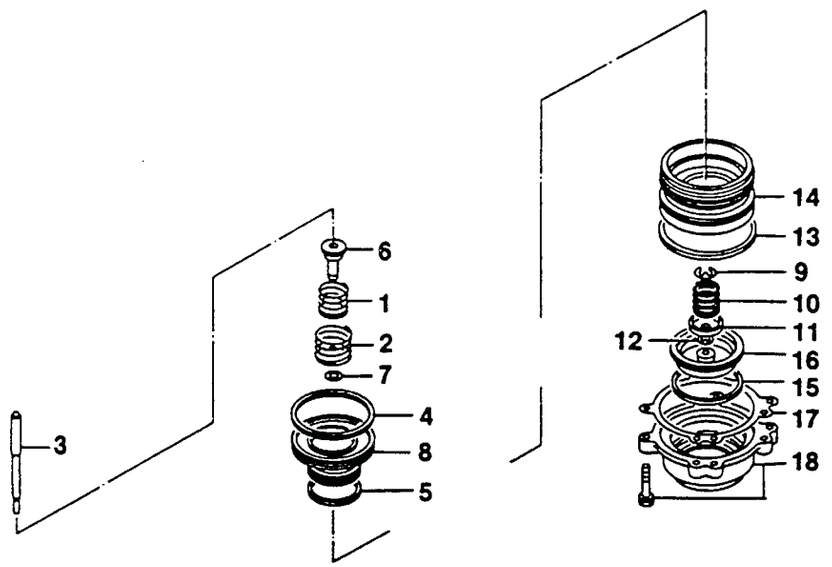
- The flange side of the low one-way clutch should face the rear.



3. Outer Race
5. Side Race
6. Forward One-way Clutch

Figure 199. Forward One-way Clutch Reassembly

BAND SERVO ASSEMBLY



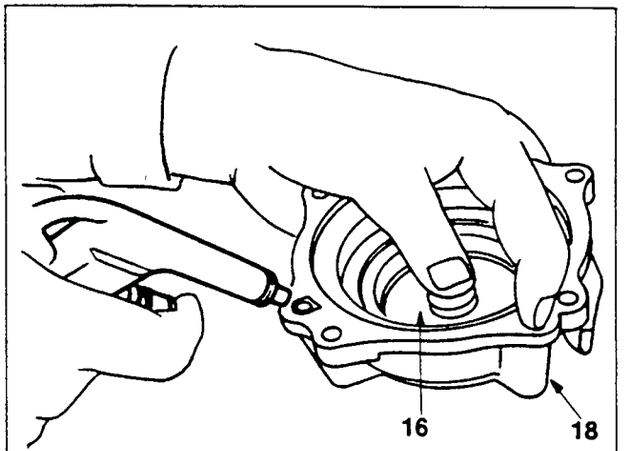
1. Return Spring
2. Return Spring
3. Piston Stem
4. D-Ring
5. D-Ring
6. Servo Cushion Spring Retainer
7. Spacer
8. Band Servo Piston
9. E-Ring (Large)
10. Return Spring
11. Servo Piston Spring Retainer
12. E-Ring (Small)
13. O-Ring
14. Servo Piston Retainer
15. D-Ring
16. O/D Band Servo Piston
17. Gasket
18. O/D Servo Piston Retainer

Figure 200. Band Servo Assembly

Disassemble

O/D Band Servo Piston (Figures 201 and 202)

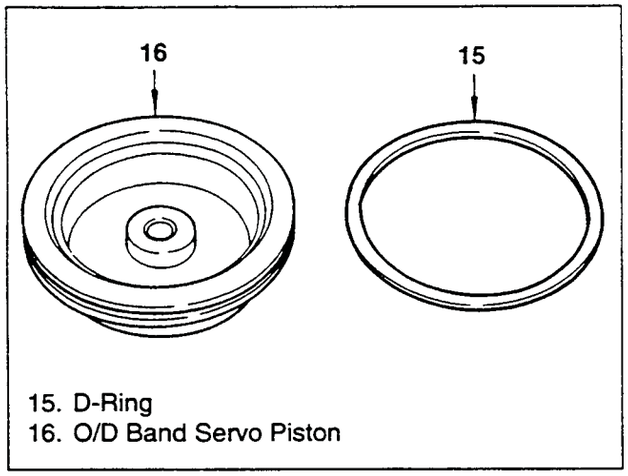
1. Using your fingers, close the oil hole of the O/D servo piston retainer and the center hole of the O/D band servo piston. By supplying 294 – 392 kPa (42 – 56 psi) air from the other oil hole of the O/D servo piston retainer, separate the O/D band servo piston from the O/D servo piston retainer (figure 201).



16. OD Band Servo Piston
18. OD Servo Piston Retainer

Figure 201. O/D Band Servo Piston Removal

2. Remove the D-ring from the O/D band servo piston (figure 202).



15. D-Ring
16. O/D Band Servo Piston

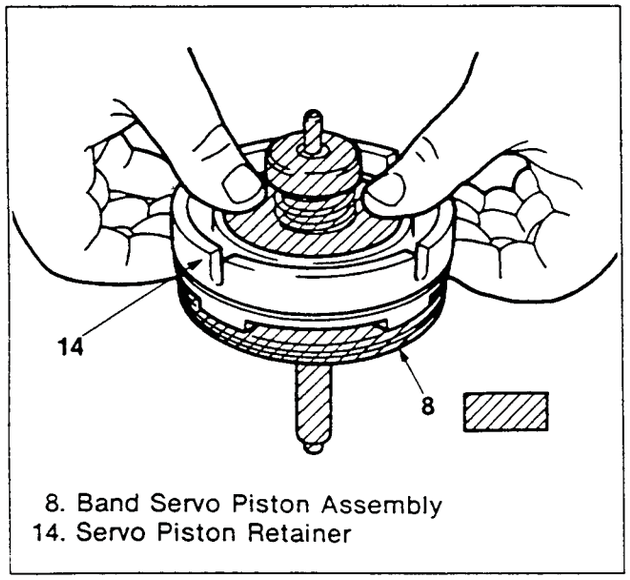
Figure 202. D-Ring Removal

Band Servo Piston Assembly
(Figures 203, 204, 205, 206, 207, 208 and 209)

Important

- Do not remove if no fault is apparent (figures 204, 205, 206 and 207).

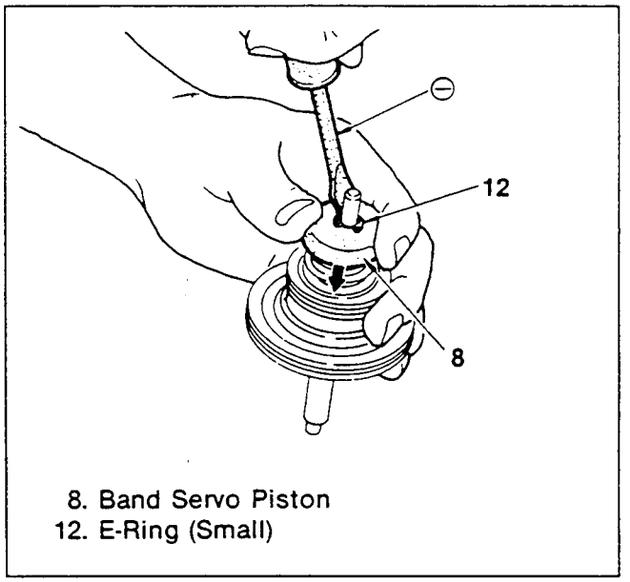
1. Using both hands, push the band servo piston assembly forward and remove it from the servo piston retainer (figure 203).



8. Band Servo Piston Assembly
14. Servo Piston Retainer

Figure 203. Band Servo Piston Removal

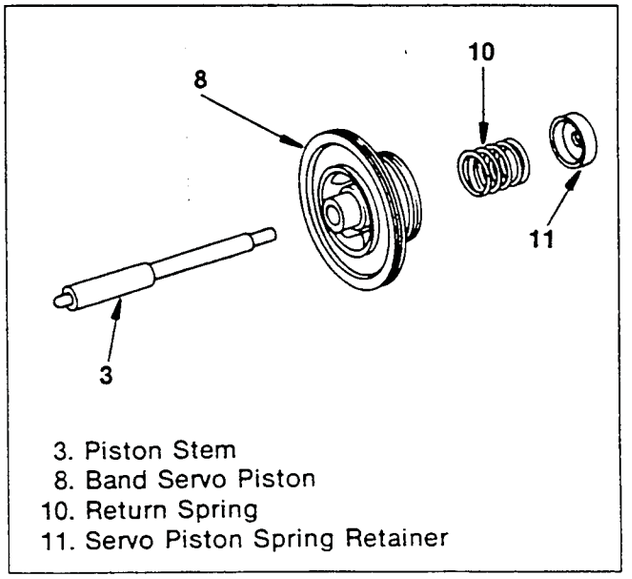
2. Place the piston stem on a piece of wood or the like. Pressing the servo cushion spring retainer down and using a flat-end screwdriver, remove the E-ring (figure 204).



8. Band Servo Piston
12. E-Ring (Small)

Figure 204. E-Ring Removal

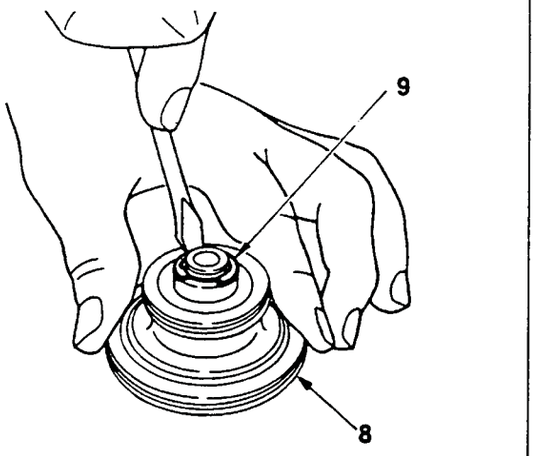
3. Remove the servo piston spring retainer, return spring and piston stem from the band servo piston (figure 205).



3. Piston Stem
8. Band Servo Piston
10. Return Spring
11. Servo Piston Spring Retainer

Figure 205. Piston Stem Removal

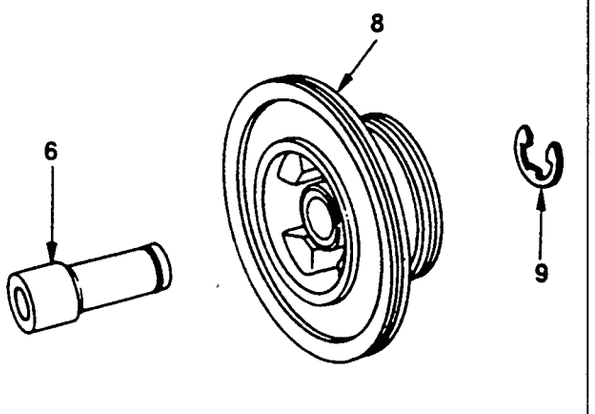
4. Remove the E-ring from the band servo piston (figure 206).



8. Band Servo Piston
9. E-Ring (Large)

Figure 206. E-Ring Removal

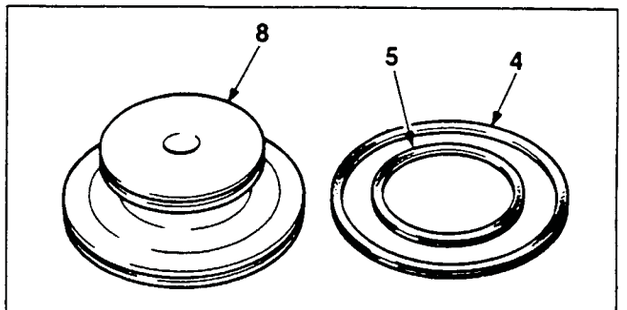
5. Remove the servo cushion spring retainer from the servo piston (figure 207).



6. Servo Cushion Spring Retainer
8. Band Servo Piston
9. E-Ring (Large)

Figure 207. Servo Cushion Spring Retainer Removal

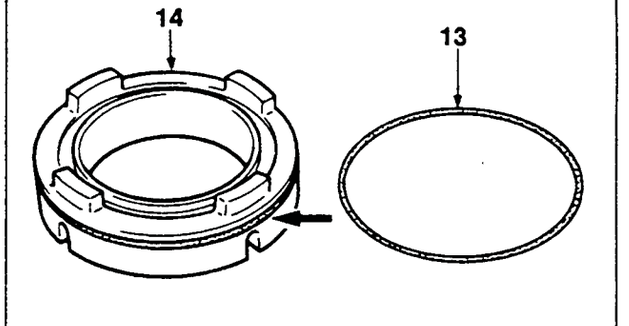
6. Remove D-ring (2pcs) from the band servo piston (figure 208).



4. D-Ring
5. D-Ring
8. Band Servo Piston

Figure 208. D-Ring Removal

7. Remove the O-ring from the servo piston retainer (figure 209).

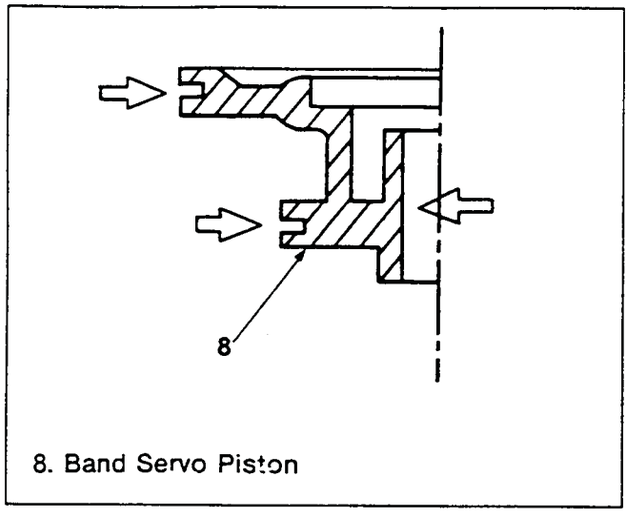


13. O-Ring
14. Servo Piston Retainer

Figure 209. O-Ring Removal

Inspect

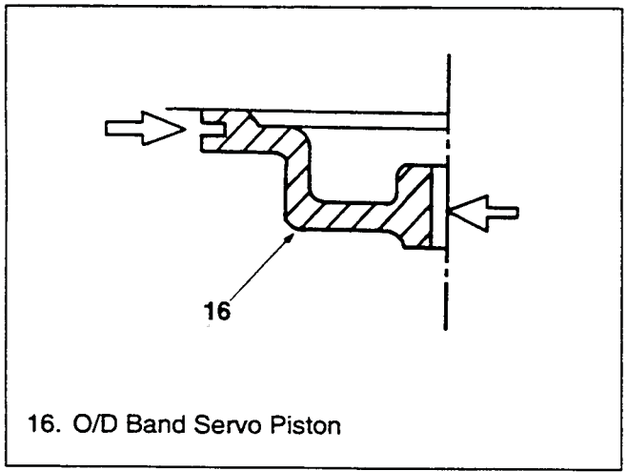
Band Servo Piston (Figure 210)
Check sliding parts for abnormal wear or damage.



8. Band Servo Piston

Figure 210. Band Servo Piston Check

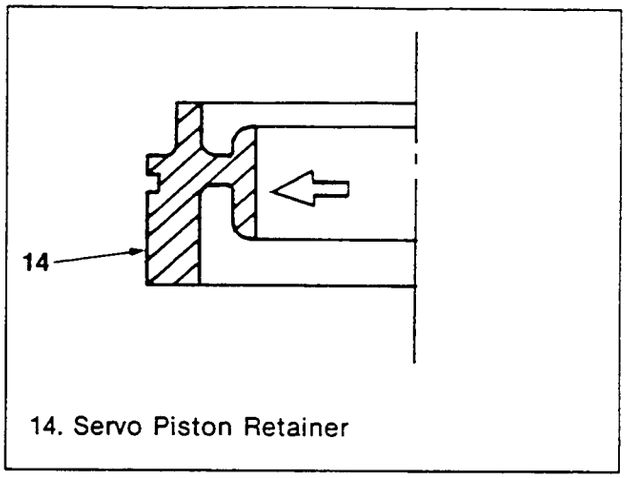
O/D Band Servo Piston (Figure 211)
Check sliding parts for abnormal wear or damage.



16. O/D Band Servo Piston

Figure 211. O/D Band Servo Piston Check

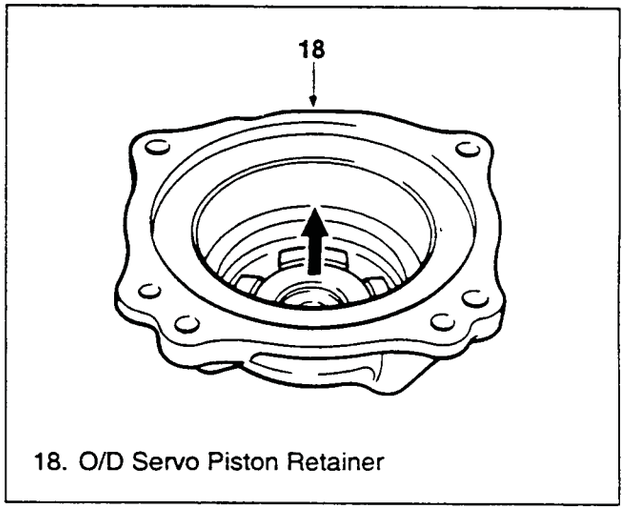
Servo Piston Retainer (Figure 212)
Check sliding parts for abnormal wear or damage.



