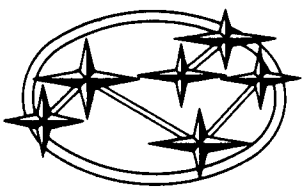
AUTOMATIC TRANSMISSION AND DIFFERENTIAL

3-2

SUBARU

1988



MECHANISM AND FUNCTION

1 Cross Sectional View

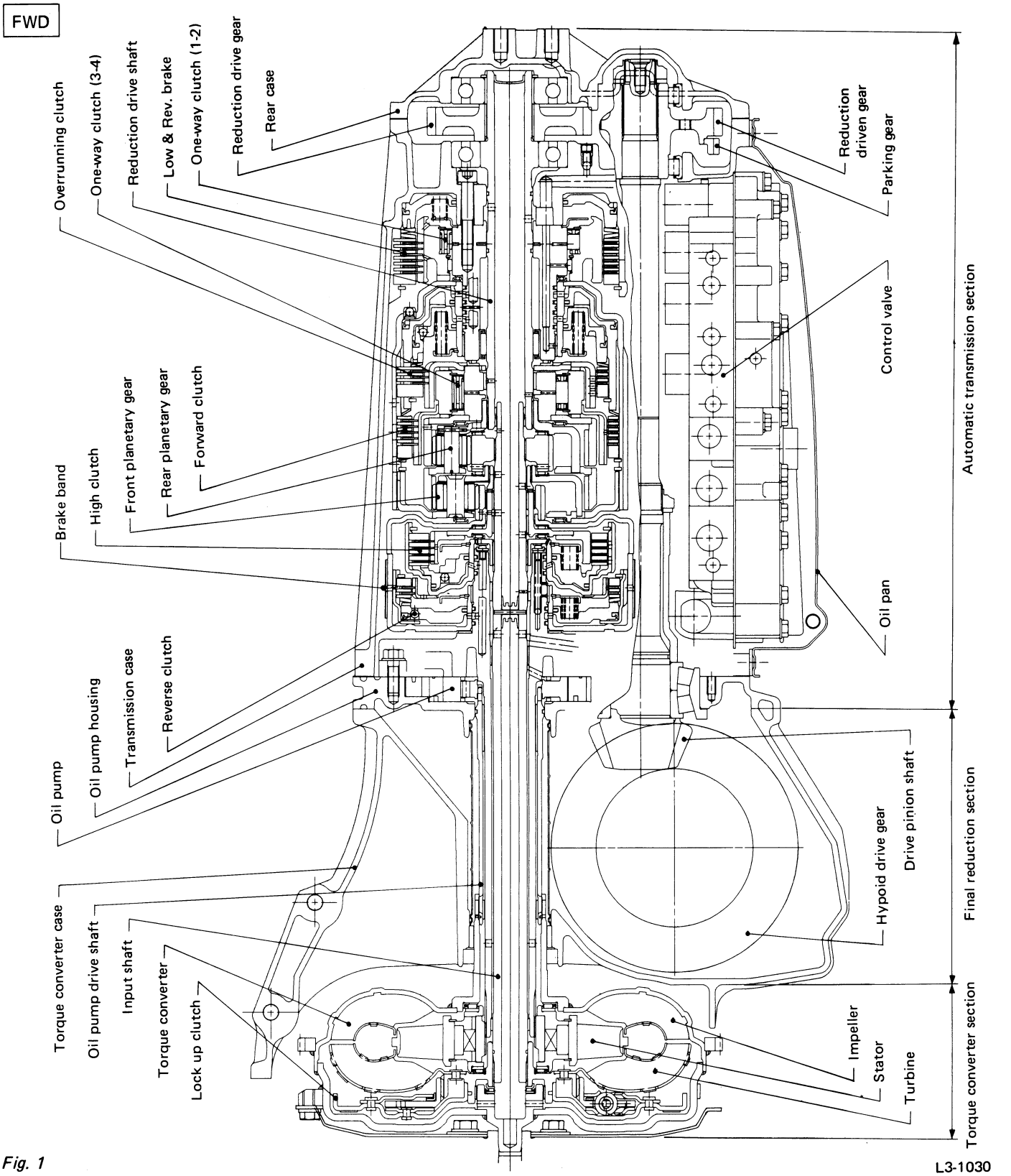


Fig. 1

L3-1030

4WD

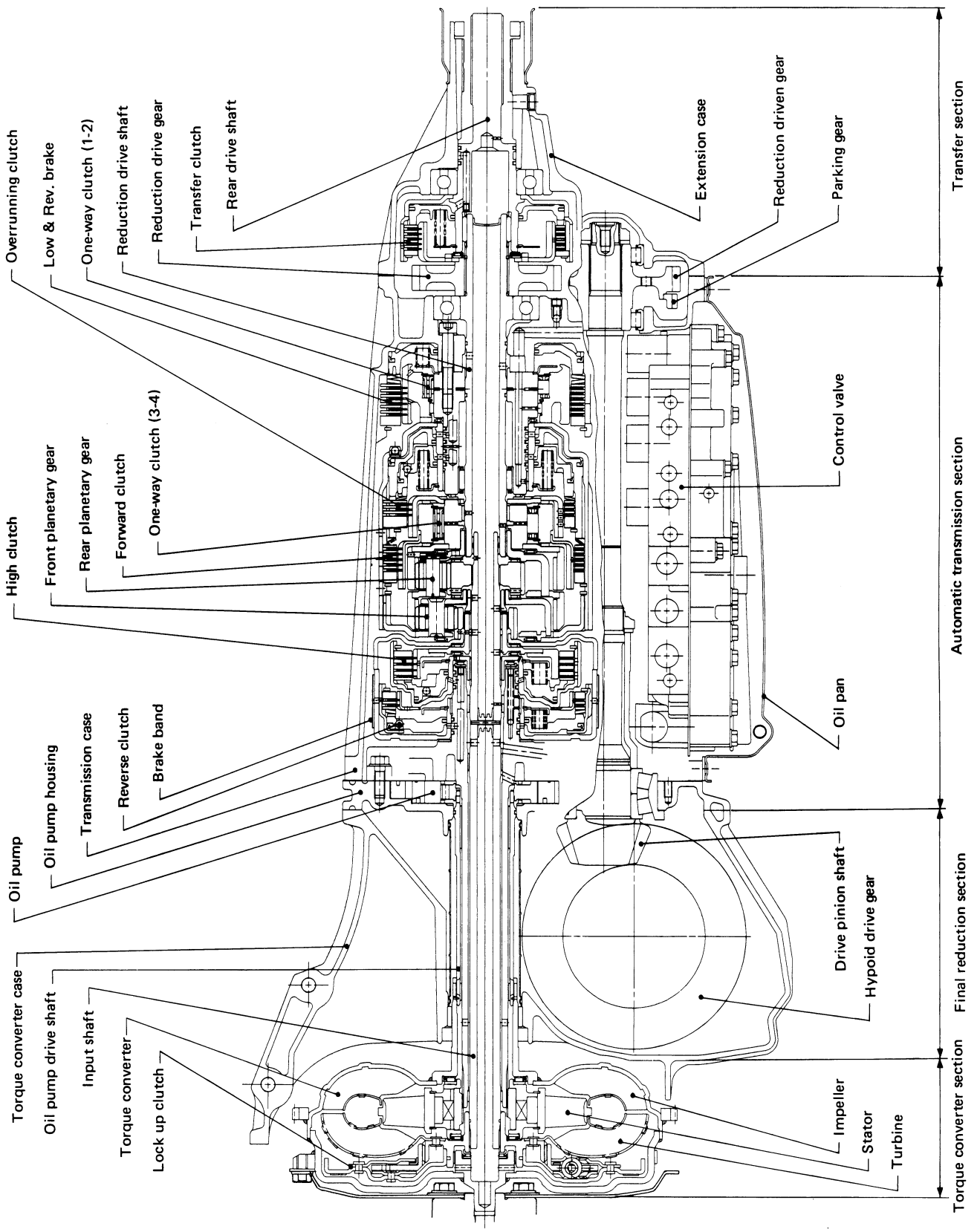


Fig. 2

L3-1031

2 Electronic Control System Schematic

FWD

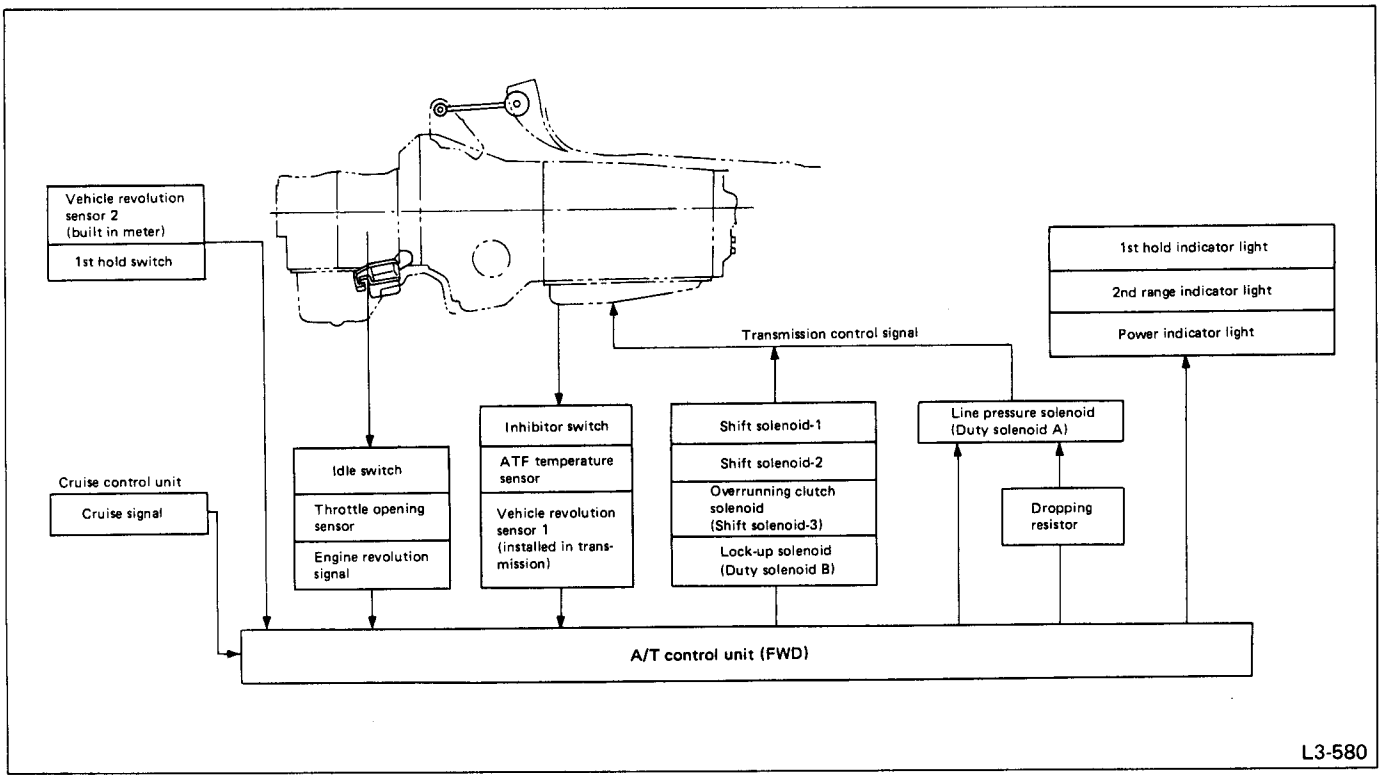


Fig. 3

4WD

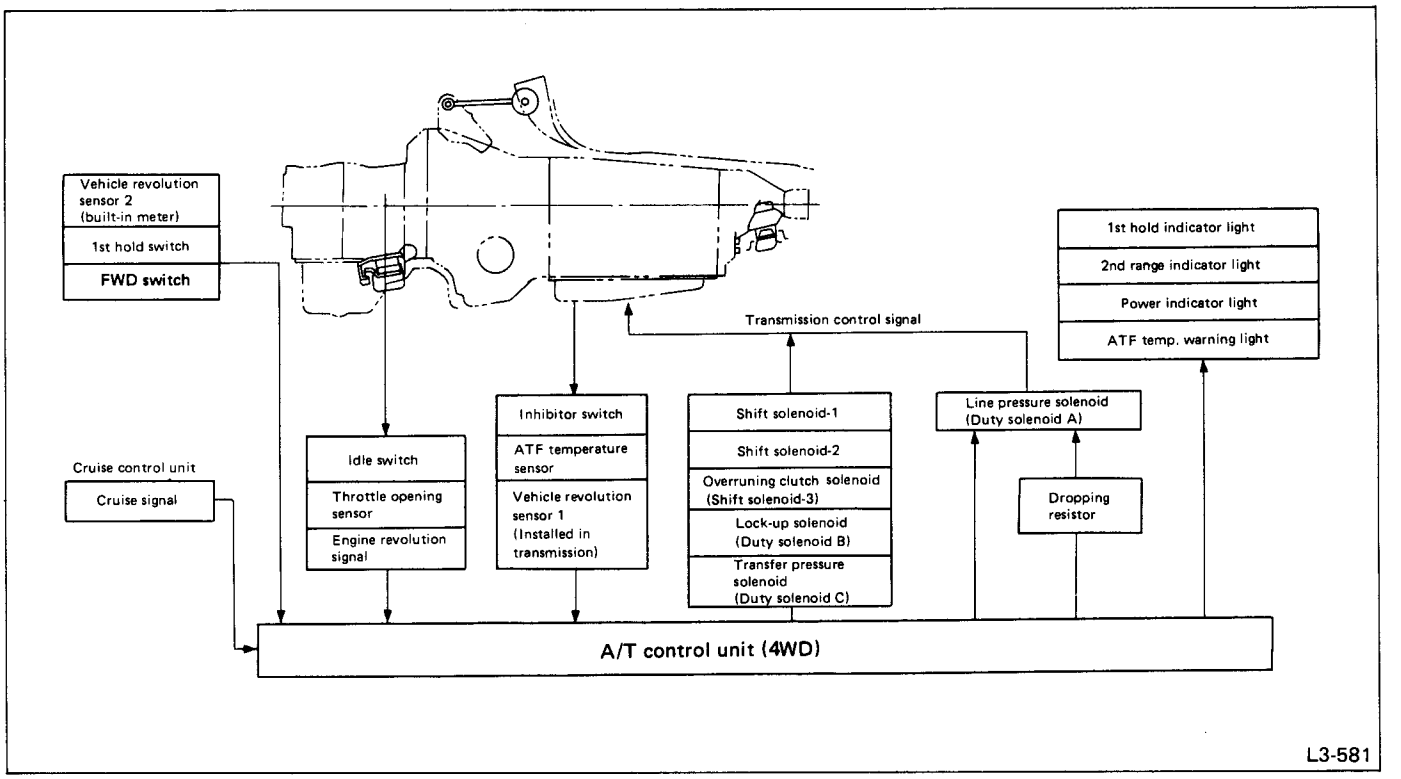


Fig. 4

3 Construction and Features of Each Component

3-1 Torque Converter

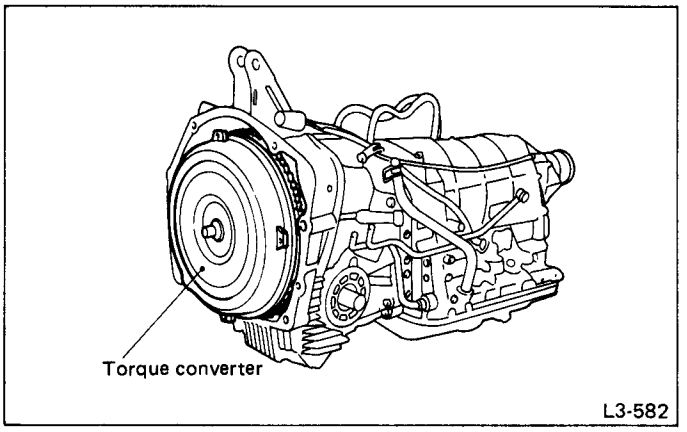


Fig. 5

Construction and Function

1) CONSTRUCTION

- The torque converter is composed of impeller, turbine, stator, and lock-up clutch. It is filled with oil; therefore it must not be disassembled.
- The impeller is directly coupled to the crankshaft via a drive plate. A sleeve for driving the oil pump, which is the source of the hydraulic pressure for the automatic transmission, is welded to the rear of the impeller.
- The turbine transmits multiplied engine torque in the torque converter range, unmultiplied engine torque in the coupling range, or engine torque itself directly through the lock-up clutch to the automatic transmission via the input shaft spline fitted to the internal spline of the turbine hub.
- The stator incorporates a Sprague type one-way clutch. The stator is spline-fitted to the oil pump cover via the inner race of the one-way clutch, and secured to the torque converter case.

2) FUNCTION

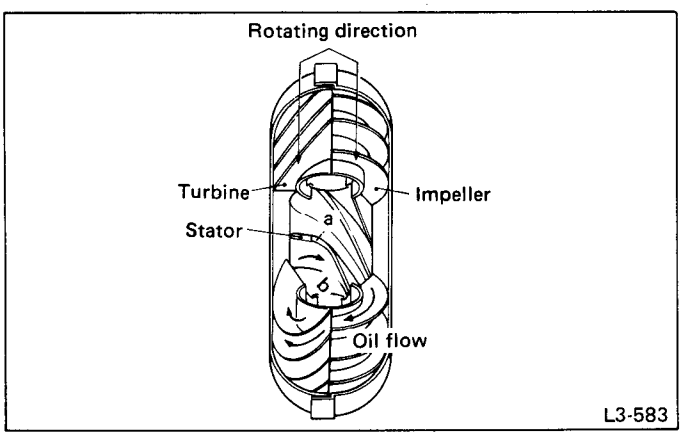


Fig. 6 Function of torque converter

When the impeller rotates, centrifugal force pushes out oil which then enters the turbine. The oil flows along the turbine blade and exerts force on the blade. This causes the turbine to rotate and power is transmitted to the input shaft.

If turbine speed is below impeller speed, the oil leaving the turbine flows in the direction impeding impeller rotation (a in Fig. 6). This direction is then changed by the stator so that the oil will assist impeller rotation (b in Fig. 6). With this action, the torque is multiplied.

The stator is subject to reverse torque when it changes the direction of oil flow, hence it must be secured to the casing.

As turbine speed increases and approaches impeller speed, the oil from the turbine begins to push directly on the back of the stator blade. (This changeover point is called the "coupling point".) If the stator is still fixed under this condition, the oil flow will be impeded by the stator. To avoid this, the stator is mounted to the case via a one-way clutch so that it can rotate freely in the same direction as the impeller and turbine.

3) PERFORMANCE

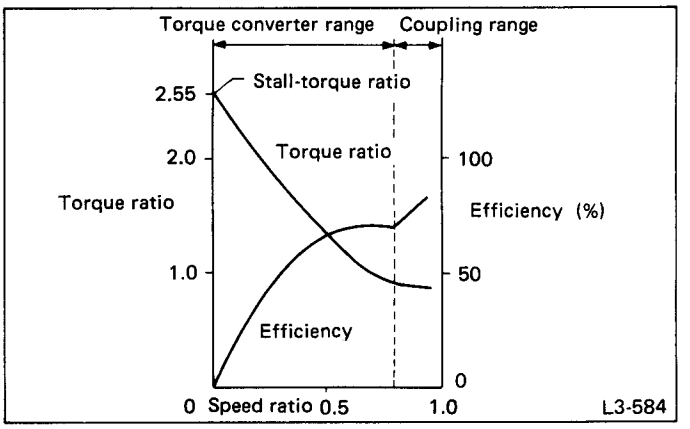


Fig. 7

The performance curve of the torque converter is shown in Fig. 7. The torque ratio, speed ratio, and efficiency respectively are represented by the following equations.

$$\text{Torque ratio} = \frac{\text{Turbine shaft torque}}{\text{Impeller shaft torque}}$$

$$\text{Speed ratio} = \frac{\text{Turbine shaft speed}}{\text{Impeller shaft speed}}$$

$$\text{Efficiency} = \frac{\text{Output horse-power}}{\text{Input horse-power}} \times 100\ (\%)$$

The torque multiplication range with stator fixed is called the "torque converter range". The range in which the stator rotates together with the impeller and turbine is called the "coupling range". In this coupling range, the torque converter functions similarly to the fluid coupling, and the torque is not multiplied. When the speed ratio is zero (0), that is, the

condition in which the impeller shaft (engine side) alone rotates and the turbine shaft does not rotate, is called the "stall point" (the vehicle is at a standstill). At this stall point, when in full throttle, the torque ratio of the turbine shaft and impeller shaft is at a maximum. The torque ratio at this point is called the "stall torque ratio", and the engine speed is called the stall speed.

4) LOCK-UP CONTROL – MECHANISM

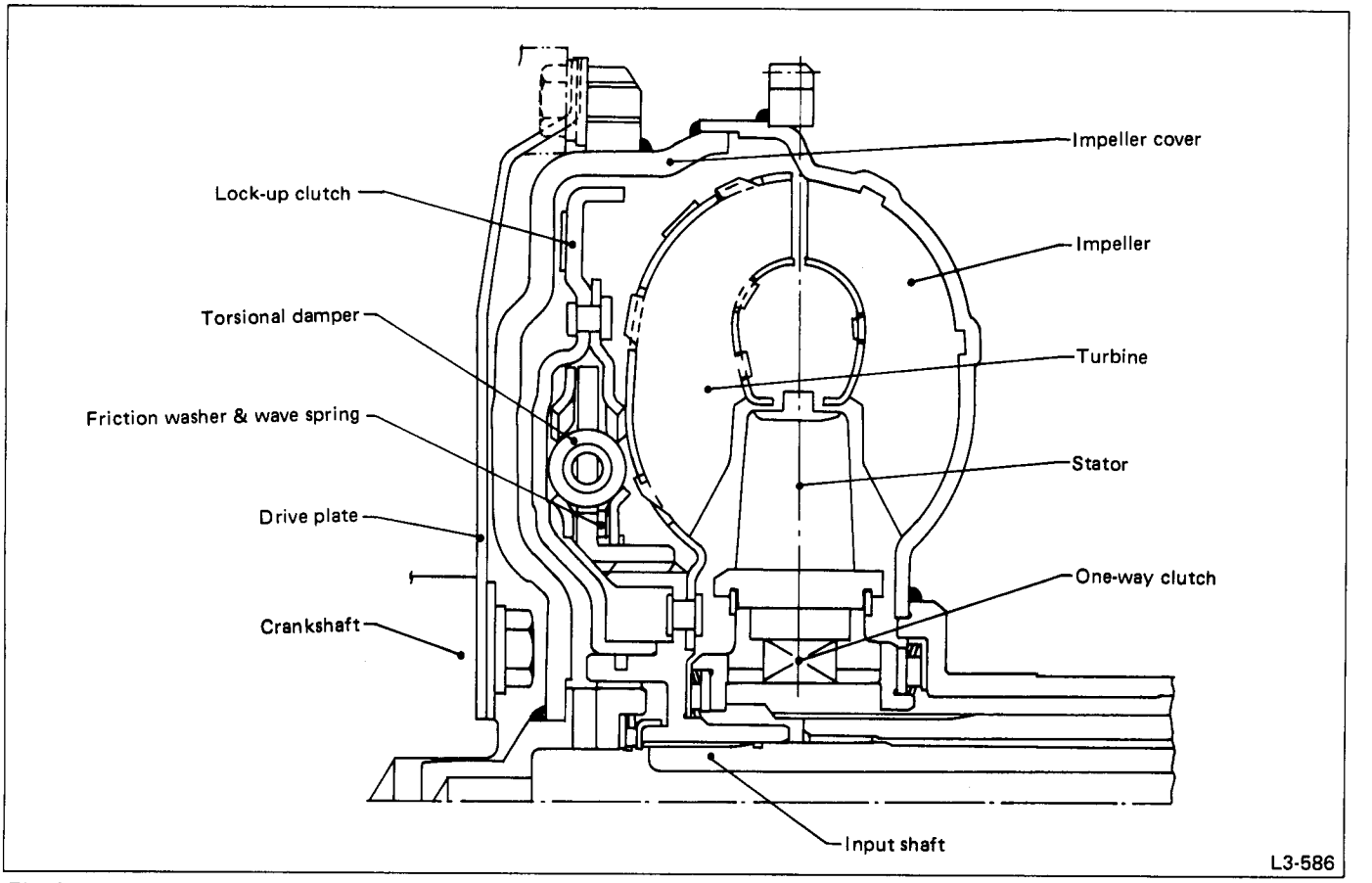


Fig. 8

The control unit controls the 50 Hz duty control (pulse width modulation) solenoid by changing its on/off time ratio. The lock-up control valve actuated by this solenoid switches the oil passages, and controls the hydraulic pressure applied to the lock-up clutch.

Pulse Width Modulation

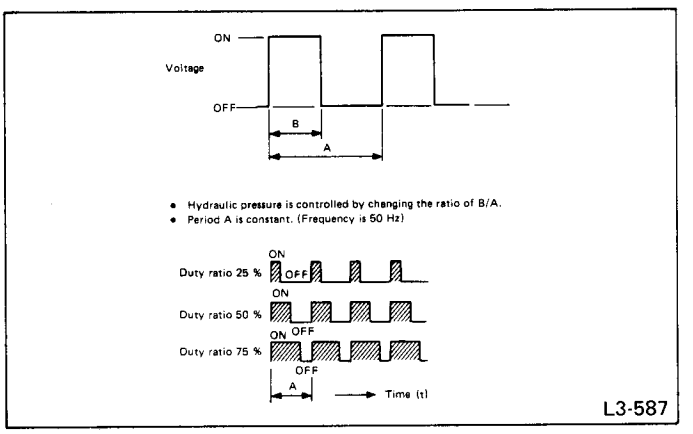


Fig. 9

The duty control solenoid is operated by applying on-off voltage pulses; and the percentage modulation is used to indicate its performance. This percentage modulation is also called the duty ratio, which is represented by the following expression.

$$\text{Duty ratio} = \frac{\text{ON time}}{\text{ON time + OFF time}} \times 100\,(\%) = \frac{B}{A} \times 100\,(\%)$$

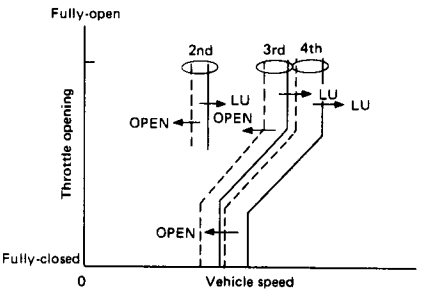
The repetition period A is defined as follows:

Period A = ON time + OFF time

Pulse width modulation means variation of duty ratio while keeping period A constant.

Content of lock-up control

<table>
<tr><th colspan="2"></th><th>Control content</th><th>Remarks</th></tr>
<tr><td>Lock-up control

Lock-up on
Duty ratio 95%
Lock-up off
Duty ratio 5%</td><td>(1) Normal control</td><td>
• Lockup on/off characteristics are set for each range, gear position and pattern by throttle opening and vehicle speed.
• Fuel consumption, power performance and shift characteristics are taken into account.
<table>
<tr><th>Range</th><th>Mode</th><th>Purpose</th></tr>
<tr><td rowspan="2">D</td><td>Normal</td><td>Lower fuel consumption</td></tr>
<tr><td>Power</td><td>Higher performance</td></tr>
</table>
</td><td>


L3-588
Fig. 10

• Lock-up non-operation condition
1) ATF temperature 40°C (104°F) or lower.
2) 1st speed, N, R, P.
3) During gear shifting.
4) When throttle is fully closed. If V> 140 km/h (87 MPH), lock-up operates even when throttle is fully closed.
5) Rapid accelerator pedal depression.
</td></tr>
<tr><td></td><td>(2) Smooth control</td><td>When switching from lock-up off to lock-up on, oil pressure for "lock-up apply" is changed gradually to ensure smooth lock-up operation.</td><td></td></tr>
</table>

5) LOCK-UP CONTROL – OPERATION

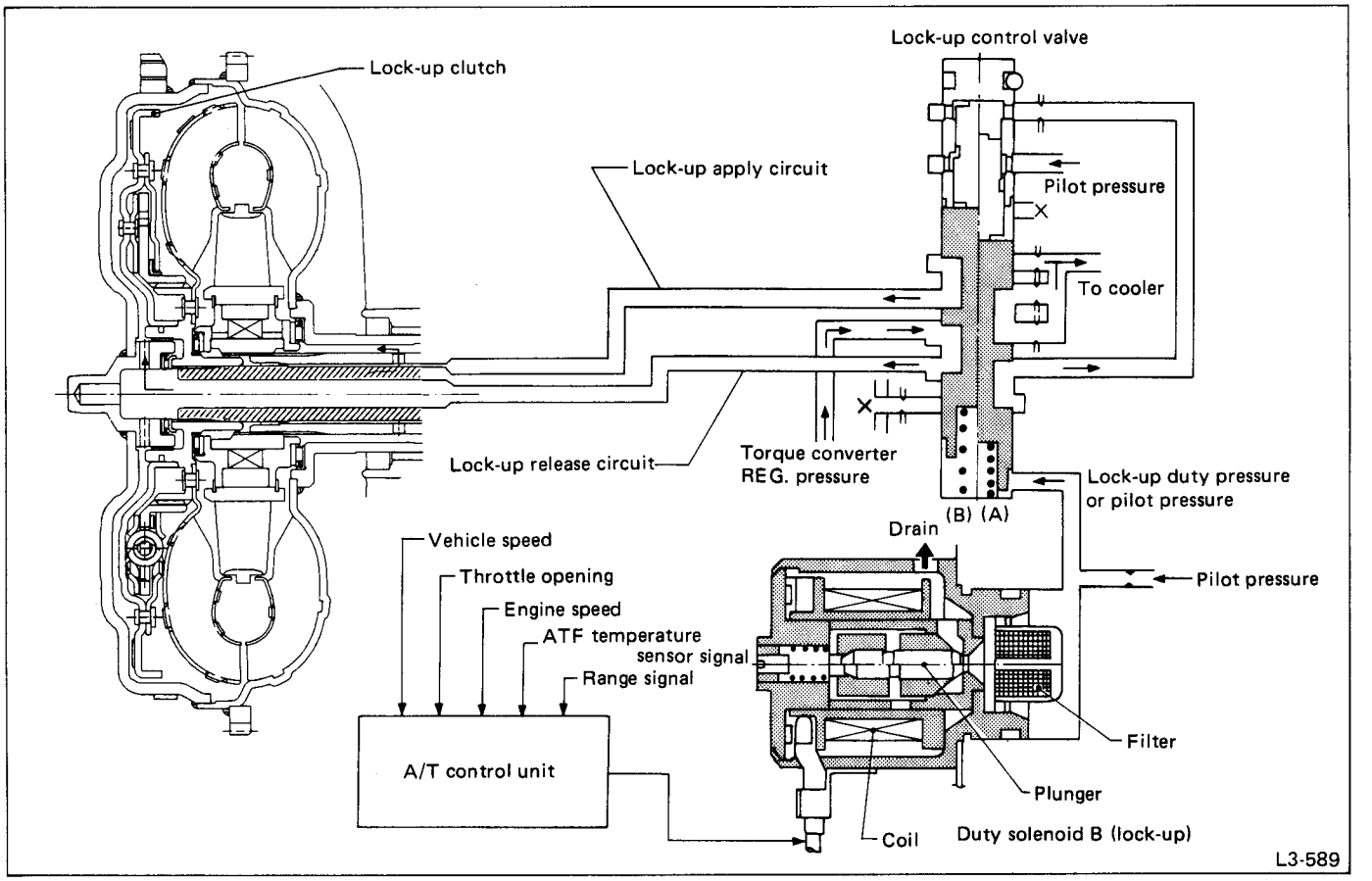


Fig. 11

The lock-up control valve is pushed downward by torque converter REG pressure and pilot pressure. It is pushed upward by lock-up duty pressure and spring force.

(1) During Lock-up Operation

Oil pressure at the lock-up control duty solenoid valve is drained (duty ratio 95%) by a signal from the automatic transmission control unit so that no lock-up duty pressure is developed and the lock-up control valve remains in condition (A). As a result, hydraulic oil flows into the lock-up apply circuit. On the other hand, the lock-up release circuit drains. This causes a pressure differential across the lock-up piston. The piston is then forced against the impeller cover and turned as an integral unit with the cover. Thus, power from the engine is directly transmitted to the transmission input shaft. That is, the transmission is directly coupled to the engine.

(2) During Non-Lock-up Operation

In this mode, the lock-up control duty solenoid is driven at a 5% duty ratio. This causes the lock-up duty pressure (pilot pressure) to be generated. With this pressure, the lock-up control valve is set to condition (B), and hydraulic oil flows into the lock-up release circuit. On the other hand, the lock-up apply circuit is connected to the oil cooler in the radiator. Accordingly, the relationship between "lock-up release pressure lock-up apply pressure" is established. As a result, the lock-up piston is forced to separate from the impeller cover, and power is transmitted from impeller to turbine to input shaft, as with an ordinary torque converter coupling.

(3) During Smooth Control

When the lock-up clutch activates, the clutch partially engages. Lock-up apply pressure increases smoothly to engage the lock-up clutch.

(4) Non-Lock-up Operation During "1st Speed", "N", "R" and "P"

In this mode of operation, pilot pressure is generated, and the lock-up control valve is set to condition (B) where lock-up is inoperative.

3-2 Oil Pump

1) CONSTRUCTION

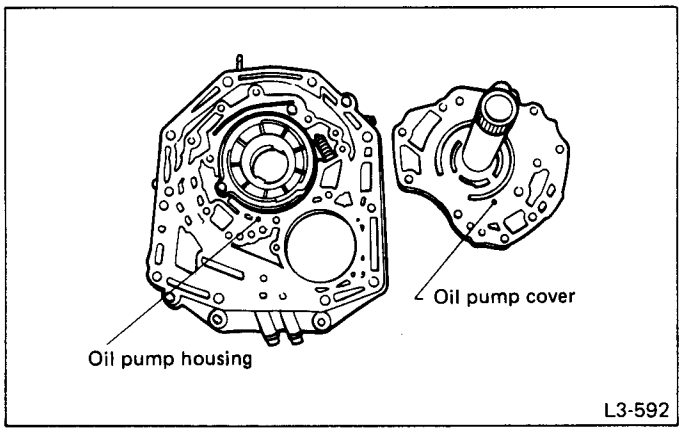


Fig. 12

The vane pump is housed in the oil pump housing. It consists of a rotor, vanes, vane rings, cam ring, control piston, return spring, seal ring and oil pump cover.
Hydraulic pressure (feedback pressure) from the oil passage (2) of the pressure regulator valve is applied to the back of the control piston.