14. Servo Piston Retainer

Figure 212. Servo Piston Retainer Check

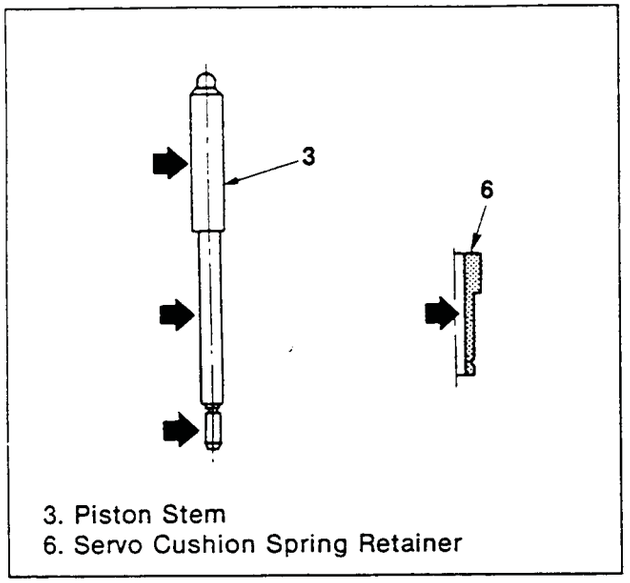
O/D Servo Piston Retainer (Figure 213)
Check sliding parts for abnormal wear or damage.



18. O/D Servo Piston Retainer

Figure 213. O/D Servo Piston Retainer Check

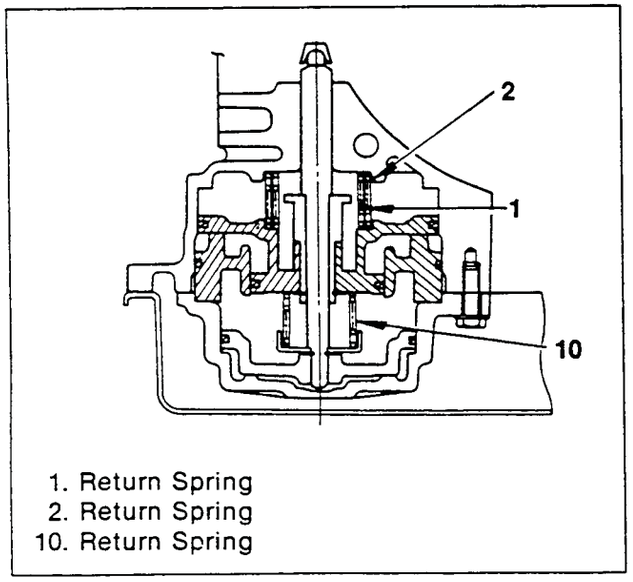
Piston Stem and Servo Cushion Spring Retainer (Figure 214)
Check sliding parts for abnormal wear or damage.



3. Piston Stem
6. Servo Cushion Spring Retainer

Figure 214. Piston Stem and Servo Cushion Spring Retainer Check

Return Spring (Figure 215)
Check the spring for damage and deformation. Check its free length, diameter, etc.



1. Return Spring
2. Return Spring
10. Return Spring

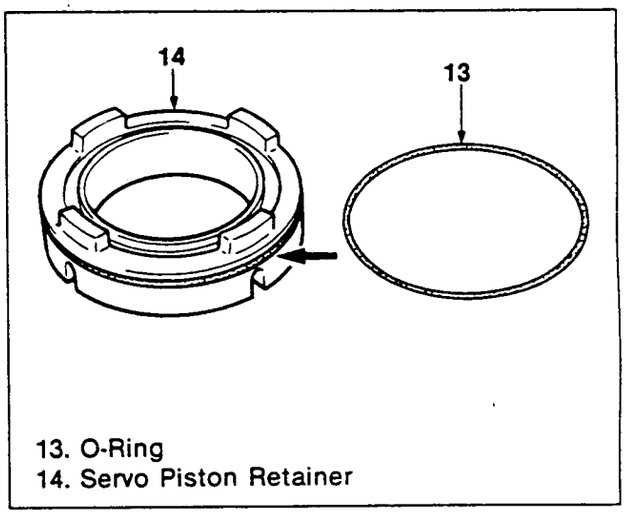
Figure 215. Return Spring Check

Return Spring free Length

Number in figure 200	Free length (mm/in)
1	44.6–46.6 / 1.75–1.83
2	52.8–54.8 / 2.07–2.16
10	28.7–30.7 / 1.13–1.21

Assemble

Servo piston retainer O-ring (Figure 216)
Apply automatic transmission fluid to a new O-ring, and fit it to the servo piston retainer.

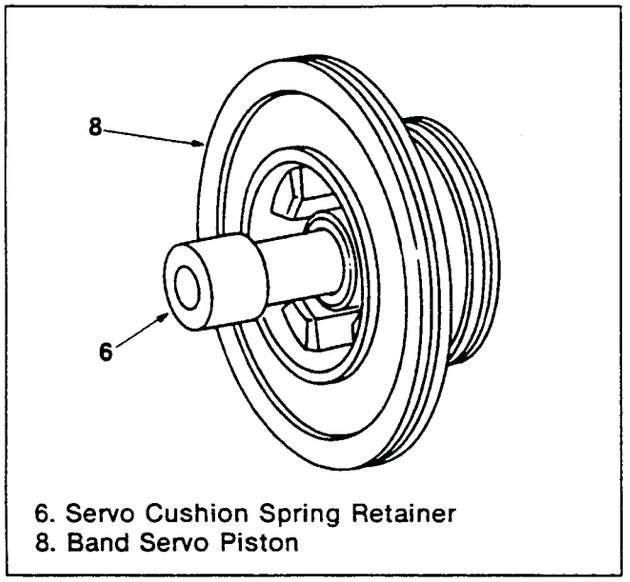


13. O-Ring
14. Servo Piston Retainer

Figure 216. O-Ring Installation

Band Servo Piston
(Figures 217, 218, 219, 220, 221 and 222)

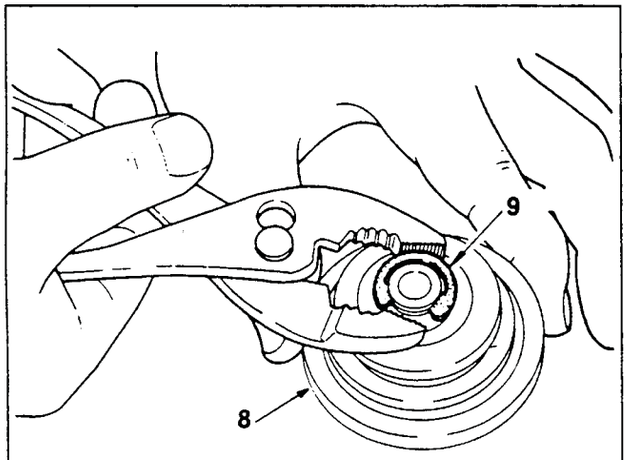
1. Attach the servo cushion spring retainer to the band servo piston (figure 217).



6. Servo Cushion Spring Retainer
8. Band Servo Piston

Figure 217. Servo Cushion Spring Retainer Installation

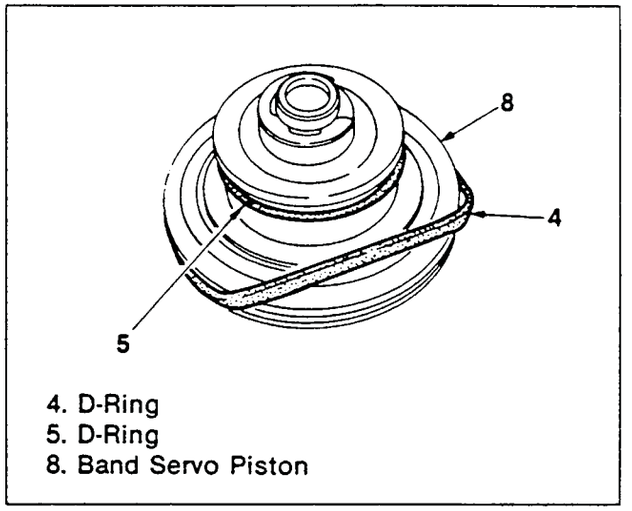
2. Using pliers, attach the E-ring to the servo cushion spring retainer (figure 218).



8. Band Servo Piston
9. E-Ring (Large)

Figure 218. E-Ring Installation

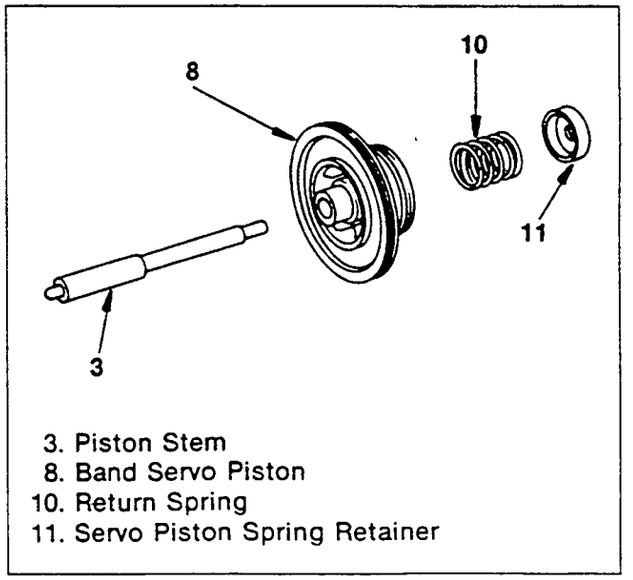
3. Apply automatic transmission fluid to new D-rings (2 pcs), and fit them to the band servo piston (figure 219).



4. D-Ring
5. D-Ring
8. Band Servo Piston

Figure 219. D-Ring Installation

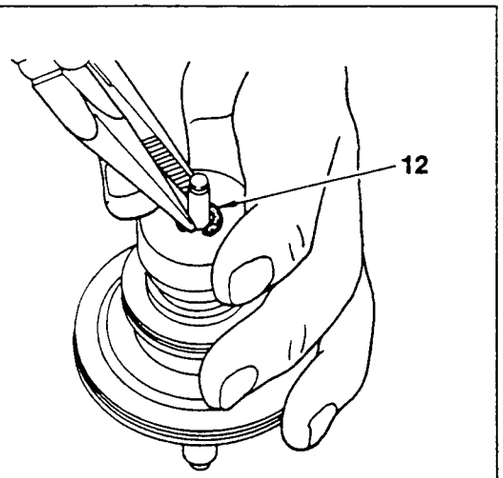
4. Fit the servo piston spring retainer, return spring and piston stem to the band servo piston (figure 220).



3. Piston Stem
8. Band Servo Piston
10. Return Spring
11. Servo Piston Spring Retainer

Figure 220. Piston Stem Installation (1)

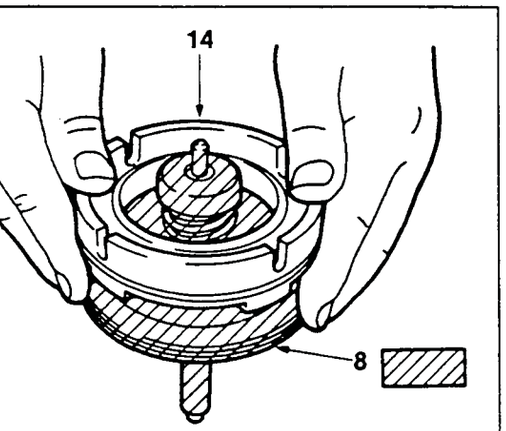
5. Place the piston stem on a piece of wood or the like. Pressing the servo piston spring retainer down and using pointed pliers, etc., attach the E-ring (figure 221).



12. E-Ring (Small)

Figure 221. Piston Stem Installation (2)

6. Using both hands, push the band servo piston assembly forward and fit it to the servo piston retainer (figure 222).

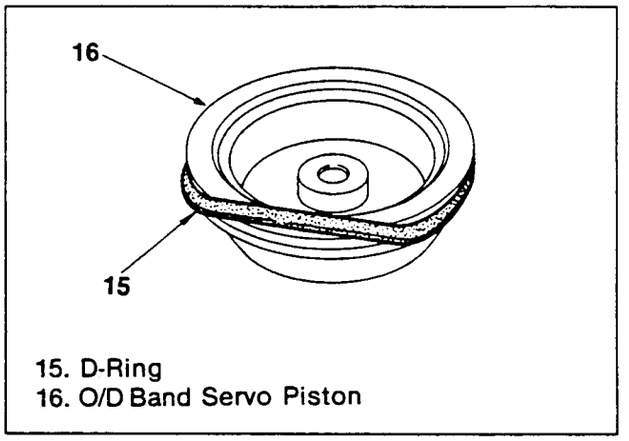


8. Band Servo Piston Assembly
14. Servo Piston Retainer

Figure 222. Band Servo Piston Installation

O/D Band Servo Piston (Figures 223 and 224)

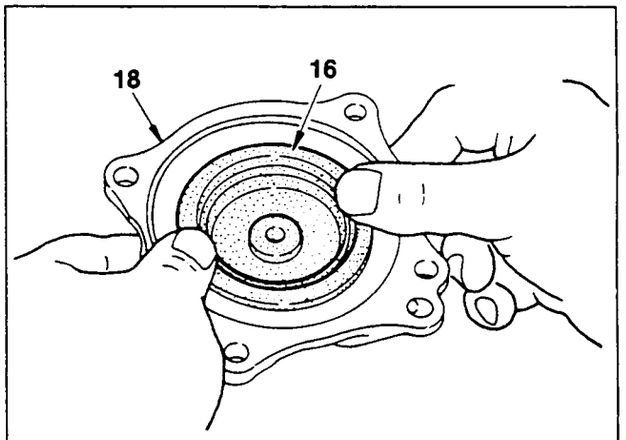
1. Apply automatic transmission fluid to a new D-ring, and fit it to the O/D band servo piston (figure 223).



15. D-Ring
16. O/D Band Servo Piston

Figure 223. D-Ring Installation

2. Using both hands, push the O/D band servo piston forward and fit it to the O/D servo piston retainer (figure 224).



16. O/D Band Servo Piston
18. O/D Servo Piston Retainer

Figure 224. O/D Band Servo Piston Installation

PARKING LINKAGE

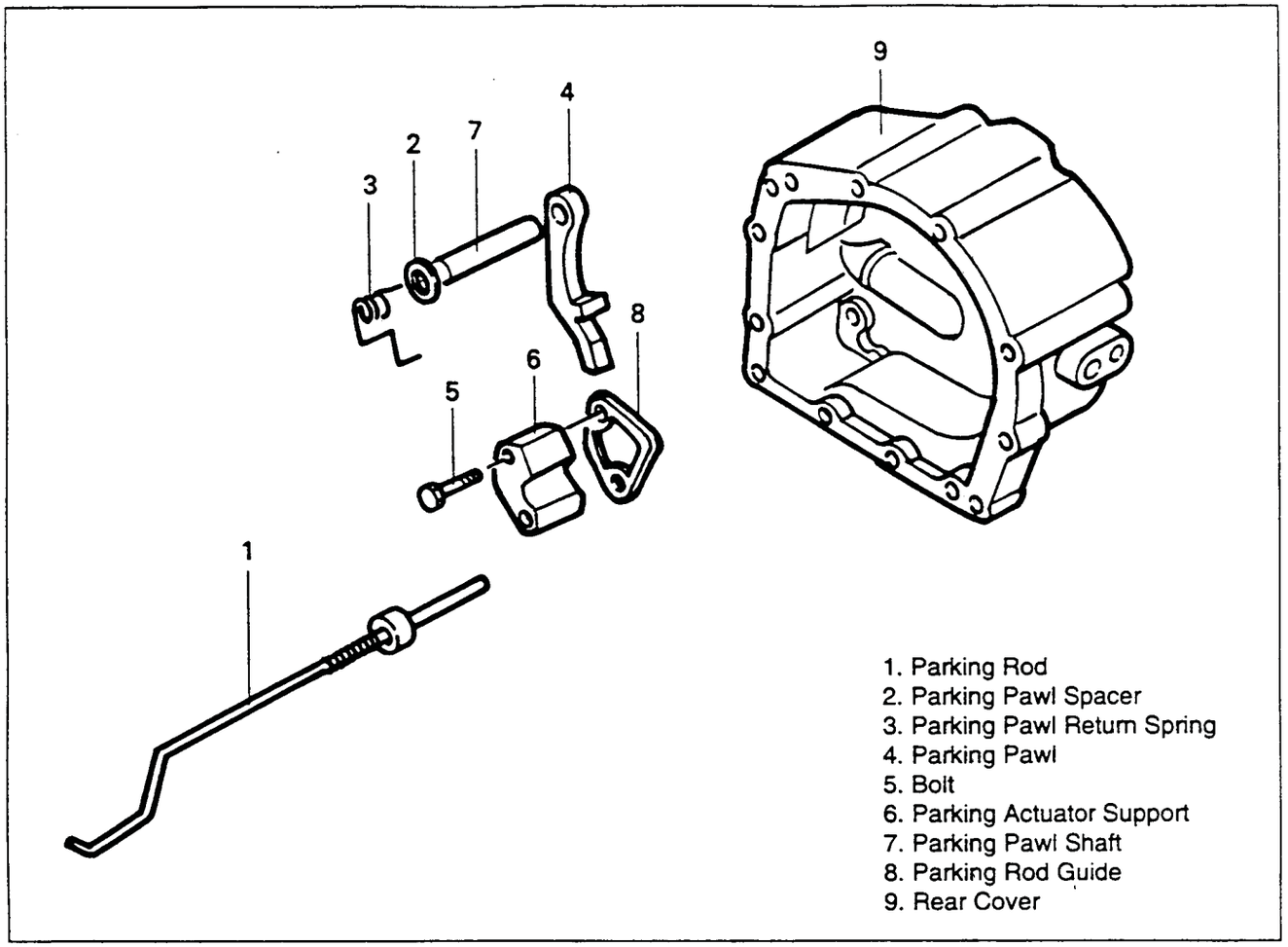


Figure 225. Parking Linkage

Inspect (Figure 226)

Check for damage and wear on each part and spring tension.

Tighten

- Parking actuator support bolts 55 N·m (41 lb·ft)

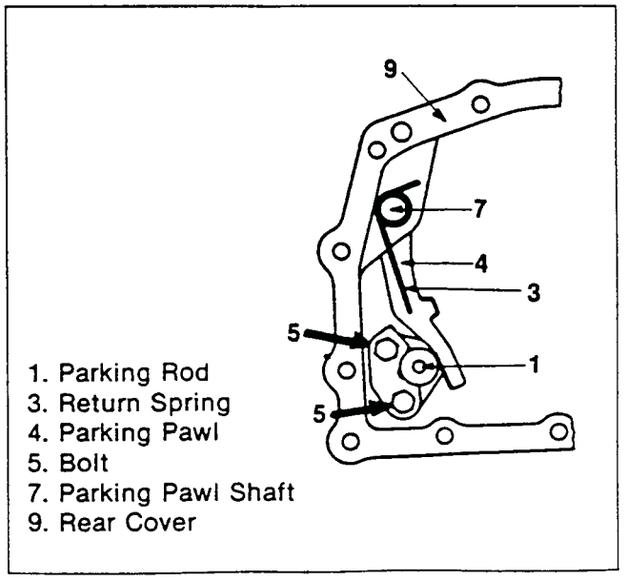


Figure 226. Parking Linkage Inspection

REASSEMBLY AND ADJUSTMENT OF MAJOR COMPONENT

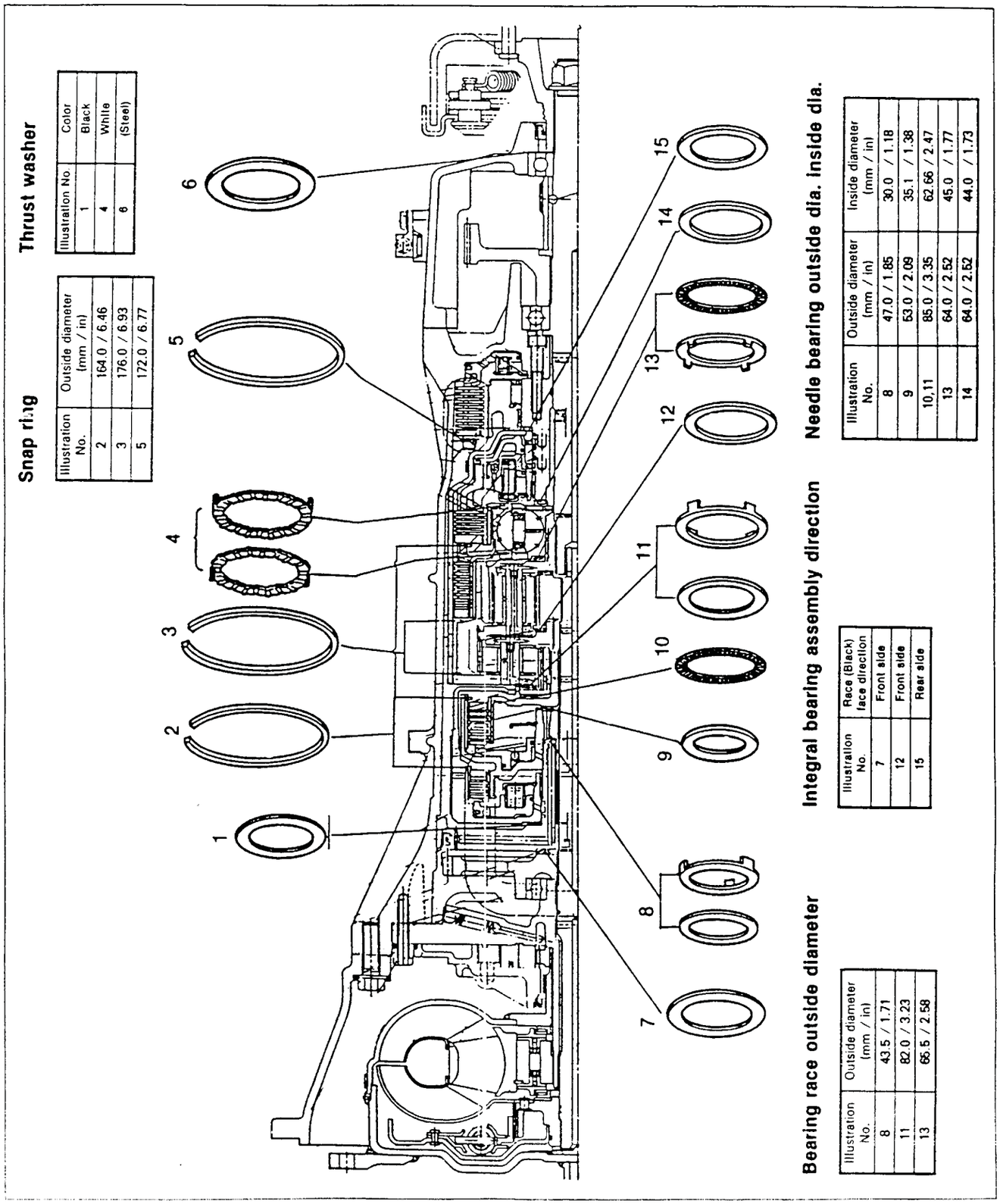


Illustration No.	Outside diameter (mm / in)
2	164.0 / 6.46
3	176.0 / 6.93
5	172.0 / 6.77

Illustration No.	Color
1	Black
4	White
6	(Steel)

Illustration No.	Race (Black) face direction
7	Front side
12	Front side
15	Rear side

Illustration No.	Outside diameter (mm / in)	Inside diameter (mm / in)
8	47.0 / 1.85	30.0 / 1.18
9	53.0 / 2.09	35.1 / 1.38
10,11	85.0 / 3.35	62.66 / 2.47
13	64.0 / 2.52	45.0 / 1.77
14	64.0 / 2.52	44.0 / 1.73

Illustration No.	Outside diameter (mm / in)
8	43.5 / 1.71
11	82.0 / 3.23
13	66.5 / 2.58

Figure 227. Snap Ring, Bearing Race , Washer Assembling Position and Dimensions

Install or Connect

Power Take-Off (PTO) cover (Figure 228)

1. Install a new gasket.
2. Install the PTO cover with six new bolts.

Tighten

- PTO cover bolts 38 N·m (28 lb·ft)

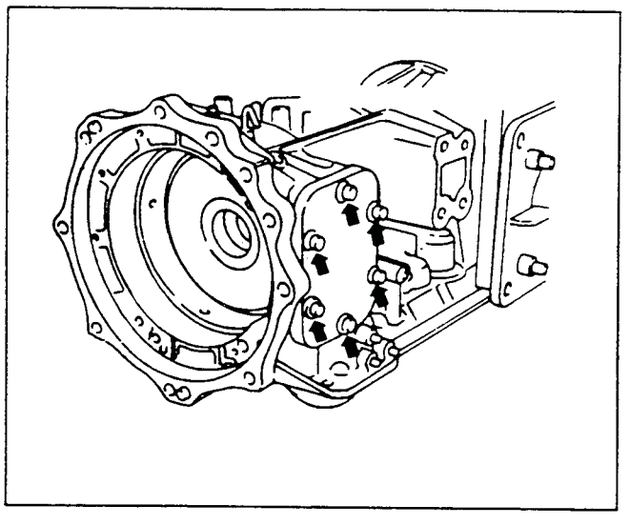
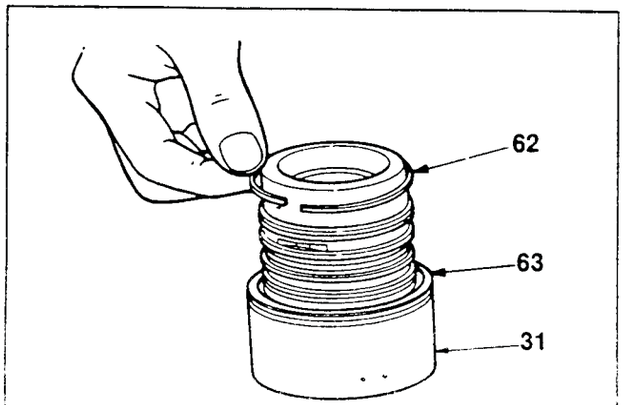


Figure 228. PTO Cover Installation

Low One-way Clutch and Inner Race (Figures 229, 230, 231 and 232)

1. Apply Vaseline to the low one-way clutch, inner race and thrust bearing and attach them in the designated position (figure 229).



31. Low One-way Clutch Inner Race
62. Seal Ring
63. Thrust Bearing

Figure 229. Low One-way Clutch Inner Race Seal Ring and Thrust Bearing Installation

Important

- Install the bearing with its black side facing the rear.

2. Apply Vaseline to four new seal rings, and install them.

Important

- When attaching the seal ring, prevent distortion by not spreading it too far.

Measure

Measure the gap between the seal ring and the groove with a thickness gage. If the thickness is beyond the limit, replace the inner race (figure 230).

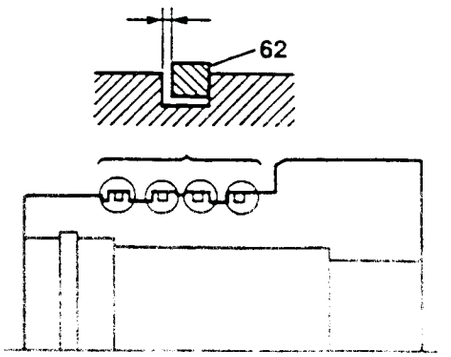
Gap
Standard: 0.10 – 0.25 mm (0.004 – 0.010 in)
Limit : 0.25 mm (0.010 in)

3. In order to prevent the seal ring from spreading out, apply Vaseline to the seal ring and fix it with tape temporarily while the seal ring is being formed.

Important

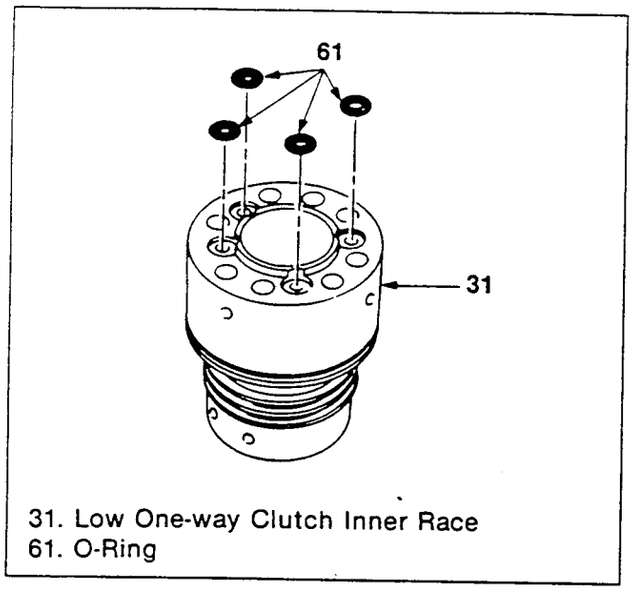
- If the seal ring is spread out, it will be damaged during the time the drum is assembled.

4. Apply Vaseline to four new O-rings and attach them in the designated positions in the inner race (figure 231).



62. Seal Ring

Figure 230. Low One-way Clutch Inner Race Inspection



31. Low One-way Clutch Inner Race
61. O-Ring

Figure 231. Low One-way Clutch Inner Race O-Ring Installation

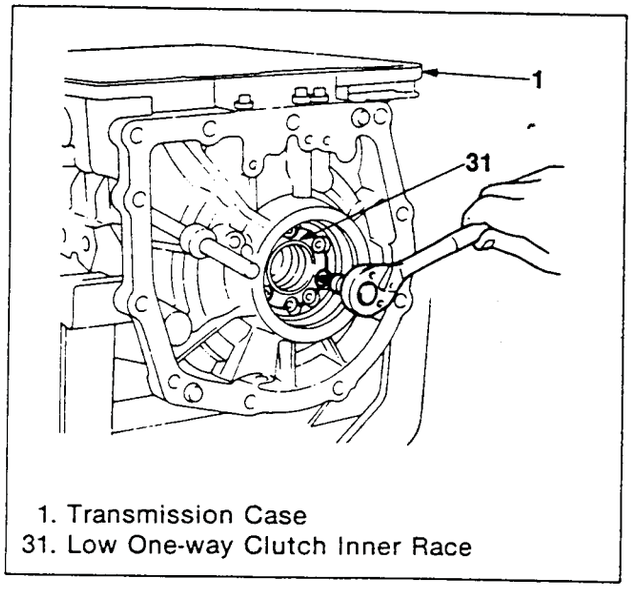
6. Install the inner race in the transmission case with new bolts and new washers (figure 232).

Tighten

- Low one-way clutch inner race bolts 25 N·m (19 lb·ft)

Important

- To properly install the inner race, all bolt holes must be aligned correctly.



1. Transmission Case
31. Low One-way Clutch Inner Race

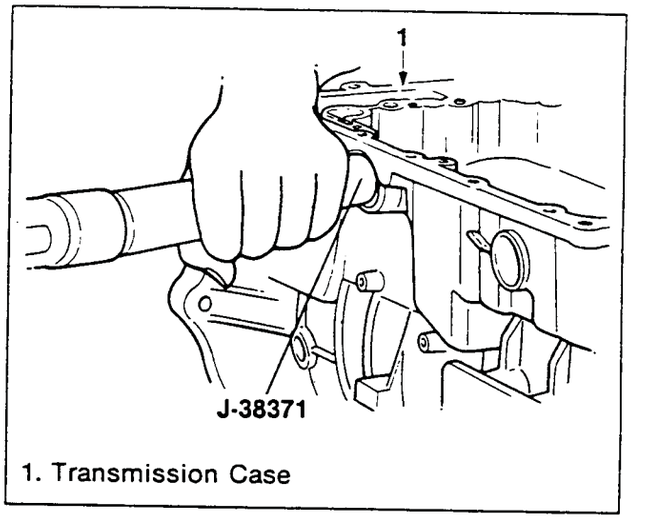
Figure 232. Low One-way Clutch Inner Race Bolt Installation

NOTICE: Do not reuse the inner race fixing bolts and washers.

Manual Shaft Oil Seal (Figure 233)

Apply automatic transmission fluid on the inside of the case and the surface of the new oil seal and strike it down with a installer.

Manual Shaft Oil Seal Installer: J-38371



1. Transmission Case

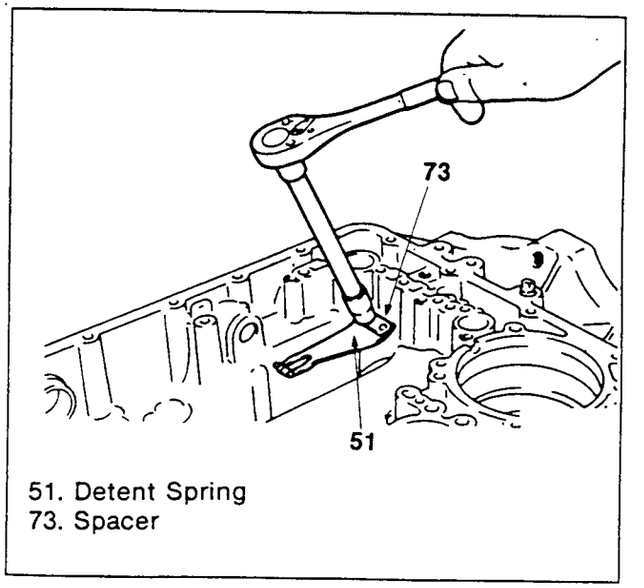
Figure 233. Manual Shaft Oil Seal Installation

Detent Spring (Figure 234)

Attach the detent spring and the spacer to the designated positions, then fasten the bolts with specific torque.

Tighten

- Detent spring bolt 5 N·m (43 lb·in)



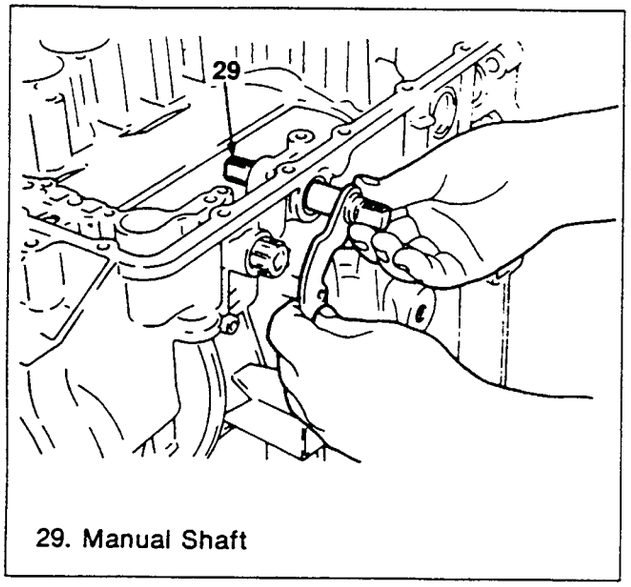
51. Detent Spring
73. Spacer

Figure 234. Detent Spring Installation

Manual Shaft (Figures 235 and 236)

1. Apply automatic transmission fluid the manual shaft and to the lip seal.
2. Insert the manual shaft slowly so the oil seal is not damaged (figure 235).
3. Drive the spring pin into the shaft groove with a hammer (figure 236).

NOTICE: Do not reuse the spring pin.

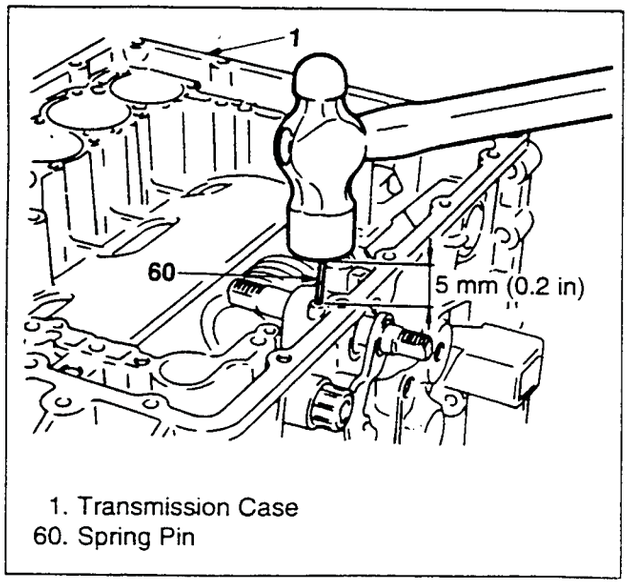


29. Manual Shaft

Figure 235. Manual Shaft Installation (1)

Important

- Locate the pin position with a thin wire, and drive the pin lightly into the groove until it protrudes 5 mm (0.2 in) above the surface.