2) OPERATION

(1) The automatic transmission fluid (ATF) is drawn through the oil strainer mounted under the control valve ASSY, and is routed to the transmission case, to the oil pump housing, and to the oil pump cover. It then goes to the suction port of section A shown in the Figure.
(2) The ATF sucked into section A rotates in the direction of the arrow (driven directly by engine), and is compressed at the delivery side of section B. It is then discharged.
(3) The discharged ATF flows from the oil pump cover to the oil pump housing. It then goes to the transmission case, the control valve and to the regulator valve, thus serving as hydraulic oil and lubricating oil for the torque converter, valves, clutch and brake.
(4) As engine speed increases, the delivery rate of the vane pump also increases.
(5) Feedback pressure from the regulator valve is applied to section C in the Figure. The cam ring position (the amount of eccentricity) is controlled by this pressure so that the pump delivery rate remains constant at speeds exceeding the preset pump speed.
(6) As the cam ring position changes, the suction volume at section A varies. In this manner, the pump delivery volume is controlled.

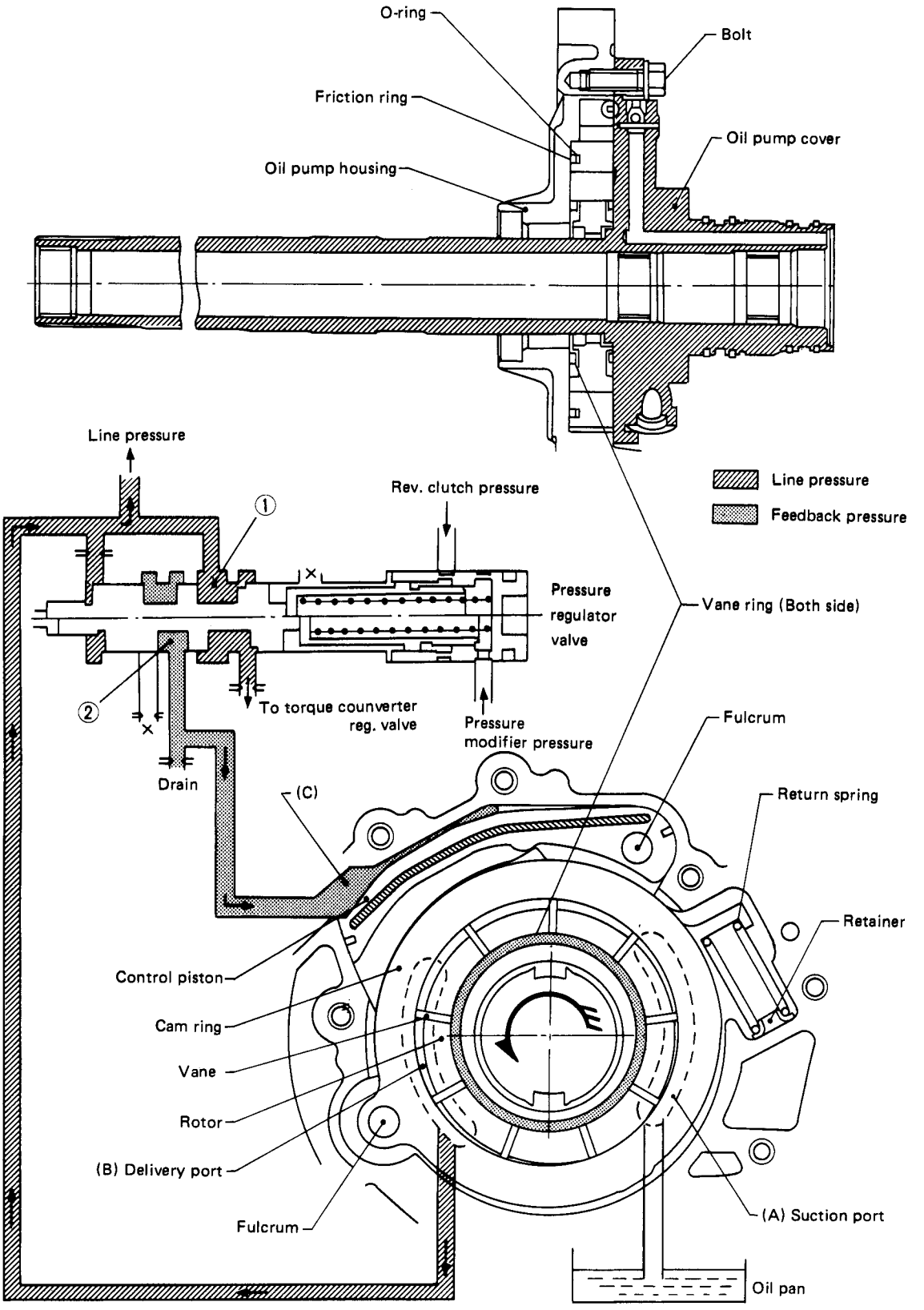

O-ring
Bolt
Friction ring
Oil pump cover
Oil pump housing
Line pressure
Rev. clutch pressure
Line pressure
Feedback pressure
①
Pressure
regulator
valve
Vane ring (Both side)
②
To torque counverter
reg. valve
Pressure
modifier pressure
Fulcrum
Drain
(C)
Return spring
Retainer
Control piston
Cam ring
Vane
Rotor
(B) Delivery port
Fulcrum
(A) Suction port
Oil pan

Fig. 13

L3-593

3-3 Transmission

The planetary gear train uses two sets of simple planetary gears (front planetary gear and rear planetary gear), four sets of multi-plate clutches (reverse clutch, high clutch, forward clutch, and overrunning clutch), one brake band, one set of multi-plate brake, and two sets of one-way clutches (one-way clutch 1-2 and one-way clutch 3-4) in order to allow shifting of four forward speeds and one reverse speed.

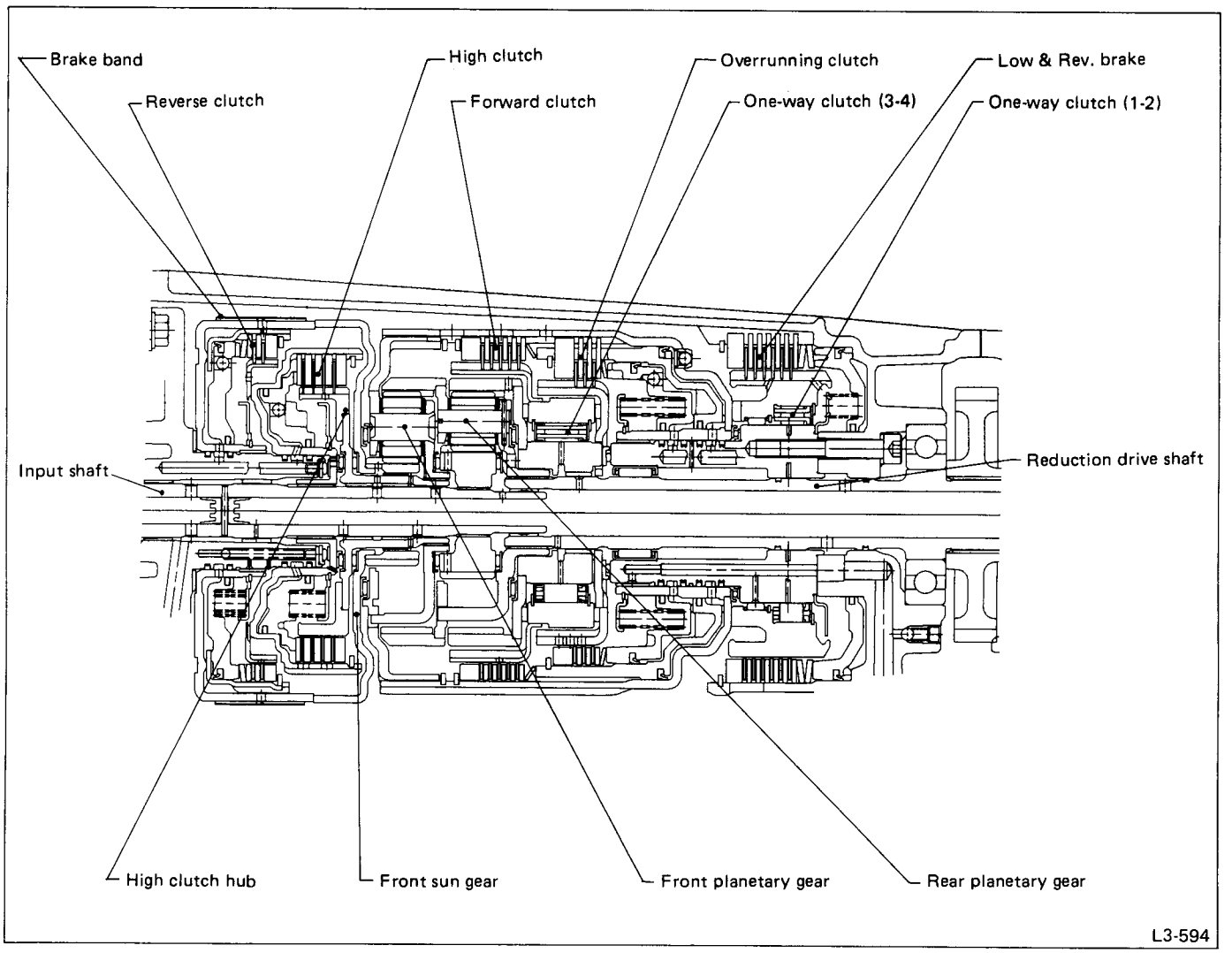


Fig. 14

1) OPERATING PRINCIPLE

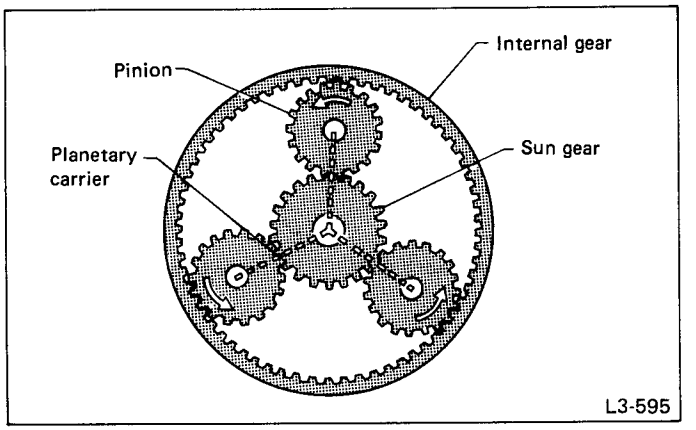


Fig. 15 Planetary gear

The automatic transmission uses a planetary gear system instead of the parallel shaft (two shafts) gear system adopted in the manual transmission.

The advantage of the planetary gear system is that it is compact because it has only one center shaft. The gear ratio can be changed by simply locking or releasing or rotating certain portions, unlike the manual transmission that requires changing gear engagement.

The construction of the planetary gear is shown above. The sun gear is located at the center, and each of the pinion gears revolves around the sun gear while rotating on its axis. These gears are all enclosed in a large ring, called the internal gear. Each pinion gear is supported by a planetary carrier, so that the pinion gears revolve an equal amount in the same direction.

As mentioned above, the planetary gear consists of four elements: the sun gear, pinion gears, internal gear, and planetary carrier. The gears are shifted by imposing certain conditions on two of the following three elements: sun gear, internal gear, and planetary carrier.

The clutches and brakes are used to impose the conditions on the planetary gear set.

2) CONSTRUCTION AND FUNCTION OF EACH ELEMENT

(1) Reverse clutch

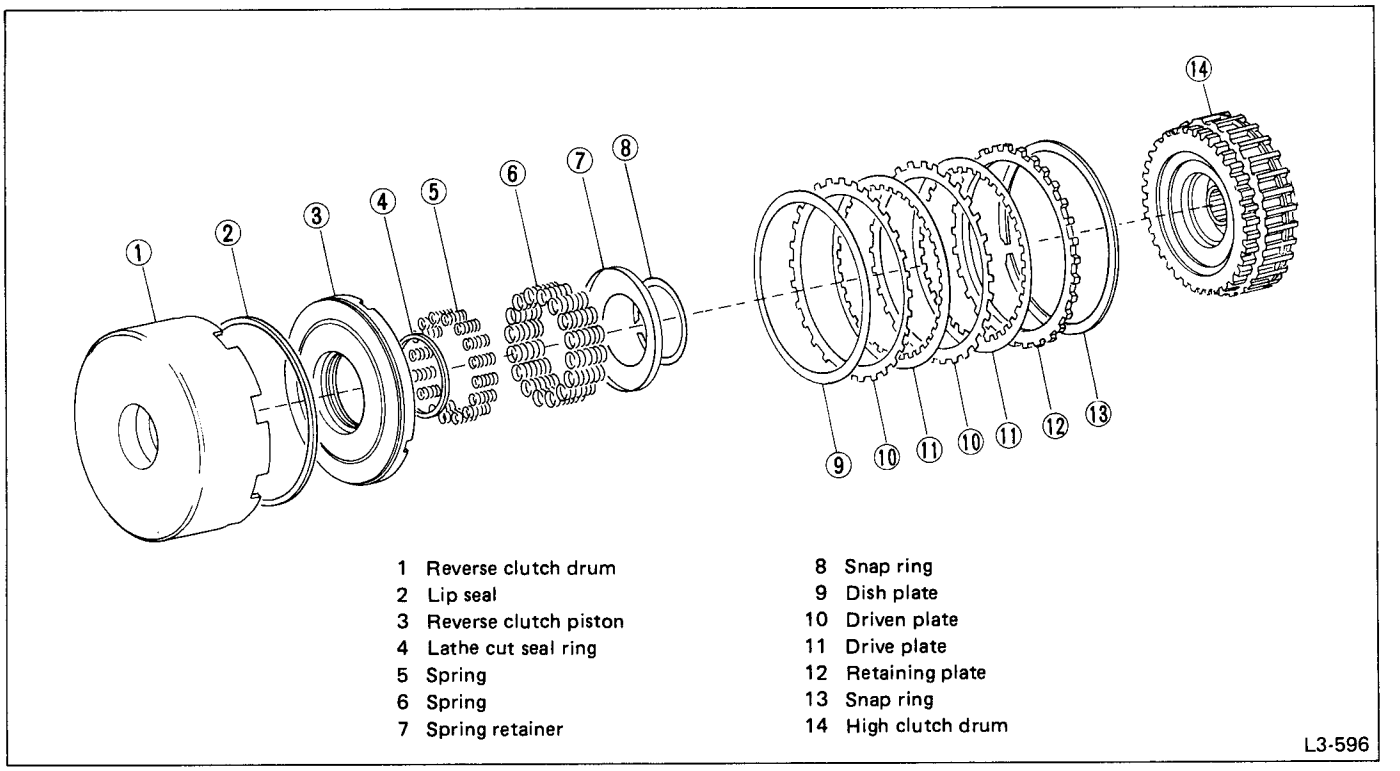


Fig. 16

During operation

Hydraulic pressure is applied to the reverse clutch piston ① from the control valve when shifting in reverse. The drive plate ② and driven plate ③ are connected by this pressure, and engine power from the high clutch drum ④ is transmitted to the front sun gear.

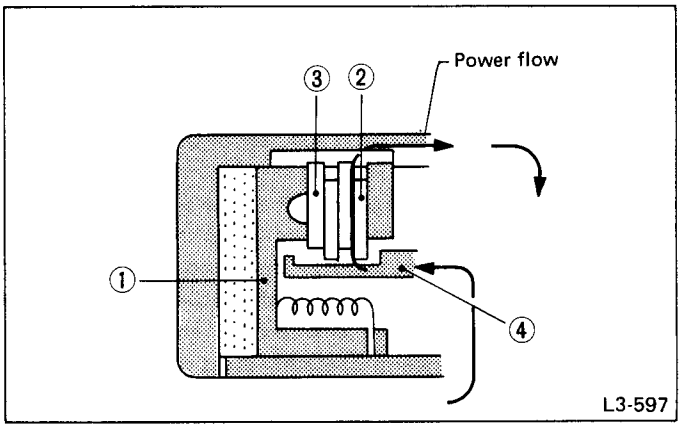


Fig. 17 Operation of reverse clutch

During non-operation

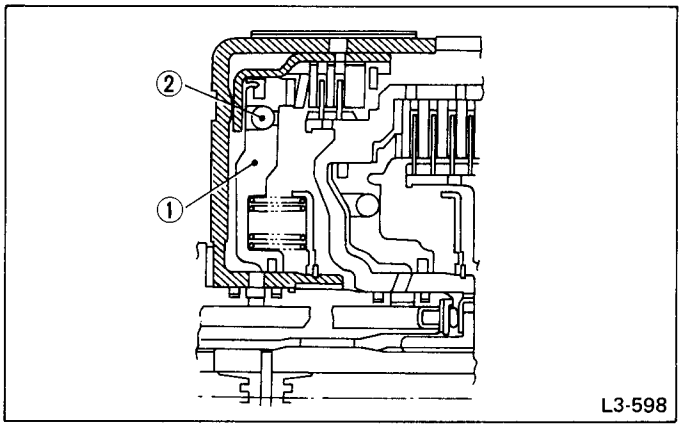


Fig. 18

When the shift lever is in any position other than reverse, no hydraulic pressure is applied to the reverse clutch piston ①. Hence the drive plate and driven plate are separated, and no power is transmitted.

The check ball ② is built into the clutch piston. This check ball releases oil pressure from the clutch piston while the drum rotates idle. It thus avoids buildup of residual pressure in the clutch drum and a resultant half-engaged clutch, which may otherwise be caused by centrifugal oil pressure.

(2) High clutch

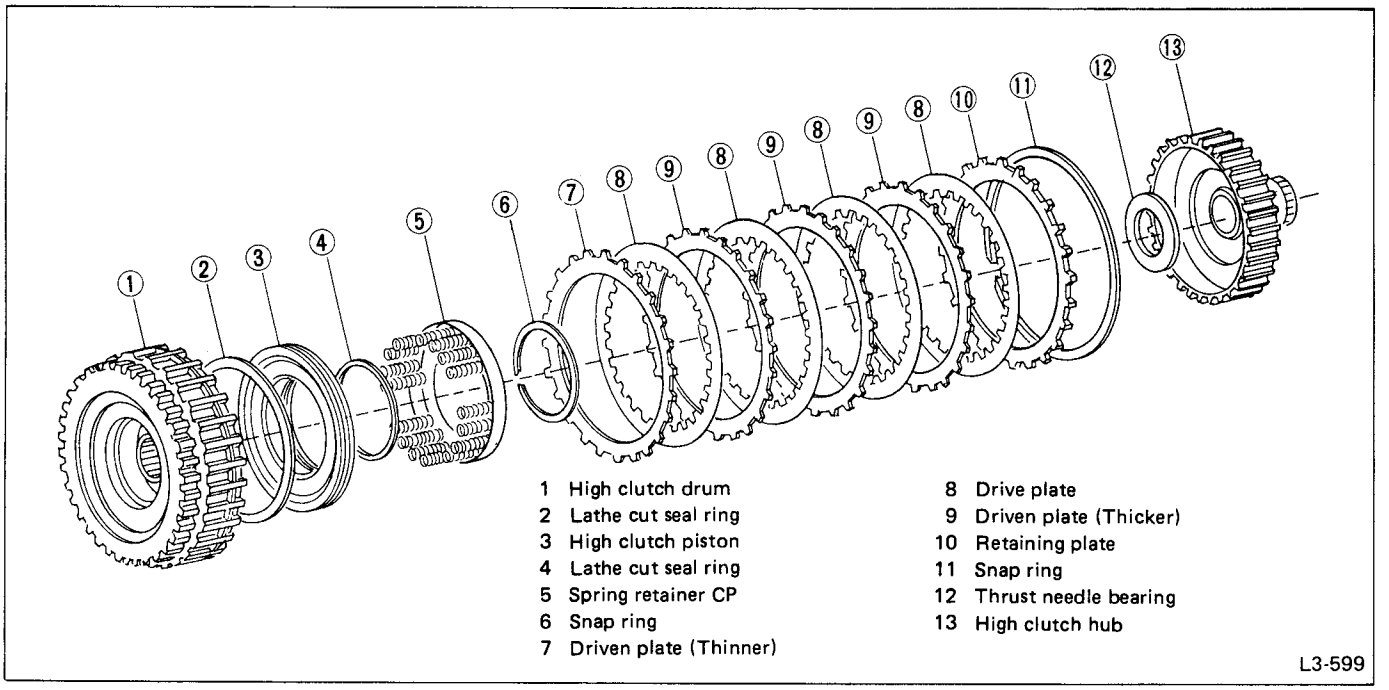


Fig. 19

In 3rd and 4th speed operation, hydraulic pressure is applied to the high clutch from the control valve and another hydraulic pressure controller. The clutch plates (drive and driven plates) are connected by this hydraulic pressure, and engine power from the input shaft is transmitted to the front planetary carrier through the high clutch hub.

(3) Band brake

- **Construction**

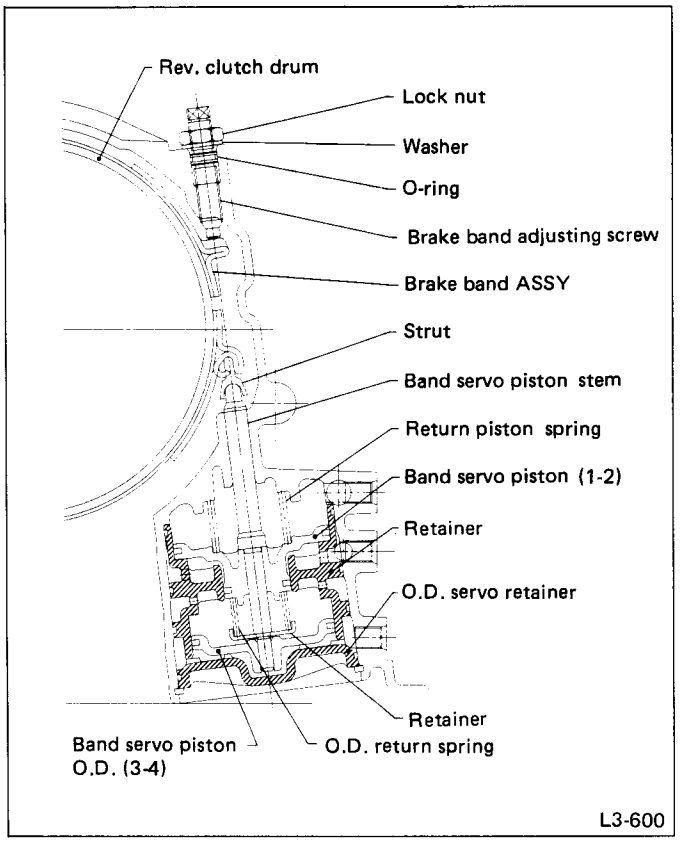


Fig. 20

The band brake consists of a flex type brake band, a band brake adjusting mechanism, two servo pistons, two retainers, two return springs, a stem, a strut, and others. The band brake can be adjusted as installed on the vehicle.

- **Function**

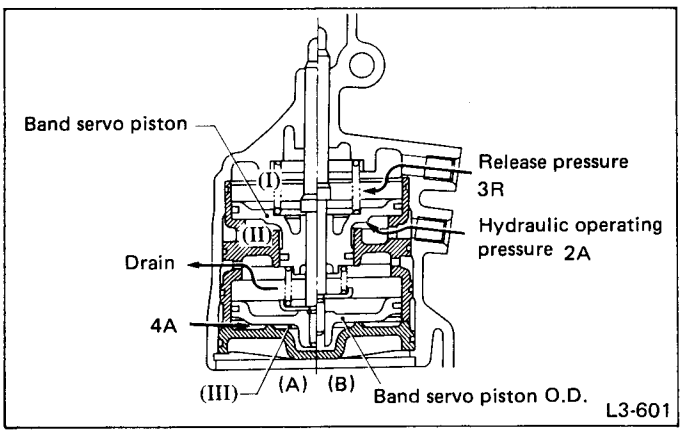


Fig. 21

One end of the brake band is secured to the transmission case via the brake band adjusting screw.

When no hydraulic pressure is applied to the servo piston from the hydraulic pressure controller, the servo piston and band servo piston O.D. are forced downward by the return spring, as shown in (A) of the Figure.

When hydraulic pressure 2A is applied to the servo chamber (II), it causes the band servo piston to come into contact with the stepped portion of the band servo piston stem, thereby pushing the band servo piston stem upward to state (B). Under this condition, the brake band slowly tightens the reverse clutch drum and fixes the front sun gear of the front planetary gear. (2nd speed state)

Next, when the release pressure 3R to the servo chamber (I) and the hydraulic operating pressure 2A to the servo chamber (II) are applied simultaneously, the band servo piston is pushed downward by the force of the return spring and the pressure difference between chamber (I) and chamber (II), caused by the difference in operating areas of the band servo pistons. Under this condition, state (A) is resumed, and the brake band loosens and releases the reverse clutch drum. (3rd speed state)

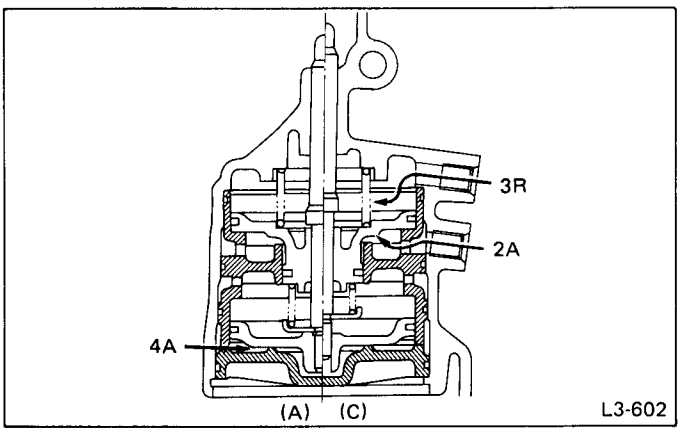


Fig. 22

When hydraulic pressure 4A is applied to the servo chamber (III) under the 3rd speed condition, the band servo piston O.D. is brought into contact with the retainer installed at the lower end of the band servo piston stem. Hence, the stem is pushed upward. As a result, state (C) is achieved where the brake band slowly tightens the reverse clutch drum and fixes the front sun gear of the front planetary gear. (4th speed state)

The accumulator is built into the transmission case as shown in the Figure. When hydraulic pressures 2A, 3R, and 4A are applied from the hydraulic control unit to the respective servo chambers, the hydraulic shock loads are absorbed by the accumulator. This is because the accumulator piston moves slowly, and the brake band is tightened or released slowly. This results in smooth gearshift operation.

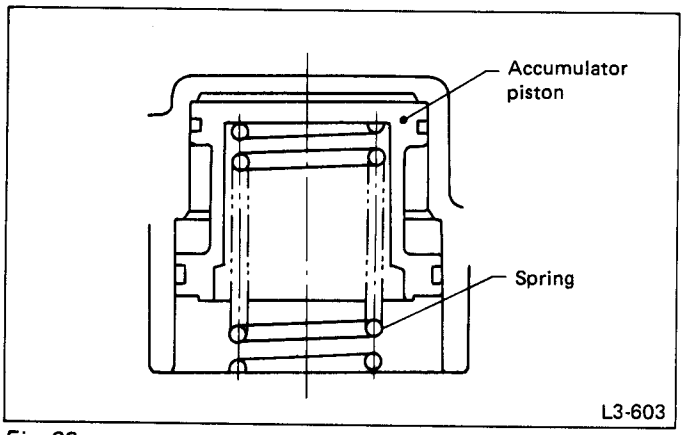


Fig. 23

	Band servo piston (1-2) O.D. mm (in)	Band servo piston (3-4) O.D. mm (in)	Retainer I.D. mm (in)	Return spring (1-2) N (kg, lb)	Return spring (3-4) N (kg, lb)
2700 cc	70 – 30 (2.76 – 1.18)	64 (2.52)	70 – 30 – 64 (2.76 – 1.18 – 2.52)	147 (15, 33) (at setting)	98 (10, 22) (at setting)
1800 cc	64 – 30 (2.52 – 1.18)	57 (2.24)	64 – 30 – 64 (2.52 – 1.18 – 2.52)	147 (15, 33) (at setting)	98 (10, 22) (at setting)

(4) One-way clutch

The one-way clutch (O.W.C.) is a Sprague type. Two clutches are used. One is mounted between the one-way clutch outer race and the rear internal gear ASSY. The other is located between the forward clutch drum and the one-way clutch inner race.

The former O.W.C. (3-4) is provided to prevent counterclockwise rotation (as viewed from the front) of the rear internal gear ASSY of the rear planetary gear during 1st, 2nd and 3rd speeds of the "D" range, "3" range, "2" range and "1st hold". At the 4th speed of the "D" range, therefore, the rear internal gear ASSY rotates clockwise so that the O.W.C. rotates freely to ensure smooth transition between 3rd and 4th speeds.

On the other hand, the latter O.W.C. (1-2) is provided to prevent counterclockwise rotation (as viewed from the front) of the forward clutch ASSY during 1st speed of the "D" range and 1st speed of the "3" range. Therefore, when shifting from 1st speed of the "D" range or "3" range to 2nd speed, the forward clutch ASSY rotates clockwise. As a result, the O.W.C. now rotates freely ensuring smooth transition between 1st and 2nd speeds.

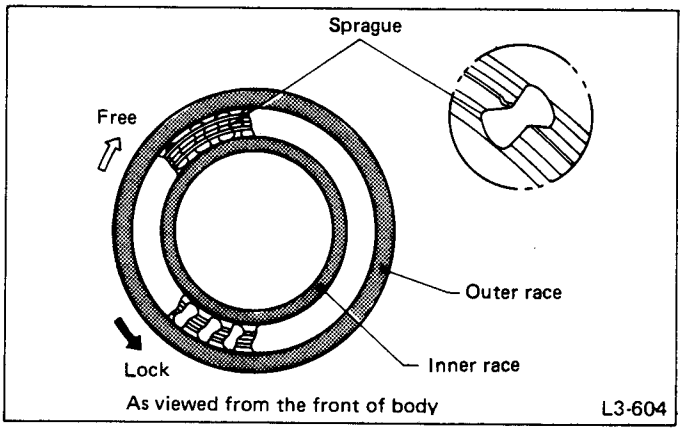


Fig. 24

Item	One-way clutch (1-2)	One-way clutch (3-4)
No. of Sprague	34	28
Width of O.W.C.	10 mm (0.39 in)	15 mm (0.59 in)

(5) Low & reverse brake

- **Construction**

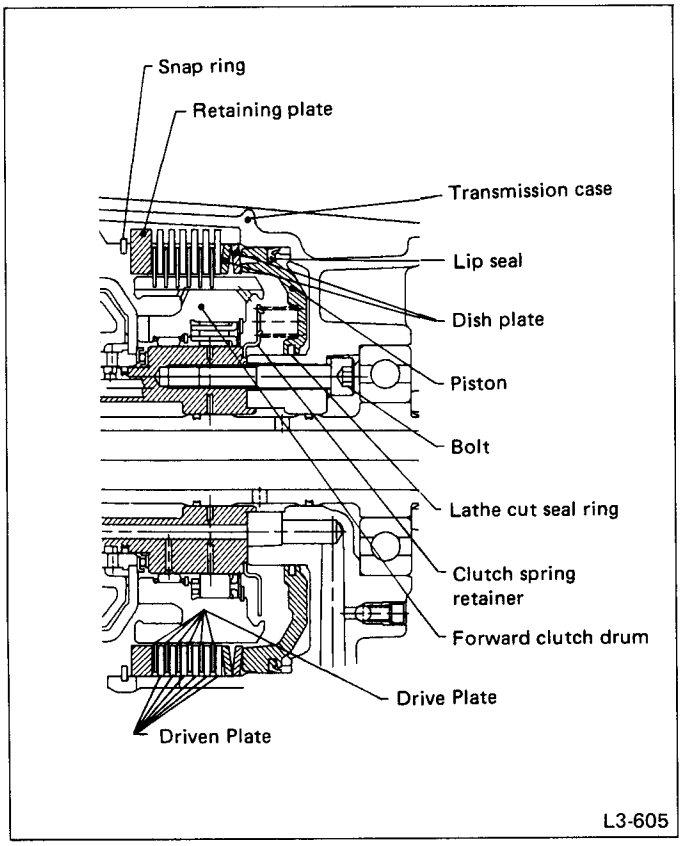


Fig. 25

The piston, dish plate, drive plate, driven plate, retaining plate and snap ring are mounted directly to the transmission case. The spring retainer which is integral with the spring is secured to the inner race of the transmission case engagement surface.

- **Function**

During 1st speed of the "2" range and 1st speed of the "1st hold", and reverse, hydraulic pressure from the hydraulic pressure controller is applied to the low & reverse piston. This pressure causes the drive plate and driven plate to engage, and the forward clutch to be fixed.

		2700 cc	1800 cc
No. of drive plates		6	4
No. of driven plates		6	4
Piston	O.D. mm (in)	148 (5.83)	148 (5.83)
	I.D. mm (in)	73 (2.87)	73 (2.87)

(6) Forward clutch & overrunning clutch

• Construction

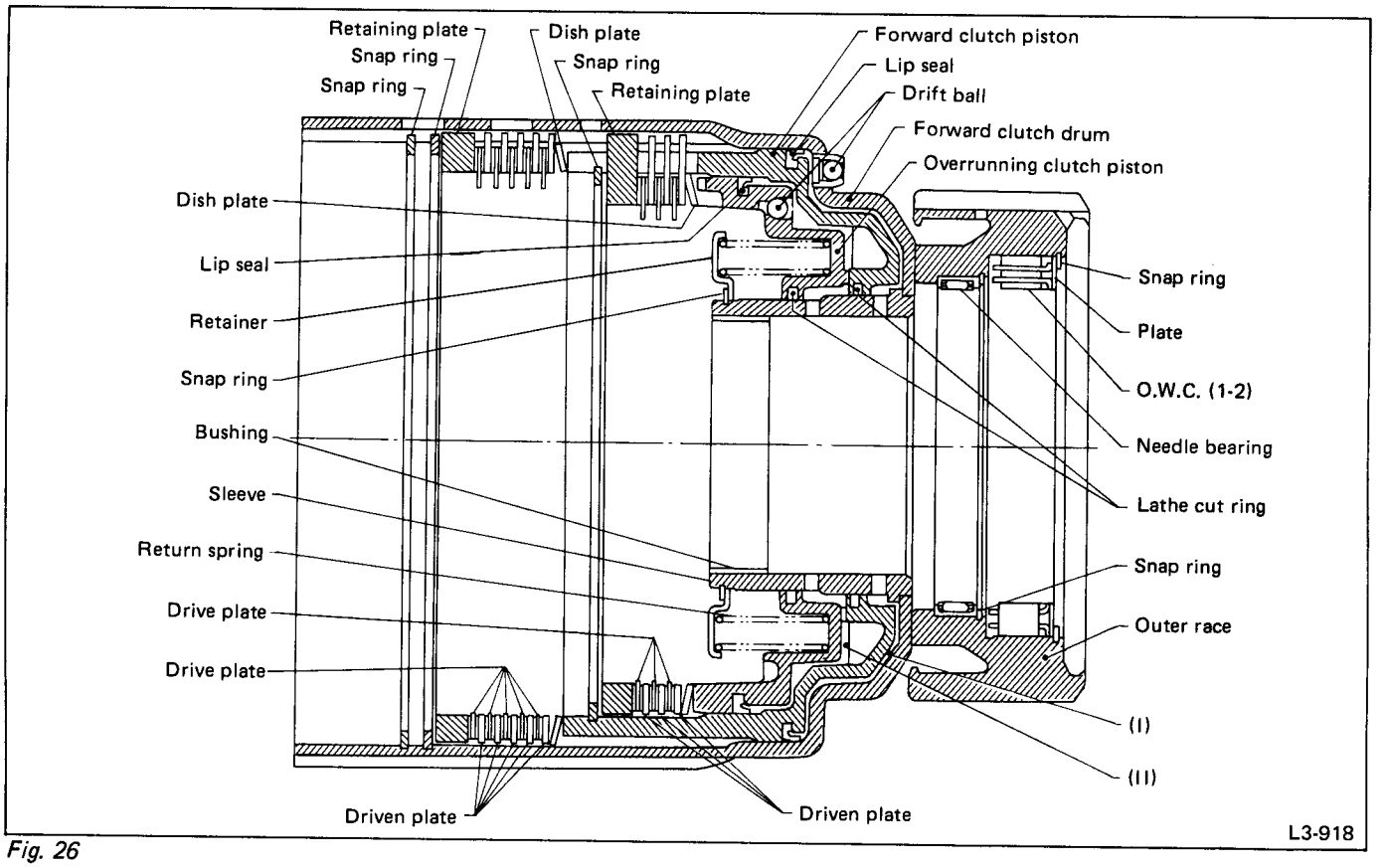


Fig. 26

The forward clutch drum is manufactured by pressing sheet metal. The clutch drum, outer race and sleeve are welded together by the electron beam welding technique. This clutch drum accommodates two multi-plate clutches (forward clutch and overrunning clutch). The overrunning clutch piston is mounted on the internal periphery of the forward clutch piston for common use of the return spring and reduction in size.