1. Transmission Case
60. Spring Pin

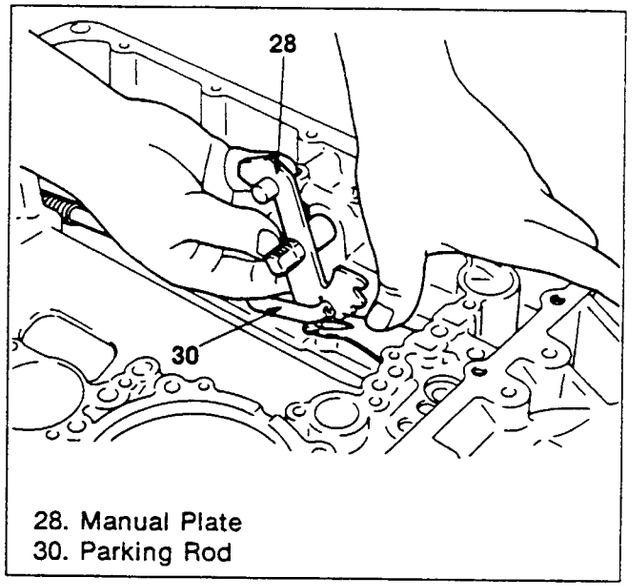
Figure 236. Manual Shaft Installation (2)

Manual Plate (Figures 237 and 238)

1. Attach the manual plate and the parking rod together (figure 237).

Important

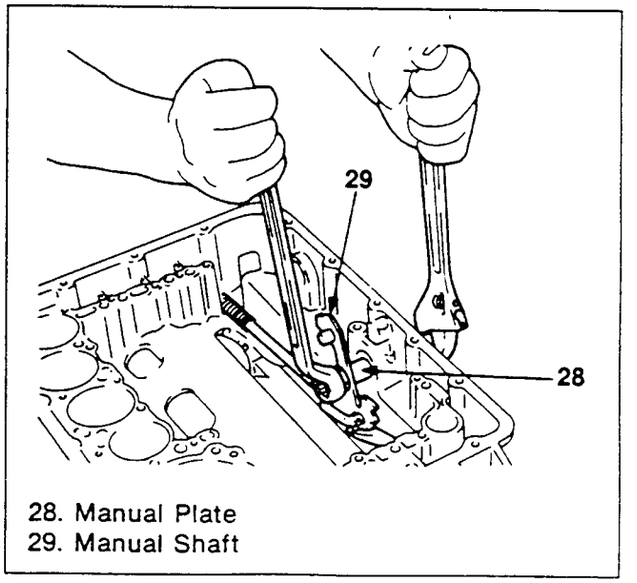
- Be careful about the parking rod direction.



28. Manual Plate
30. Parking Rod

Figure 237. Manual Plate Installation (1)

2. Attach the plate to the manual shaft by pushing down the detent spring lightly.



28. Manual Plate
29. Manual Shaft

Figure 238. Manual Plate Installation (2)

Important

- Be careful about the manual plate direction.

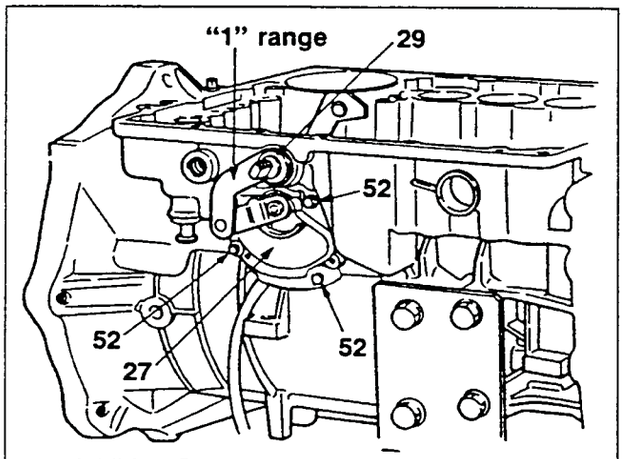
3. Hold the manual shaft at the flat area with an adjustable wrench and install the manual plate with two lock nuts (figure 238).

Tighten

- Manual plate 35 N·m (26 lb·ft)

Inhibitor Switch (Figures 239, 240 and 241)

1. Set manual shaft to range "1" (figure 239).
2. Attach the inhibitor switch and clips to tentative positions.



27. Inhibitor Switch
29. Manual Shaft
52. Bolt

Figure 239. Inhibitor Switch Installation (1)

Important

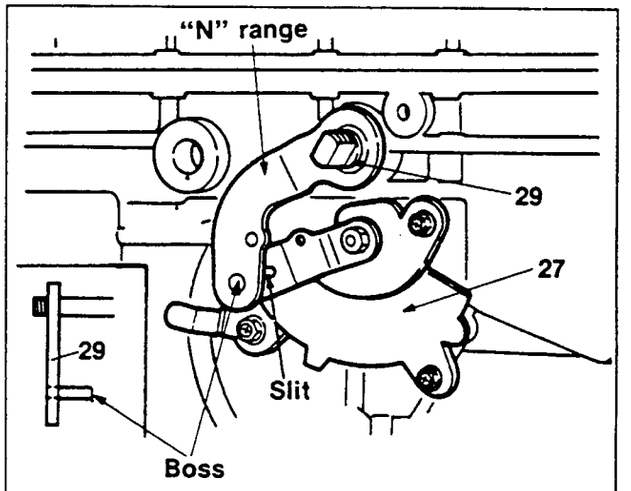
- Insert the slit of the inhibitor switch between the manual shaft lever bosses (figure 240).

3. Set the manual shaft to "N".
4. Insert pin (4.0 mm /0.16 in in diameter) vertically into the hole, which decide the positions of the inhibitor switch and the manual shaft lever, and bolt them (figure 241).

Tighten

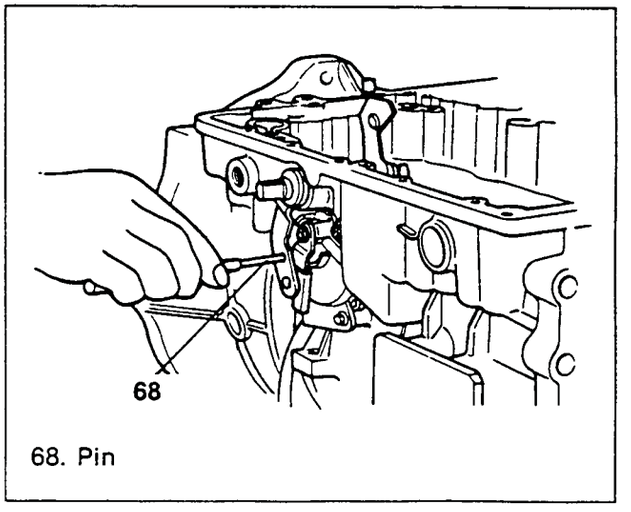
- Inhibitor switch bolts 3 N·m (26 lb·in)

5. Remove the pin.



27. Inhibitor Switch
29. Manual Shaft Lever

Figure 240. Inhibitor Switch Installation (2)



68. Pin

Figure 241. Inhibitor Switch Alignment

Accumulator (Figures 242 and 243)

1. Apply automatic transmission fluid (ATF) to new O-rings, then install them to the accumulator pistons (figure 242).

Size of O-ring contacts

Accumulator	Diameter (mm / in)	
	Small side	Large side
A	29 / 1.14	45 / 1.77
B	32 / 1.26	50 / 1.97
C	45 / 1.77	50 / 1.97
D	29 / 1.14	45 / 1.77

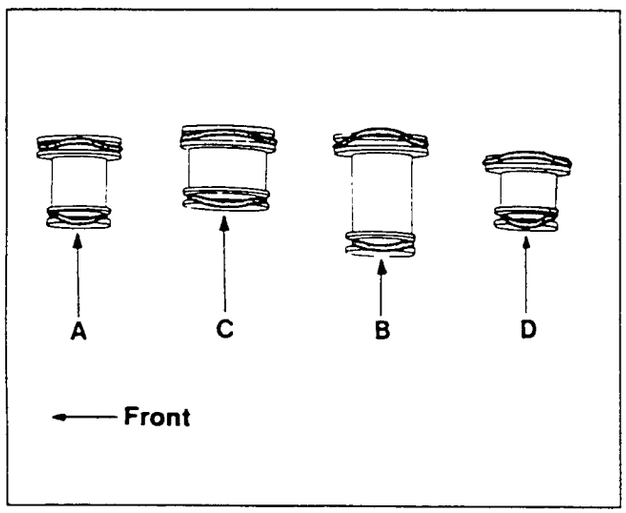


Figure 242. Accumulator Piston

2. Put the spring into the case hole of the accumulator (figure 243).

Free length of the springs

Accumulator	Flee length (mm / in)
A	42.0 – 44.0 / 1.65 – 1.73
B	65.0 – 67.0 / 2.56 – 2.64
C	44.0 – 46.0 / 1.73 – 1.81
D	57.4 – 59.4 / 2.26 – 2.34

3. Put four accumulator pistons into the case holes.

Important

- Attach them in the right positions

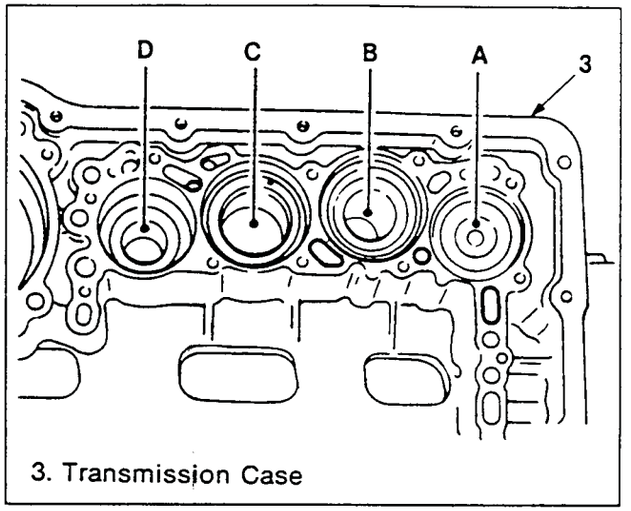


Figure 243. Accumulator Case Hole

Band Servo (Figures 244 and 245)

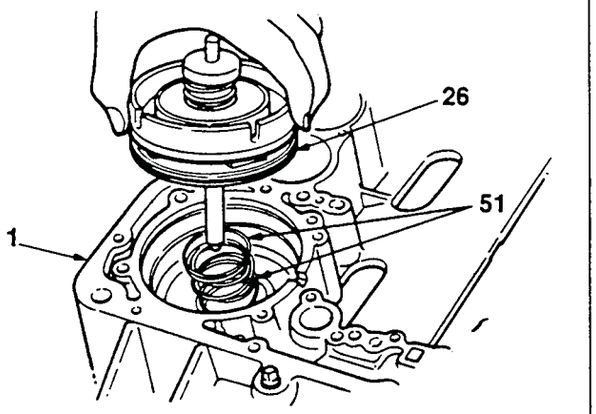
1. Put two return springs into the case (figure 244).
2. Apply ATF to the outer surface of the piston and inside the case, and push the piston by hand into the case.
3. Install the new gasket.
4. Install the retainer and fasten it with bolts (figure 245).

Tighten

- Retainer bolts 8 N·m (69 lb·in)

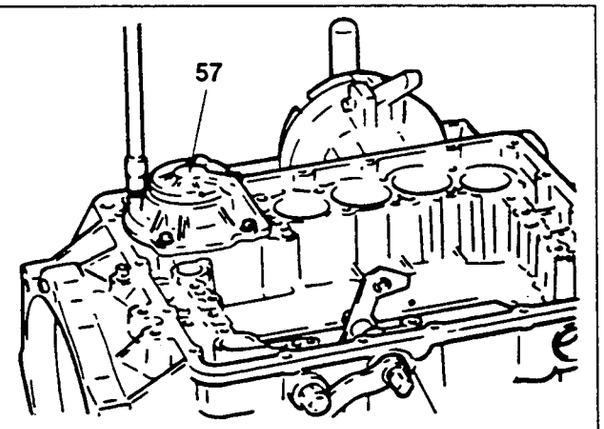
Important

- Install the retainer in the right direction



1. Transmission Case
26. Band Servo
51. Return Spring

Figure 244. Band Servo Installation



57. Retainer

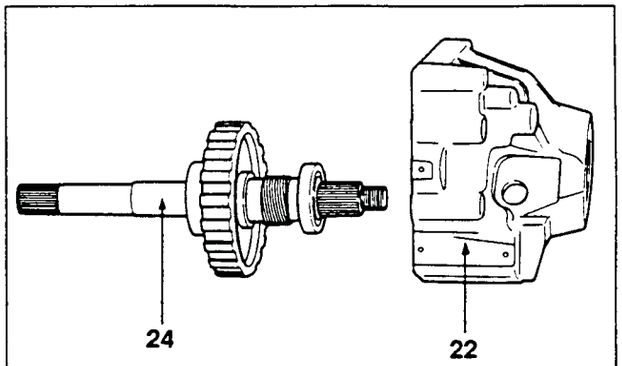
Figure 245. Band Servo Retainer Installation

Rear Cover
(Figures 247, 248, 249, 250, 251 and 252)

1. Install the new gasket.
2. Install the output shaft assembly to the rear cover (Figure 247).
3. Install the rear cover to the case (Figure 248).

Important

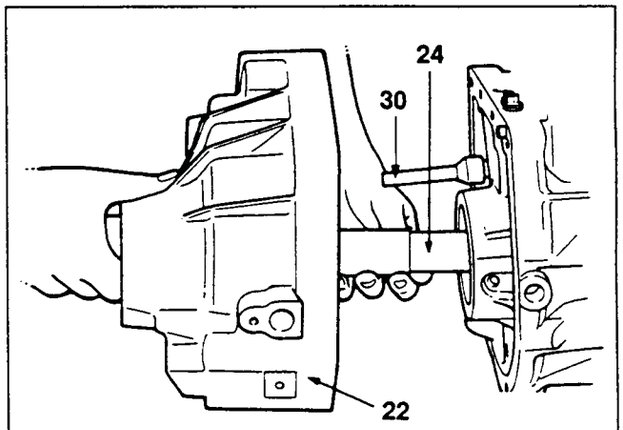
- Be sure to insert the parking rod into the parking pawl.



22. Rear Cover
24. Output Shaft Assembly

Figure 247. Rear Cover and Output Shaft Installation (1)

4. Attach the rear cover with the proper new bolts, paying attention to the lengths (figure 249).



22. Rear Cover
24. Output Shaft
30. Parking Rod

Figure 248. Rear Cover and Output Shaft Installation (2)

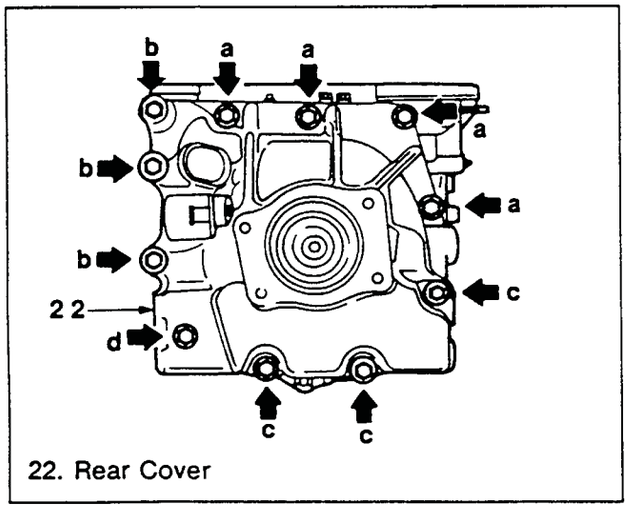
Length and quantity of the bolts

Chart mark	Length of shank (mm / in)	Quantity
a	50 / 1.97	4
b	85 / 3.35	3
c	115 / 4.53	2
d	115 / 4.53 (with hole)	1

Tighten

- Rear cover bolts 65 N·m (48 lb·ft)

NOTICE: Do not reuse the rear cover fixing bolts and washers.



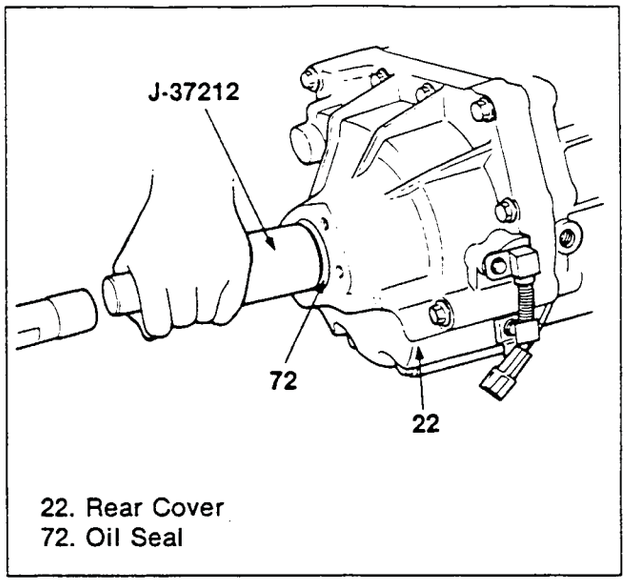
22. Rear Cover

Figure 249. Rear Cover Bolt Installation

5. Apply Vaseline to the outer surface of the new oil seal and inner circle of the rear cover.
6. Install oil seal to the rear cover using a installer (figure 250).
   Rear Oil Seal Installer: J-37212
7. Attach three clips (figure 251).