		Forward clutch	Overrunning clutch
No. of drive plates		5	3
No. of driven plates		5	3
Piston	O.D. mm (in)	147 (5.79)	133 (5.24)
	I.D. mm (in)	73 (2.87)	75 (2.95)

• Function

When hydraulic pressure is applied to the pressure chamber (I) from the hydraulic pressure controller during forward operation in the "D", "3", "2" range or "1st hold", the forward clutch piston forces the overrunning clutch piston. This causes the drive and driven plates of the forward clutch to engage while causing the drive and driven plates of the overrunning clutch to slide forward.

A groove is provided on the outside of the retaining plate and driven plate of the overrunning clutch in which the forward clutch piston slides.

When hydraulic pressure is applied to the pressure chamber (II) from the hydraulic pressure controller during "3" range, "2" range or "1st hold" operation, the forward clutch piston is forced onto the side of the forward clutch drum. The overrunning clutch piston, however, is moved to the left by the hydraulic pressure. This causes the drive and driven plates of the overrunning clutch to engage. When this occurs, the outside splines of the overrunning clutch retaining plate and driven plate fit into the internal spline grooves of the forward clutch. This allows power to be transmitted between the overrunning clutch hub and the forward clutch drum.

(7) Planetary gear

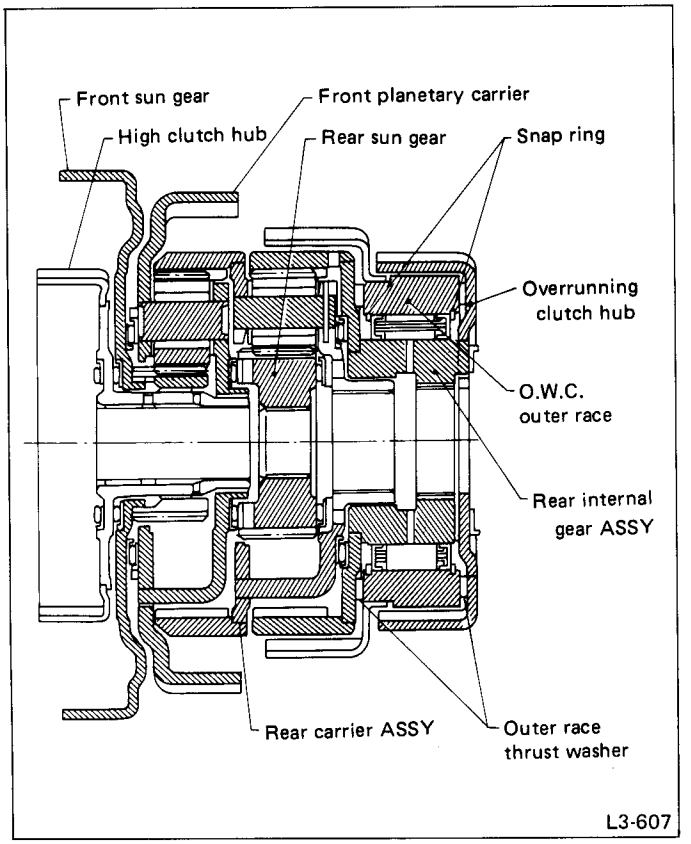


Fig. 27

Two sets of simple planetary gears are used to allow gear shifting from 1st speed to 4th speed or to reverse. Both the front and rear planetary gear carriers are made from pressed steel which is electron-beam welded to other structural members. The front planetary gear has three pinions while the rear planetary gear has four pinions. Both are part of an integral unit, and disassembling is not allowed.

3-4 Input Shaft

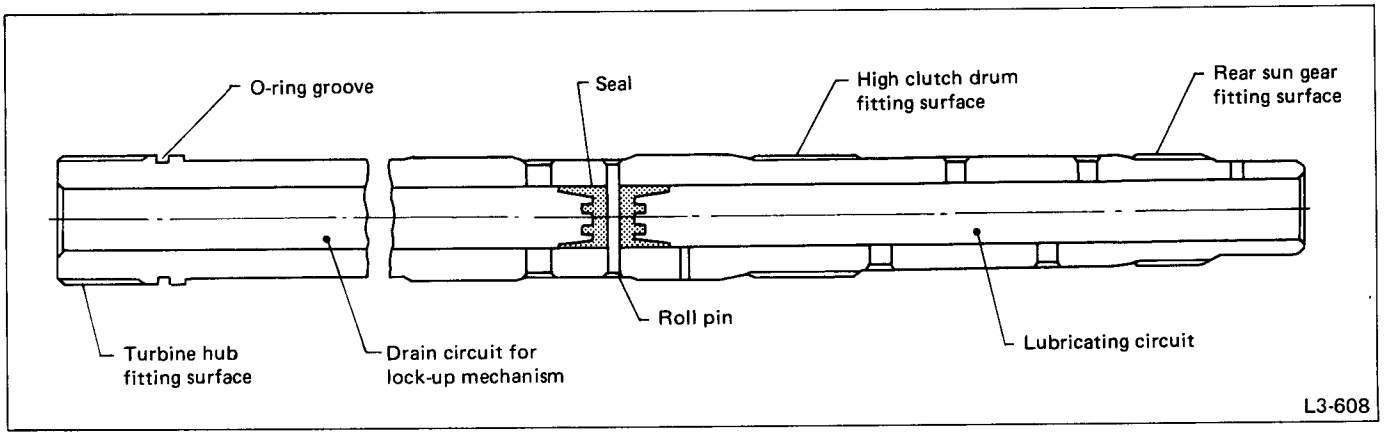


Fig. 28

The input shaft front end is spline-fitted to the torque converter turbine hub. The rear end is spline-fitted to the high clutch drum and rear sun gear. Power from the torque converter is transmitted to the high clutch drum and rear sun gear. The input shaft is hollow. A seal is fitted inside the shaft by a roll pin. The torque converter side of the shaft becomes the drain circuit for the lock-up mechanism. The other side becomes the lubricating circuit for the planetary gears and high clutch.

3-5 Reduction Gear

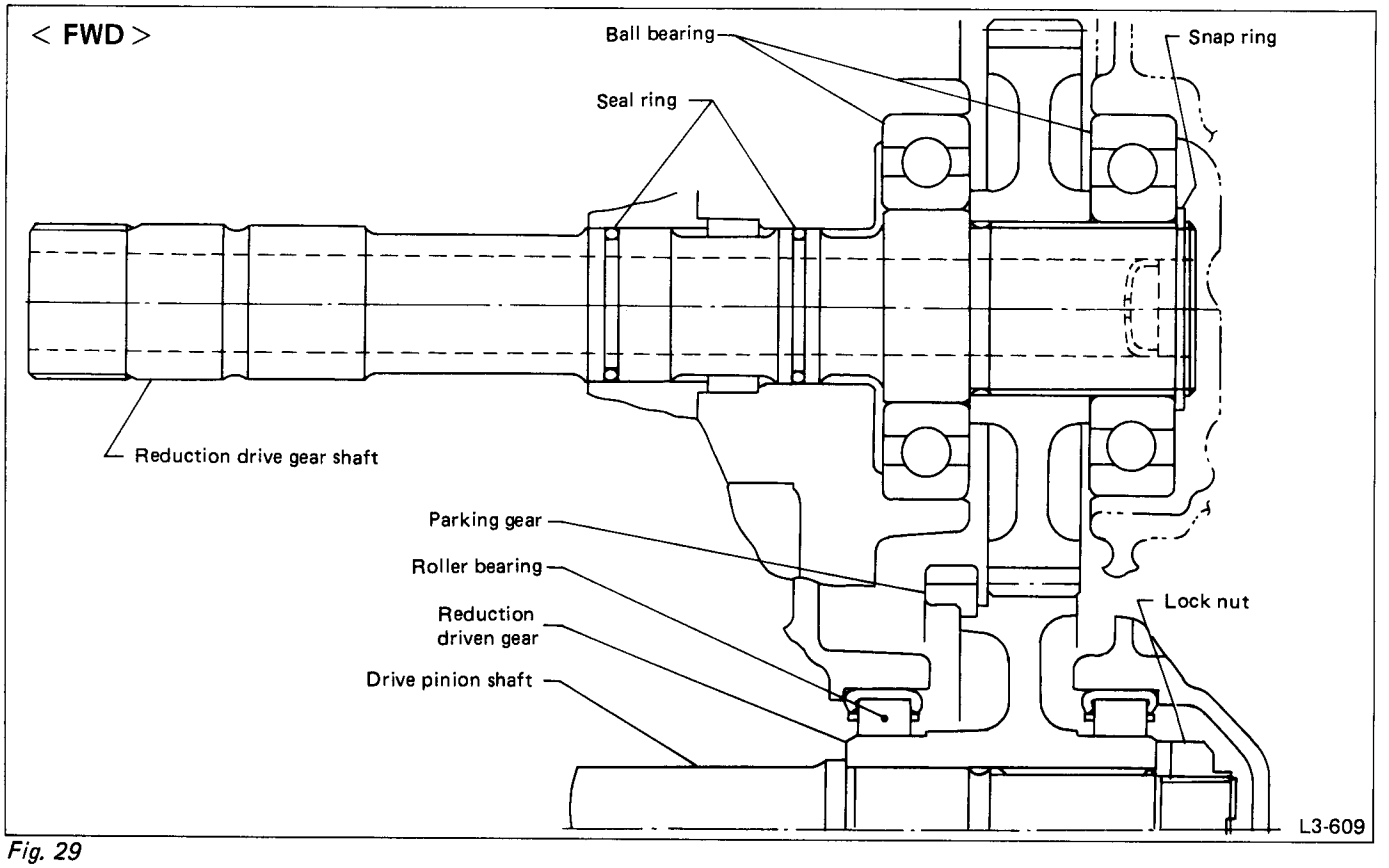


Fig. 29

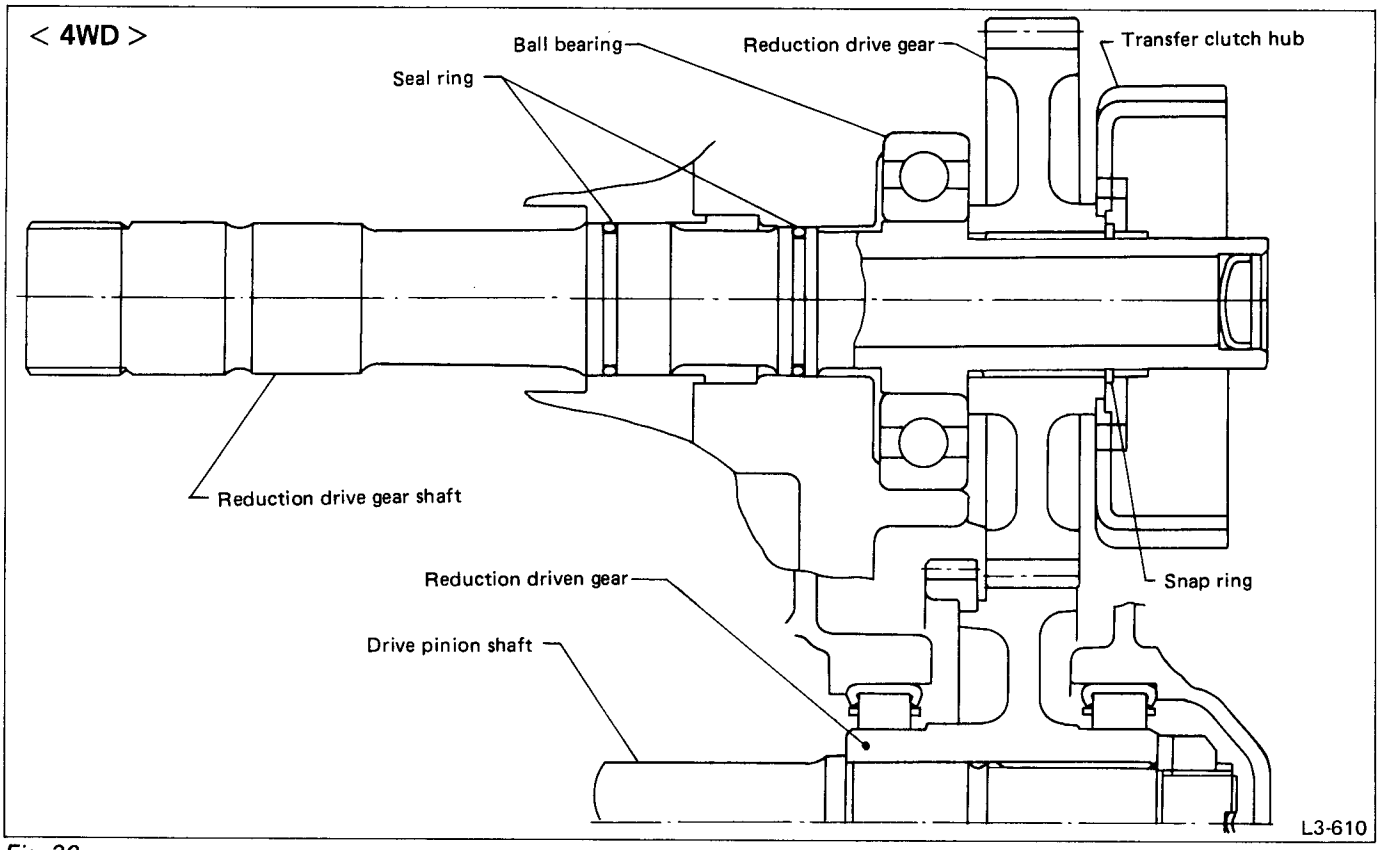


Fig. 30

Engine power is transmitted from the rear planetary carrier to the reduction drive shaft and the reduction drive gear. In a FWD vehicle, power is then transmitted to the final gear through the reduction driven gear and drive pinion. In a 4WD vehicle, power transmission to the front wheels is the same as a FWD vehicle. Power to the rear wheels is transmitted from the transfer clutch hub, welded to the side of the reduction drive gear, and passes through the transfer clutch (multi-plate clutch), to the rear drive shaft → propeller shaft → rear differential → rear wheel.

3-6 Final Reduction Gears

The hypoid drive gear is mounted to the cast iron oil pump housing by double taper roller bearings. The hypoid driven gear and the differential are mounted to the differential case. Both ends rotate and are supported by taper roller bearings in the converter case.

1) HYPOID GEAR

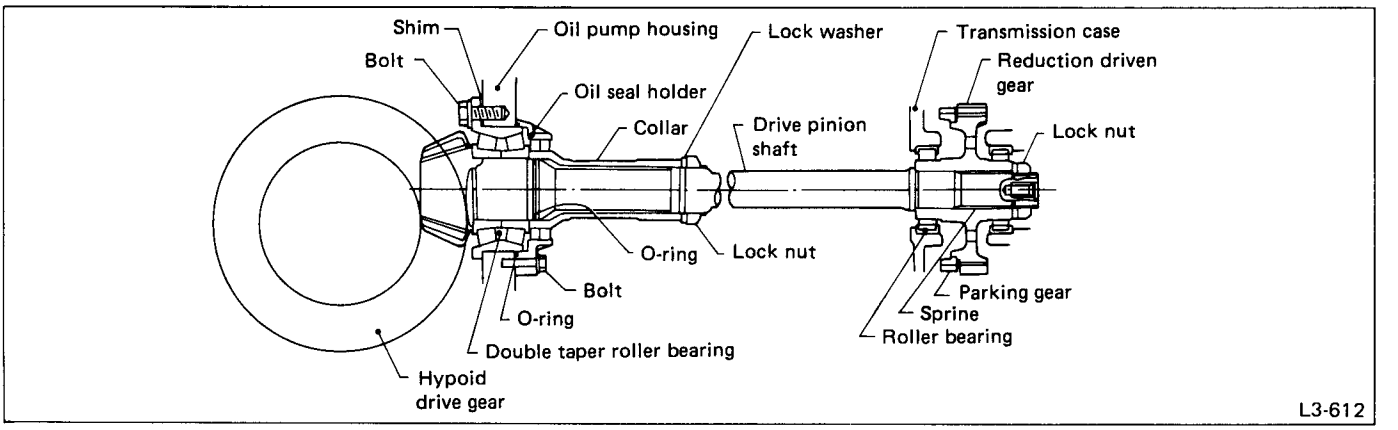


Fig. 31

The front end of the drive pinion shaft is supported by the double-taper roller bearing on the oil pump housing. The rear end is supported by two roller bearings on the transmission case and extension case (rear case for FWD vehicle). The double-taper roller bearing is preloaded by tightening the lock nut to a specified torque via the collar. The tooth contact of the hypoid gear is adjusted by changing the shim thickness between the double-taper roller bearing flange and oil pump housing.

The rear end of the drive pinion shaft is spline-fitted to the reduction driven gear, which is secured with a lock nut. The external helical spline has a length, and the reduction driven gear is force-fitted to this shaft end.

	2700 cc	1800 cc
No. of drive pinion shaft teeth	10	10
No. of hypoid drive gear	37	39
Diameter of hypoid drive gear mm (in)	170 (6.69)	170 (6.69)
Hypoid offset mm (in)	23 (0.91)	23 (0.91)

2) DIFFERENTIAL GEAR

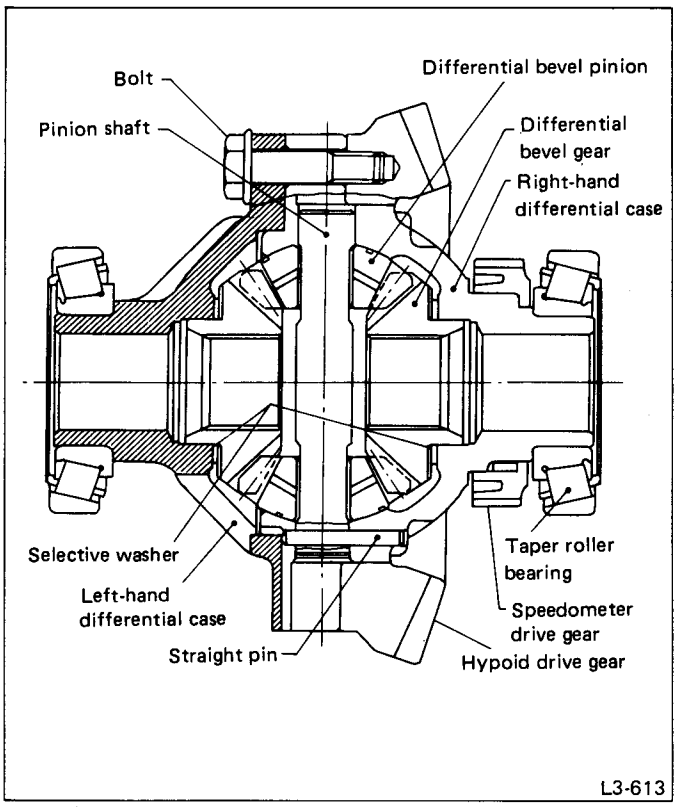


Fig. 32

The differential bevel gear is locked to the axle shaft by a clip.

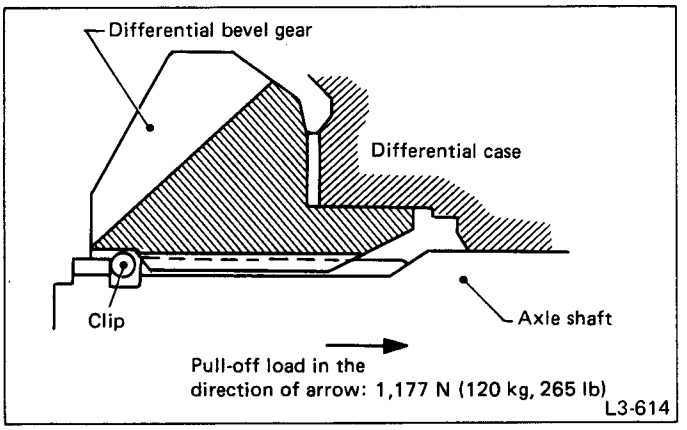


Fig. 33

The speedometer drive gear is mounted directly on the differential case, and the flexible cable is led from the right side of the converter case. With this arrangement, the speedometer drive and driven gears are properly lubricated.

3-7 Hydraulic Control System

The hydraulic control system consists of an oil pump, control valve bodies, clutches, brakes and connecting passages and pipes. When it is activated manually, or automatically by the electronic control system, it hydraulically controls the gear-shifting mechanism.

3) SPEEDOMETER GEAR SYSTEM

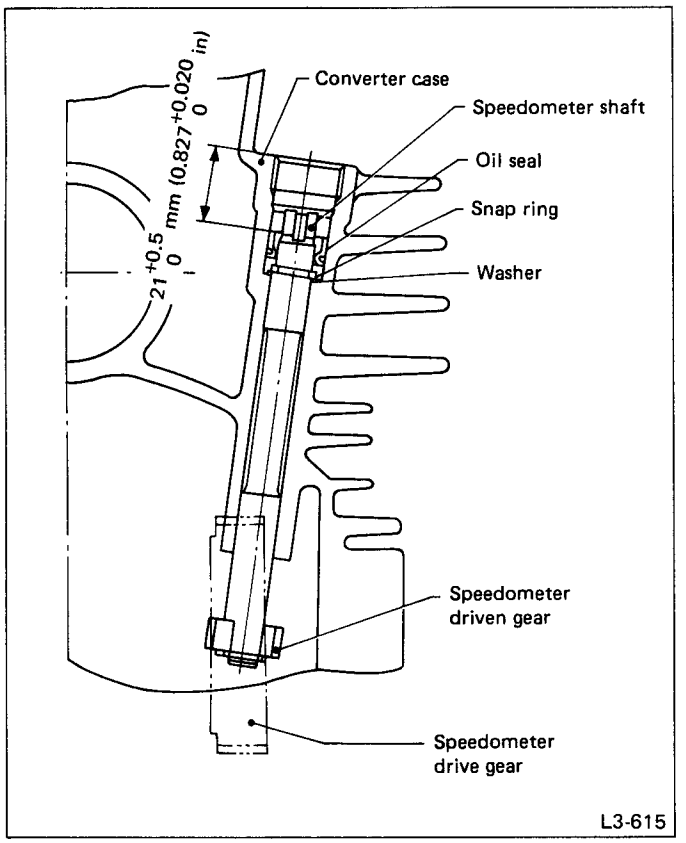
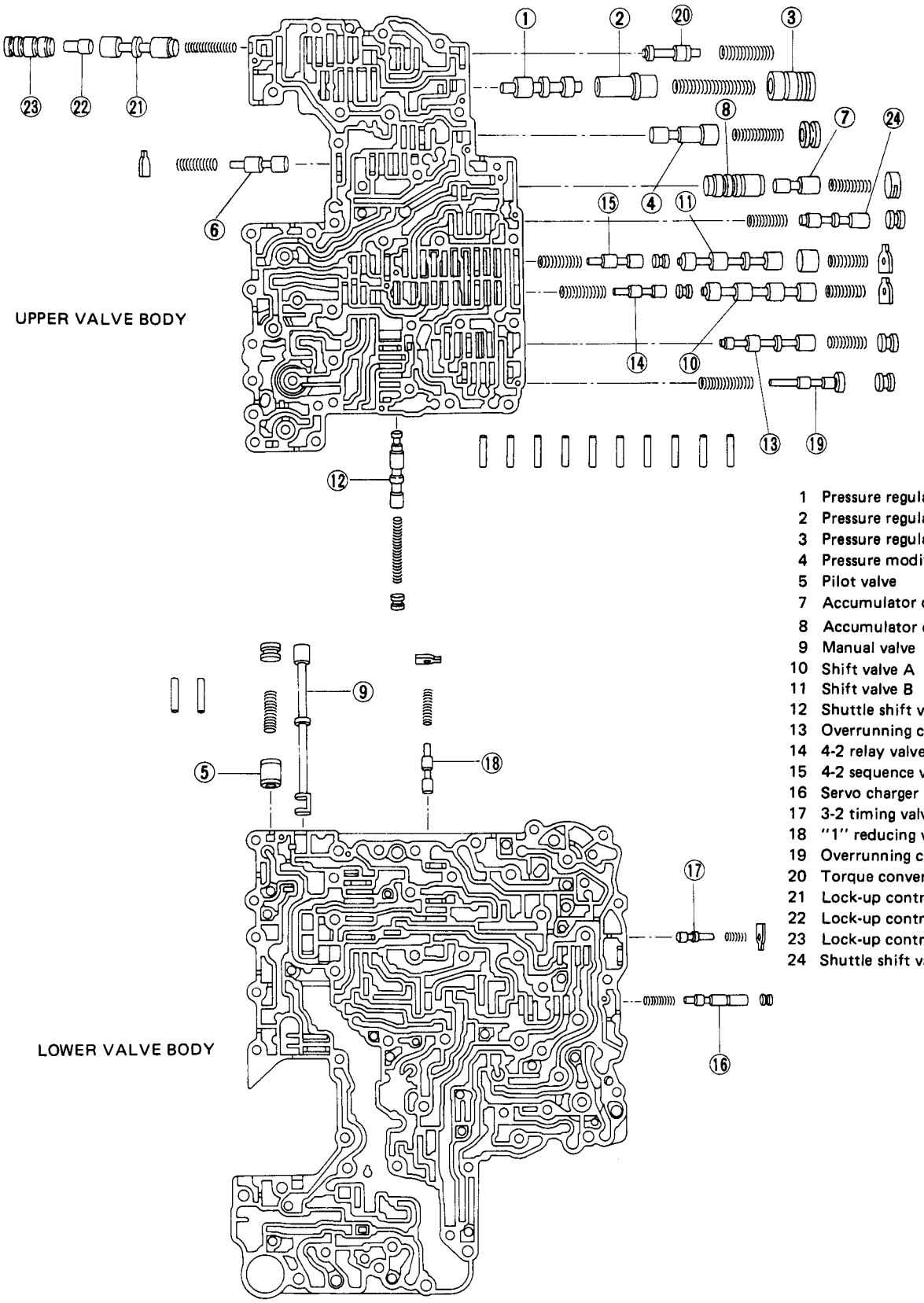


Fig. 34

1) CONSTRUCTION OF CONTROL VALVE

(1) Overall



1 Pressure regulator valve
2 Pressure regulator plug
3 Pressure regulator sleeve plug
4 Pressure modifier valve
5 Pilot valve
7 Accumulator control plug
8 Accumulator control sleeve
9 Manual valve
10 Shift valve A
11 Shift valve B
12 Shuttle shift valve B
13 Overrunning clutch control valve
14 4-2 relay valve
15 4-2 sequence valve
16 Servo charger valve
17 3-2 timing valve
18 "1" reducing valve
19 Overrunning clutch reducing valve
20 Torque converter relief valve
21 Lock-up control valve
22 Lock-up control plug
23 Lock-up control sleeve
24 Shuttle shift valve D

Fig. 35 L3-919

(2) Valve Body Configuration

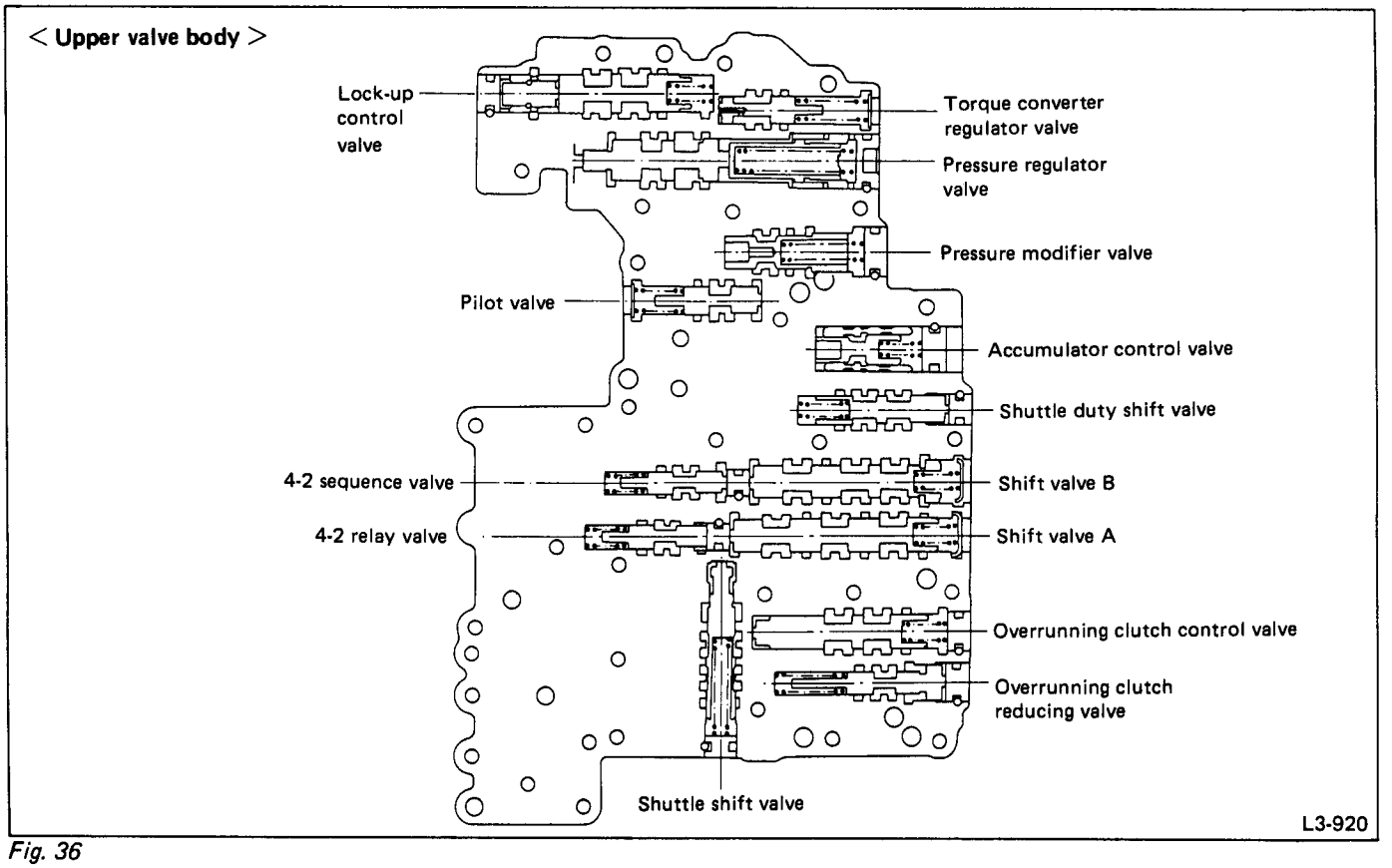


Fig. 36

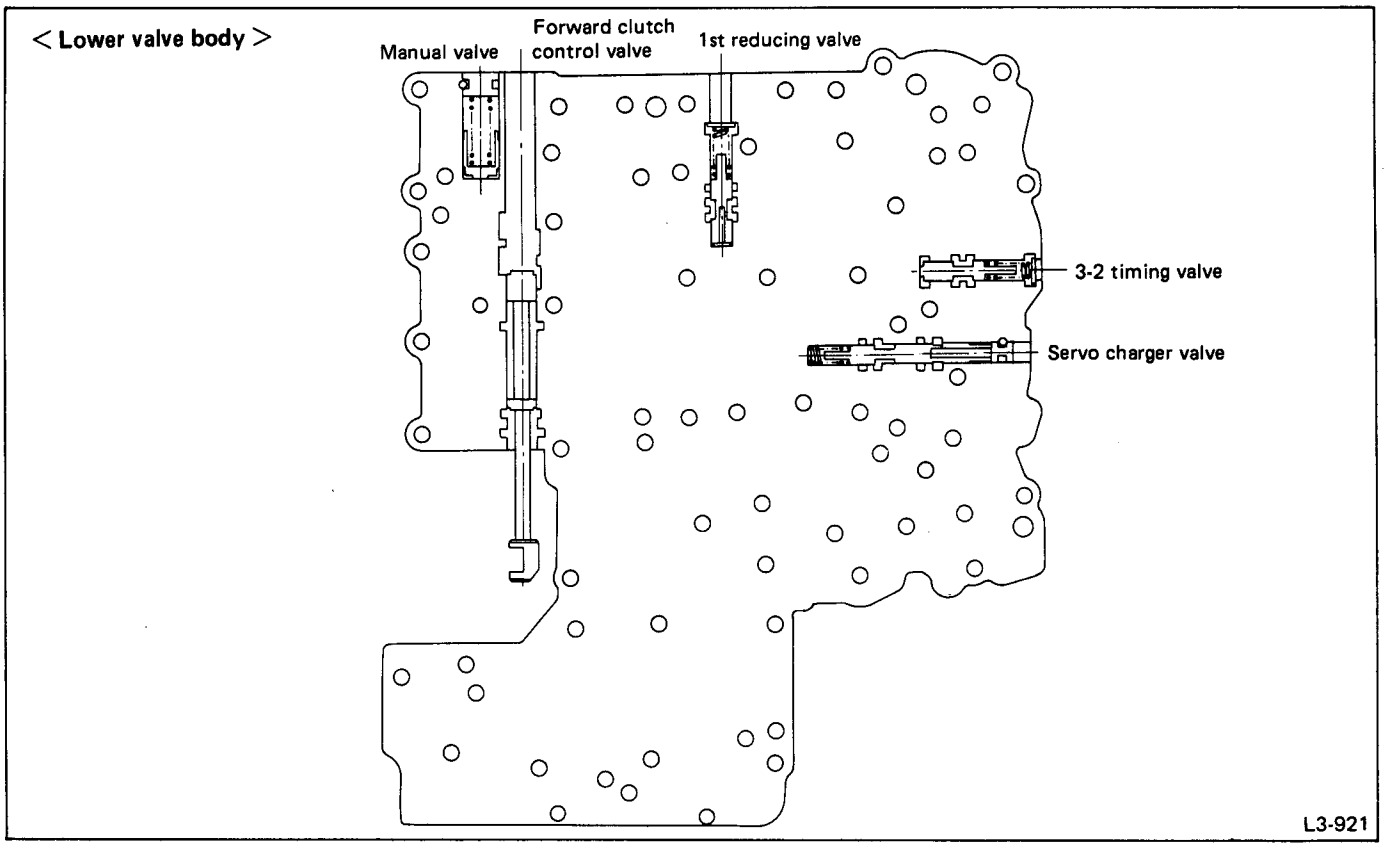


Fig. 37

(3) Related Parts (1)

The control valve body is fitted with Solenoid 1 (shift), Solenoid 2 (shift), Solenoid 3 (overrunning clutch), Duty solenoid A (line pressure), Duty solenoid B (lock-up) and an ATF temperature sensor.

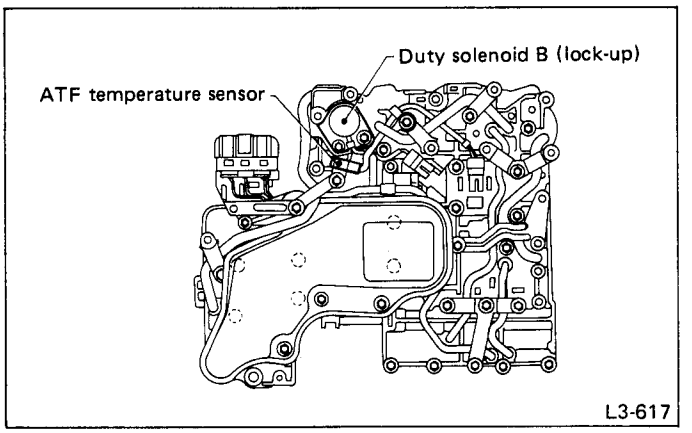


Fig. 38 Lower surface of control valve

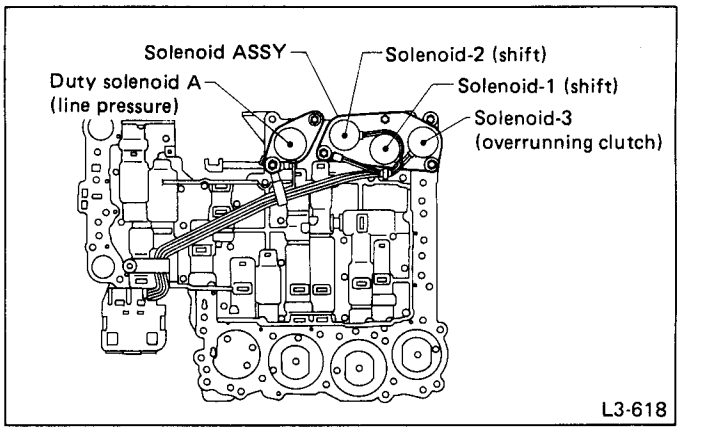


Fig. 39 Upper surface of control valve

(4) Related Parts (2)

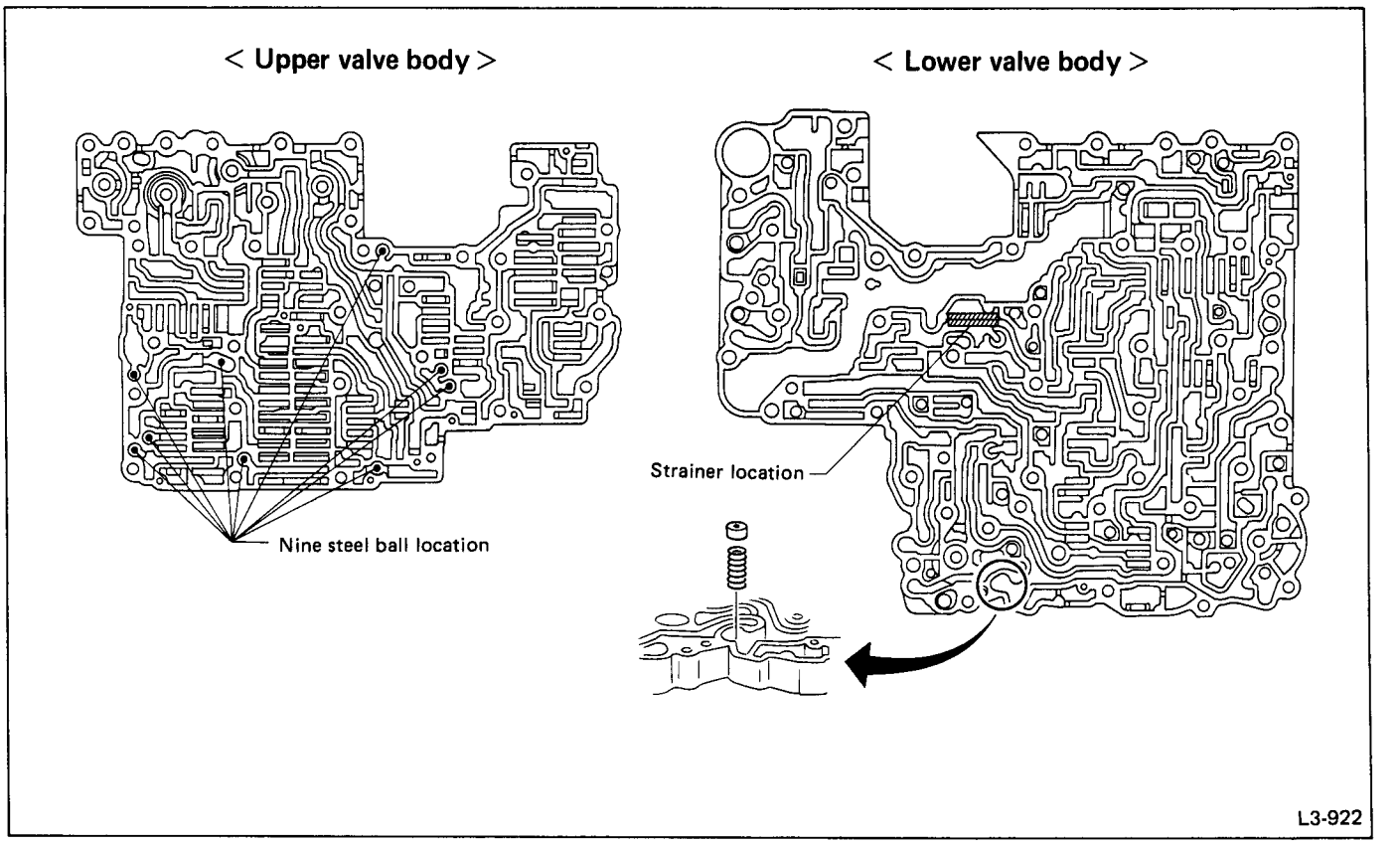


Fig. 40

(5) Related Parts (3)

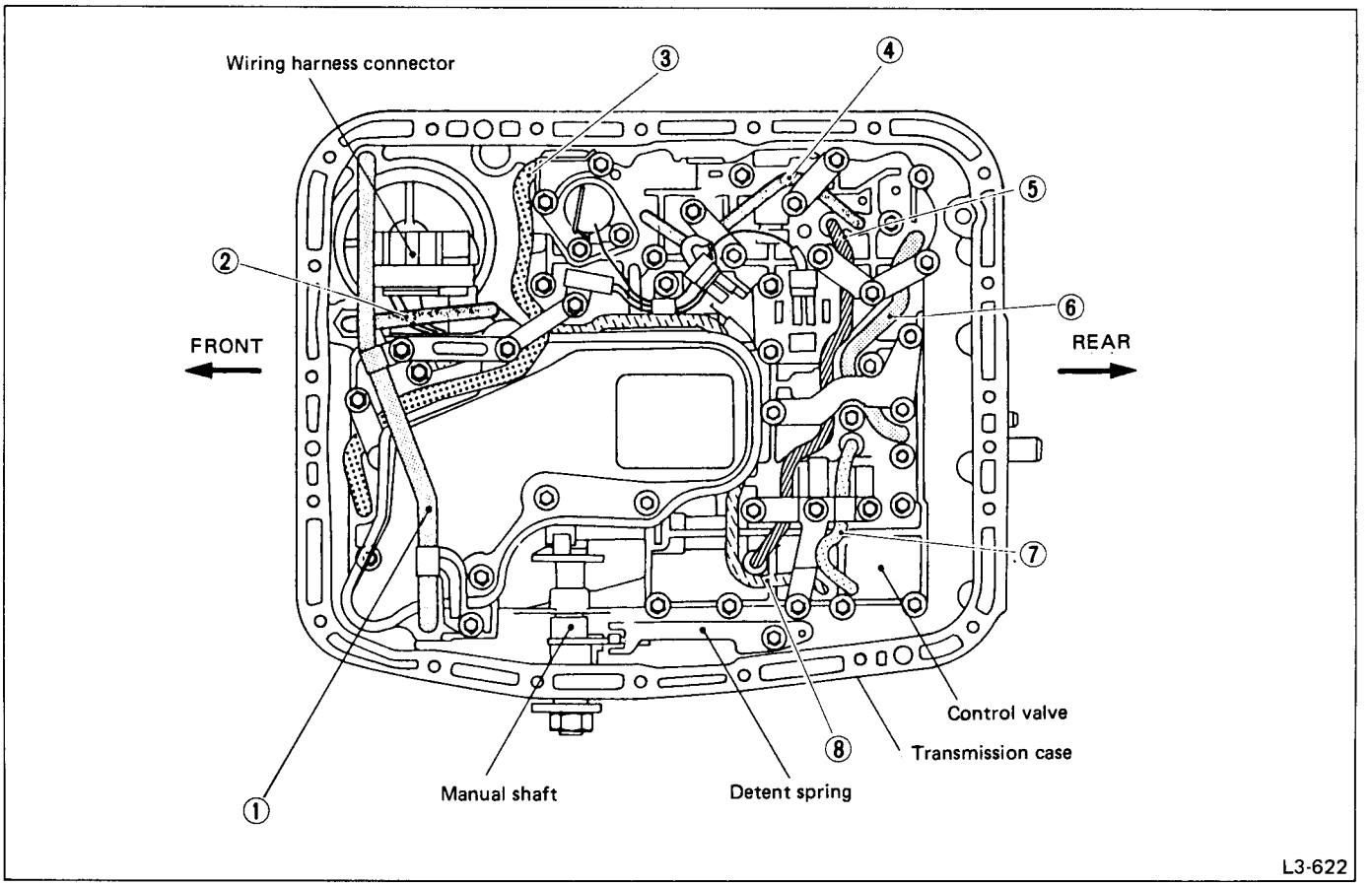


Fig. 41

< Pipe names >

No.	Description	Hydraulic circuit
①	Oil cooler outlet pipe	Cooling line from control valve to oil cooler inside radiator
②	Transfer control pipe	Line-pressure supply line to transfer control valve
③	Reverse clutch pressure pipe	Accumulator circuit of reverse clutch pressure
④	4A pressure pipe	4A pressure circuit
⑤	3R pressure pipe	3A pressure circuit
⑥	Forward clutch pressure pipe	Supply line to N → D accumulator
⑦	Pilot pressure pipe	Pilot pressure supply line to shuttle shift valve S
⑧	Pressure-modifier pressure pipe	Supply line to pressure modifier accumulator

2) FUNCTION OF EACH VALVE

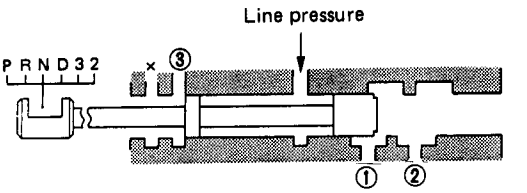
<table>
<tr><th>Name</th><th>Function</th></tr>
<tr><td>• Pressure regulator valve
• Pressure regulator plug
• Pressure regulator sleeve plug</td><td>Regulates the pressure of oil delivered from the oil pump to an optimum level (line pressure) corresponding to vehicle running conditions.</td></tr>
<tr><td>Pressure modifier valve</td><td>An auxiliary valve for the pressure regulator valve. This valve adjusts pressure used to regulate line pressure to an optimum level corresponding to running conditions.</td></tr>
<tr><td>Pressure modifier accumulator piston</td><td>Smoothes the pressure regulated by the pressure modifier valve to prevent pulsation in line pressure.</td></tr>
<tr><td>Pilot valve</td><td>Creates the constant pressure (pilot pressure) necessary to control line pressure, lock-up, overrunning clutch, 3-2 timing, and gearshift operations from line pressure.</td></tr>
<tr><td>• Accumulator control plug
• Accumulator control sleeve</td><td>Adjusts accumulator back pressure to correspond to running conditions.</td></tr>
<tr><td>Manual valve</td><td>Delivers line pressure to each circuit corresponding to the selected position.
<table>
<tr><th>Circuit / Range</th><th>①</th><th>②</th><th>③</th></tr>
<tr><td>P</td><td></td><td></td><td></td></tr>
<tr><td>R</td><td></td><td></td><td>○</td></tr>
<tr><td>N</td><td></td><td></td><td></td></tr>
<tr><td>D</td><td>○</td><td></td><td></td></tr>
<tr><td>3</td><td>○</td><td></td><td></td></tr>
<tr><td>2</td><td>○</td><td>○</td><td></td></tr>
</table>


Fig. 42 L3-924
When the valve is set in the "line pressure no delivery" position, the pressure is relieved.</td></tr>
<tr><td>Shift valve A</td><td>Simultaneously changes three different oil passages using shift solenoid 1 output pressure corresponding to such operating conditions as vehicle speed and throttle opening. Combined with shift valve B, this valve permits automatic shifting of 1st ⇄ 2nd ⇄ 3rd ⇉ 4th speeds.</td></tr>
<tr><td>Shift valve B</td><td>Simultaneously changes three different oil passages using shift solenoid 2 output pressure corresponding to such operating conditions as vehicle speed and throttle opening. Combined with shift valve A, this valve permits automatic shifting of 1st ⇄ 2nd ⇄ 3rd ⇇ 4th speeds.</td></tr>
<tr><td>Shuttle shift valve S</td><td>Changes the 3-2 timing control and overrunning clutch control oil passages corresponding to the throttle opening. When the throttle is wide open, the overrunning clutch becomes inoperative to prevent interlocking at 4th speed.</td></tr>
<tr><td>Overrunning clutch control valve</td><td>Changes oil passages so as to prevent simultaneous operation of the overrunning clutch when the brake band is actuated at 4th speed. (Operation of overrunning clutch at D4 speed results in interlocking.)</td></tr>
</table>

Name	Function
4-2 relay valve	Memorizes the 4th speed position, and prevents gear shifting from 4th to 3rd to 2nd speeds due to combined operation of the 4-2 sequence valve, shift valve A and shift valve B when shifting down from 4th to 2nd speeds.
4-2 sequence valve	Inhibits release of band servo operating pressure acting at 4th speed until the high clutch operating pressure and band servo release pressure (same hydraulic circuit) are drained when shifting down from 4th speed to 2nd speed.
Servo charger valve	The 2nd speed band servo actuating hydraulic circuit has an accumulator and one-way orifice for relieving shift shock when shifting from 1st speed to 2nd speed. The servo charger valve is installed to ensure sufficient oil flow when shifting down from 4th to 2nd speed, or from 3rd to 2nd speed. It operates at 3rd or higher speeds and supplies the 2nd speed band servo actuating pressure by bypassing the one-way orifice.
3-2 timing valve	When shifting down from D 3rd to D 2nd speed, the timing valve retards the release of band-servo pressure and creates a temporary neutral condition so that vehicle speed can be changed smoothly.
"1" Reducing valve	Reduces the low & reverse brake operating pressure so as to relieve engine braking shock when changing from "2" range 2nd speed to 1st speed.
Overrunning clutch reducing valve	Reduces the operating pressure applied to the overrunning clutch so as to relieve engine braking shock. In the "2" and "3" ranges, line pressure is applied to the valve to raise the pressure adjusting point, thereby increasing engine braking capacity.
Torque converter regulator valve	Prevents excessive rise of torque converter pressure.
• Lock-up control valve • Lock-up control plug • Lock-up control sleeve	Controls the operation of the lock-up function. Smoothes the transition between the lock-up state and release state.
Shuttle shift valve D	Changes the oil passage so that output pressure to the duty solenoid B (lock-up) will be applied to the lock-up valve in the "D" range 2nd, 3rd, or 4th speed. (Lock-up at 1st speed is inhibited.) at 1st speed is inhibited.) * Lock-up control is not actuated if the lock-up solenoid does not generate output pressure when signaled from the control unit, even if the vehicle is in the "D" range 2nd, 3rd, or 4th speeds.

3) OPERATION OF EACH VALVE

(1) Pressure Regulator Valve

In the regulator valve, force "F_L" generated by oil pump pressure (line pressure) acts to the right, while force "F_{MF}" generated by the pressure modifier pressure, force "$F_{R/C}$" and spring force "Fs" act to the left.
If F_L becomes larger than $F_{MF} + F_{R/C} + Fs$, the valve moves toward the right, and passage ① communicates with passage ② . Hydraulic pressure is then applied to the control piston of the oil pump, decreasing the oil pump discharge pressure. As a result, oil pump pressure is adjusted to maintain an equilibrium between F_L and $F_{MF} + F_{R/C} + Fs$.
With this valve, the discharge pressure of the oil pump is adjusted to an optimum pressure (line pressure) corresponding to the running conditions of the vehicle, so that oil pump driving energy loss is reduced and gearshift shock is relieved.

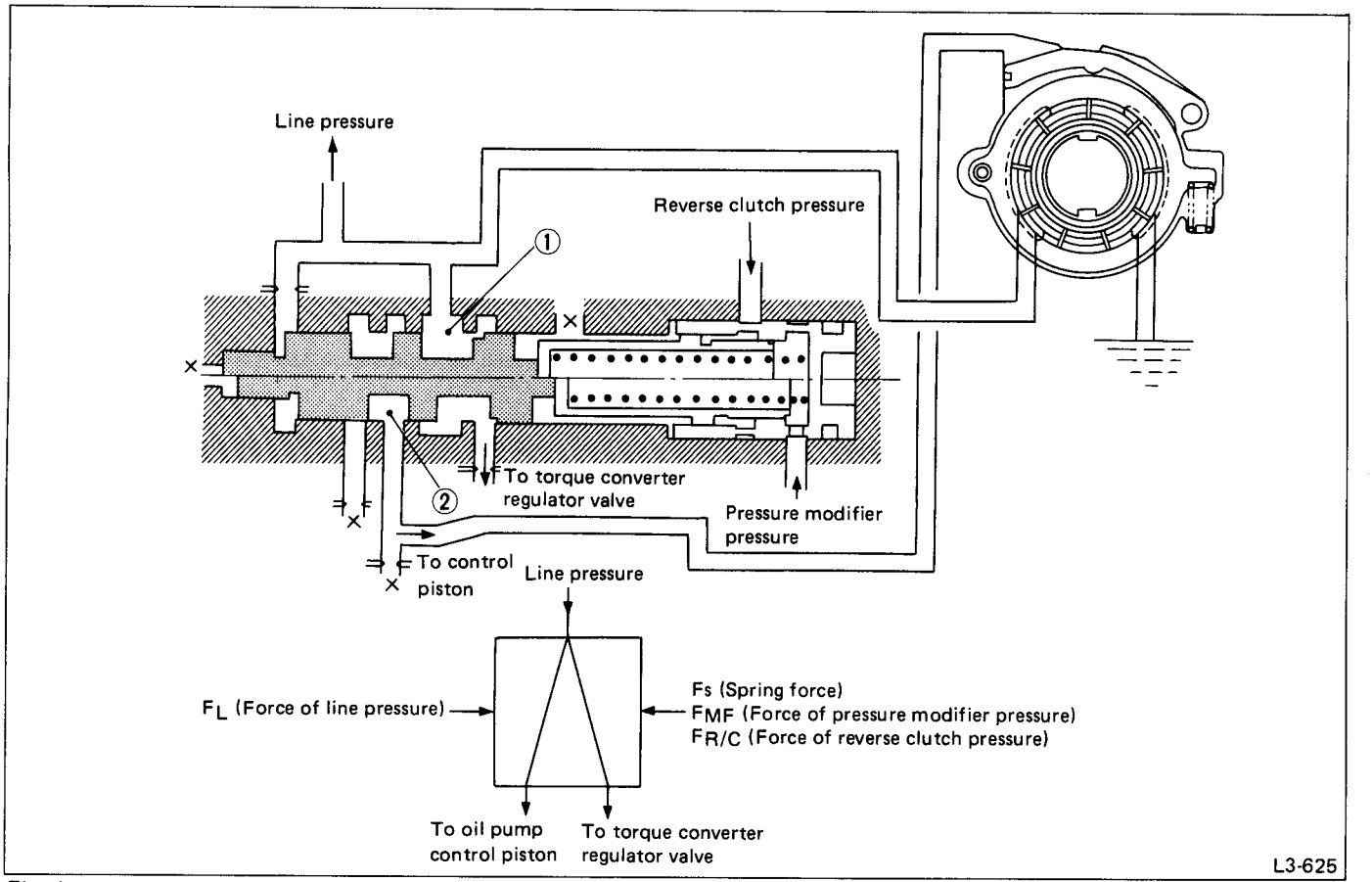


Fig. 43

(2) Torque Converter Regulator Valve

Torque converter pressure is applied to the valve as a force pushing the valve to the right. If the force generated by torque converter pressure becomes greater than the spring force, the valve moves toward the right, and torque converter pressure is relieved. Accordingly, torque converter pressure will not exceed the set pressure 686 kPa (7 kg/cm^2, 100 psi).

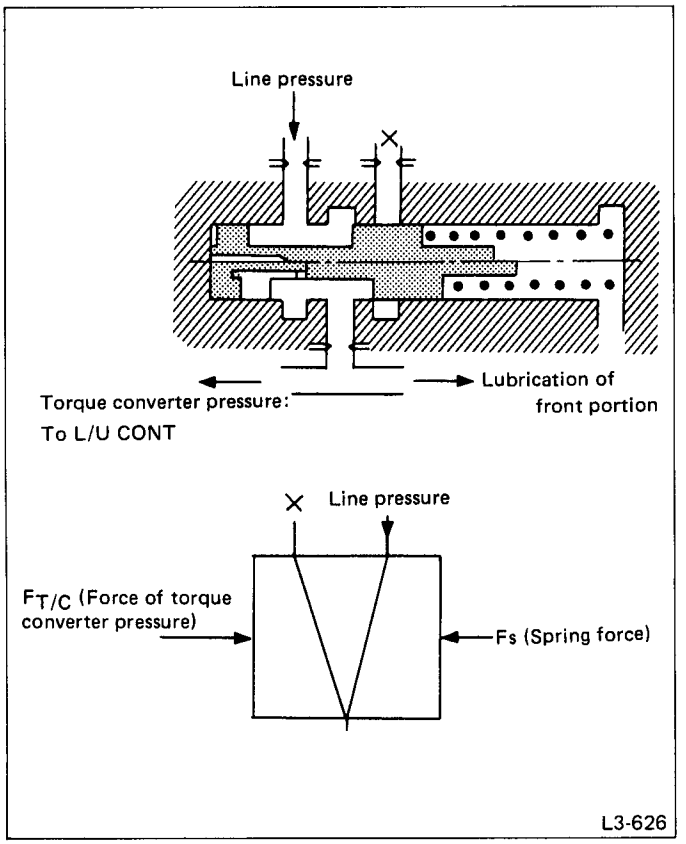


Fig. 44

(3) Pressure Modifier Valve

The force of the P_L duty pressure, which is pulse-width modulated by the line pressure duty solenoid, and spring pressure push the valve to the right. Meanwhile, oil entering through the oil passage ① passes through the orifice and enters the chamber ②, pushing the valve to the left. The pilot pressure entering from passage ③ to chamber ④ also pushes the valve to the left. Accordingly, oil pressure from the passage ① is regulated to obtain equilibrium in the valve. This is the pressure modifier pressure.

This pressure modifier valve serves as a pilot valve for the pressure regulator valve. It is used to create the pilot pressure needed to regulate line pressure to an optimum level corresponding to the driving conditions of the vehicle.

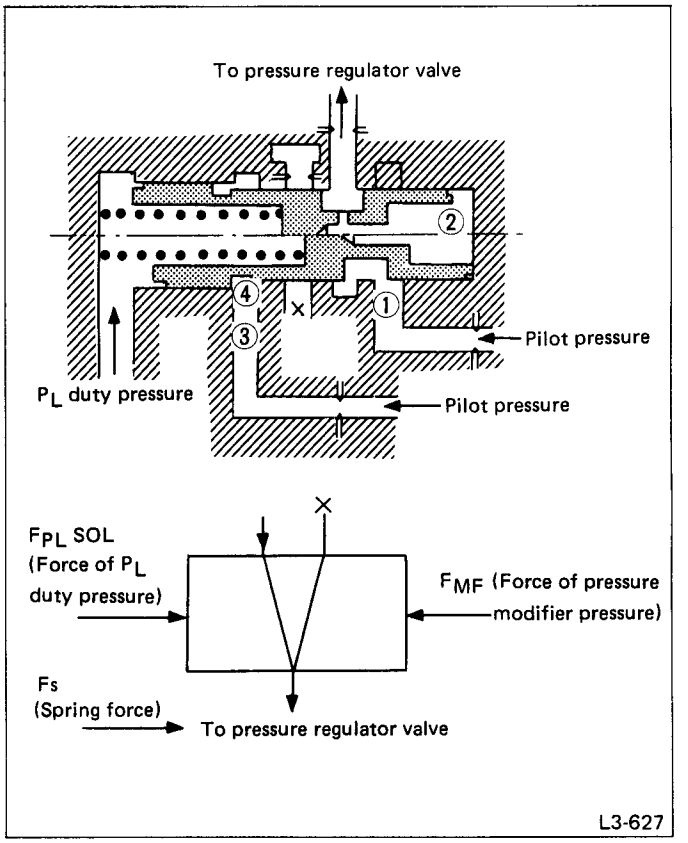


Fig. 45

(4) Accumulator Control Valve

The force of the P_L duty pressure, which is pulse-width-modulated by the line pressure duty solenoid and the spring force push the valve to the right. Meanwhile, the force of the oil coming from the oil passage ① into the chamber ② pushes the valve to the left. The oil pressure from passage ① is adjusted to maintain an equilibrium of forces in the valve, and this pressure is used as the accumulator back pressure.

This valve adjusts accumulator back pressure corresponding to running conditions, thereby reducing gearshift shock.

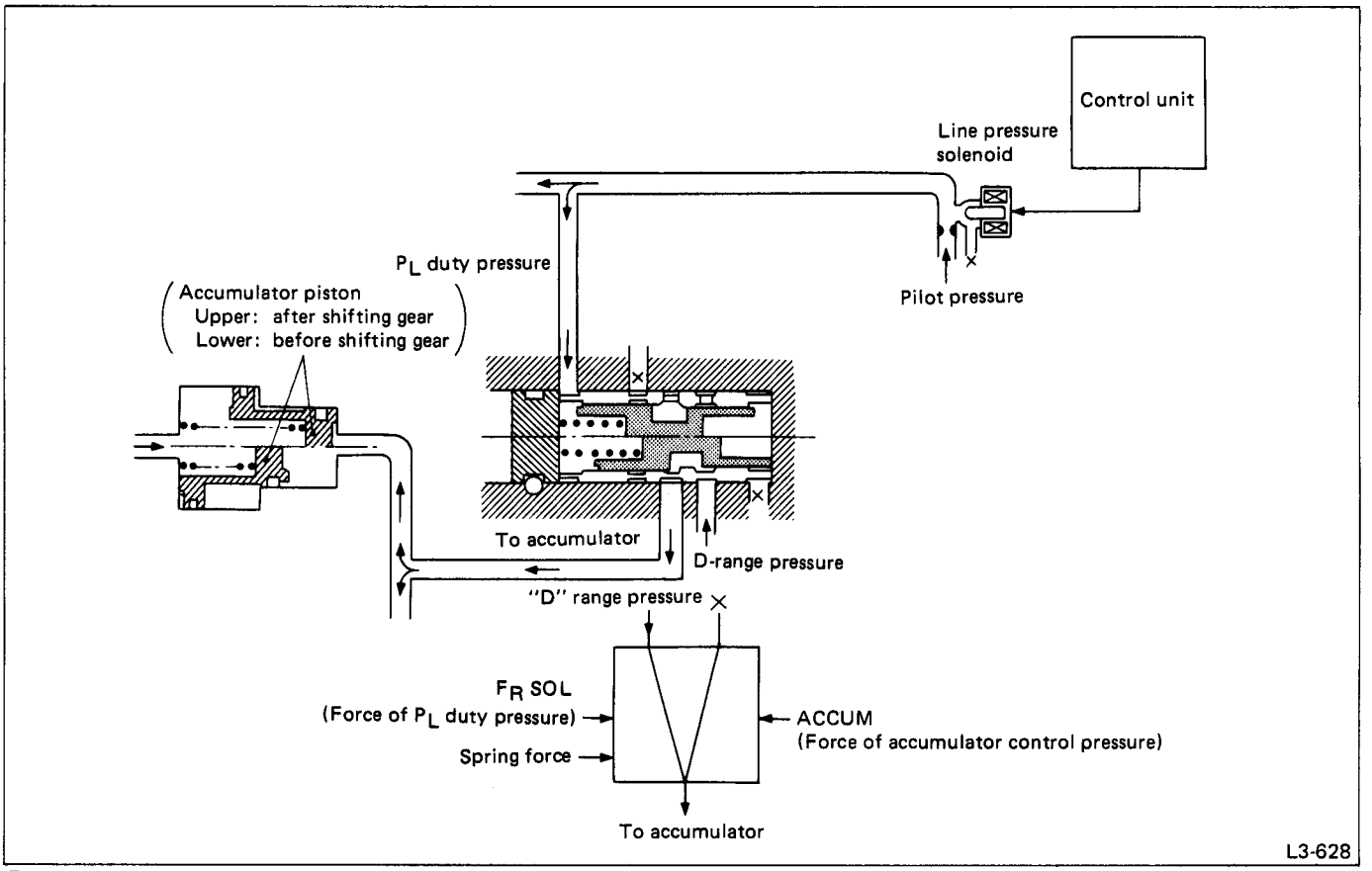


Fig. 46

(5) Shuttle Shift Valve D

The 2A pressure pushes the valve to the right, while the spring force pushes the valve to the left.

- In 1st speed, and in "N", "R", or "P" range:
  The shuttle shift valve is in condition (b). The pilot pressure flows to the lock-up control valve and keeps the torque converter lock-up clutch in the unlocked position (i.e., the condition of torque converter coupling).
- In 2nd, 3rd, or 4th speed:
  The shuttle shift valve D is in condition (a). The lock-up duty pressure is routed to the lock-up control valve, and keeps the torque converter in the lock-up (direct-connection) position.

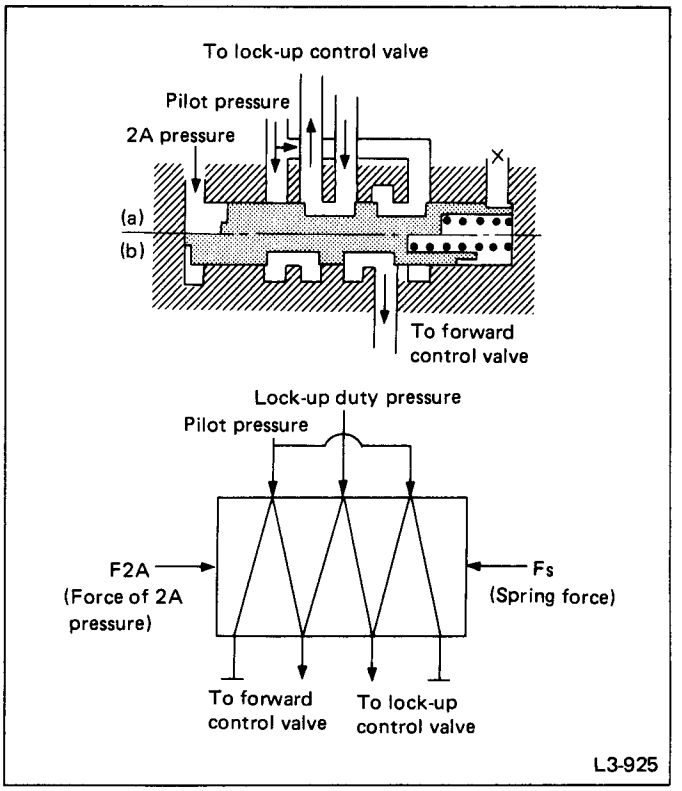


Fig. 47

(6) Shift Valve B and 4-2 Sequence Valve

Shift valve B

The shift solenoid 2 pressure pushes shift valve B to the left, while spring force pushes the valve to the right.

- In 1st or 2nd speed: Shift solenoid pressure is ON.
  Shift valve B is in condition (a). When "2" range 1st speed or hold range 1st speed is selected, the oil from passage ① flows to the low & reverse brake from passage ② via shift valve A.

  When shifting down from 4th to 2nd, the 4-2 relay pressure oil flows from the passage ⑤. It then flows to the 4-2 sequence valve via passage ⑥.
- In 3rd or 4th speed: Shift solenoid 2 pressure is OFF.
  Because no shift solenoid 2 pressure is generated, the valve remains in condition (b), and oil pressure from passage ④ serves as the operating pressure for 3R and H/C via passage ③.