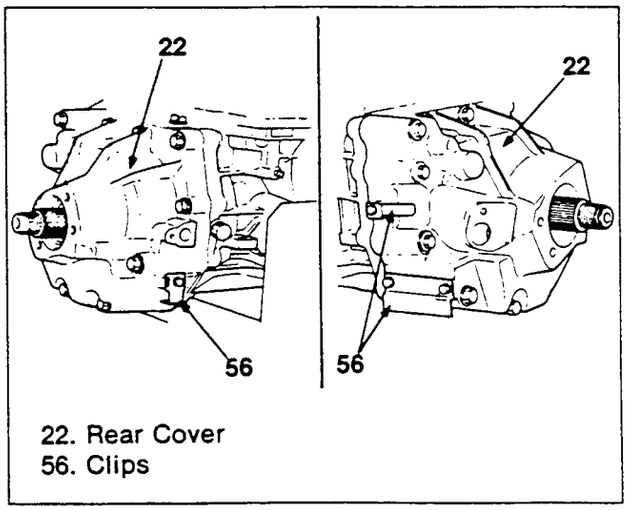
Tighten

- Clip bolts 6 N·m (52 lb·in)



22. Rear Cover
72. Oil Seal

Figure 250. Rear Oil Seal Installation



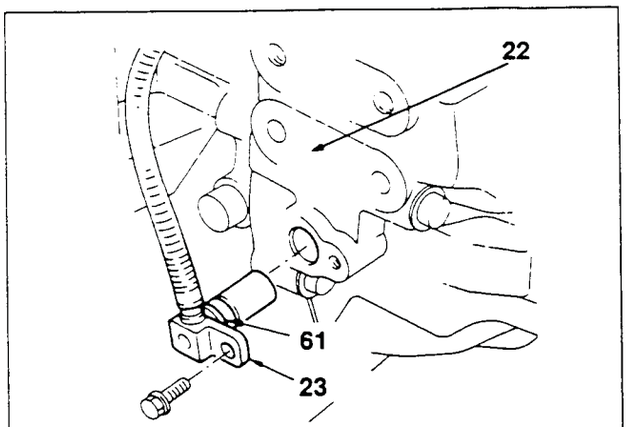
22. Rear Cover
56. Clips

Figure 251. Rear Cover Clip Installation

8. Apply Vaseline to the new O-ring then attach to the vehicle speed sensor (figure 252).
9. Attach the vehicle speed sensor to the rear cover and fasten it with the bolts.

Tighten

- Vehicle speed sensor 6 N·m (52 lb·in)

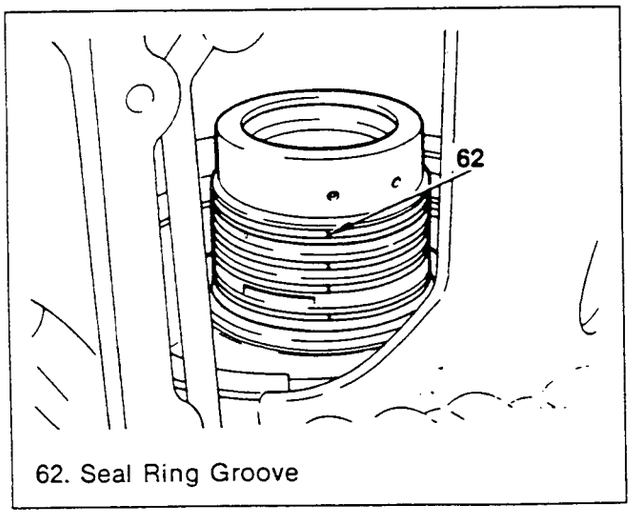


22. Rear cover
23. Vehicle Speed Sensor
61. O-Ring

Figure 252. Vehicle Speed Sensor Installation

Forward Clutch Assembly (Figures 253 and 254)

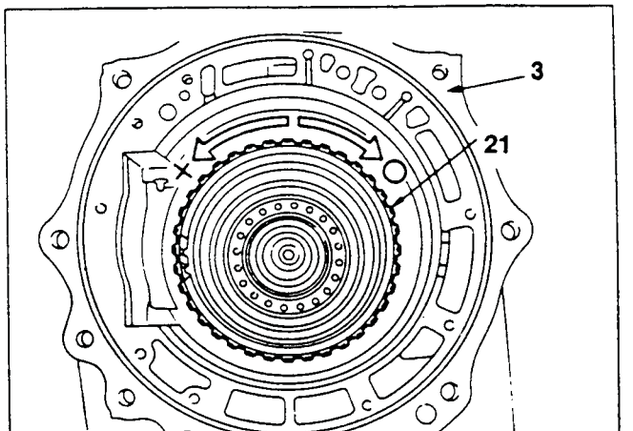
1. Remove the tape, etc which was used to prevent the forward clutch assembly from spreading from the low one-way clutch seal ring, and push the seal ring into the groove using Vaseline (figure 253).



62. Seal Ring Groove

Figure 253. Forward Clutch Seal Ring Installation

2. Put the forward clutch assembly into the case while turning it clockwise (figure 254).

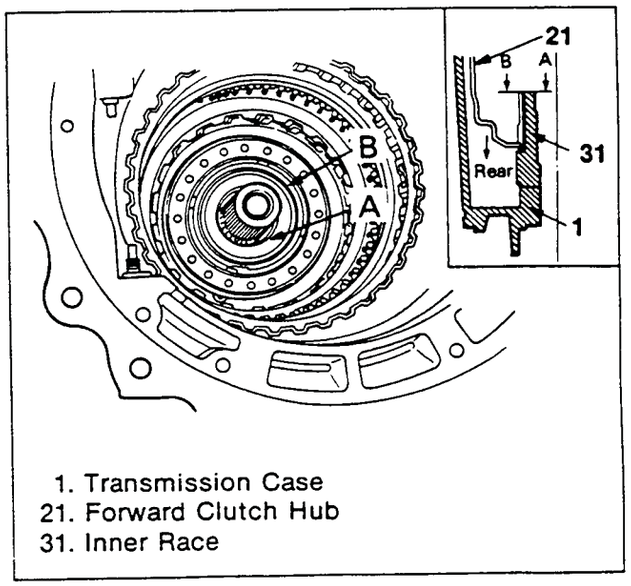


3. Transmission Case
21. Forward Clutch Assembly

Figure 254. Forward Clutch Assembly Installation

Important (Figure 255)

1. Normally, the forward clutch drum turns only clockwise.
   If it turns counterclockwise, check the installation of the low one-way clutch.
2. Push the forward clutch assembly in deeply so the inner race front (A) shows 0.5 – 1.0 mm (0.02 – 0.04 in) from the end of the clutch assembly inner drum (B) (figure 255).

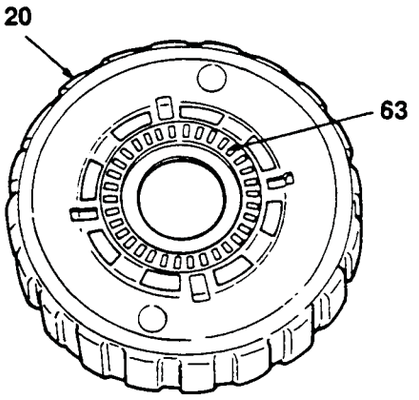


1. Transmission Case
21. Forward Clutch Hub
31. Inner Race

Figure 255. Forward Clutch Assembly Inspection

Overrun Clutch Hub (Figures 256 and 257)

1. Apply Vaseline to the thrust bearing and the thrust washer, and install them to the overrun clutch hub (figure 256).
2. Install overrun clutch hub to the forward clutch assembly (figure 257).

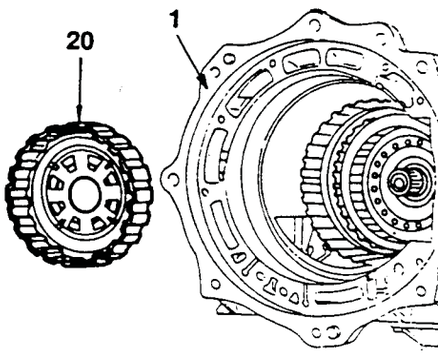


20. Overrun Clutch Hub
63. Thrust Bearing

Figure 256. Overrun Clutch Hub Installation (1)

Important

- Insert the overrun clutch hub so the thrust bearing contacts the inner race.

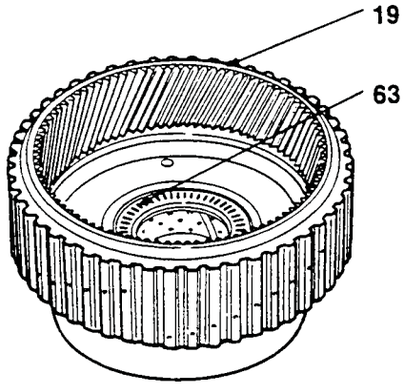


1. Transmission Case
20. Overrun Clutch Hub

Figure 257. Overrun Clutch Hub Installation (2)

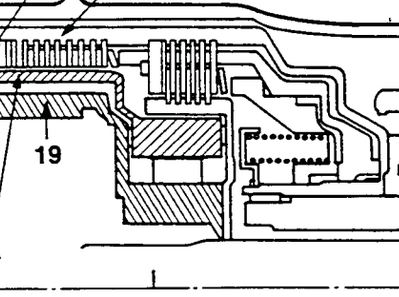
Forward Clutch Hub and Rear Internal Gear (Figures 258 and 259)

1. Apply Vaseline to the thrust bearing and attach it to the rear internal gear (figure 258).



19. Rear Internal Gear
63. Thrust Bearing

Figure 258. Forward Clutch Hub and Rear Internal gear Installation (1)



19. Rear Internal Gear
21. Forward Clutch
A. Forward Clutch Hub
B. Forward Clutch Retaining Plate

Figure 259. Forward Clutch Hub and Rear Internal Gear Installation (2)

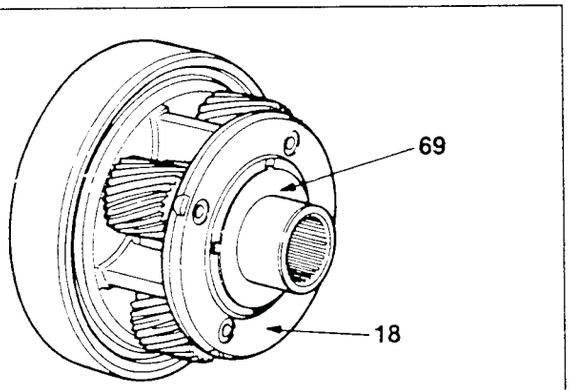
2. Put the forward clutch hub and the rear internal gear together and install them to the forward clutch assembly.

Important

- Assemble the forward clutch inner race and the overrun clutch hub completely together. If the assembly is completed, the end of the forward clutch hub (A) comes to approximately 1 mm (0.04 in) from the front surface (B) of the retaining plate in the forward clutch assembly (figure 259).

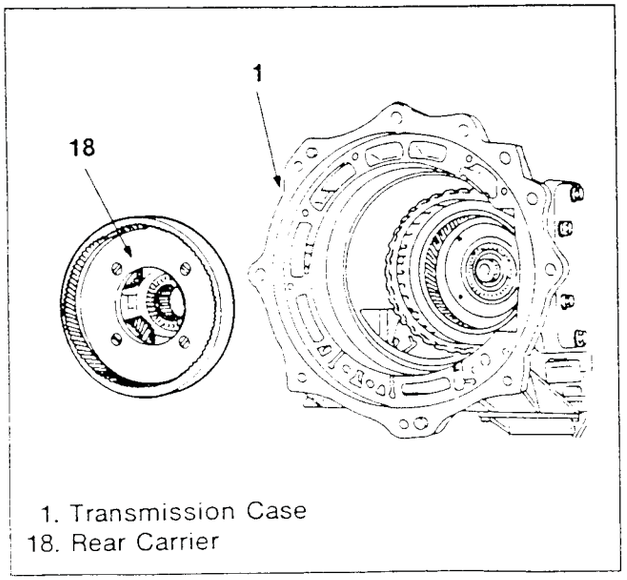
Rear Carrier (Figures 260 and 261)

1. Apply Vaseline to the bearing race and install it to the rear carrier (figure 260).
2. Attach the rear carrier to the rear internal gear (figure 261).



18. Rear Carrier
69. Bearing Race

Figure 260. Rear Carrier Installation (1)



1. Transmission Case
18. Rear Carrier

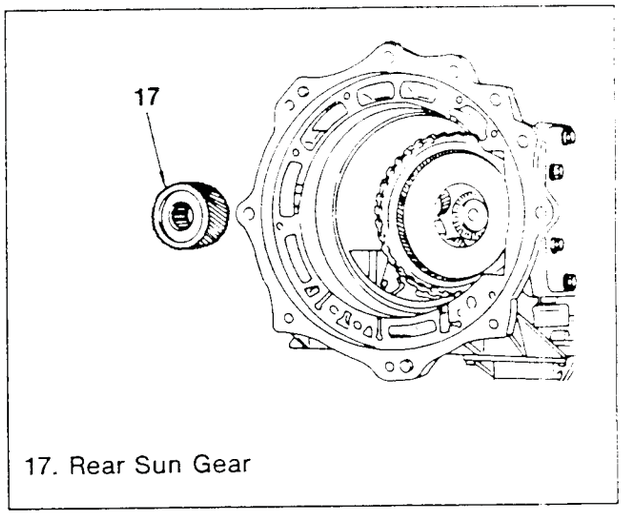
Figure 261. Rear Carrier Installation (2)

Rear Sun Gear (Figure 262)

Install the rear sun gear into the rear carrier

Important

- Install it so the side with wider polished surface to the rear.

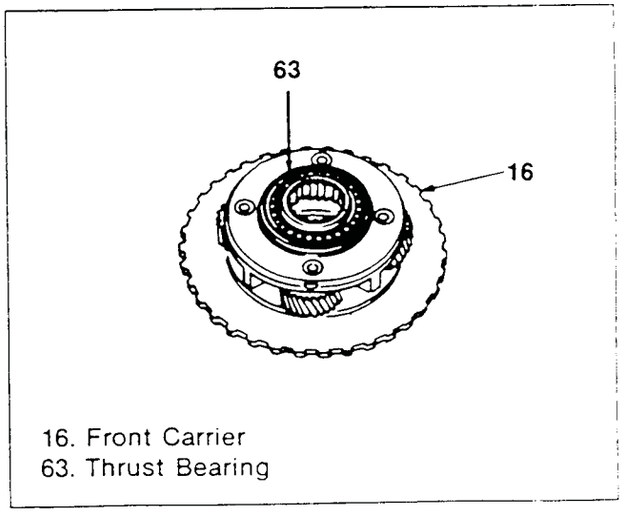


17. Rear Sun Gear

Figure 262. Rear Sun Gear Installation

Front Carrier (Figures 263 and 264)

1. Apply Vaseline to the thrust bearing combined with the thrust washer and attach it into the front carrier (figure 263).



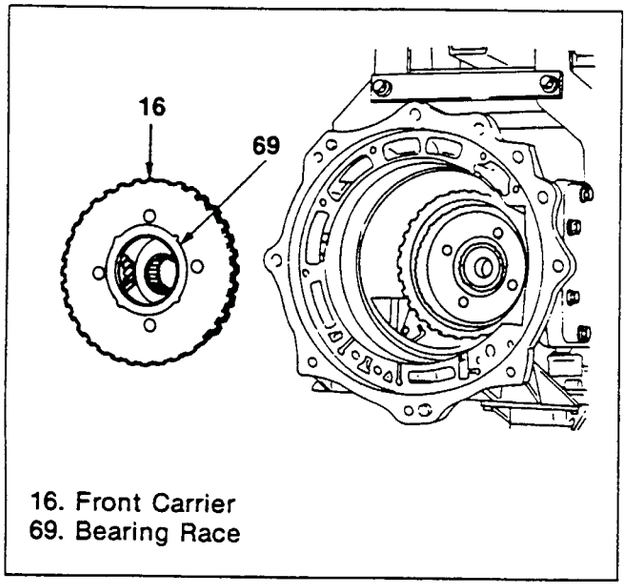
16. Front Carrier
63. Thrust Bearing

Figure 263. Front Carrier Installation (1)

2. Attach the front carrier to the forward clutch assembly (figure 264).

Important

- Check that the front face of the front carrier and the face of the forward clutch drum are in same level. If not, check the installation processes from the forward clutch assembly, to see if there is anything wrong.

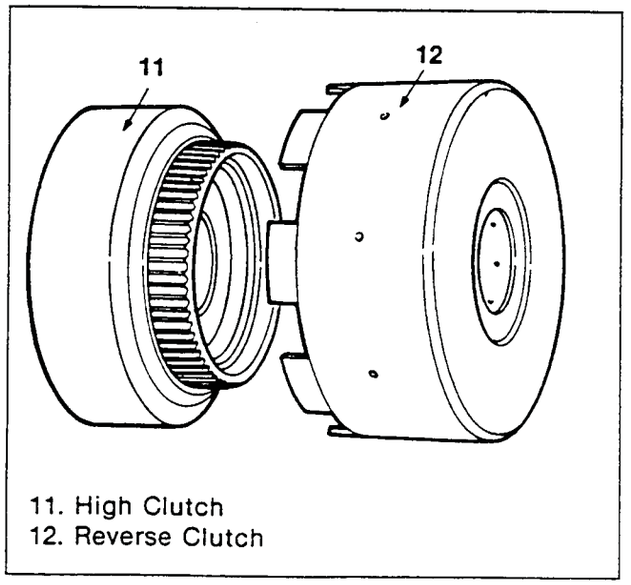


16. Front Carrier
69. Bearing Race

Figure 264. Front Carrier Installation (2)

Clutch Pack (Figures 265, 266, 267 and 268)

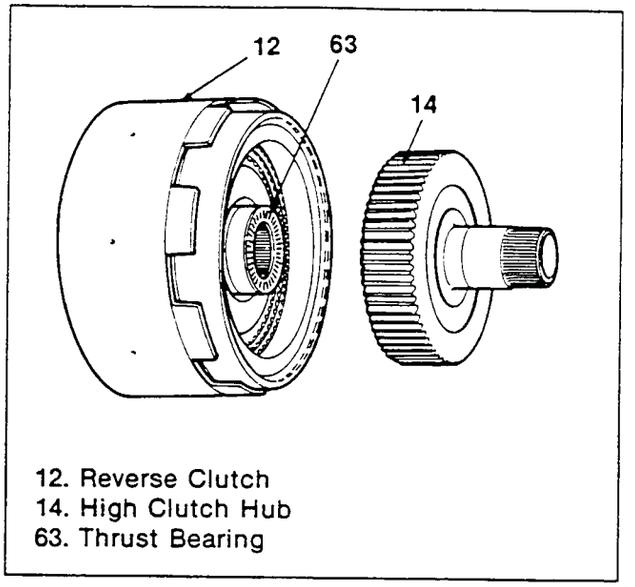
1. Put the high clutch and the reverse clutch together (figure 265).