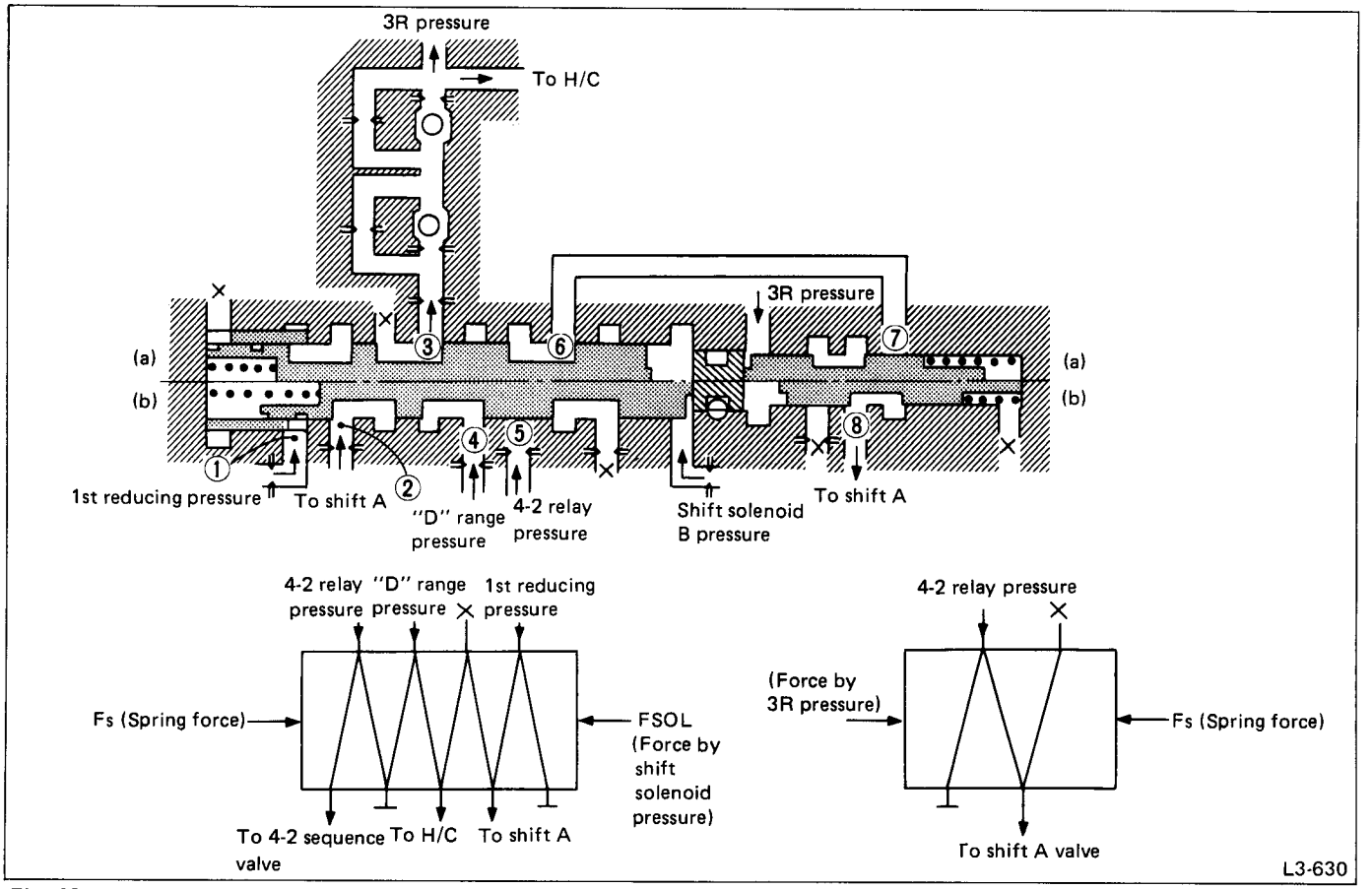


Fig. 48

4-2 sequence valve

The 3R pressure pushes the valve to the right, while the spring force pushes the valve to the left. (When shifting down from 4th to 2nd.)

The valve remains in condition (b) as long as 3R pressure exists. In this condition, the 4-2 relay pressure (line pressure) flows from passage ⑦. It then flows to shift valve A from passage ⑧.

(7) Shift Valve A and 4-2 Relay Valve

Shift valve A

The pressure from the solenoid 1 pushes the valve to the left, while spring force pushes the valve to the right.

- In 2nd or 3rd speed: Shift solenoid 1 pressure is OFF. The valve is in condition (a). Oil pressure from passage ⑤ is applied to the servo 2A chamber from oil passage ④.
- In 4th to 2nd shift down: Oil from oil passage ⑧ is applied to the servo 4A chamber and 4-2 relay valve through passage ⑦ if 3R 4A pressure exists.
- In 1st or 4th speed: Shift solenoid 1 pressure is ON. The valve is in condition (D). In F2 range 1st speed, or hold range 1st speed, oil from passage ① is applied to the L&R/B from oil passage ②. In 4th speed position, oil pressure from passage ⑥ is applied to the servo 4A chamber through oil passage ⑦.

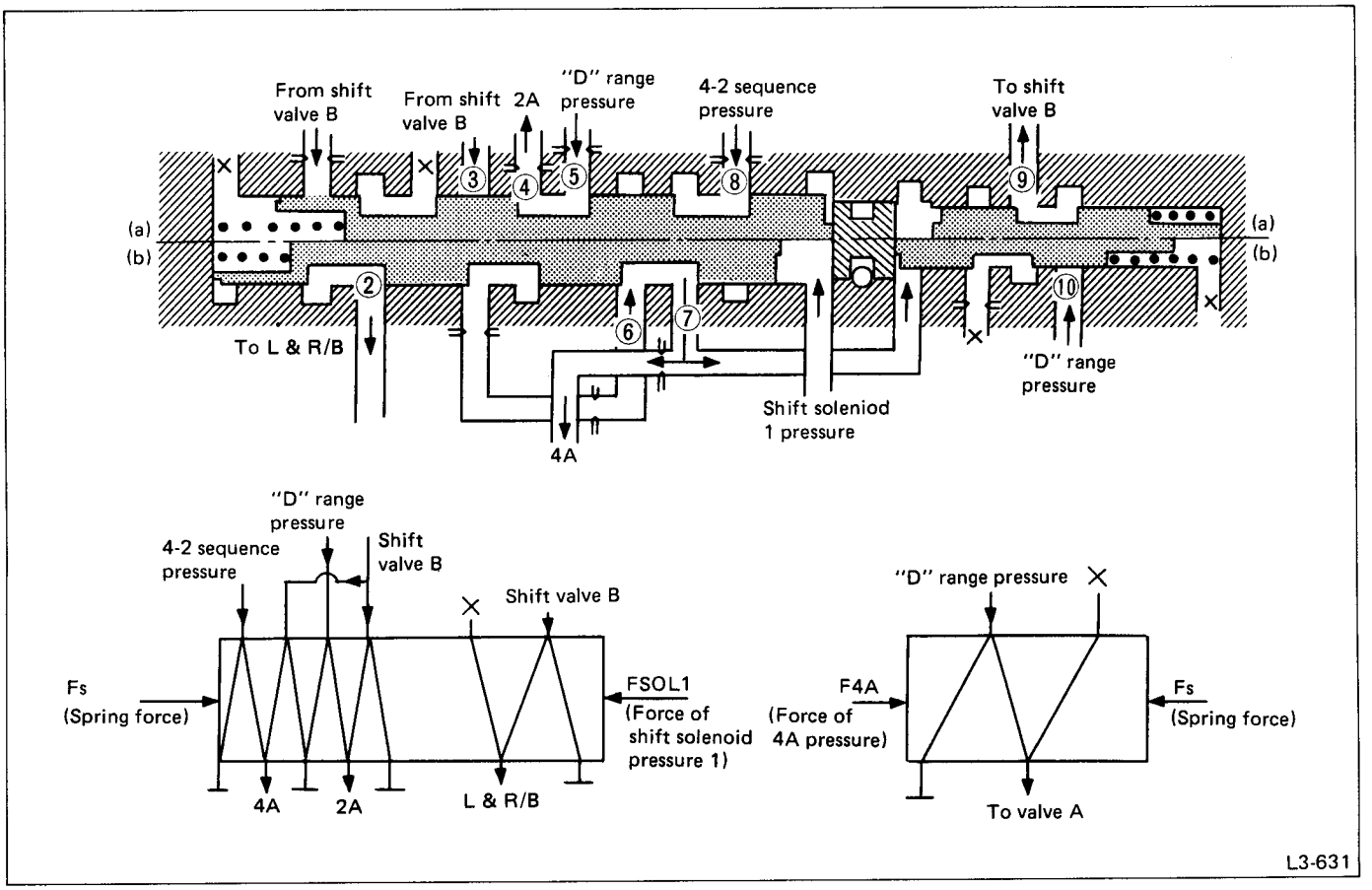


Fig. 49

4-2 relay valves

The force generated by 4A pressure pushes the valve to the left, while the spring force pushes the valve to the right. When shifting from 4th to 2nd, status (a) is attained if 4A pressure exists. Oil from passage ⑩ is routed to the 4-2 sequence valve via shift valve B from oil passage ⑨.

(8) Overrunning Clutch Control Valve

During coasting, no oil flows into passage ⑤, and the valve is set to condition (b) by spring force. Oil from passage ④ exerts pressure on the overrunning clutch via the overrunning clutch reducing valve from passage ③.

Under conditions other than coasting, oil flows into passage ⑤, and the valve is set in condition (a). In 4th speed, the oil from passage ① exerts pressure on the servo 4A chamber via passage ②.

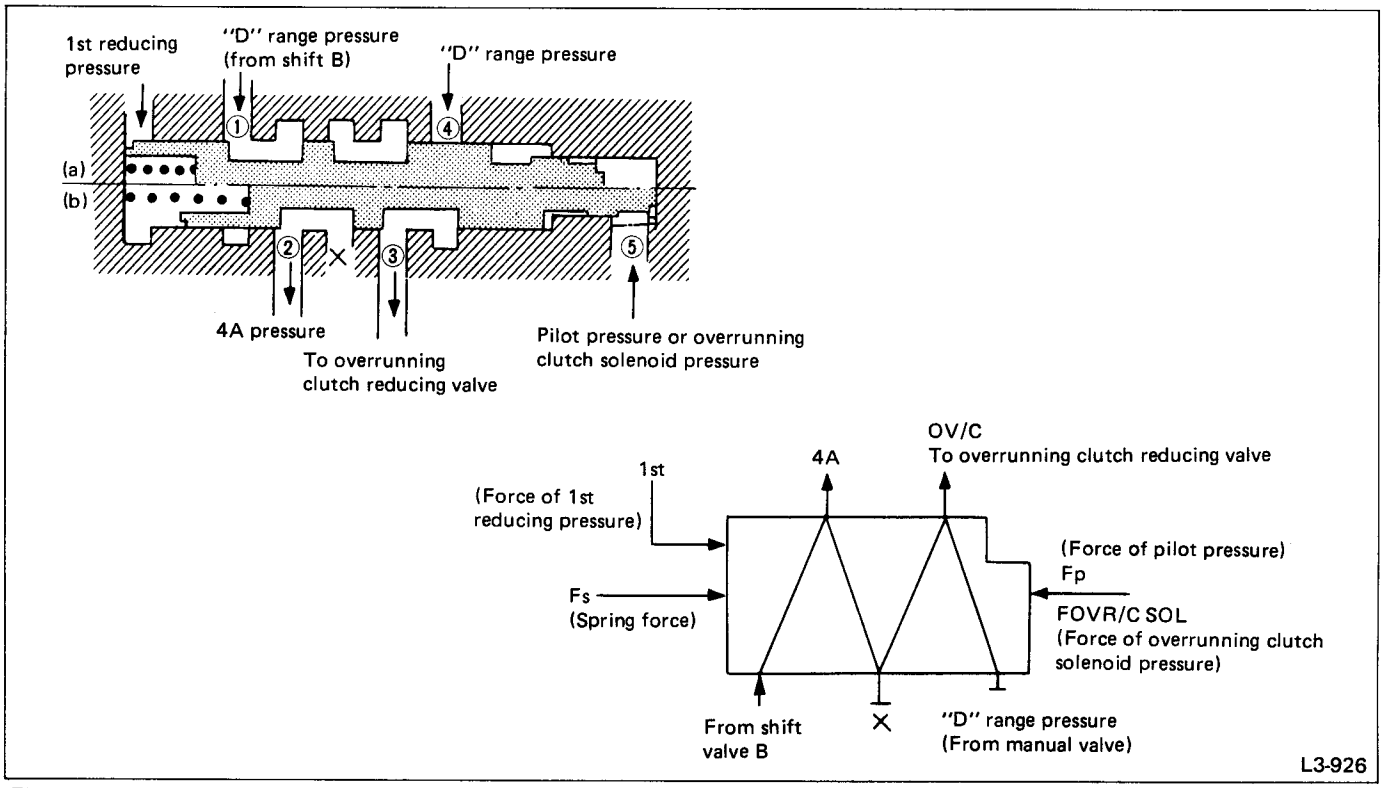


Fig. 50

(9) Overrunning Clutch Reducing Valve

"D" range

Oil from the overrunning clutch control valve to passage ③ exerts the overrunning clutch pressure to chamber ① via orifice ⑤, and pushes the valve to the right. If overrunning clutch pressure exceeds spring force, the valve moves further to the right. This releases the overrunning clutch pressure. As a result, overrunning clutch pressure is maintained at a constant level.

"3" range

In addition to the forces mentioned above, the valve is also pushed to the left by the force of oil coming from the manual valve into the chamber ②. Accordingly, overrunning clutch pressure is adjusted at a higher level than that of "D" range.

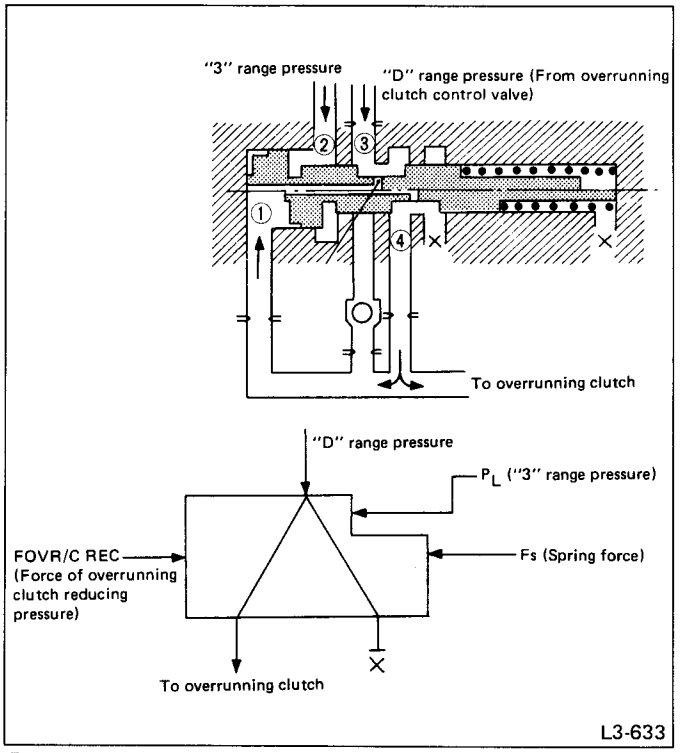


Fig. 51

(10) Shuttle Shift Valve S

"D", "3" range

The valve is pushed to the right by spring force, and is pushed to the left by the "D" and "3" range pressure.
When the throttle opening is small ($F_S > F_D$), the valve is set in condition (a). Overrunning clutch solenoid pressure (shift solenoid 3 pressure) from passage ③ is then applied to the overrunning clutch control valve via passage ②. Engagement of the overrunning clutch is controlled by this pressure.
When the throttle opening is large ($F_S < F_D$), the valve is set in condition (b). Accordingly, pilot pressure from passage ① is applied to the overrunning clutch control valve via passage ②. This pressure prevents the overrunning clutch from engaging. The oil coming from passage ③ exerts pressure on the 3-2 timing valve via passage ④.

"2" range

The "2" range pressure is applied to the valve, setting the valve in condition (a). In this state, engagement of the overrunning clutch can be controlled by the overrunning clutch solenoid pressure (shift solenoid 3 pressure).

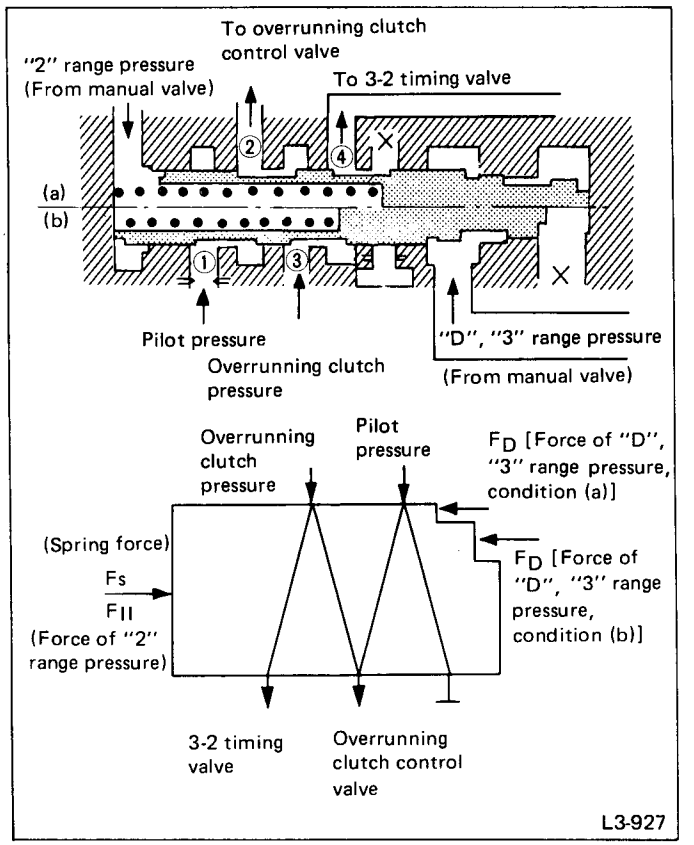


Fig. 52

(11) Pilot Valve

The valve is pushed to the right by pilot pressure, and is pushed to the left by spring force. If pilot pressure force exceeds spring force, the valve moves to the right, and pilot pressure is released. Accordingly, pilot pressure is maintained at a constant level.

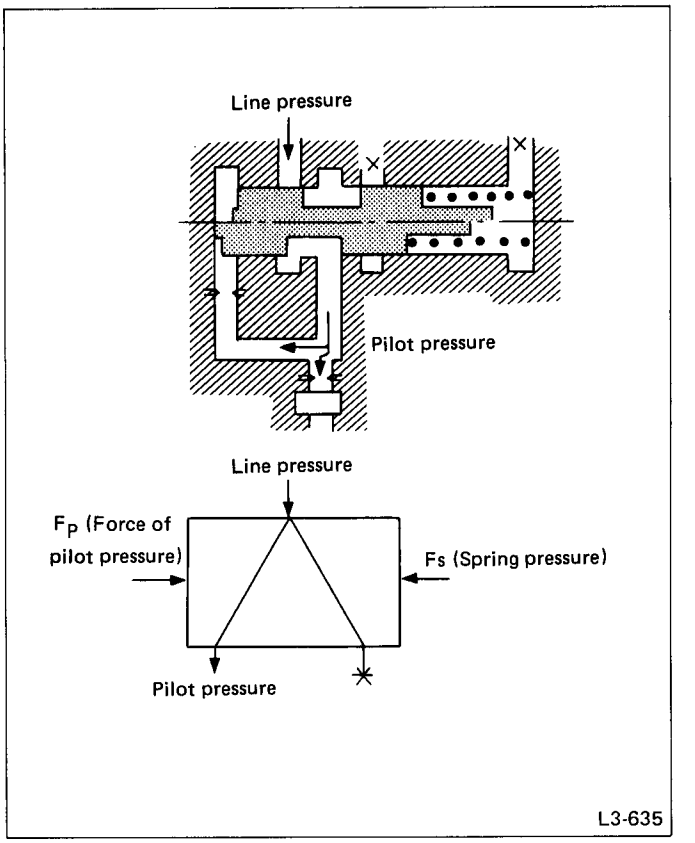


Fig. 53

(12) Manual Valve

Rotary motion of the range select lever is changed into reciprocating motion of the manual valve by the manual lever. In "P","R", "N", "D", "3", and "2" positions, the manual valve is set respectively so that line pressure ④ is distributed to the following line pressure circuits:

"P" range:
Line pressure ③ → ⑤ → drain

"R" range:
Line pressure ③ → ④ → reverse clutch
→ low & reverse brake

"N" range:
Line pressure ③ → None

"D" range & "3" range:

Line pressure ③ → ① → forward clutch
- 4-2 relay valve
- shuttle shift valve S
- shift valve A
- shift valve B
- overrunning clutch control valve

"2" range:

Line pressure ③ → ① → same as "D" range
- ② → shuttle shift valve S
- overrunning clutch reducing valve

"2" range:

1st hold

Line pressure ③ → ① → same as "D" range
- ② → 1st reducing valve
- Same as "2" range

When the valve spool is set in a position where no line pressure is delivered from port ③, pressure at ports ①, ② and ④ is drained from port ③.

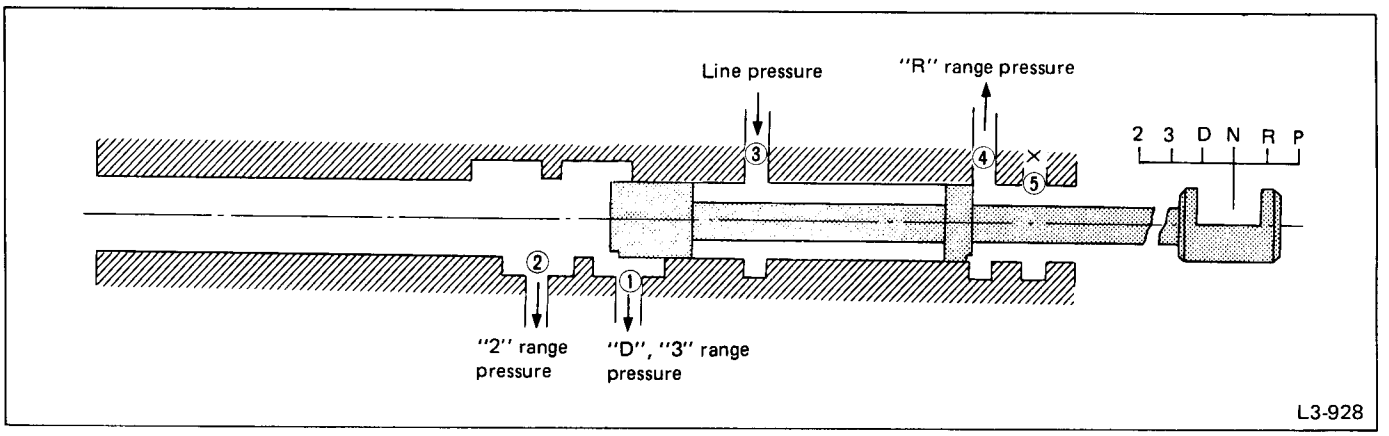


Fig. 54

(13) Lock-up Control Valve

The lock-up control valve is pushed to the right by the torque converter REG pressure and the pilot pressure. Meanwhile, it is pushed to the left by the lock-up duty pressure and spring pressure.

When lock-up is operating:

No lock-up duty pressure is generated, and the valve is set in condition (A). Oil flows to the torque converter AP side, applying lock-up.

In smooth control:

Torque converter REG pressure is controlled by the lock-up duty pressure. Hence, the force applied to the lock-up clutch is controlled for smooth lock-up clutch engagement.

When lock-up is not operating:

Lock-up duty pressure is generated. The valve is set in condition (B). Oil flows into the torque converter REG side, making the lockup inoperative.

In 1st speed "N", "R", and "D" range:

Pilot pressure is generated. The valve is set in condition (B), and lock-up is inoperative.

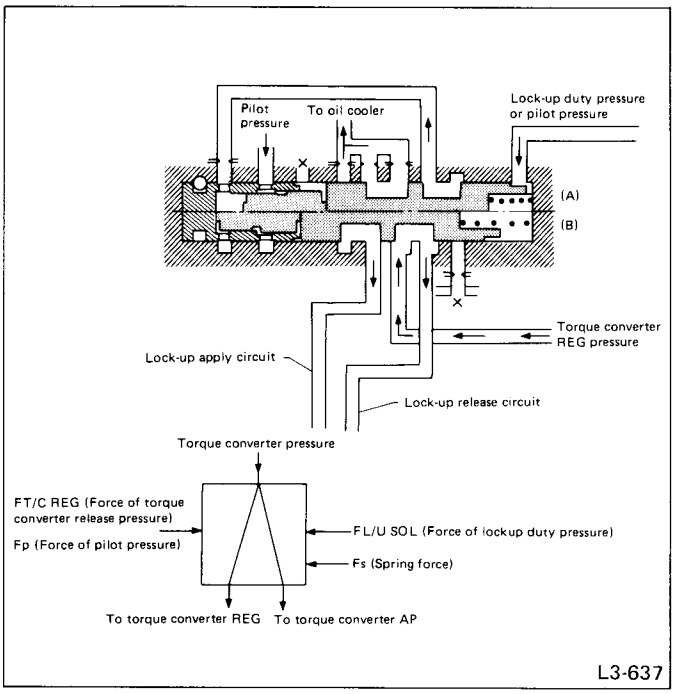


Fig. 55

(14) 1st Reducing Valve

This valve is pushed to the left by the oil in chamber ② coming from passage ①. If the oil pressure exceeds spring pressure, the valve moves to the left, and the oil is drained. Hence, the 1st reducing pressure remains constant.

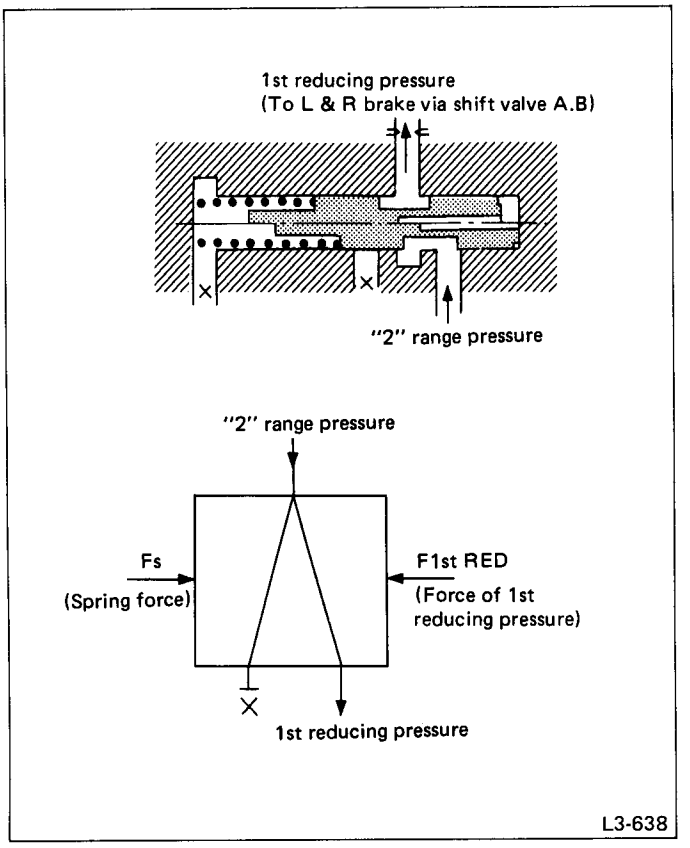


Fig. 56

(15) 3-2 Timing Valve

When shifting from "D" range 3rd to "D" range 2nd:

This valve switches the 3R pressure releasing time.

When oil passes through orifice A only:

The valve is set in condition (B), and the 3R release oil passes through orifice A. Hence, release time is prolonged.

When oil passes through both orifice A and valve:

The valve is in condition (A), and the 3R release oil passes through orifice A and the valve. Hence, release time is shortened.

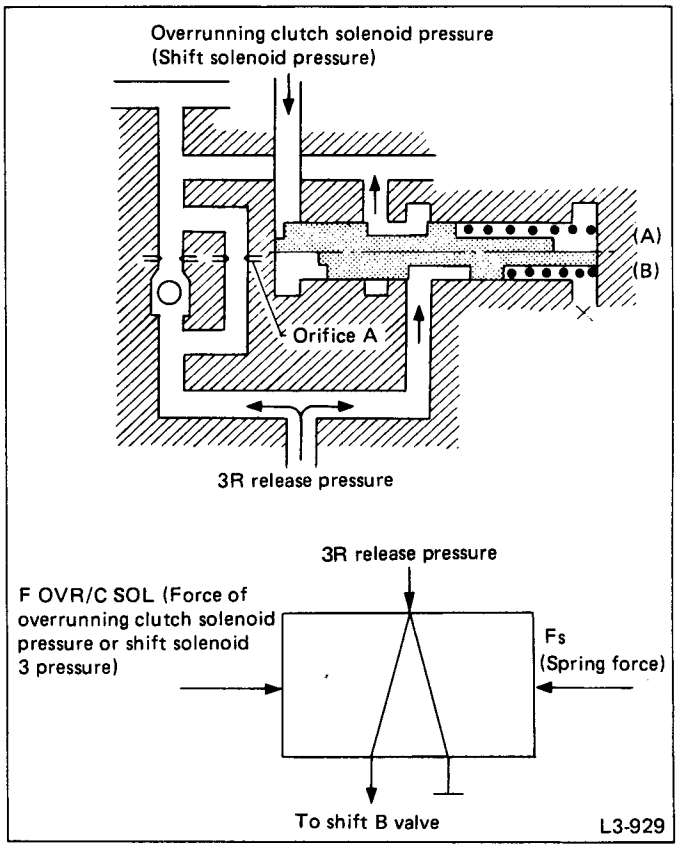


Fig. 57

(16) Servo Charger Valve

When shifting from "D" range 3rd to "D" range 2nd:

In "D" range 3rd speed, the valve is in condition (A). Passage ① communicates with chamber ②. If the 3R pressure exceeds spring pressure, the valve shifts to condition (B), where passage ③ communicates with chamber ②. Accordingly, the valve will remain in condition (B) as long as 2A pressure exists. This means that oil can be fed to the servo 2A chamber without passing through the orifice. Thus, it is possible to quickly compensate for the oil drained through the servo 3R chamber. This prevents engine racing while downshifting.

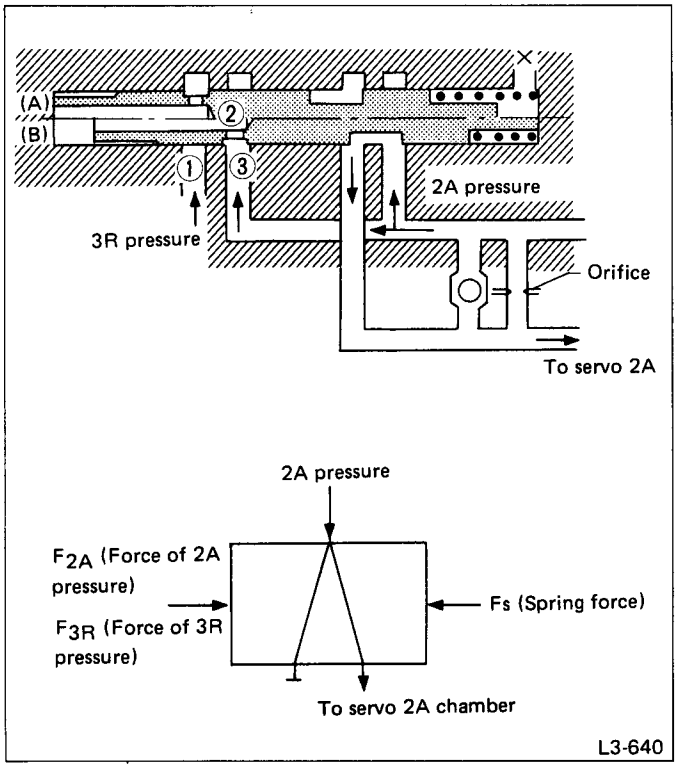


Fig. 58

(17) Accumulator

The job of the accumulator is to lessen the shock when shifting gears. The accumulators used in the present system are the 2A, 3R and 4A accumulators. They are located, respectively, in the 2nd apply pressure circuit, 3rd release pressure circuit and 4th apply pressure circuit to lessen shifting shocks. An N-D accumulator is also provided to reduce shock in selecting.

In addition to electronic control of line pressure, the 2A, 3R and 4A accumulators provide electronic control over the resistance of the accumulators, which serve as shock absorbers in the line pressure passages, according to shifting conditions.

If oil pressure is suddenly applied to the clutch without using an accumulator, the clutch will not engage smoothly, causing an uncomfortable shock. Further, while oil pressure increases smoothly in mechanical types of accumulators, the way it increases is constant. Accordingly, they cannot cope with various operating conditions. For these reasons, in this full-range, electronically-controlled automatic transmission, the resistance of the accumulators is electronically-controlled to correspond to operating conditions. This always assures the optimum, smooth increase of oil pressure when it is applied to the clutch.

- **Electronically-controlled accumulator system (2A accumulator)**

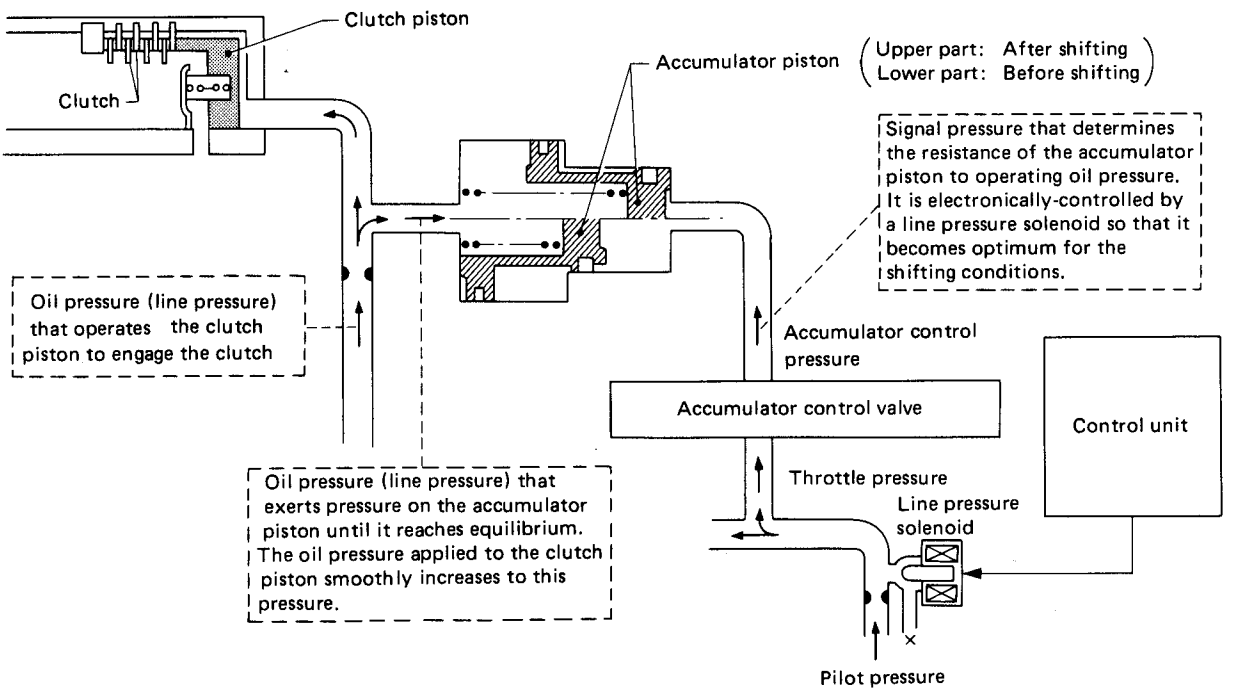


Fig. 59

- **Control of clutch operating oil pressure by an electronically-controlled accumulator**

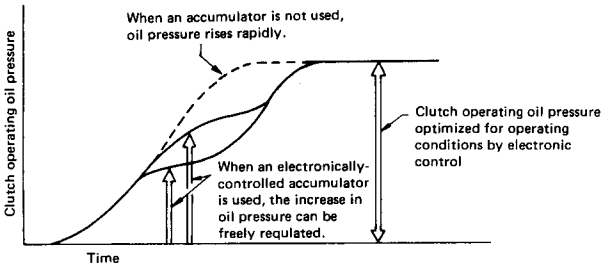


Fig. 60

The four accumulators are arranged in series under the transmission case, in the order of 4A, 2A, 3R and N-D from the front side.

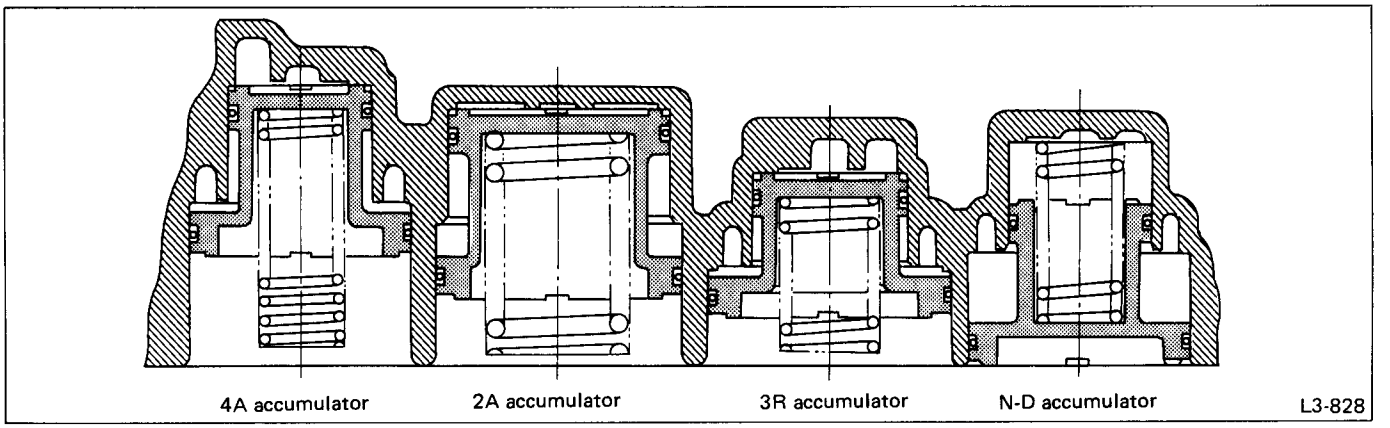


Fig. 61

3-8 Electronic-Hydraulic Control System

1) OUTLINE

The electronic-hydraulic control system consists of various sensors and switches, a transmission control unit and the hydraulic controller including solenoid valves. The system controls the transmission proper including shift control, lock-up control, overrunning clutch control, line pressure control, auto pattern select control and shift timing control. It also controls the 4WD transfer clutch. In other words, the system detects various operating conditions from various input signals and sends output signals to shift solenoids 1, 2 and 3 and duty solenoids A, B and C (a total of six solenoids for 4WD and five solenoids for FWD).

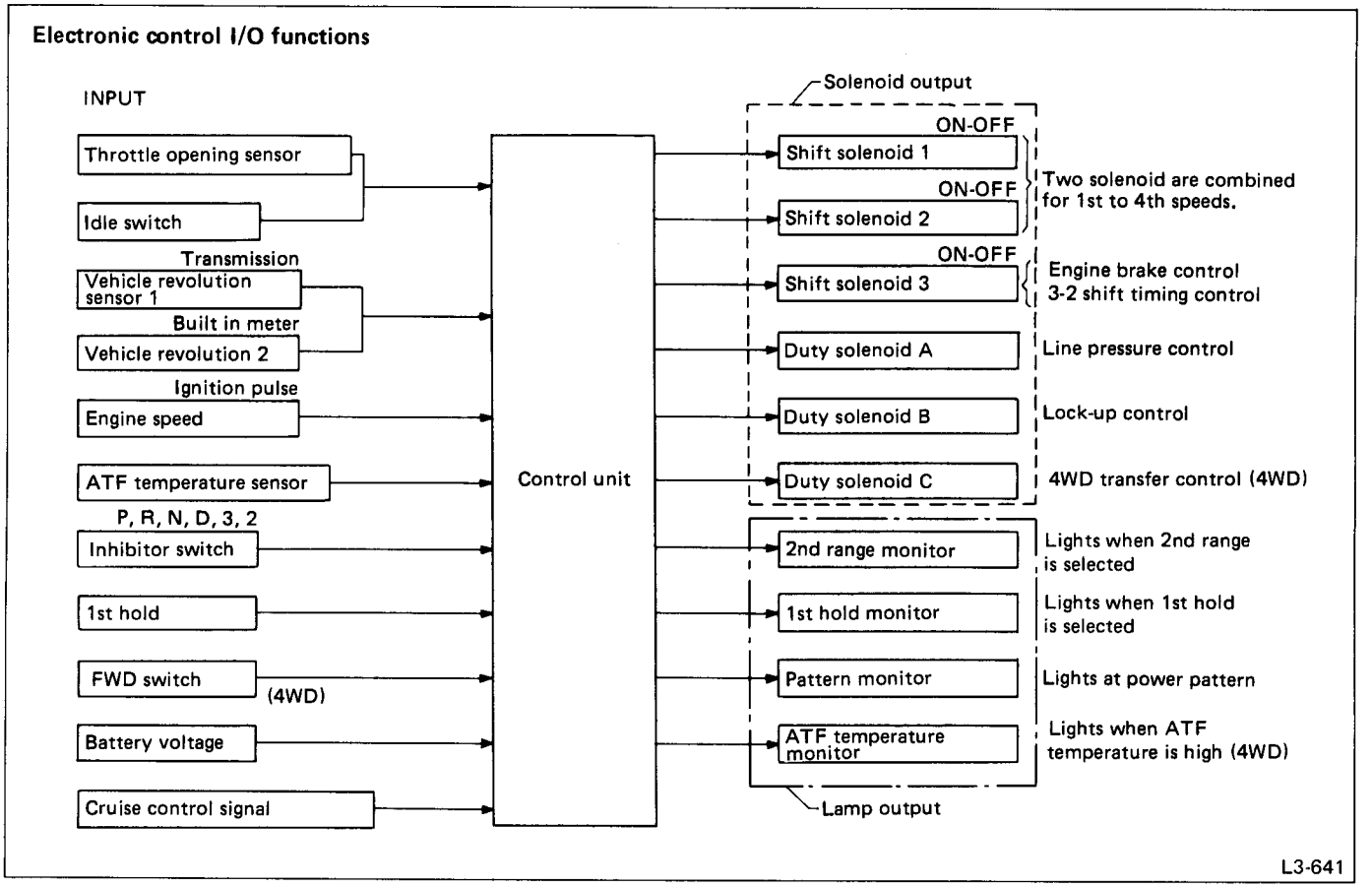


Fig. 62

(1) Input Signal Name and Function

Signal name	Major function
Throttle sensor	Detects throttle opening and determines shift point, line pressure and lock-up vehicle speed according to engine load.
Vehicle revolution sensor 1 (mounted to transmission)	Detects vehicle speed. This signal is used to control shifting, lock-up, line pressure, and transfer clutch.
Vehicle revolution sensor 2 (built-in meter)	FWD . . . Used as backup in case of failure of vehicle revolution sensor 1. 4WD . . . Used to control transfer clutch and as backup in case of failure of vehicle revolution sensor 1.
Ignition pulse	Detects engine speed. This signal is used for lock-up clutch smooth, control at lock-up and to prevent engine overrunning at "2" range "1st hold".
Inhibitor switch	Used to determine shifting and line pressure for respective ranges "P", "R", "N", "D", "3", and "2".
Idle (I/D) switch	Detects throttle closing. This signal is used for lock-up release, and for line pressure control.
Cruise switch (cruise control)	Detects operation of cruise control, and expands "4th" operating range.
4th cut switch (cruise control)	Causes forced release of "4th" from cruise control unit if large difference exists between set vehicle speed and actual speed when cruise is selected.
ATF temperature sensor	Detects ATF temperature. This signal is used for inhibition of lock-up, release of OD and detection of ATF temperature.
"1st hold" switch	Used to maintain the transmission in 1st when going up or down steep hills, running on sand, mud, or slippery surfaces.
FWD switch	Used to change the driving mode from 4WD to FWD. Also used to adapt the vehicle to FWD tester roller. Changeover from 4WD to FWD can be accomplished by inserting a fuse into the fuse holder. (4WD only)

(2) Output Signal Name and Function

Signal name	Function
Shift solenoids 1, 2	Controls shift stage by turning solenoid ON/OFF. Relationship between solenoid operation and shifting stage is shown in Table below. When shifting, timing is controlled for each solenoid to reduce shock.
Shift solenoid 3 (Overrunning clutch)	Controls 3-2 shift timing and overrunning clutch operation. Shift timing is controlled by controlling release speed of oil pressure to reduce shock while downshifting. The overrunning clutch is controlled so that it will operate during coasting to apply engine brake.
Duty solenoid A (line pressure)	Regulates the line pressure according to driving conditions.
Duty solenoid B (lock-up)	Regulates the hydraulic pressure of the lock-up clutch and operates in three modes (open, smooth and lock-up).
Duty solenoid C (transfer pressure)	Regulates the hydraulic pressure of the transfer clutch and controls the driving force to the rear drive shaft.
"Power" indicator light	Indicates whether the shift pattern is "Normal" or "Power". The indicator lights in power mode. This light is also used for "self-diagnosis".
"2nd range" indicator light	Lights when the "1st hold switch" turned OFF in "2" range.
"1st hold" indicator light	Lights when 1st speed is achieved with the "1st hold switch" turned ON and shift lever set to "2" range.
ATF temperature warning light	Lights when ATF becomes hot (exceeds a set temperature level). (4WD only)

(3) Relationship Between Solenoid Operation and Shift Position

Shift position		Shift solenoid 1	Shift solenoid 2	Shift ratio
"D" range		○	○	1st
		X	○	2nd
		X	X	3rd
		○	X	4th
"3" range		○	○	1st
		X	○	2nd
		X	X	3rd
"2" range	1st hold released	○	○	1st
		X	○	2nd
		X	X	3rd
	1st hold applied	○	○	1st
		X	○	2nd
		X	X	3rd

○ : Energized X : Not energized

2) CONTROL SYSTEM

FWD

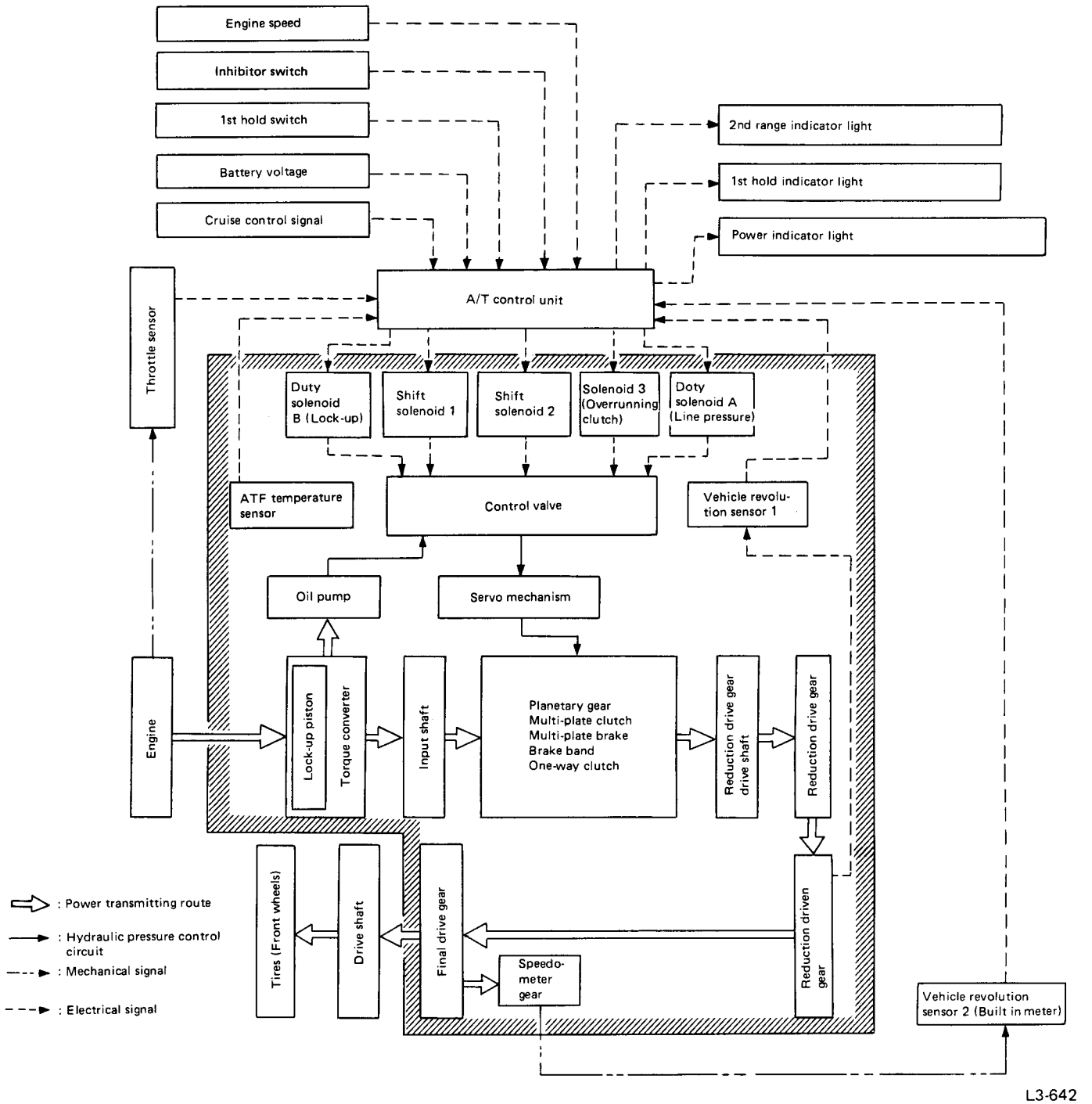


Fig. 63

2) CONTROL SYSTEM

4WD

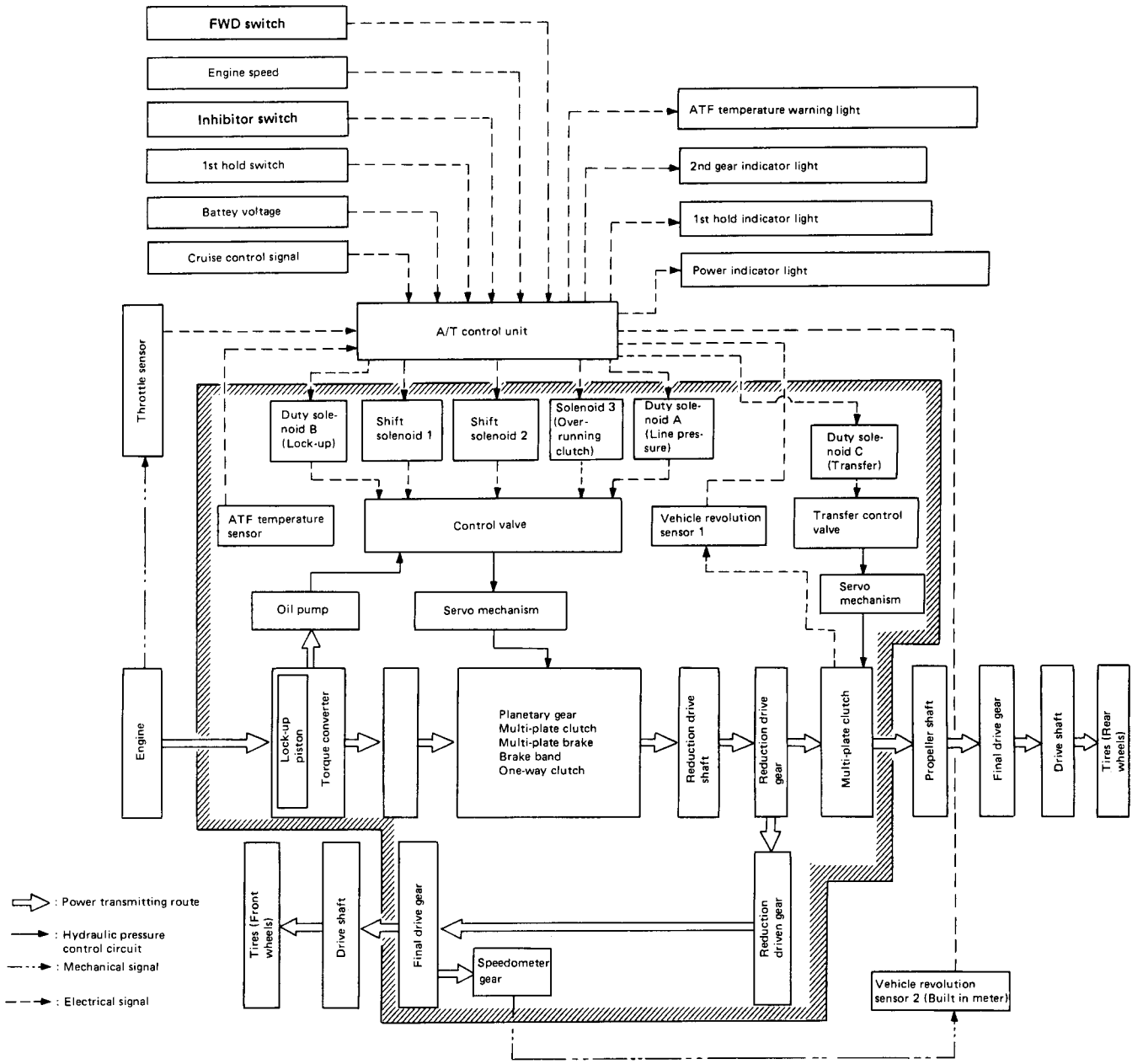


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Fig. 64

(1) Functions and Control Items

Control item			Description of control
Transmission control	Gear shift control	Normal shift control ● Normal pattern ● Power pattern	Upshifting and downshifting are set for each range, gear position and pattern according to throttle opening and vehicle speed.
		Control with cruise control	When cruise control is set, 4th gear operating range is expanded. [V ≧ 40 km/h (25 MPH)]
		ATF low temperature control	Shifting into 4th gear is prevented when ATF temperature is below the preset value.
		1st hold control	1st hold range is limited only when selector lever is in "2" and 1st hold switch is ON.
	Lock-up control	Normal lock-up control ● "Normal": "D" range only ● "Power" : R, 3, 2 ranges	Lock-up ON/OFF is set for each range, gear position, and pattern according to throttle opening and vehicle speed. (Basically lock-up is OFF during gear shifting.)
		Smooth control	Smooth lock-up is performed when lock-up is switched on.
	Overrunning clutch control	Engine brake control	Overrunning clutch is operated according to range, vehicle speed, and cruise control signals in order to apply engine brake properly.
		3-2 timing control	This control speeds the release of servo piston pressure 3R when shifting down from 3rd to 2nd, thereby preventing engine racing.
	Line pressure control	Ordinary control	Line pressure is regulated according to throttle opening, vehicle speed and range signals.
		Shifting control	Line pressure is reduced when shifting to lessen shifting shock.
		Starting control	Line pressure is at a minimum so as to reduce engine cranking load.
	Automatic pattern select control	Power pattern control (POWER light ON)	Power pattern is selected when throttle opening speed exceeds the preset value.
		Normal pattern control	When throttle opening is less than the preset value, normal pattern is resumed immediately if vehicle speed ≧ 60 km/h (37 MPH), or within three seconds if vehicle speed < 60 km/h (37 MPH).
		ATF temperature	Power pattern is selected if ATF temperature is above the preset value.
	Shift timing control	Shift step control	ON/OFF timing for shift solenoid is controlled.
		Lock-up control	When shifting, the lock-up clutch is temporarily released.
		Overrunning clutch control (3rd to 2nd: small throttle opening in coasting, 2nd to 1st: in coasting)	When shifting down, the overrunning clutch is temporarily disconnected to reduce shifting shock.
		Line pressure control	When shifting, line pressure is controlled to the optimum level so as to reduce shifting shock.

Control item		Description of control
4WD transfer clutch control	Ordinary transfer control	Transfer oil pressure is regulated according to the throttle opening angle and vehicle speed.
	1st hold control	Transfer oil pressure is increased.
	Slip control	Immediately after detecting a slip, transfer oil pressure is controlled to the same pressure as "1st hold". (This control is canceled if V ≧ 60 km/h (37 MPH), or when throttle is closed fully.)
	Control in turns	Transfer oil pressure is reduced after detecting the turn.

(2) Power Indicator Light

The automatic transmission equipped vehicle is capable of automatically selecting two driving patterns; a normal pattern suitable for ordinary driving and a power pattern suitable for driving uphill or rapid acceleration. The power indicator light lights when the power pattern is selected. See the table below:

Selector lever position	Changeover from normal pattern to power pattern	Power indicator light ON/OFF
"D" range	Pattern is changed automatically according to depression of accelerator pedal.	• "Normal" pattern: OFF • "Power" pattern: ON

(3) 1st Hold Indicator Light

The 1st hold indicator light lights when 1st speed is attained with the 1st hold switch set to ON and A/T selector lever set to "2" range. See the following table:

Selector lever	1st hold SW position	Vehicle speed	1st hold indicator light ON/OFF
"2" range	ON	Below 50 km/h (31 MPH)	ON
		Over 50 km/h (31 MPH)	OFF
Other than "2" range	ON	0 km/h (0 MPH) to Max. speed	OFF
Other than "2" range	OFF	0 km/h (0 MPH) to Max. speed	OFF

3) A/T CONTROL UNIT

The A/T control unit is mounted to the side face. It's front faces the wheel arch with the left side toward the rear seat. It receives various sensor signals and determines the running conditions of the vehicle. It then sends control signals to each solenoid according to the preset gearshift characteristic data, lock-up operation data, and transfer clutch torque data (duty ratio).

Item \ Control item		Gearshift control	Lock-up control	Line-pressure control	Shift-pattern selection control	Engine brake control	4WD control	Fail-safe function	Self-diagnosis function
Input	Throttle sensor	O	O	O	O	O	O	O	O
	Vehicle revolution sensor 1 (output shaft revolution sensor mounted to transmission)	O	O	O	O	O	O	O	O
	Vehicle revolution sensor 2 (built into meter panel)	(Note 1) O	(Note 1) O	(Note 1) O	(Note 1) O	(Note 1) O	O		O
	Ignition pulse	O	O	O					O
	Inhibitor switch	O	O		O	O	O	O	(Note 2) O
	1st hold switch	O				O	O		(Note 2) O
	ATF temperature sensor	O	O	O	O		O		O
	Idle switch	O	O	O			O		(Note 2) O
	Cruise control — Set signal	O				O			
	Cruise control — **"4th" range release signal**	O				O			
	FWD switch						O		(Note 3) O
Output	Shift solenoid 1	O						O	O
	Shift solenoid 2	O						O	O
	Duty solenoid A (line pressure)			O				O	O
	Duty solenoid B (lock-up)		O					O	O
	Overrunning clutch solenoid	O				O		O	O
	Duty solenoid C (transfer)						O	O	O
	ATF temperature warning light						O		
	Power indicator light				O				O
	1st hold indicator light	O							
	2 range indicator light	O							

NOTES: (1) Provided as spare for car-speed sensor 1 (mounted to transmission)
(2) Used as the diagnosis starting condition. If self-diagnosis does not begin, there is trouble somewhere in the system.
(3) Used to display trouble history.

(1) Shift Pattern Select Control

Shift pattern is selectable automatically between a normal pattern suitable for ordinary economy running and a power pattern suitable for climbing uphill or rapid acceleration.
In the power pattern, the shift down point and shift up point are set higher than those of the normal pattern.
When the power pattern is selected, the POWER indicator light in the meter lights up.

Selector position	Changeover from normal to power pattern	Meter indication
"D" range	Performed automatically corresponding to accelerator pedal depression.	• Normal pattern: OFF • Power pattern: ON

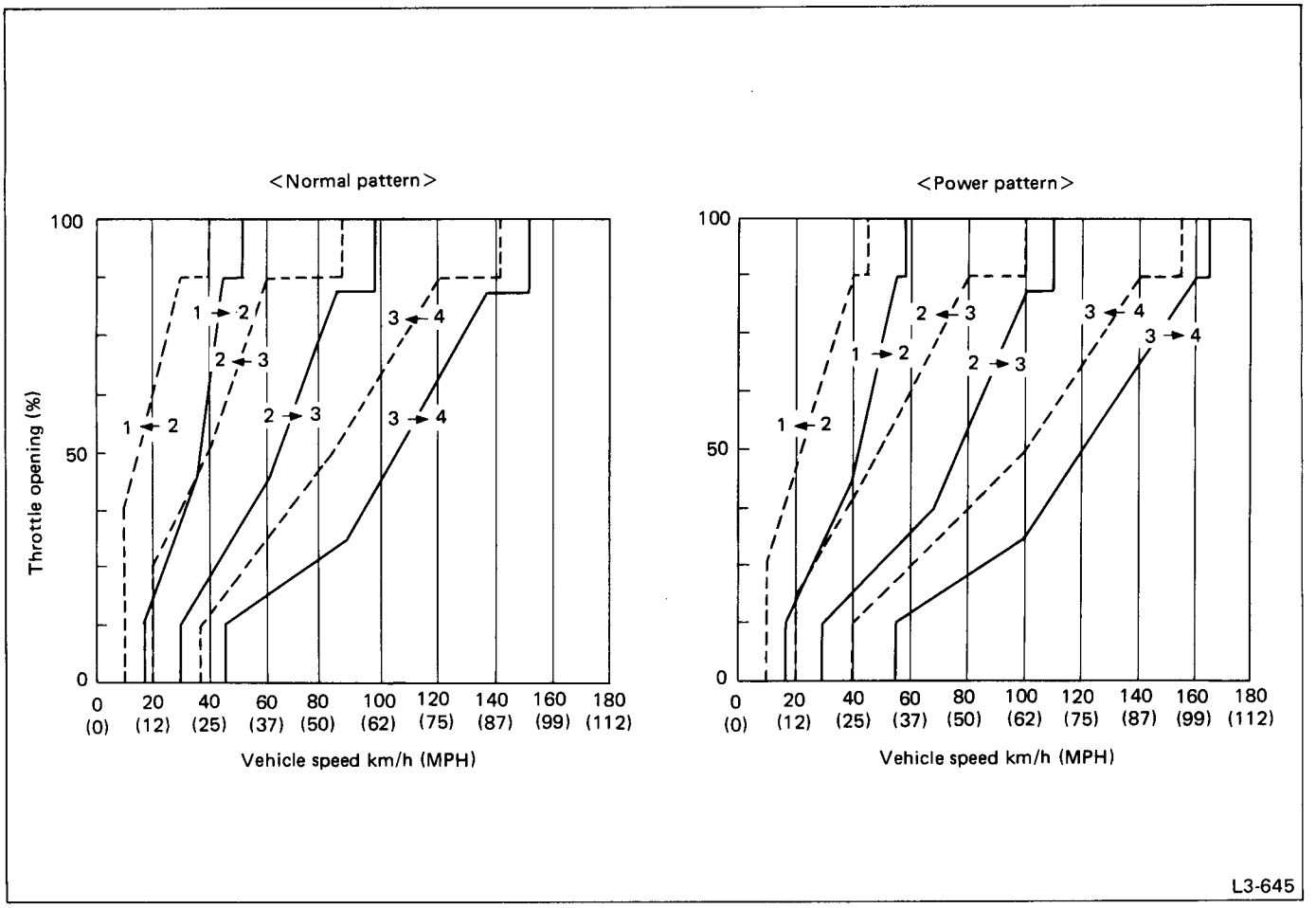


Fig. 65 Shift characteristics

Shift pattern changeover conditions

① Normal pattern to power pattern

Select lever	"D" range
Accelerator depression speed	Greater than set value*

*** Depending on throttle opening and vehicle speed, 16 areas as shown in the figure are set. Accelerator depression speed for pattern changeover is set for each area.**
When the accelerator depression speed exceeds this set value, the pattern changes from normal to power.

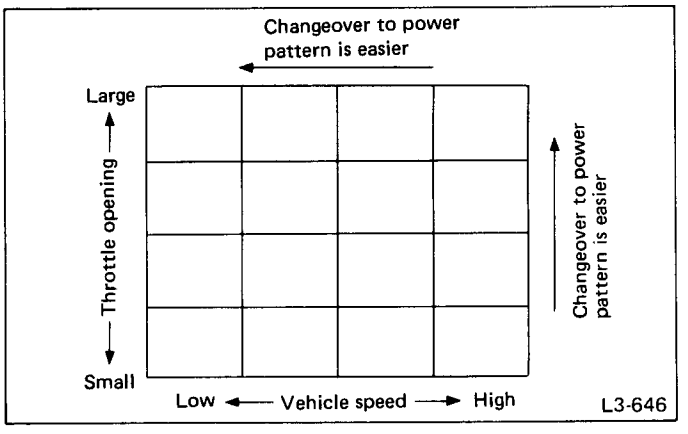


Fig. 66

② Power pattern to normal pattern
The power pattern is shifted to the normal pattern, depending on car speed. Shifting to the normal pattern is determined by the throttle position as shown in Figure below. Time lag in shifting is also determined by car speed. The maximum time lag is 3 seconds.

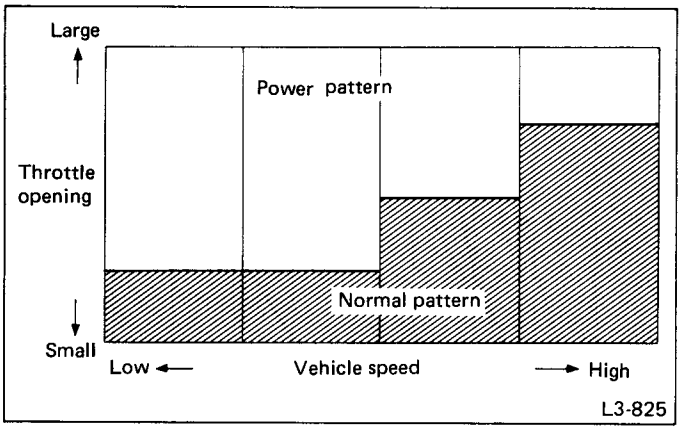


Fig. 67

(2) Shift Control

Gearshifting is controlled in response to driving conditions, according to the shift point characteristic data, as shown in the following diagram, stored in the A/T control unit. Solenoids are operated at the proper time corresponding to the shift pattern, throttle opening, and vehicle speed for smooth shifting.

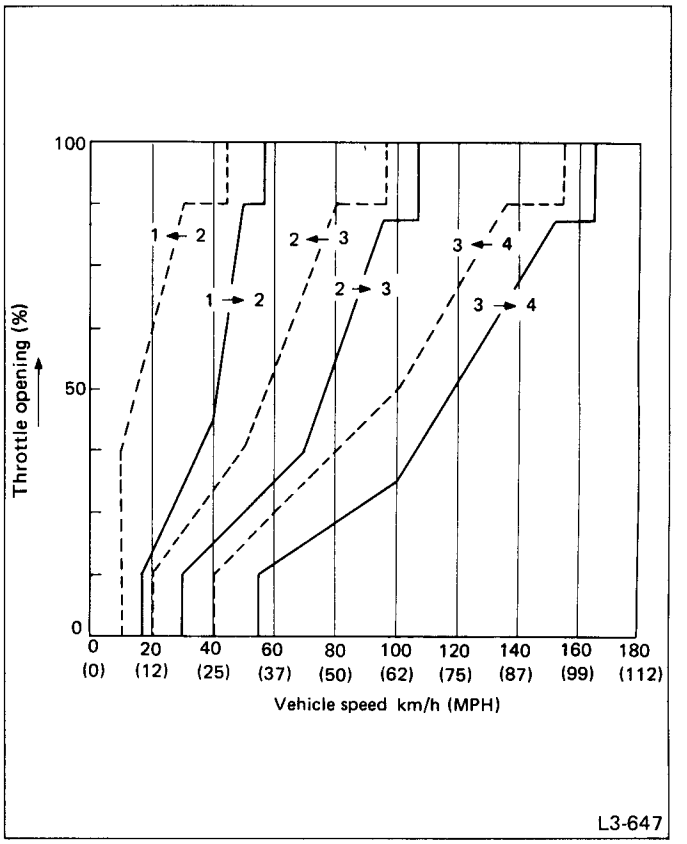
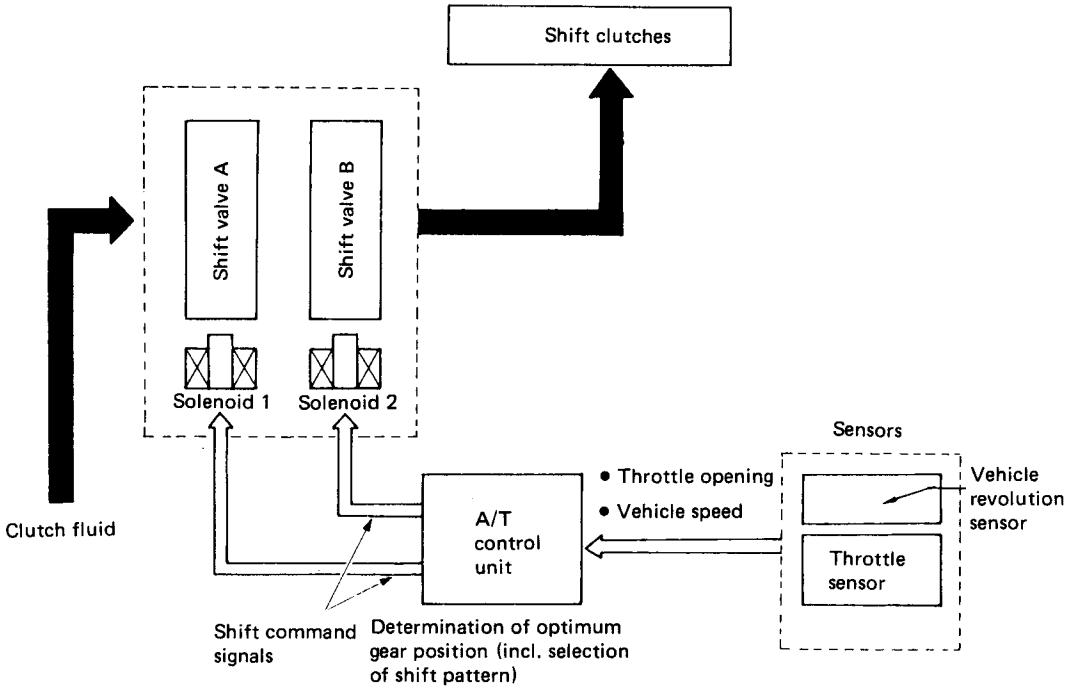
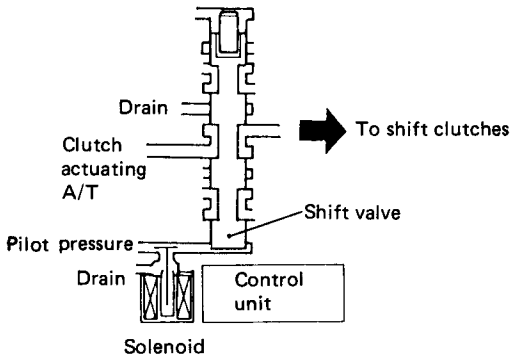


Fig. 68

When oil temperature is below approximately 10°C (50°F), the vehicle cannot be shifted to the 4th range.