11. High Clutch
12. Reverse Clutch

Figure 265. Clutch Pack Reassembly (1)

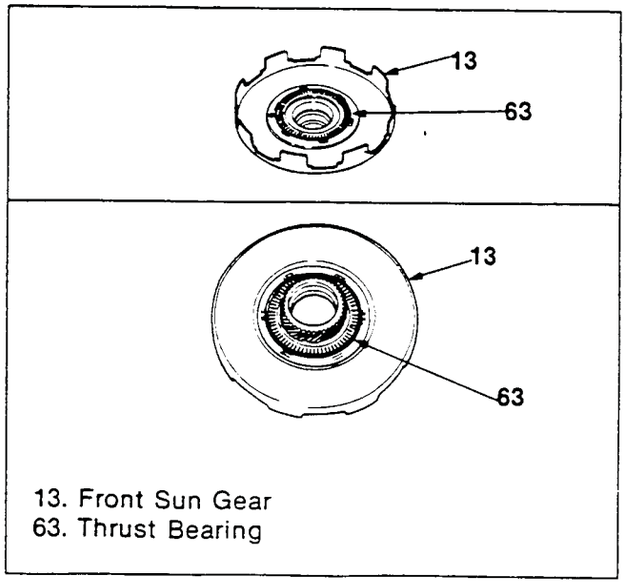
2. Attach the thrust bearing to the rear side of the high clutch (figure 266).
3. Install the high clutch hub.



12. Reverse Clutch
14. High Clutch Hub
63. Thrust Bearing

Figure 266. Clutch Pack Reassembly (2)

4. Apply Vaseline to the two thrust bearings, then install them to the front sun gear (figure 267).

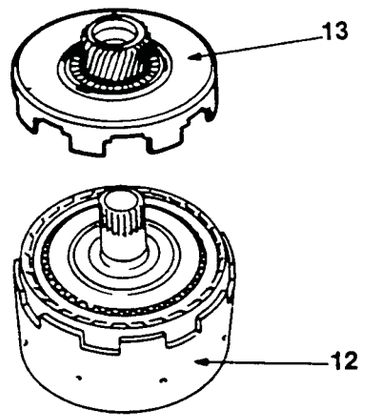


13. Front Sun Gear
63. Thrust Bearing

Figure 267. Clutch Pack Reassembly (3)

5. Install the front sun gear to the reverse clutch (figure 268).

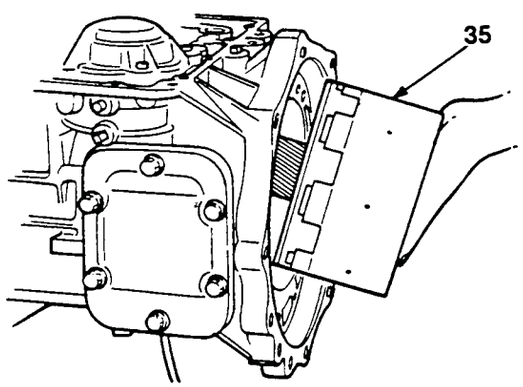
NOTICE: There shouldn't be any gap in the joint between the front sun gear and the reverse clutch. If there is, reinstall the high clutch and repeat the process.



12. Reverse Clutch
13. Front Sun Gear Assembly

Figure 268. Clutch Pack Reassembly (4)

6. Install the clutch pack into the front carrier (figure 269).



35. Clutch Pack

Figure 269. Clutch Pack Installation

7. Insert the clutch pack until there is no gap between it and the front carrier.

Important

- If the clutch pack comes off during installation, go back and reassemble it. After installation, push on the clutch pack firmly to ensure proper fit.

Brake Band (Figure 270)

1. Apply the sealing compound (Three Bond 1215 or equivalent) to mid part thread of the anchor end pin and install the anchor end pin.

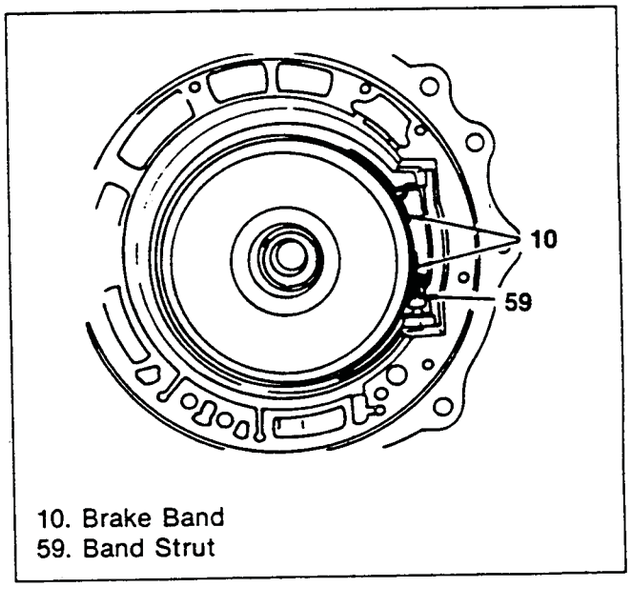
NOTICE: Do not reuse the anchor end pin.

2. Attach the band strut to the brake band.
3. Install the brake band in the case so it will fit with the anchor end pin and the servo piston (figure 270).

Important

- Attach the band strut to the side of the servo piston.

4. Tighten the anchor end pin manually so the reverse clutch doesn't move.



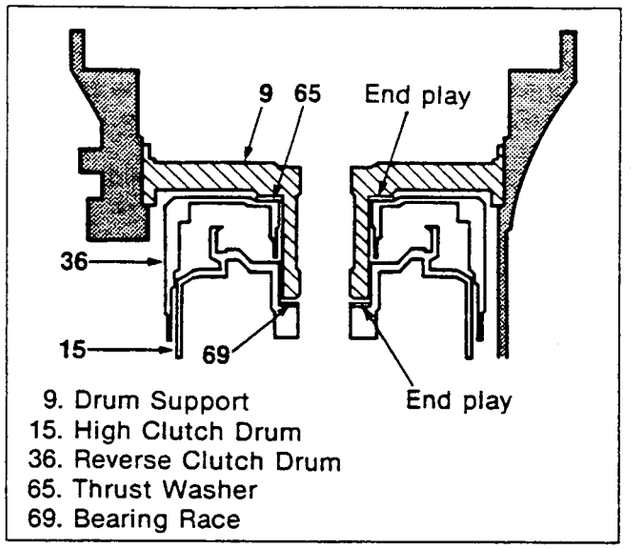
10. Brake Band
59. Band Strut

Figure 270. Brake Band Installation

End play measurement
(Figures 271, 272, 273, 274, 275 and 276)

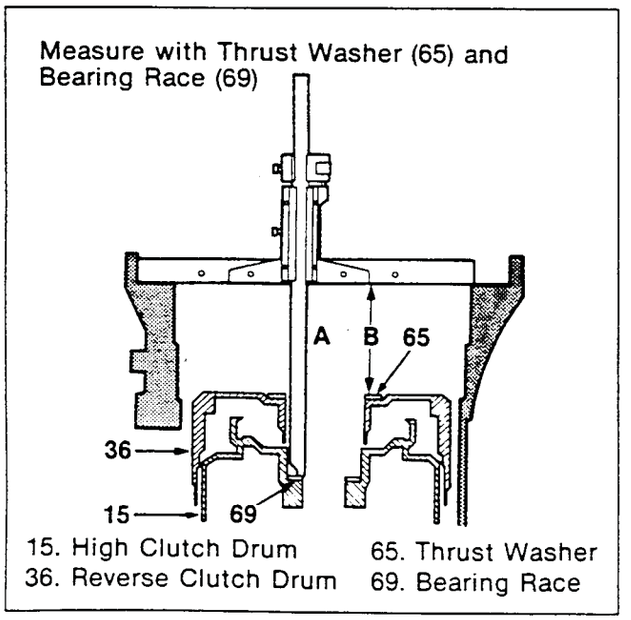
- End play is front-to-back movement of the rotating parts in the automatic transmission. The gap where movement occurs must be adjusted to the proper end play (figure 271).
- Select the thickness of the thrust washer and the bearing race to adjust the end play using the following instructions.

Thrust washer location : Between the reverse clutch and the drum support
Bearing race location : Between the high clutch drum and the drum support



9. Drum Support
15. High Clutch Drum
36. Reverse Clutch Drum
65. Thrust Washer
69. Bearing Race

Figure 271. End Play Measurement (1)



15. High Clutch Drum
36. Reverse Clutch Drum
65. Thrust Washer
69. Bearing Race

Figure 272. End Play Measurement (2)

1. Turn the case so input side faces upward.
2. Install the thrust washer and the bearing race.
3. Measure "A" and "B" with a depth gage (figure 272).

Important

- Measure with the thrust washer and the bearing race properly installed.

4. Apply special grease (included in the repair kit) to the outer surface of the drum support and inner surface of the case. Install the drum support with two slide hammers and adapter (special tool) with the input shaft as a guide (figure 273).

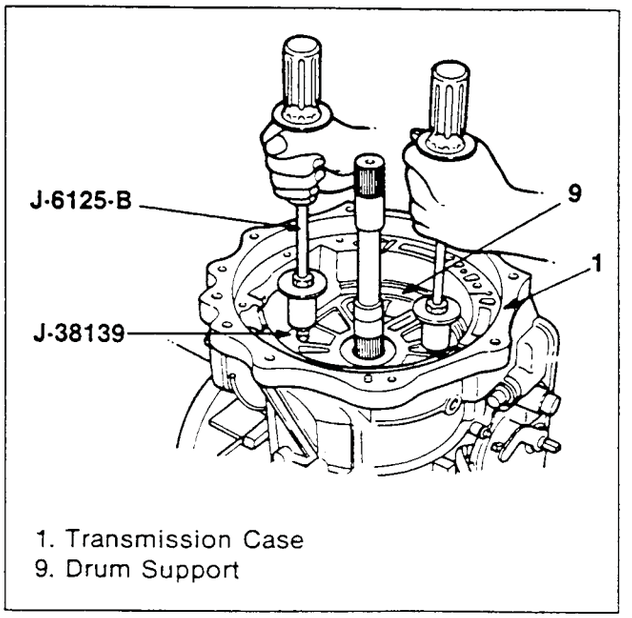
Important

- Do not attach the four plain seals.
  Slide Hammers : J-6125-B
  Slide Hammer Adapters : J-38139

Important

- If a contact mark is made in round-cornered surface or polished surface, polish that portion with No. 1000 sand-paper applying automatic transmission fluid. Later, wipe the surface with solvent.

5. Secure the drum support to the case with three fixing bolts (one for locating: 42 N·m or 31 lb·ft; two: 23 N·m or 17 lb·ft) and apply aligning marks to them with a felt pen to use for assembling with plain seals.
6. Measure "C" without thrust bearing (figure 274).
7. Remove the drum support with the slide hammer using the input shaft as a guide.



1. Transmission Case
9. Drum Support

Figure 273. Drum Support Installation

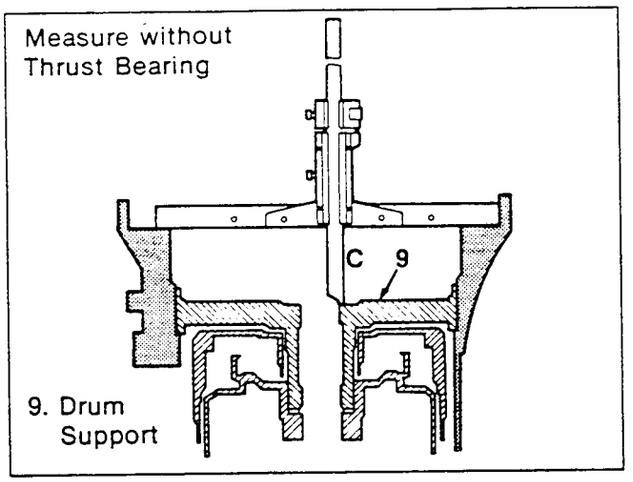


Figure 274. End Play Measuremen t (3)

8. Place the drum support onto a flat surface plate (figure 275).
9. Install the thrust bearing.
10. Measure "D" and "E" with a depth gauge (figure 275).

Important

- Measure "D" and "E" with the thrust bearing attached.

11. Turn over the drum support and measure "F" with a depth gage (figure 276).

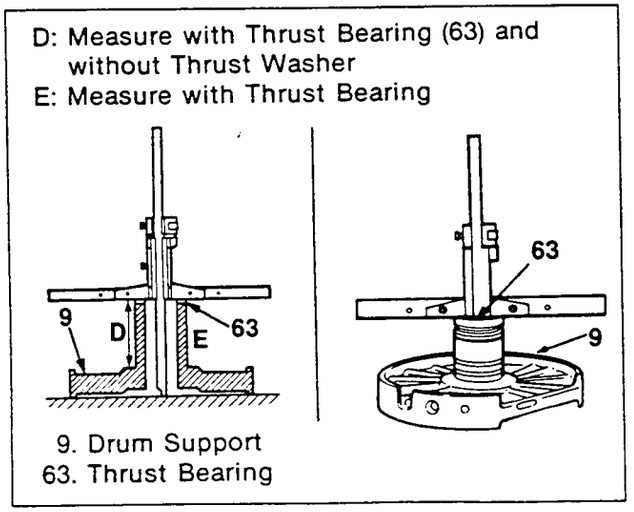


Figure 275. End Play Measurement (4)

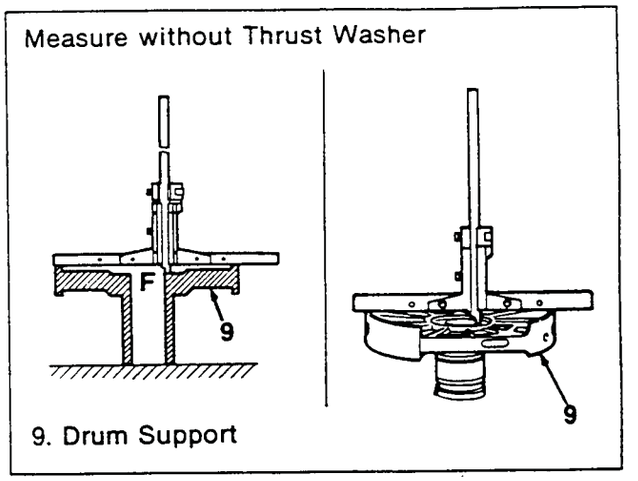


Figure 276. End Play Measurement (5)

Calculate thrust washer clearance
Clearance = B - C + D - E + F
Standard clearance range: 0.55 – 0.90 mm (0.022 – 0.035 in)

- If clearance exceeds the standard range, measure the thickness of the original washer and choose a thicker or thinner washer to achieve the correct clearance.

Thickness of Washer (mm / in)
0.7 / 0.028
0.9 / 0.035
1.1 / 0.043
1.3 / 0.051
1.5 / 0.059
1.7 / 0.067
1.9 / 0.075

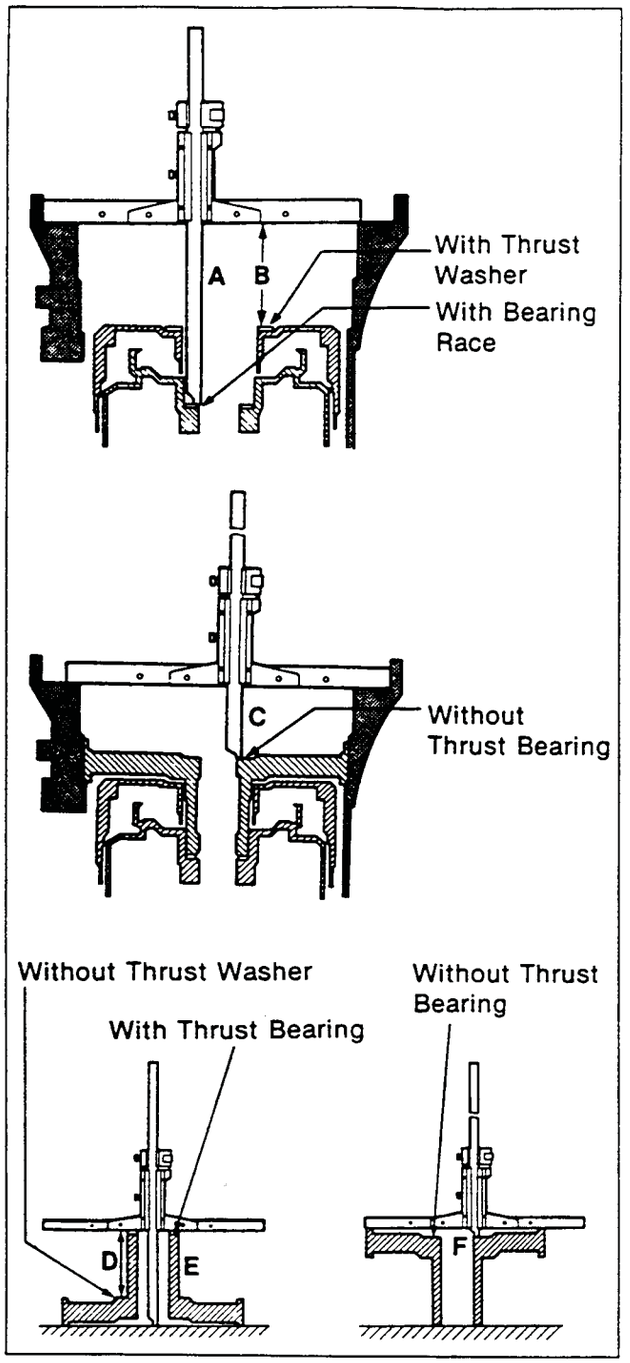


Figure 276a. End Play Measurement Summary

Calculate bearing race clearance
Clearance = A - C - E + F
Standard clearance range: 0.25 – 0.55 mm
(0.010 – 0.022 in)

- If clearance exceeds the standard range, measure the thickness of the race and choose a thicker or thinner bearing race to achieve the correct clearance.