	Solenoid 1	Solenoid 2
1st	○	○
2nd	×	○
3rd	×	×
4th	○	×

① Control unit activates both solenoids 1 and 2 in response to throttle and vehicle speed signals.
② Shift valve moves in response to solenoid operation, supplying/interrupting clutch pressure to the line.
③ Gears are shifted by ON-OFF operation of both solenoids as indicated in Table above.

*When clutch pressure is supplied to the line.

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Fig. 69 Shift valve operation system

(3) 3-2 Timing Control

When shifting from 3rd to 2nd, the high clutch is disengaged. At the same time, oil pressure (which releases the brake band) is also released from the servo piston 3rd release chamber (3R).

At this point, the servo piston moves to release oil pressure from the 3rd release chamber (3R) and apply oil pressure to the 2nd apply chamber. This causes the brake band to be applied. In other words, high clutch "release" and brake band "application" are properly timed by electronic control. This eliminates engine rev-up under no load or hesitation.

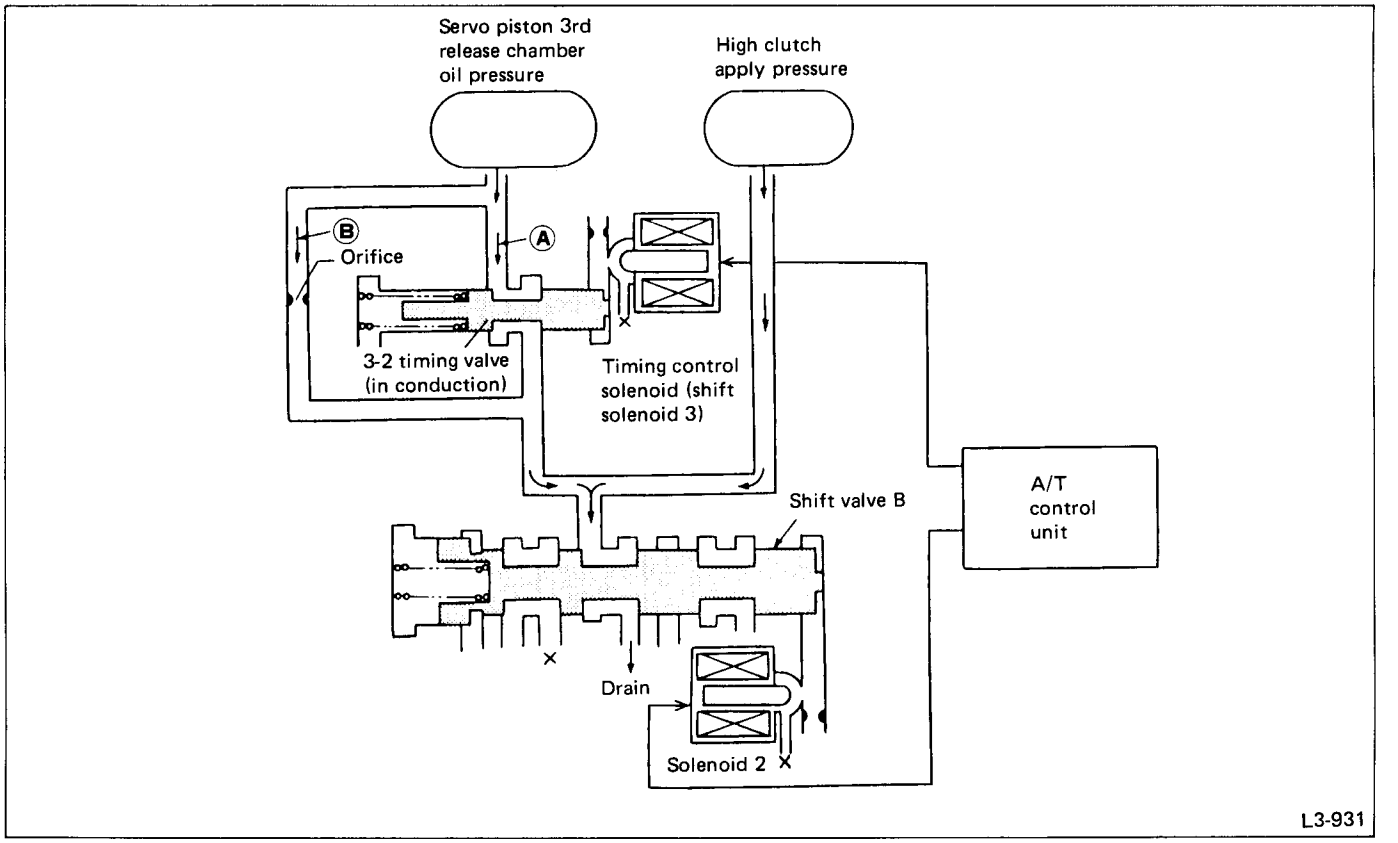


Fig. 70

- When the 3-2 timing valve conducts, oil pressure applied to the 3rd release chamber is quickly released through passage Ⓐ.
- When the 3-2 timing valve does not conduct, oil pressure applied to the 3rd release chamber is slowly released through passage Ⓑ (provided with an orifice).

(4) Line-pressure Control

① Ordinary line-pressure control and starting control

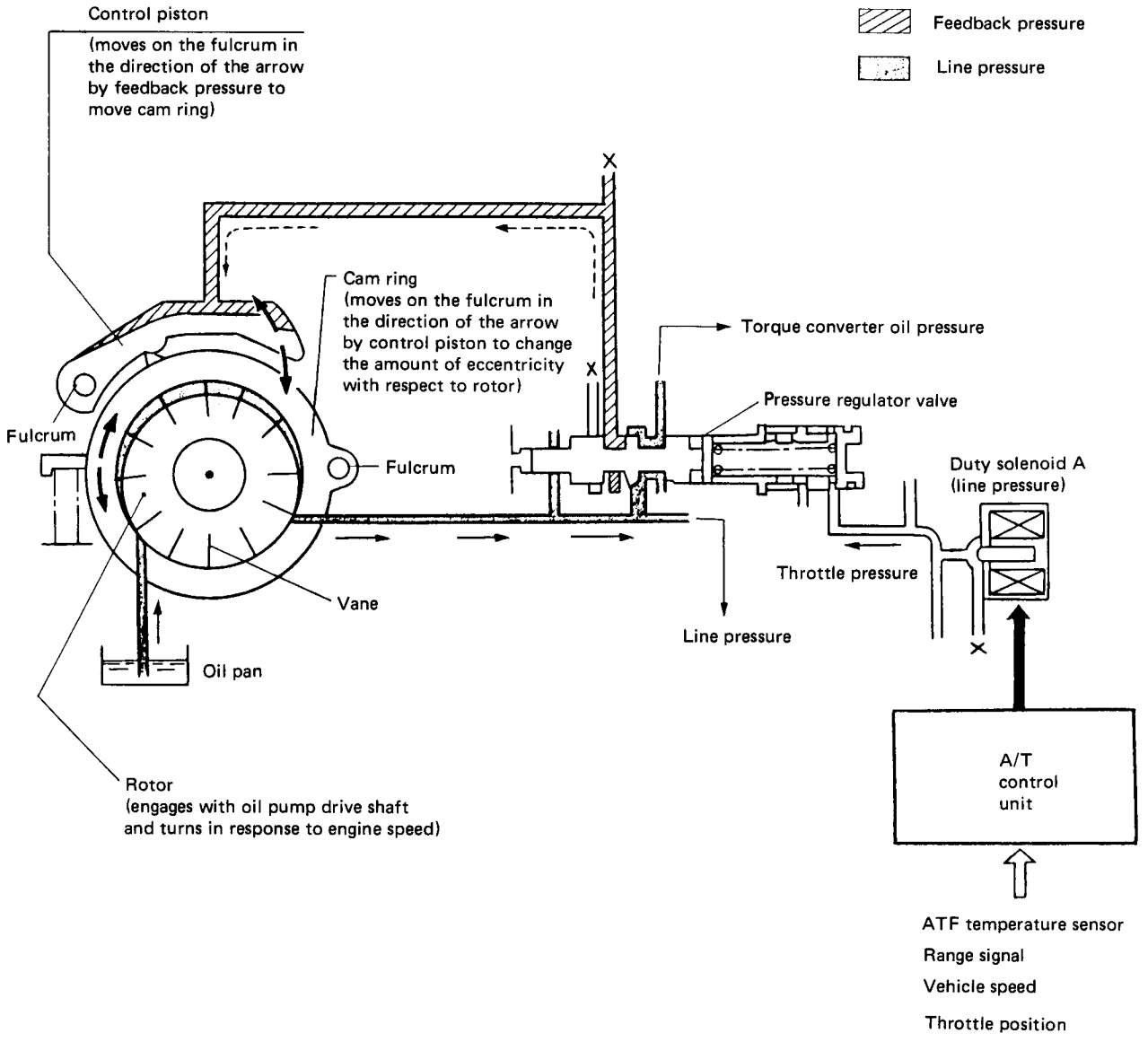


Fig. 71

② Shifting control (Line-pressure control)

Oil pressure which engages shift clutches (to provide 1st through 4th speeds) is electronically controlled to meet varying operating conditions.

In other words, line pressure decreases to match the selected shift position, minimizing shifting shock.

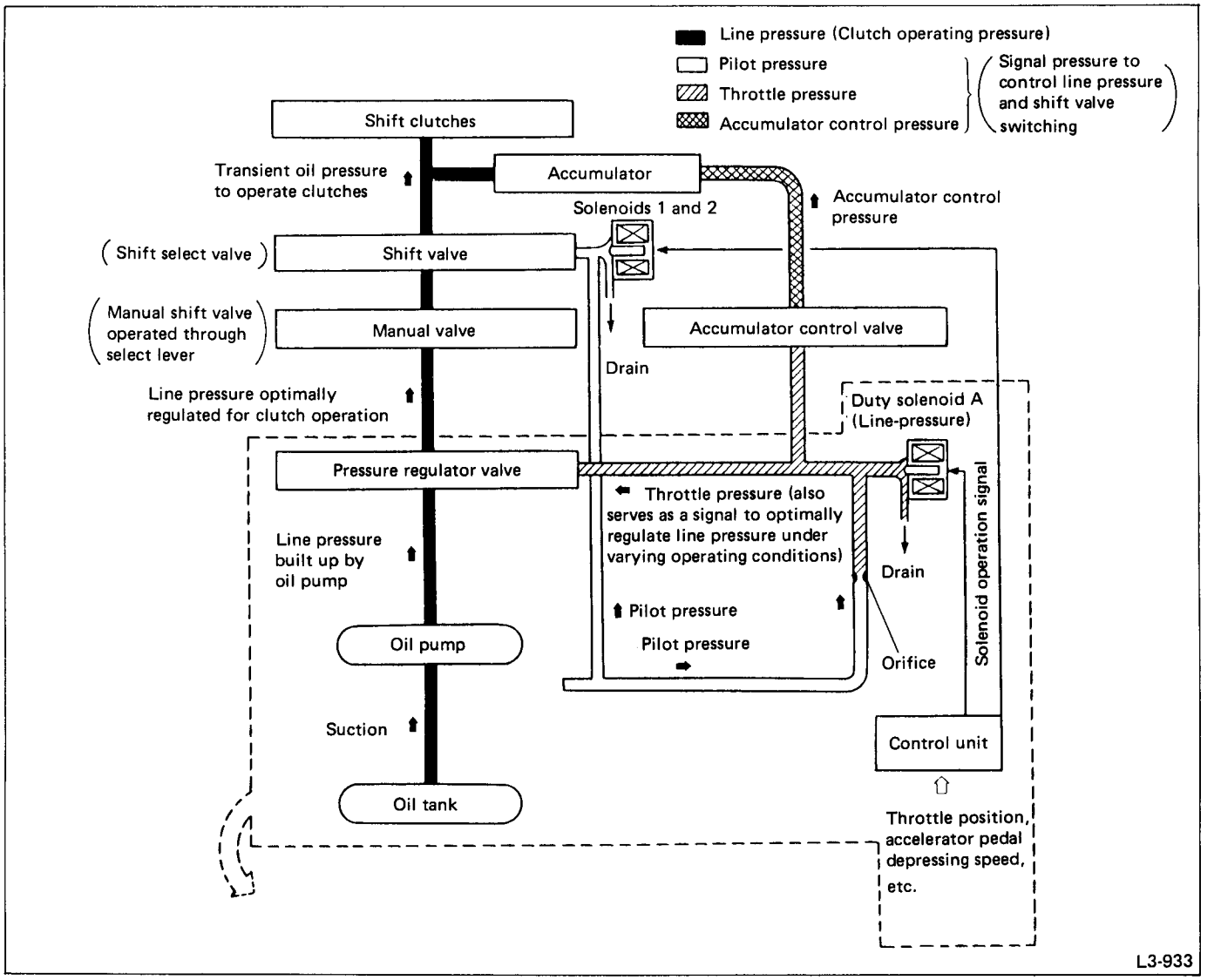


Fig. 72

• Electronic control of clutch oil pressure in summary

a. Solenoids activate through the control unit which receives various control signals (throttle signal, etc.)

b. Control signals are converted into throttle pressure, which is transmitted to the pressure regulator valve.

c. The pressure regulator valve optimally regulates line pressure (built-up by oil pump) in response to throttle pressure, matching varying operating conditions.

(5) Fail-safe Function N

A fail-safe function is provided to maintain driveability even if trouble should occur in the vehicle revolution sensor, throttle sensor, inhibitor switch, or any of the solenoids.

① Vehicle revolution sensor

A dual speed-sensing system is used. The speed signal is taken from the transmission (output shaft revolution sensor) and also from a sensor built into the speedometer. Even if one sensor system fails, the vehicle can be controlled normally with the other sensor system.

② Throttle sensor

If throttle sensor becomes faulty, throttle will be set to the predetermined position. (In all ranges, throttle is set to the 5/8 position.)

③ Inhibitor switch

If two signals are inputted due to inhibitor switch failure, the vehicle can be driven under the following priority.

D > N (P) > R > 3 > 2

Same as with "2nd" range if "1st hold" switch is faulty.

④ Sol 1 (shift) and sol. 2 (shift)

If trouble occurs in either solenoid, the other one is turned OFF to attain the following gear setting to allow vehicle operation. Should trouble occur in both solenoids, the hydraulic circuit operates mechanically.

Shift position		Normal state			Faulty solenoid 1			Faulty solenoid 2			Faulty solenoids 1, 2		
		1	2	Gear	1	2	Gear	1	2	Gear	1	2	Gear
"D" range		○	○	1st	–	○→X	3rd	○→X	–	3rd	–	–	3rd
		X	○	2nd	–	○→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd
		○	X	4th	–	X	3rd	○→X	–	3rd	–	–	3rd
"3" range		○	○	1st	–	○→X	3rd	○→X	–	3rd	–	–	3rd
		X	○	2nd	–	○→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd
"2" range	1st hold switch released	○	○	1st	–	○→X	3rd	○→X	–	3rd	–	–	3rd
		X	○	2nd	–	○→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd
	1st hold switch operated	○	○	1st	–	○→X	3rd	○→X	–	3rd	–	–	3rd
		X	○	2nd	–	○→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd

○ : Energized X : Non-energized – : Failed

⑤ Duty sol. A (Line pressure)

If duty solenoid A fails, the solenoid is turned OFF and line pressure is raised to maximum to enable vehicle operation.

⑥ Duty sol. B (Lock-up)

If duty solenoid B fails, the solenoid is turned OFF and lock-up is released.

⑦ Sol. 3 (Overrunning clutch)

If the overrunning clutch solenoid fails, the solenoid is turned OFF. The overrunning clutch will engage so that the engine brake will be applied when reducing vehicle speed.

⑧ Duty sol. C (Transfer)

When the duty solenoid C becomes inoperative, it turns OFF. This causes maximum oil pressure to be applied to the transfer clutch so that the power is always transmitted to rear axles. (Direct-coupling 4WD)

4) THROTTLE SENSOR

The throttle sensor provides electrical signals corresponding to the throttle opening. It has the following characteristics. The throttle opening and accelerator depression speed are detected by this throttle sensor output.

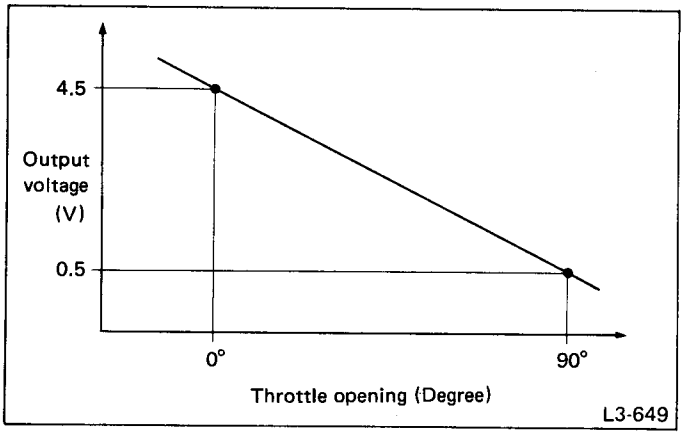


Fig. 73

5) VEHICLE REVOLUTION SENSOR 1 (MOUNTED INSIDE THE TRANSMISSION)

[FWD]

The vehicle revolution sensor (output shaft rotation sensor) is mounted to the transmission case (front to the reduction driven gear). This sensor outputs a pulse signal which is transmitted to the A/T control unit where it is converted to vehicle speed.

[4WD]

The vehicle revolution sensor (output shaft rotation sensor) is mounted to the extension case (from the outside of the case). The sensor outputs a pulse signal which is transmitted to the A/T control unit where it is converted to vehicle speed.
The transfer clutch drum is connected directly to the rear wheel driving propeller shaft. Vehicle revolution sensor 1 on the 4WD model detects rear-wheel speed.

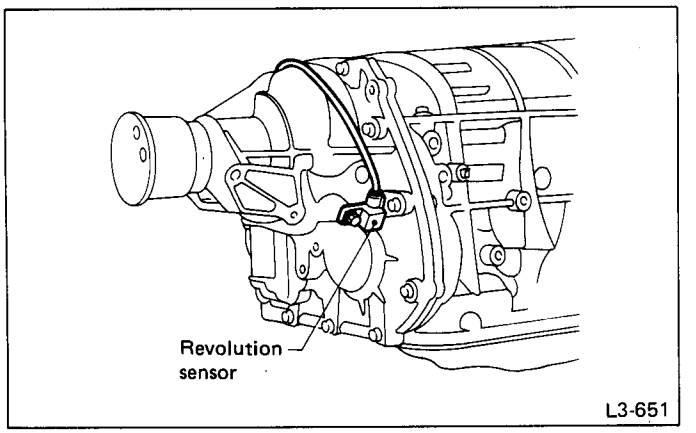


Fig. 74

6) ATF TEMPERATURE SENSOR

This sensor is mounted to the control valve in the transmission. It detects temperature change as an analog electrical signal. The output characteristics of the sensor are shown below.

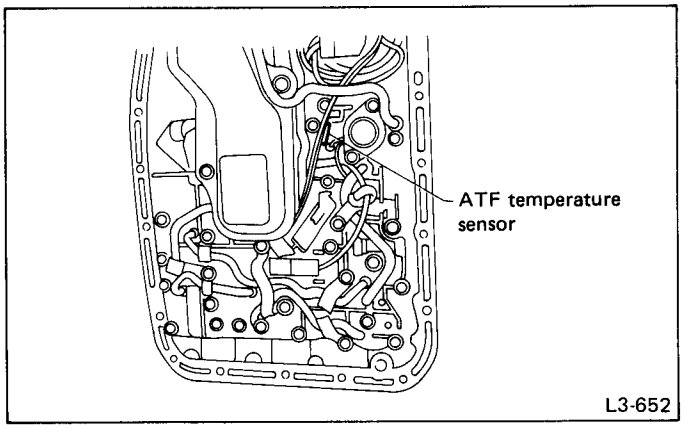


Fig. 75

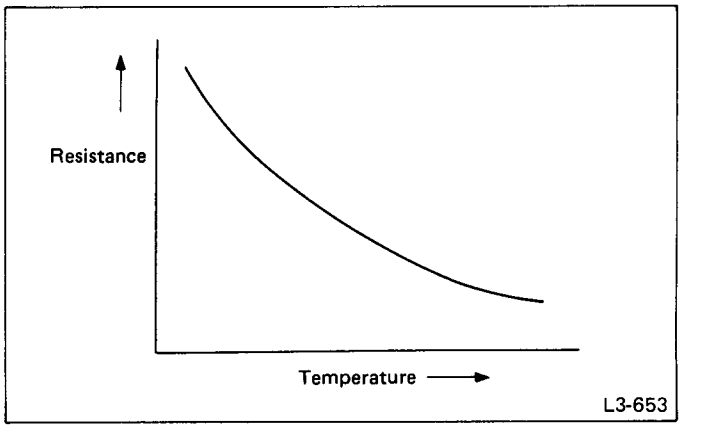


Fig. 76

7) SOLENOIDS

1) SOL. 1 (Shift) and SOL. 2 (Shift)

These solenoids are mounted to the control valve. They are turned ON or OFF according to signals sent from the A/T control unit. The gear positions are changed according to the ON and OFF condition of these solenoids.

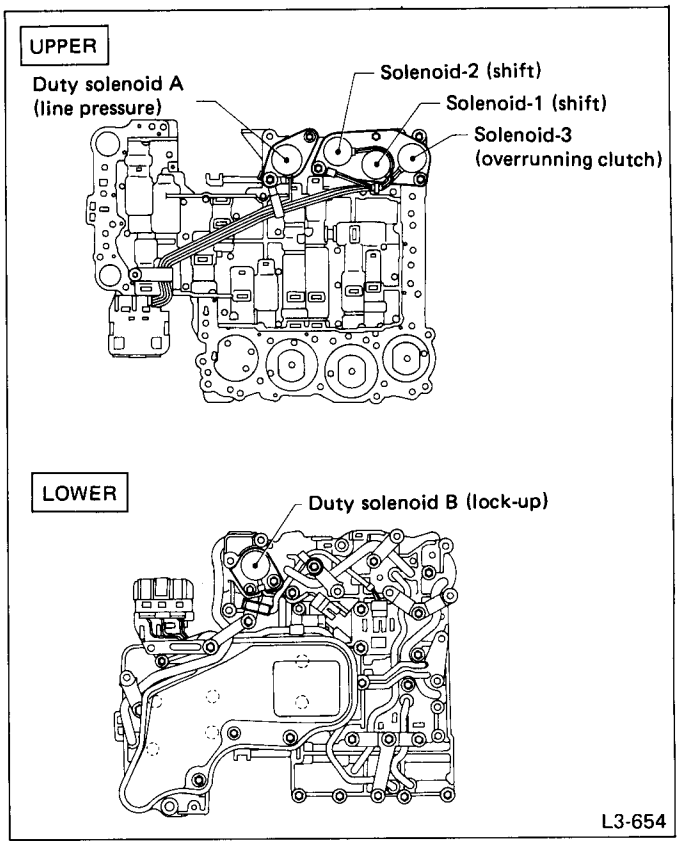


Fig. 77

2) DUTY SOL. A (Line pressure) and DUTY SOL.B (Lock-up)
These solenoids are mounted to the control valve. They repeat ON and OFF at 50 Hz (0.02 sec period)* according to signals sent from the A/T control unit to open/close the drain circuit, thereby controlling the oil pressure to a specified level.

*: A duty cycle type solenoid is used. It is capable of controlling the ON/OFF time ratio in one cycle over the entire range from 0 to 100%. For example, a duty ratio of 50 means 0.01 sec of ON period and 0.01 sec of OFF period in one cycle of 0.02 sec.

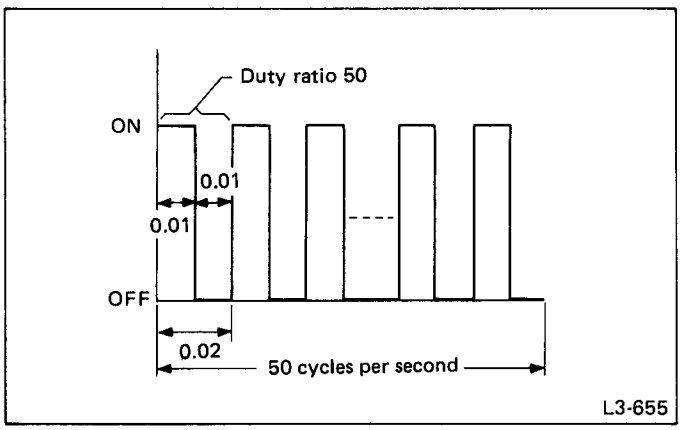


Fig. 78

3) SOL. 3 (Overrunning clutch)
This solenoid is also mounted to the control valve. It is turned ON or OFF according to the signal sent from the A/T control unit. This operation controls the engagement and disengagement of the overrunning clutch.

4) DUTY SOL. C (Transfer)
This solenoid is mounted to the transfer control valve on the side face of the extension case. It repeats ON and OFF at 50 Hz (0.02 sec period) according to signals from the A/T control unit. This operation opens and closes the drain circuit to control transfer oil pressure.

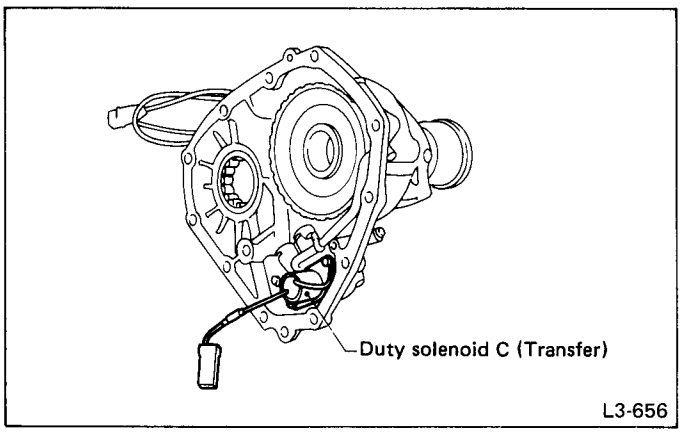


Fig. 79

8) INHIBITOR SWITCH

The inhibitor switch assures safety when starting the engine. This switch is mounted on the right side of the transmission case, and is operated by the range selector lever.

When the selector lever is set to "P" or "N", the electrical circuit is connected in the inhibitor switch and the starter circuit is energized for cranking the engine.

When the selector lever is "R", "D", "3", "2", or "1st hold" range, the electrical circuit is disconnected in the inhibitor switch. Hence engine cranking is disabled. In the "R" range, the backup light circuit is completed in the switch, and the backup lights come on.

In addition to the above function, the inhibitor switch incorporates a circuit for detecting the selected range position and sending the range signal to the A/T control unit.

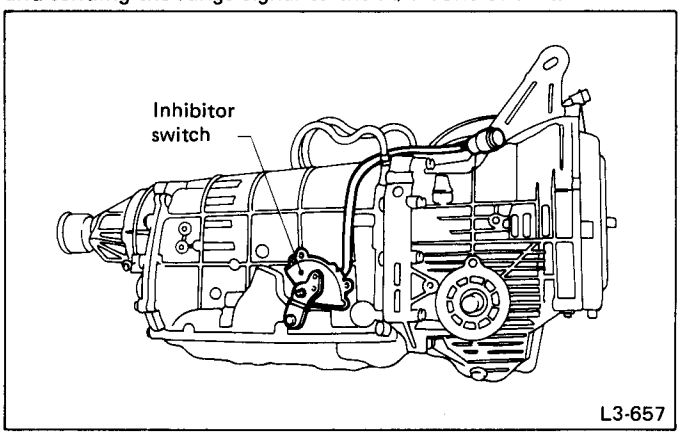


Fig. 80

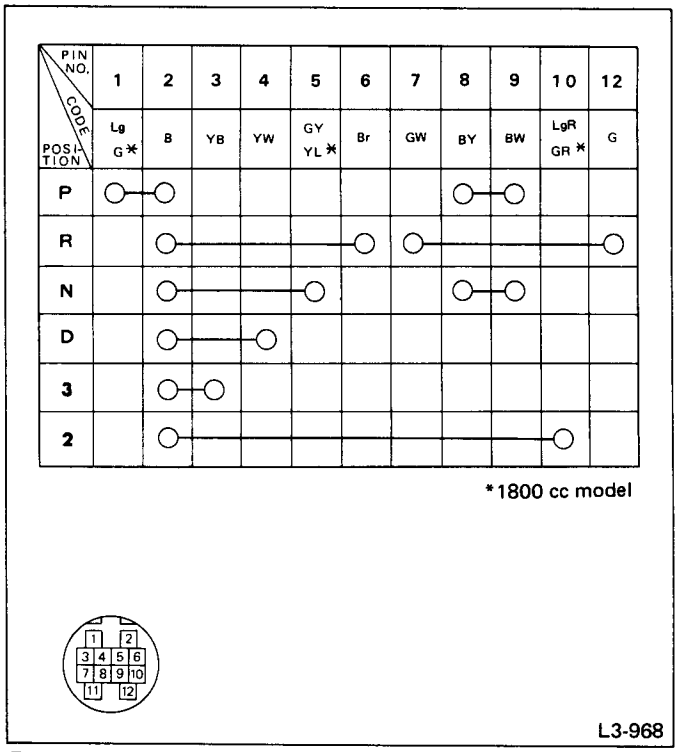


Fig. 81

3-9 4WD Transfer Unit (Full-time 4WD)

1) OUTLINE

This 4WD transfer unit is an electronically controlled MP-T type, full-time, four-wheel driving system which is unique to SUBARU vehicles. It consists of a transfer hydraulic control system composed of various sensors, a transmission control unit, duty solenoids and a combination of hydraulic multi-plate clutches.

The sensors and transmission control unit are also used in common for gearshift control, lock-up control and hydraulic pressure control.

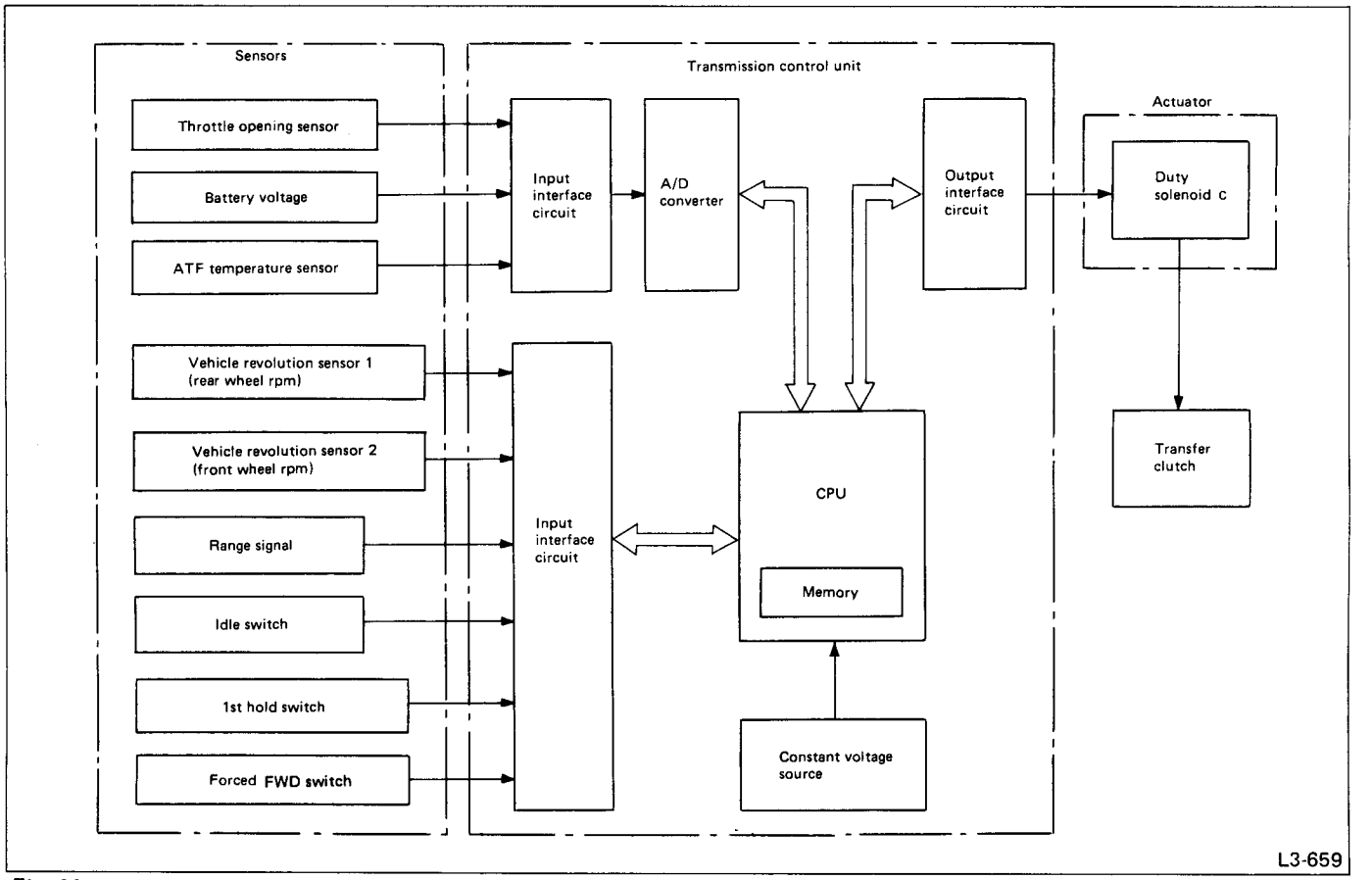


Fig. 82

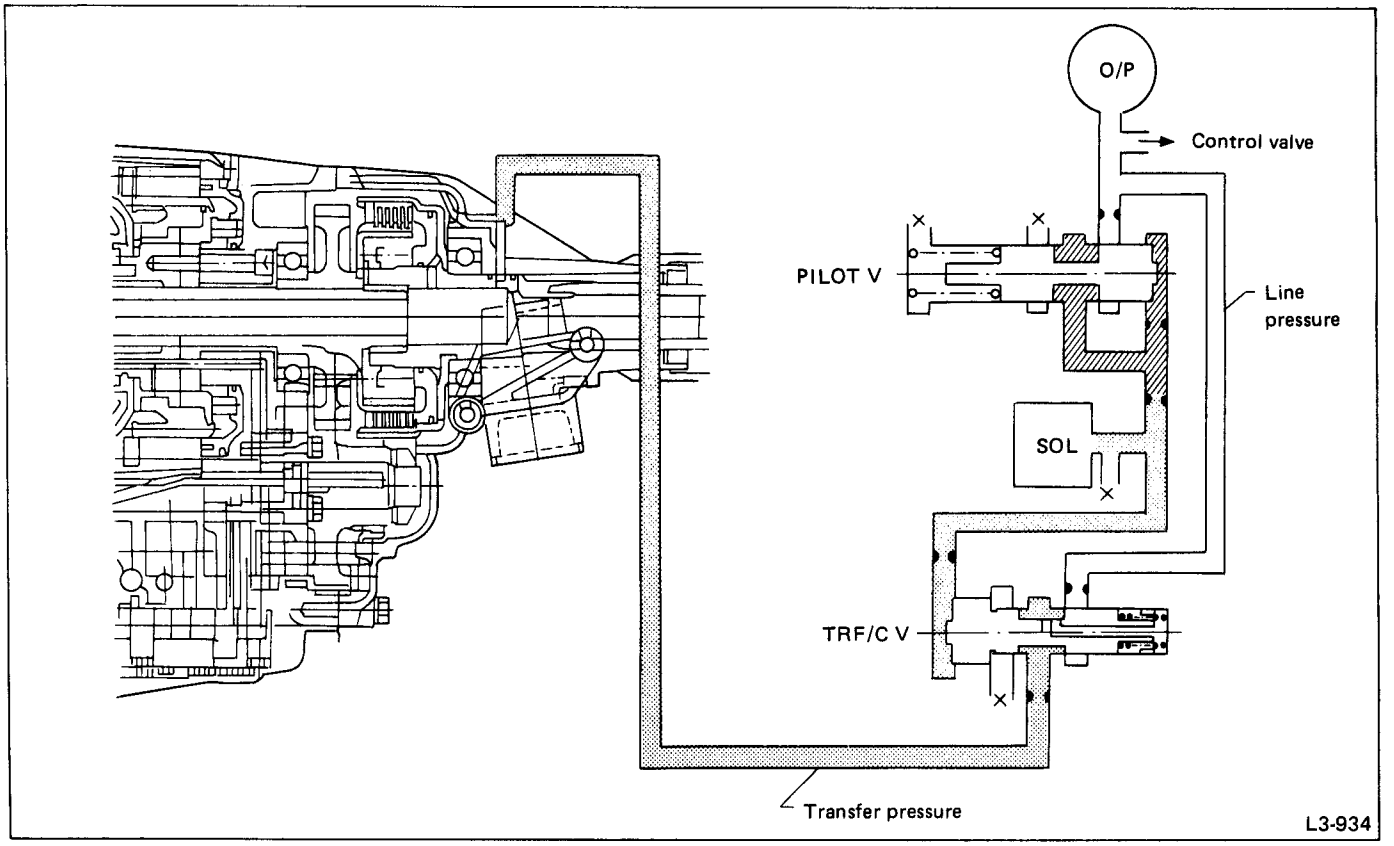

O/P
Control valve
PILOT V
Line pressure
SOL
TRF/C V
Transfer pressure
L3-934

Fig. 83

2) MAJOR COMPONENTS AND THEIR FUNCTIONS

Component name		Function
Sensor	Throttle opening sensor	Detects throttle opening. This signal is used for determining the transfer oil pressure.
	Battery voltage	Detects battery voltage. Used for voltage compensation of duty solenoid.
	ATF temperature sensor	Detects ATF temperature. Used for temperature compensation of duty solenoid.
	Vehicle revolution sensor 1	Detects rear-wheel speed. 30 pulses are generated per rotation of propeller shaft. This signal is used for determining the transfer oil pressure.
	Vehicle revolution sensor 2	Detects front-wheel speed. Four pulses are generated per rotation of speedometer cable. This signal is used for determining the transfer oil pressure.
	Inhibitor switch	Detects selected range signal. Used for determining the transfer oil pressure.
	Idle switch	Used to release control when "slip" is detected.
	Forced FWD switch	Detects FWD mode. Releases transfer clutch.
	1st hold switch	When 1st hold range is selected increases the transfer oil pressure.
Actuator	Duty solenoid C	This solenoid is operated by a signal sent from transmission control unit with duty ratio of 5 to 95% at driving frequency of 50 Hz. This solenoid controls the transfer clutch hydraulic pressure.
Transmission control unit		Computes the duty ratio according to signals sent from various sensors, and issues a signal to the duty solenoid for driving.