Thickness of Washer (mm / in)
0.7 / 0.028
0.9 / 0.035
1.1 / 0.043
1.3 / 0.051
1.5 / 0.059
1.7 / 0.067
1.9 / 0.075

Bearing Race (Figure 277)
Apply Vaseline to the race and attach it to the high clutch drum.

Important

- Make sure the lugs of the race are in the high clutch drum holes.

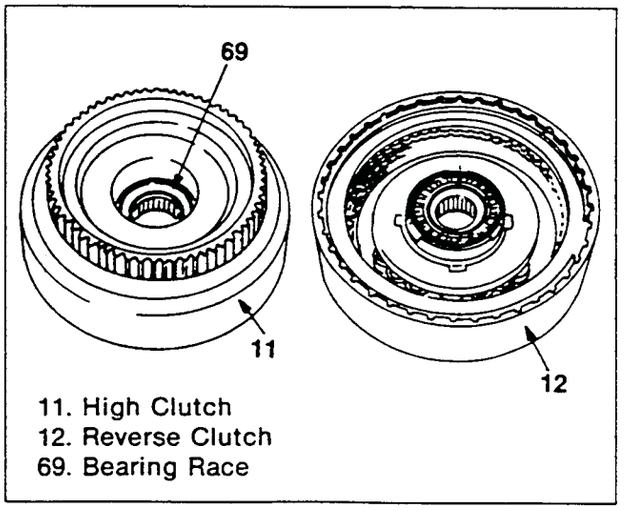
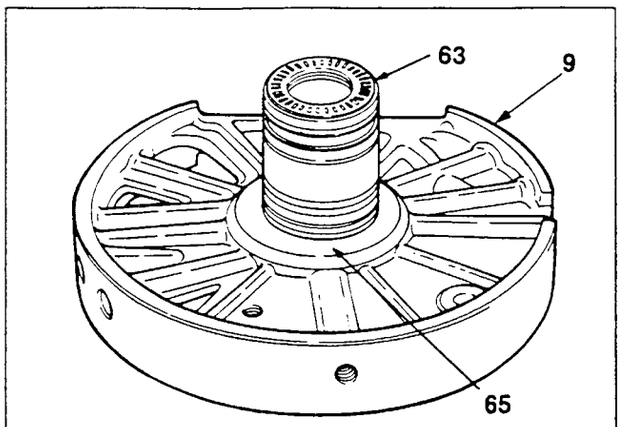


Figure 277. Bearing Race Installation

Thrust Washer and Thrust Bearing (Figure 278)
1. Apply Vaseline to the thrust washer and attach it to the drum support.
2. Apply Vaseline to the thrust bearing and attach it to the drum support (figure 278).

Important

- Be careful about the direction of the thrust bearing when installed.



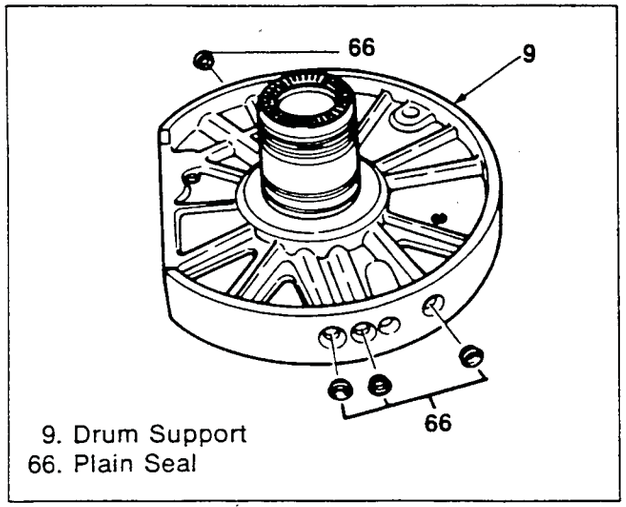
9. Drum Support
63. Thrust Bearing
65. Thrust Washer

Figure 278. Drum Support Thrust Bearing and Thrust Washer Installation

Drum Support (Figures 279, 280, 281 and 282)

1. Generously apply special grease (included in the repair kit) to the outer surface of the drum support.
2. Apply special grease to four plain seals and attach them to the drum support (figure 279).
3. Generously apply special grease to the inner surface of the case.

NOTICE: If a contact mark is made in the round-cornered surface or polished surface, polish that portion with No. 1000 sand-paper applying automatic transmission fluid. Later, wipe the surface with solvent.



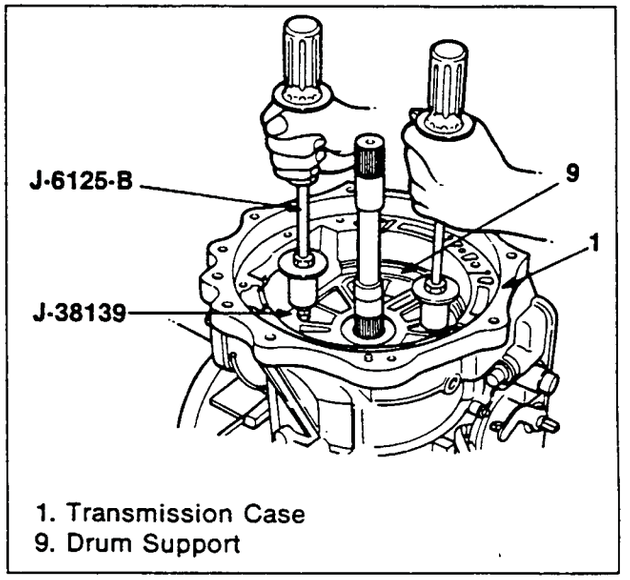
9. Drum Support
66. Plain Seal

Figure 279. Drum Support Installation (1)

4. Put the drum support and the input shaft together, use the shaft as a guide along with the drum support and insert using a slide hammer and adapter (special tool) vertically into the case (figure 280).
   Slide Hammer : J-6125-B
   Slide Hammer Adapter: J-38139

Important

- If the seal gets stuck on the round-cornered surface, insert it lightly, partly elevating it. Never insert it forcibly.



1. Transmission Case
9. Drum Support

Figure 280. Drum Support Installation (2)

5. Attach the drum support vertically along the marked line.

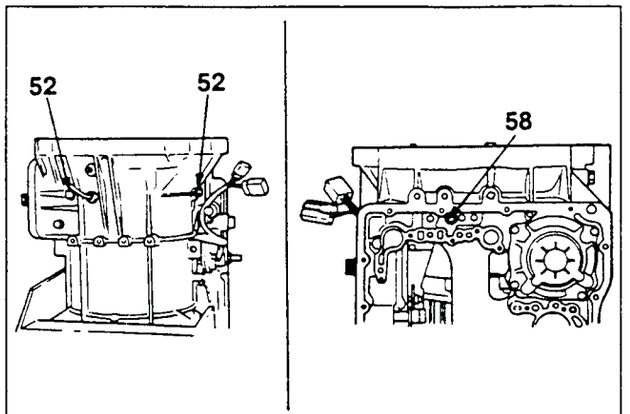
Important

- Do not turn the drum support to prevent plain seal damage after about 20 mm (0.8 in) of drum support is left to be inserted.

6. Fasten the drum support with three bolts, first the locate bolt followed by the other two. Apply sealing compound (Three Bond 1215 or equivalent) to the flange face of the two bolts outside the case (figure 281).

Tighten

- Locating bolt 42 N·m (31 lb·ft)
- Support bolts 23 N·m (17 lb·ft)

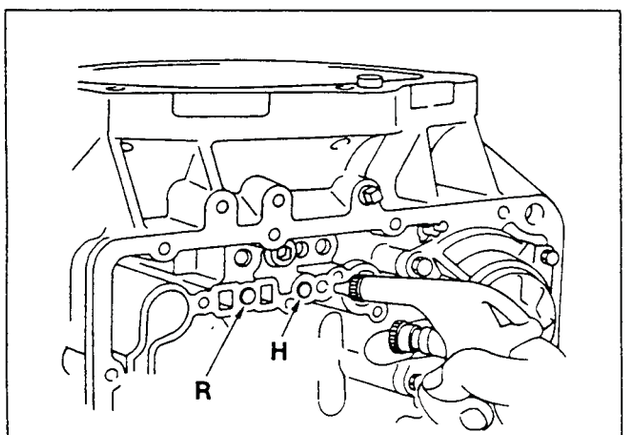


52. Support Bolt
58. Locate Bolt

Figure 281. Drum Support Installation (3)

7. Blow air (294 – 392 kPa or 42 – 56 psi) into the oil holes and check that there are no air leaks at the two check points (only for high clutch circuit and reverse clutch circuit) (figure 282).

NOTICE: If there is any leakage, replace the plain seal, which is most likely to be damaged.

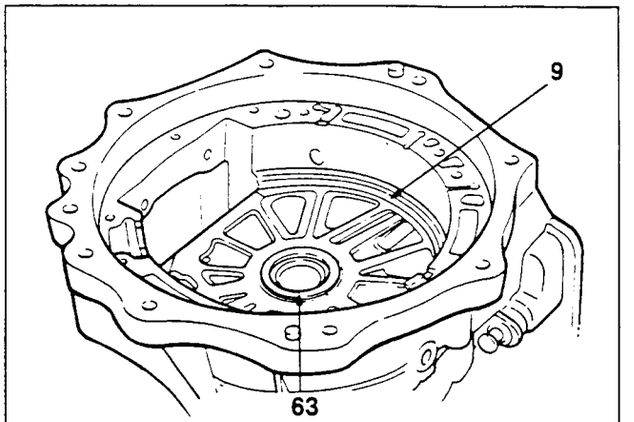


H. High Clutch Circuit
R. Reverse Clutch Circuit

Figure 282. Drum Support Installation (4)

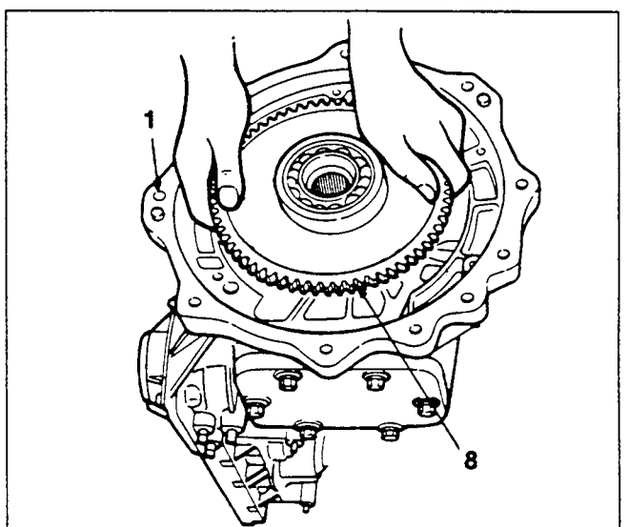
Power Take-Off (PTO) Gear (Figures 283 and 284)

1. Apply Vaseline to the thrust bearing and install it into the drum support (figure 283).
2. Install the PTO gear (figure 284).



9. Drum Support
63. Thrust Bearing

Figure 283. PTO Gear Installation (1)



1. Transmission Case
8. PTO Gear

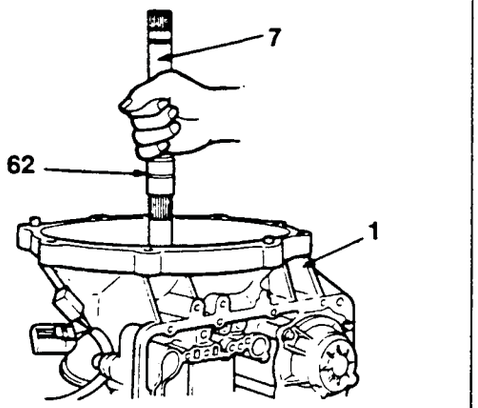
Figure 284. PTO Gear Installation (2)

Input Shaft (Figure 285)

1. Apply Vaseline to the seal ring and put it onto the input shaft.
2. Install the input shaft.

Important

- Insert the input shaft until its spline engages completely.



1. Transmission Case
7. Input Shaft
62. Seal Ring

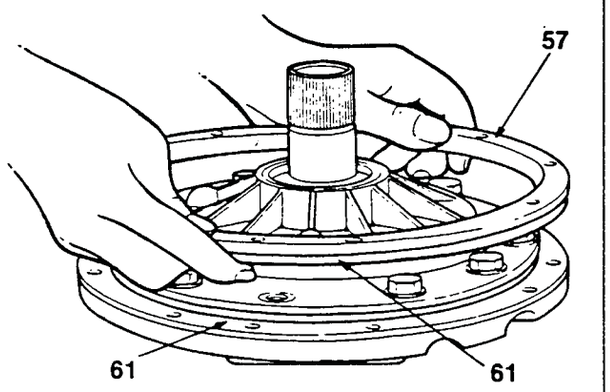
Figure 285. Input Shaft Installation

Oil Pump (Figures 286, 287, 288 and 289)

1. Apply Vaseline to the O-ring around the oil pump outer surface and install the retainer (figure 286).

Important

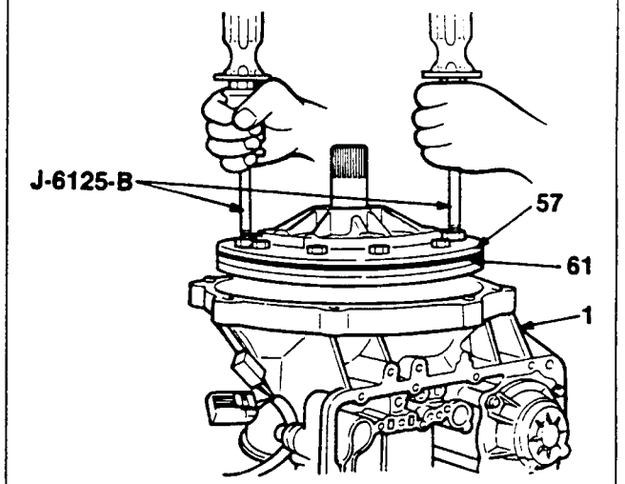
- Hold the retainer with your hand so it doesn't float.
  Place it so the bolt holes of the retainer and the oil pump align.



57. Retainer
61. O-Ring

Figure 286. Oil Pump Installation (1)

2. Install the new gasket in the case.
3. Install the oil pump puller to the oil pump.
4. Insert one oil pump fixing bolt and install the oil pump in the case with slide hammers (special tool), paying attention to the position. Fix it with the bolt (figure 287).
   Slide Hammer: J-6125-B



1. Transmission Case
57. Retainer
61. O-Ring

Figure 287. Oil Pump Installation (2)

5. While installing the oil pump, ask someone to hold the retainer so it doesn't float and fix it with bolts.
   Apply sealing compound (Three Bond 1215 or equivalent) to the flange face of the bolts (figure 288).

Important

- Do not let the O-ring on the retainer cut in between the retainer and the oil pump.

Tighten

- Retainer bolts 27 N·m (20 lb·ft)

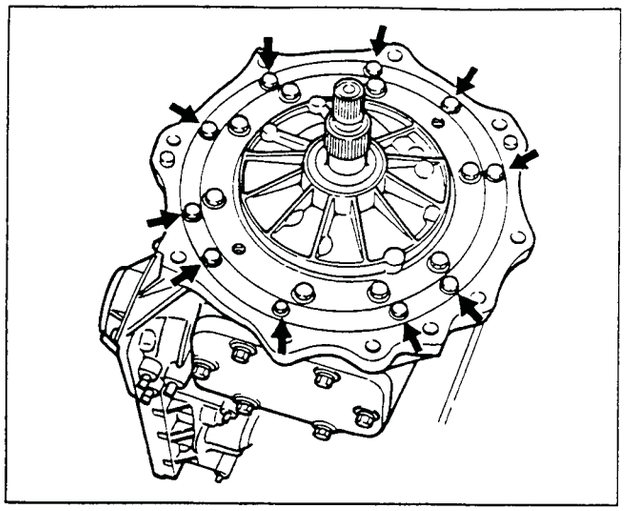


Figure 288. Oil Pump Installation (3)

6. Remove the slide hammers and fix it with two new bolts to which flange face sealing compound is applied (figure 289).
   - Sealing compound: Three Bond 1215 or equivalent.

Tighten

- Oil pump housing bolts 57 N·m (42 lb·ft)

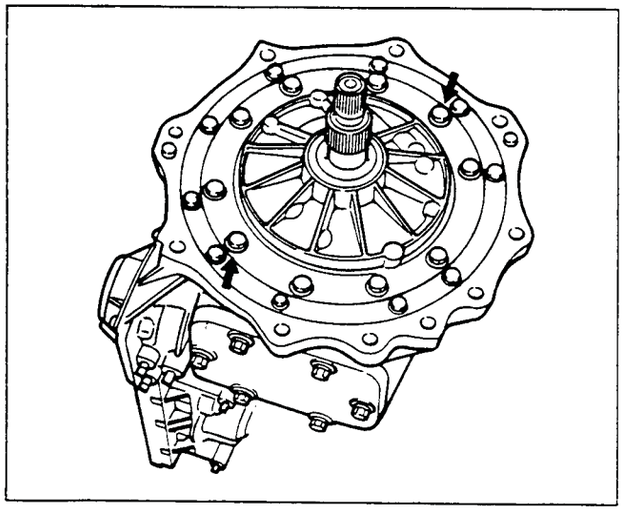
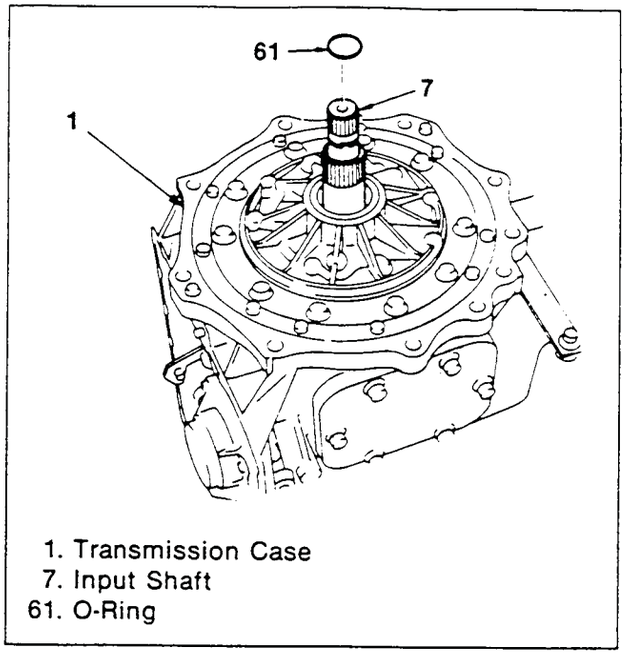


Figure 289. Oil Pump Installation (4)

O-Ring (Figure 290)

Apply Vaseline to O-ring and install it around the input shaft.



1. Transmission Case
7. Input Shaft
61. O-Ring

Figure 290. Input Shaft O-ring Installation

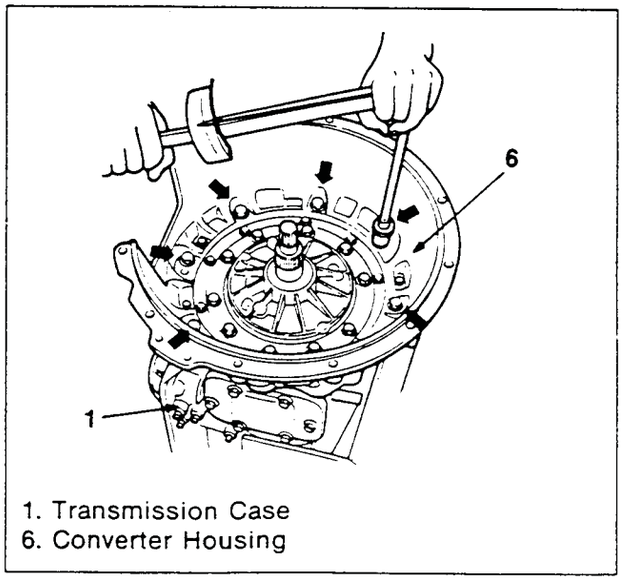
Converter Housing (Figure 291)

Install the converter housing and fix it with 8 new bolts.

NOTICE: Do not reuse the converter housing bolts.

Tighten

- Converter housing bolts 123 N·m (90 lb·ft)



1. Transmission Case
6. Converter Housing

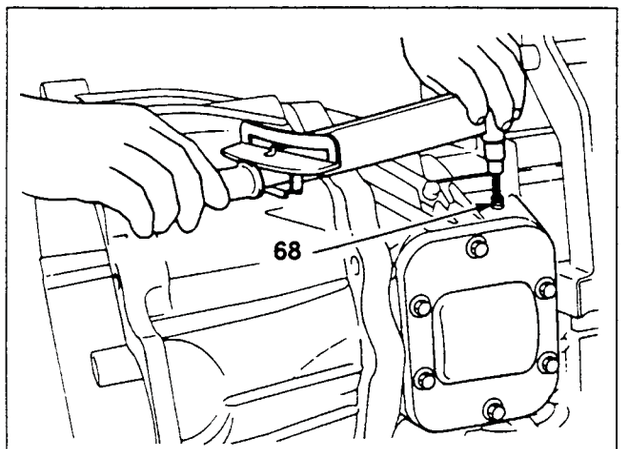
Figure 291. Converter Housing Installation

Adjustment of the brake band (Figures 292, 293 and 294)

1. Turn the case so the oil pan side is down.
2. Loosen the lock nuts and fasten the anchor end pin (figure 292).

Tighten

- Anchor end pin 5 N·m (43 lb·in)



68. Anchor End Pin

Figure 292. Brake Band Adjustment (1)

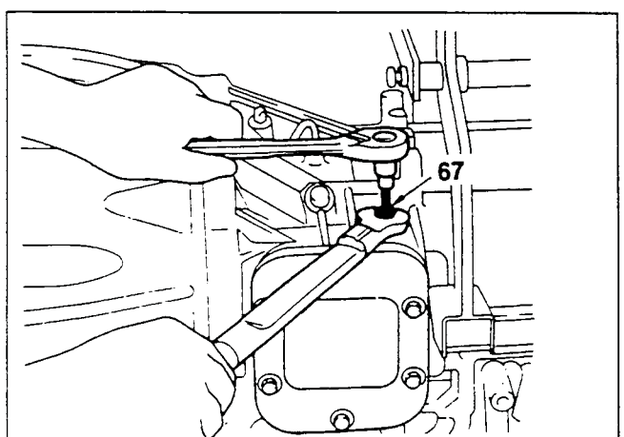
3. Loosen the anchor end pin by turning it back two and a half turns.
4. Fasten it with a lock nut (figure 293).

Tighten

- Lock nut 38 N·m (28 lb·ft)

Important

- Turn the anchor end pin exactly 2.5 times.



67. Lock Nut

Figure 293. Brake Band Adjustment (2)

5. Blow air into the oil holes shown at below and check operation (figure 294).

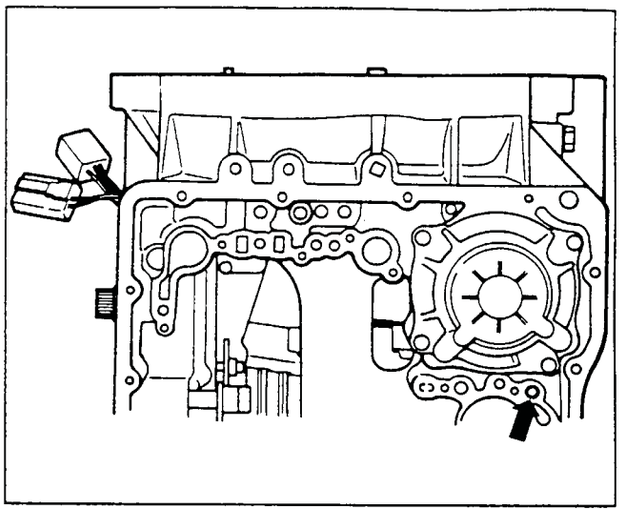


Figure 294. Brake Band Adjustment (3)

Valve Body Assembly (Figures 295, 296 and 297)

1. Install the LP filter into the transmission case (figure 295).

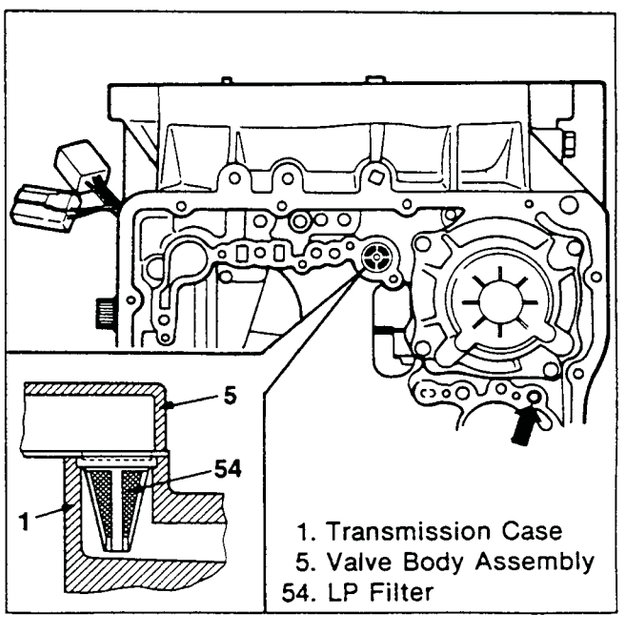
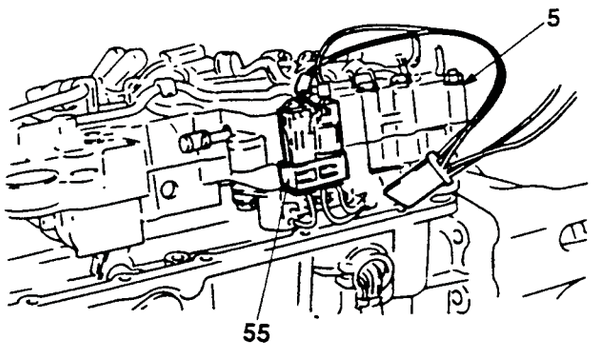


Figure 295. LP Filter Installation

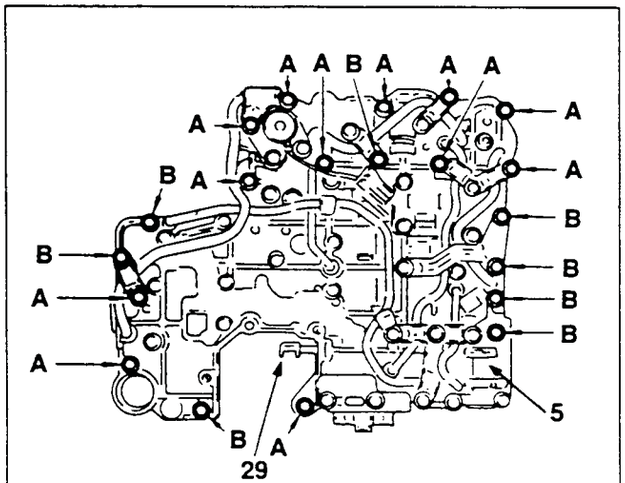
2. Put the valve body assembly into the case and install harness connectors.
3. Fasten them with brackets (figure 295a).



5. Valve Body Assembly
55. Bracket

Figure 295a. Harness Connector Installation

4. Install the valve body assembly by aligning the notch of the manual valve to the manual plate boss (figure 296).
5. Fasten it with bolts.
   (A) shank 37 mm (1.46 in) 12 pieces
   (B) shank 50 mm (1.97 in) 8 pieces



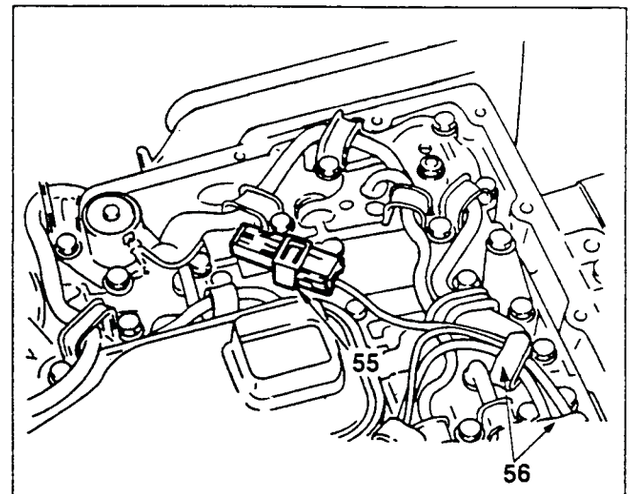
5. Valve Body Assembly
29. Manual Shaft

Figure 296. Valve Body Bolts Location

Tighten

- Valve body bolts 8 N·m (69 lb·in)

6. Install two harness connectors and fasten them with brackets.
7. Fasten the harness with clips (figure 297).



55. Bracket
56. Clip

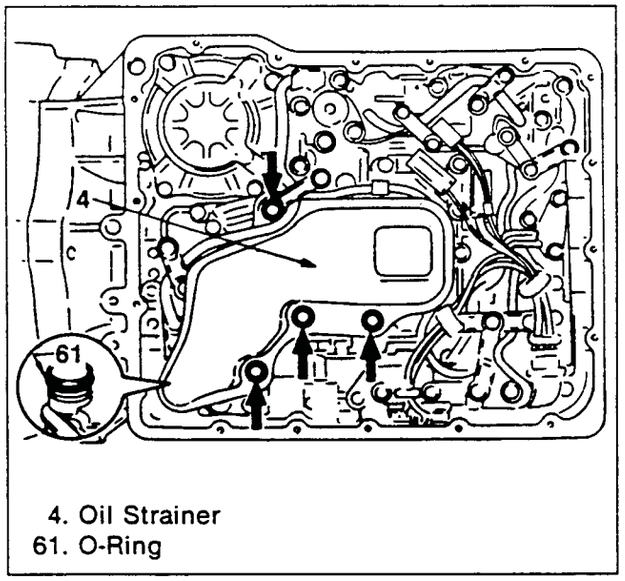
Figure 297. Terminal Clips Installation

Oil Strainer (Figure 298)

1. Apply Vaseline to the new O-ring and put it to the oil strainer.
2. Attach the oil strainer to the control valve (figure 298).

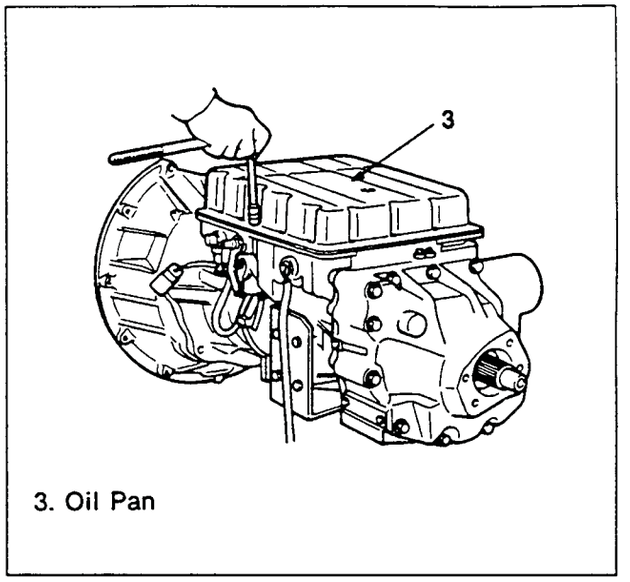
Tighten

- Oil strainer bolt 8 N·m (69 lb·in)



4. Oil Strainer
61. O-Ring

Figure 298. Oil Strainer Installation



3. Oil Pan

Figure 299. Oil Pan Installation

Oil Pan (Figure 299)

1. Install the new oil pan gasket.
2. Install the oil pan onto the transmission case.

NOTICE: Use new gasket. Clean the oil pan and magnet.

Tighten

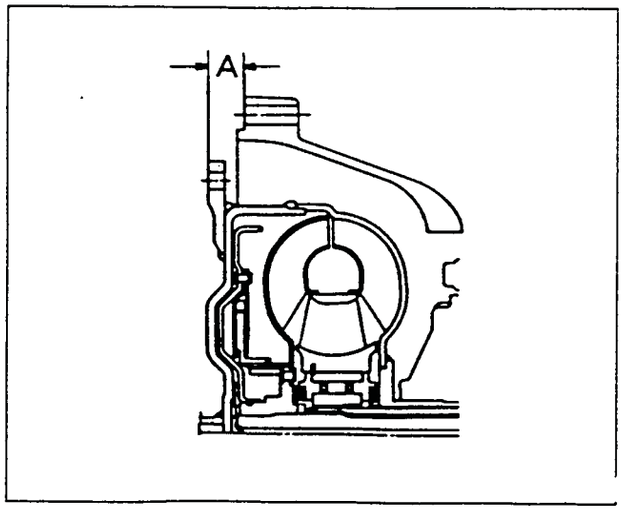
- Oil pan bolts 7 N·m (61 lb·in)

3. Replace the washer (packing) and install the drain plug.

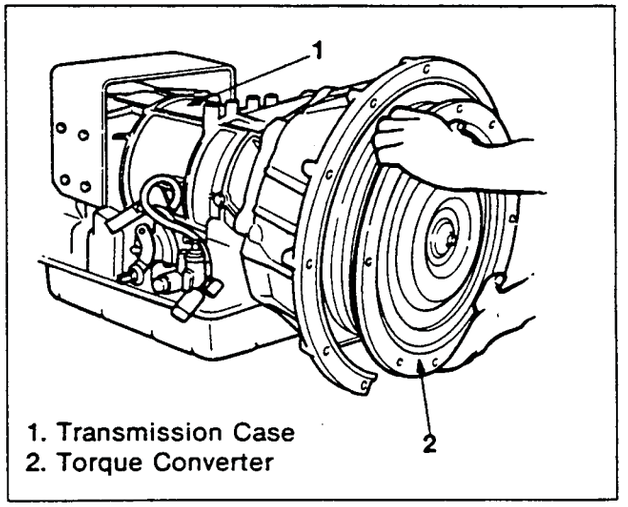
Tighten

- Drain plug 35 N·m (26 lb·ft)

NOTICE: Do not reuse old washer (gasket). Clean the drain plug (especially the threaded section).



Torque Convertor (Figures 300 and 301)



1. Transmission Case
2. Torque Converter

Figure 300. Torque Convertor Installation (1)

1. Install the torque converter, and then measure clearance A as shown to confirm that the torque converter fits correctly (figure 301).
   - Dimension A: 23 mm (0.91 in) maximum.

Figure 301. Torque Convertor Installation (2)

2. Remove the automatic transmission from the holding fixture base.
3. Remove the holding fixture (special tool) from the automatic transmission.