3) 4WD TRANSFER UNIT

The transfer unit consists of a hydraulic multi-plate clutch and a transfer hydraulic control system incorporating a duty solenoid valve. It is housed in the extension case together with the bearings, rear drive shaft, etc.

(1) Transfer Clutch (Multi-plate clutch)

The transmission control unit has duty ratios memorized in advance according to running conditions. In order to obtain the optimum transfer torque for the running condition, the oil pressure that is applied to the drive plates and driven plates is controlled by applying oil pressure to the transfer piston from the transfer oil pressure control device including the duty solenoid.

Also, the transfer clutch drum and rear drive shaft are joined to each other by welding. The rear drive shaft has drilled oil passages for transfer clutch control and also for lubrication of extension bushing and ball bearing in it.

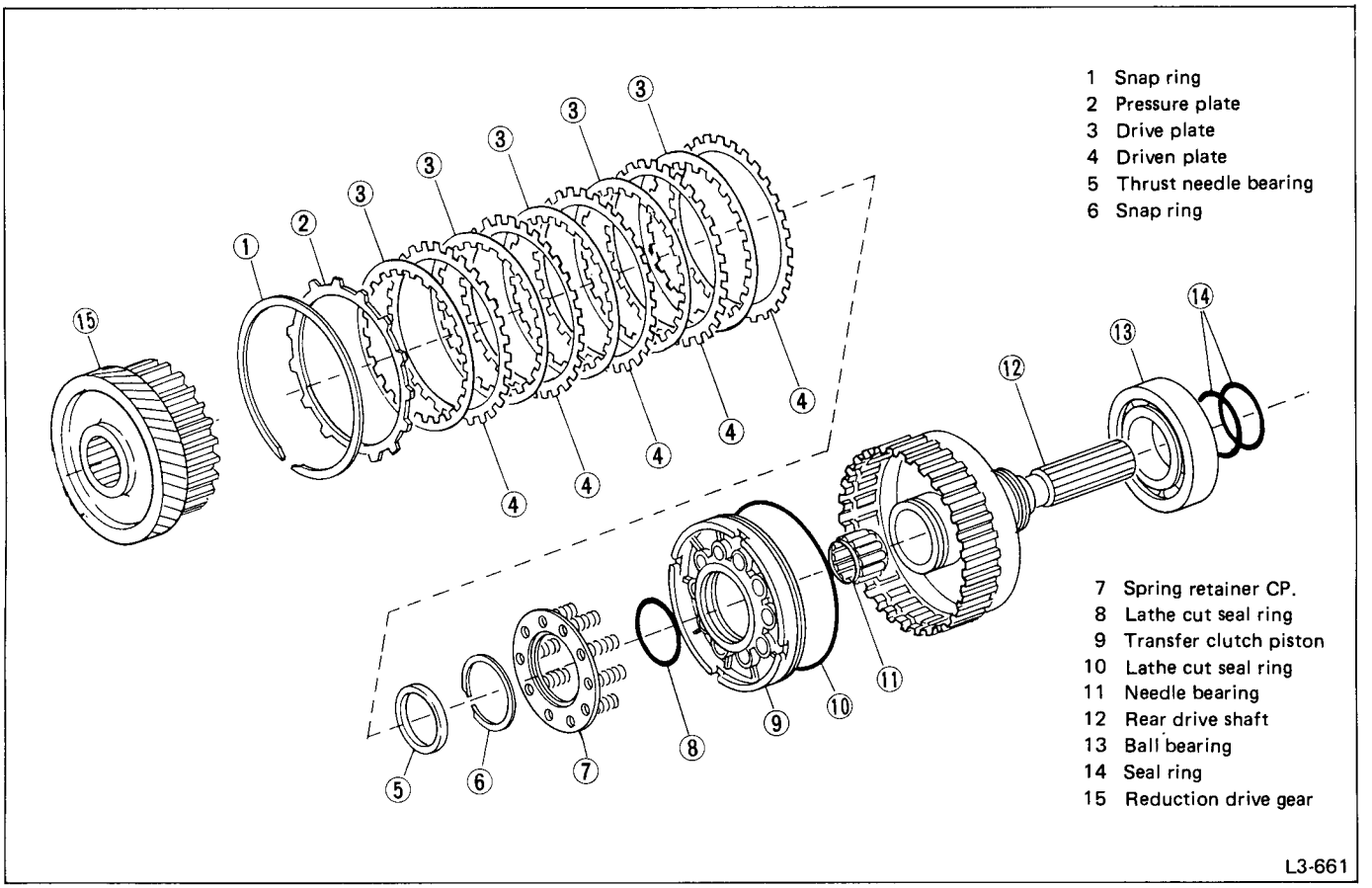


Fig. 84

(2) Transfer Oil Pressure Control Device

The transfer valve body is bolted to the side of the extension case through two gaskets and one separate plate.
Operating oil for the transfer valve body is routed to the extension case through a pipe connecting the discharge circuit of the oil pump on the front of the transmission case to the rear of the case. It is then delivered to the oil pressure circuit provided in the plane on which the transfer valve body is mounted.
This line pressure is reduced to a fixed level by the pilot valve, and becomes the initial pressure of the duty solenoid C. Line pressure is also delivered to the transfer control valve, where it is regulated by duty pressure variations to control the oil pressure so that optimum rear torque distribution is obtained according to running conditions.

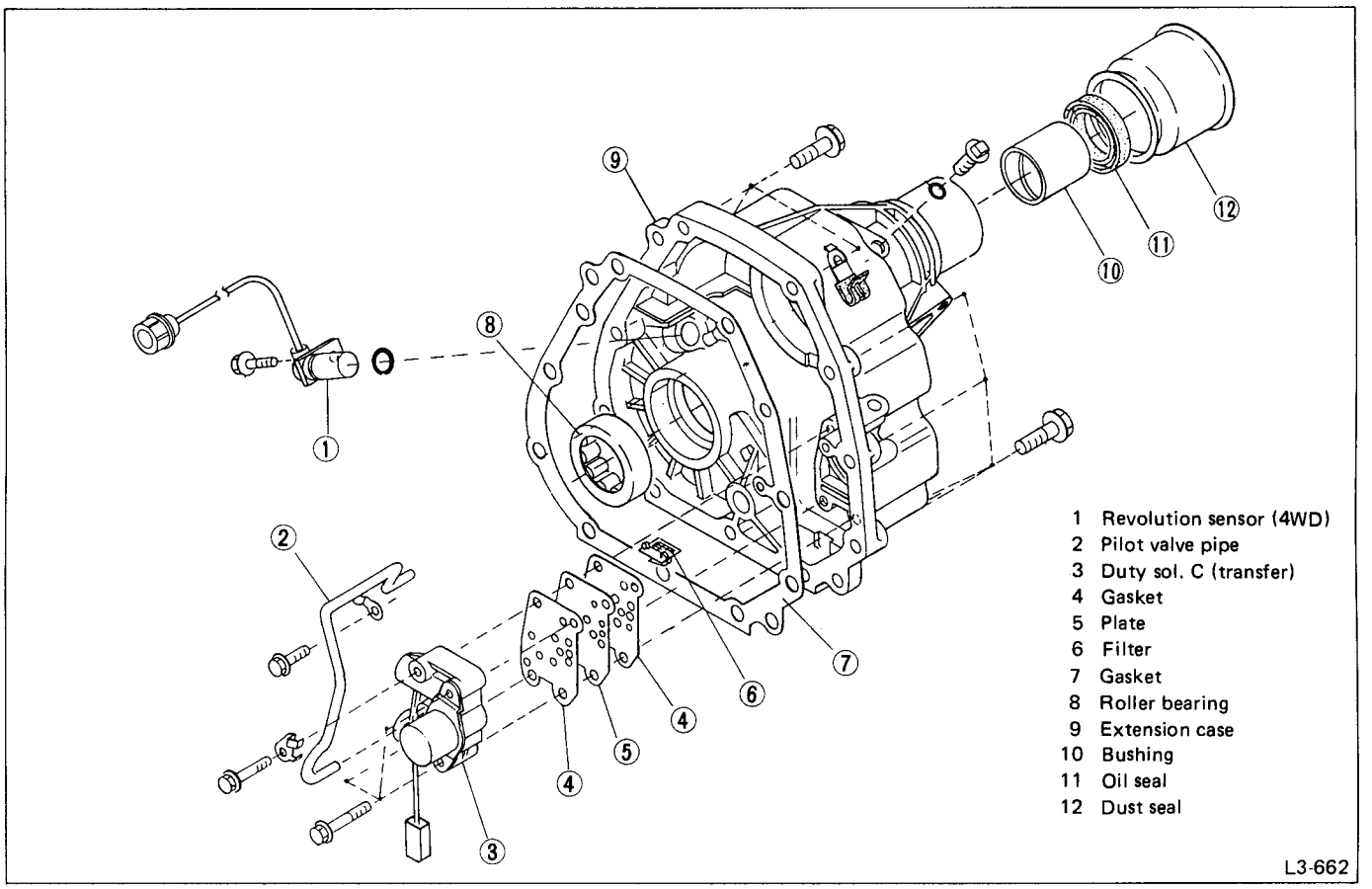


Fig. 85

• Pilot valve (transfer)

The pilot pressure acts on the valve to force it to the right, and the spring acts to force the valve to the left. Therefore, when pilot pressure exceeds the force of the spring, the valve moves to the right and drains the pilot pressure so that it does not exceed the fixed level.

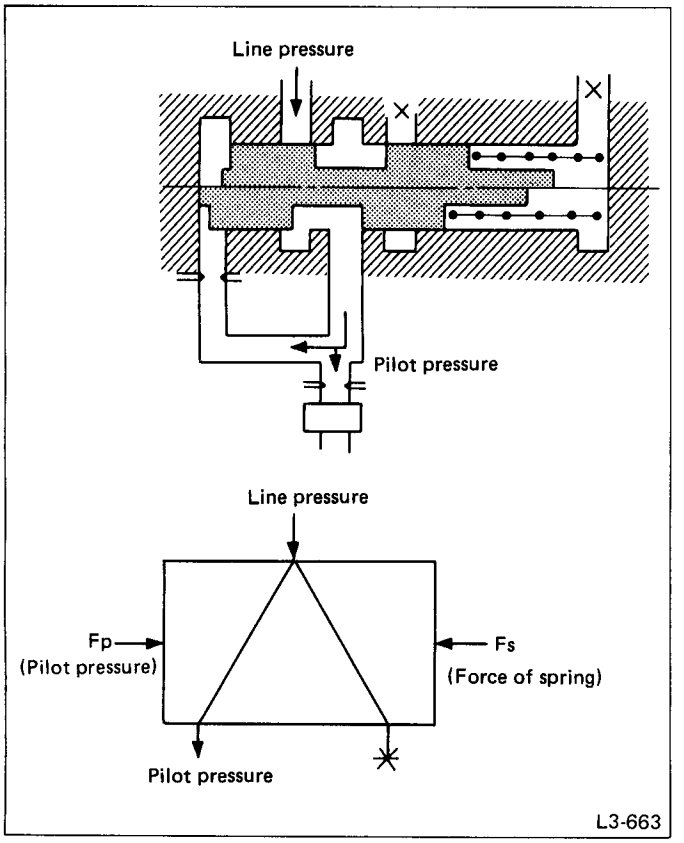


Fig. 86

• Transfer control valve

The duty pressure, which is controlled by pulse amplitude modulation by duty solenoid C, acts on the valve as a force pressing it to the right. On the other hand, oil entering from the oil passage ① flows through the throttle inside the valve into the oil chamber ②, where it acts as a force pressing the valve to the left together with the spring. Therefore, oil entering from the oil passage ① is regulated so as to be balanced by the forces acting in both directions and becomes the transfer clutch control oil pressure.

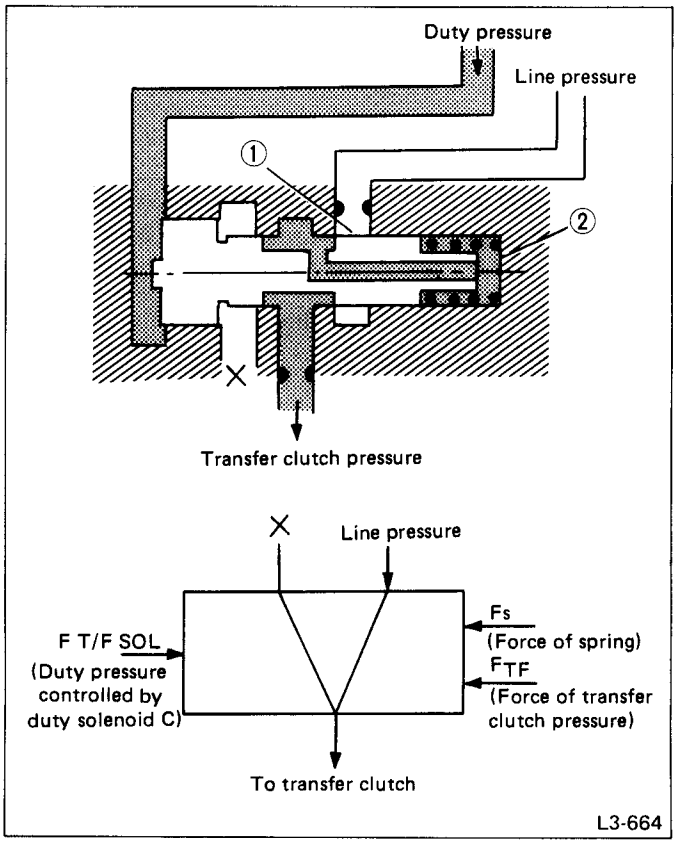
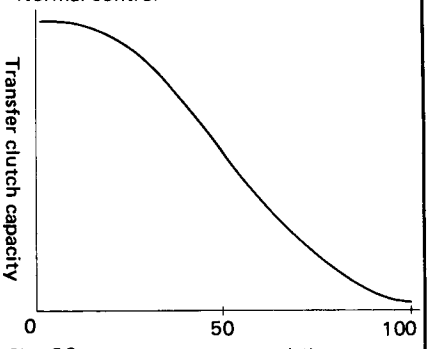


Fig. 87

4) 4WD TRANSFER CONTROL

		Type of control	Gear position	Remarks
1	Basic control	Regulates transfer oil pressure in response to throttle position and vehicle speed.	1st thru 4th and reverse	Normal control  *Fig. 88*
2	Control in 1st hold range	Increases transfer oil pressure (as compared with basic control 1 .)	1st hold range	–
3	Control during "slip" detection	Returns transfer oil pressure to the same as in 1st hold range immediately after "slip" detection.	1st thru 4th and reverse	Release: At more than set vehicle speed and fully closed throttle
4	Control in turns	Decreases transfer oil pressure upon detection of vehicle turns.	1st thru 4th and reverse	–

4 Power Transmission System

4-1 Gearshifling Mechanism

1. OPERATION OF EACH GEARSHIFT MEMBER

			Rev./C	B/B	High/C	FWD/C	OWC (3-4)	OVR/C	Lo / Rev./B	OWC (1-2)
Selector lever operation	P									
	R		○						○	
	N									
	D	1ST				○	○			○
		2ND		○		○	○			
		3RD			○	○	○			
		4TH		○	○	○				
	3	1ST				○	○			○
		2ND		○		○	○			
		3RD			○	○	○	○		
	2	1ST				○	○	○	○	
		2ND *1		○		○	○	○		
		3RD			○	○	○	○		
Switchbutton handling	1st HOLD	1ST *1				○	○	○	○	
		2ND *1		○		○	○	○		
		3RD			○	○	○	○		

Only when selector lever is in "2" and 1st hold button is ON.

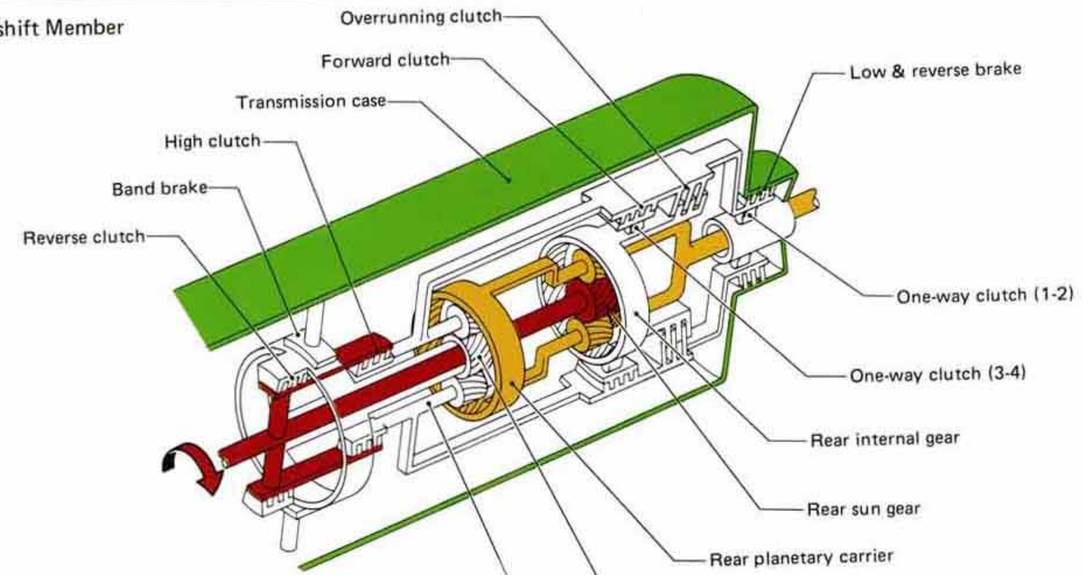
*1: For prevention of over-revolution

L3-1029

Fig. 89

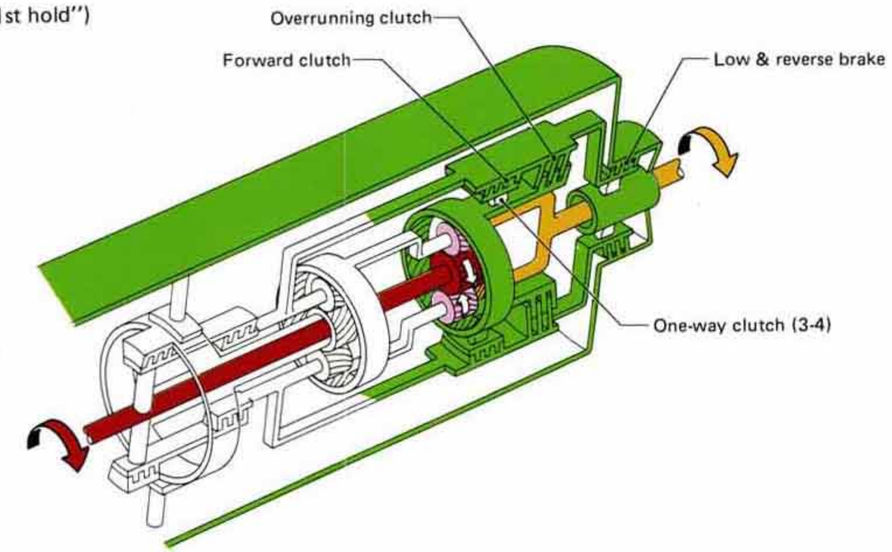
Power Transmission System
SCHEMATIC DRAWING

Gearshift Member



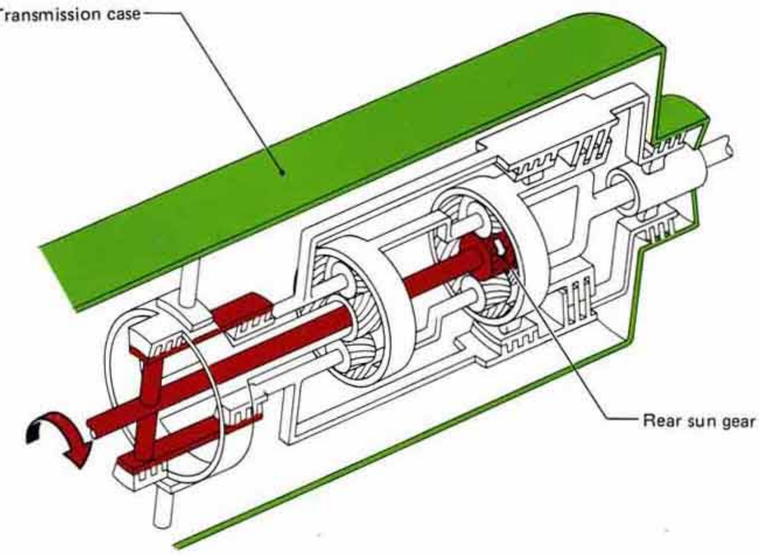
L3-1021

1st ("2" and "1st hold")



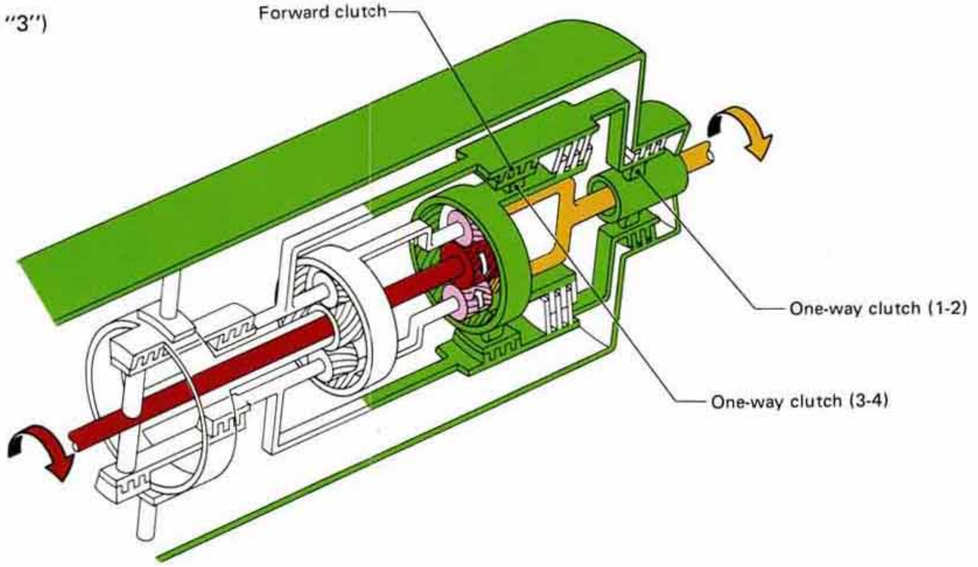
L3-1023

"N" and "P"



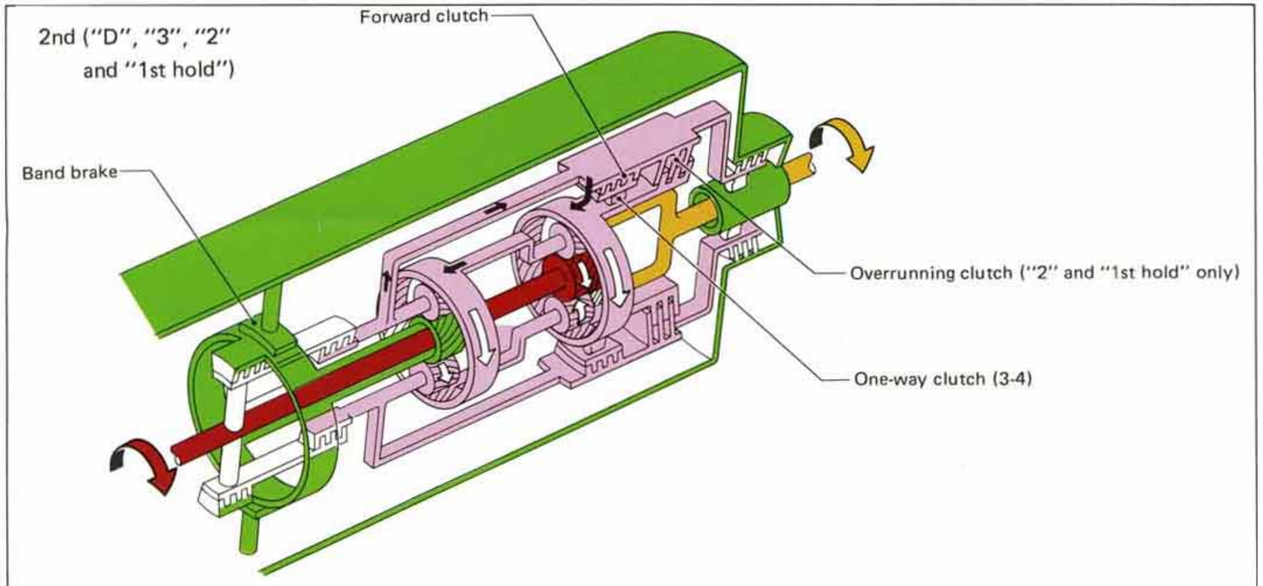
L3-1022

1st ("D" and "3")



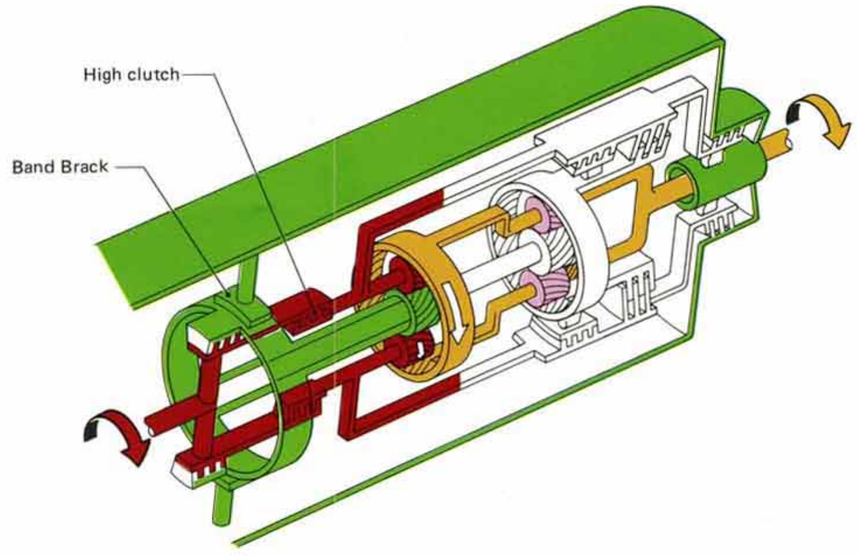
L3-1024

2nd ("D", "3", "2" and "1st hold")



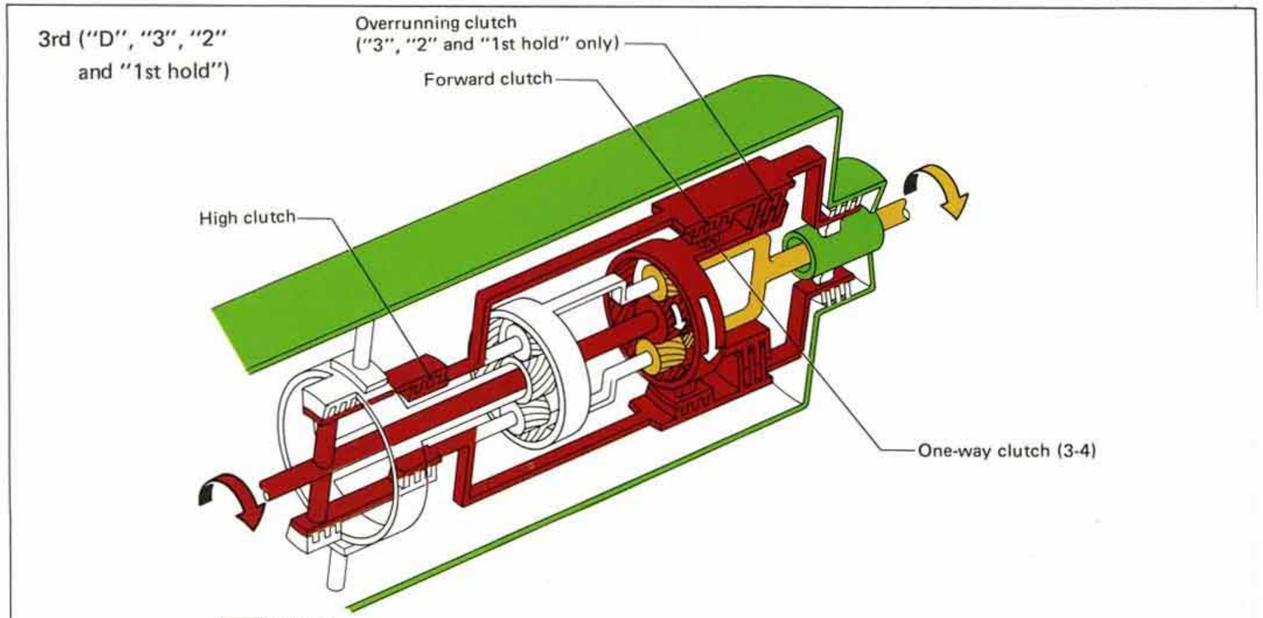
L3-1025

4th



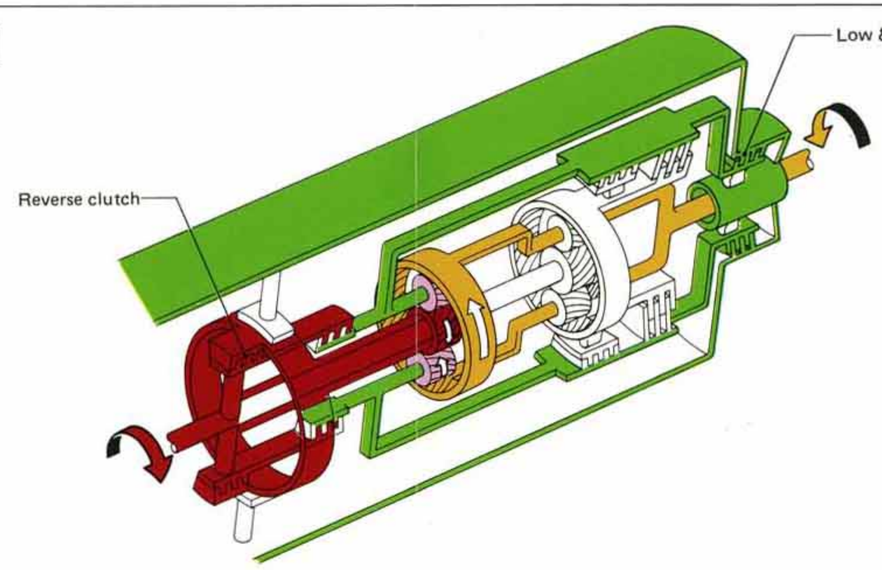
L3-1027

3rd ("D", "3", "2" and "1st hold")



L3-1026

Rev.



L3-1028

	1st	2nd	3rd	4th	Rev.
Input member	R_S	R_S	R_S F_C R_I	R_S F_C	R_S F_S
Output member	F_I R_C	F_I R_C	F_I R_C	F_I R_C	F_I R_C
Fixed member	F_C R_I	F_S		F_S	F_C
Free member	F_S	F_C R_I	F_S	R_I	R_I
Gear ratio	2.785	1.545	1.000	0.694	2.272

Abbr.

F_S	: Front sun gear
R_S	: Rear sun gear
F_C	: Front planetary carrier
R_C	: Rear planetary carrier
F_I	: Front internal gear
R_I	: Rear internal gear

L3-669

Fig. 90

4-2 Power Train

The gear train consists of two sets of planetary gears, four sets of multi-plate clutches, one brake band, one set of multi-plate brake and two sets of one-way clutches.

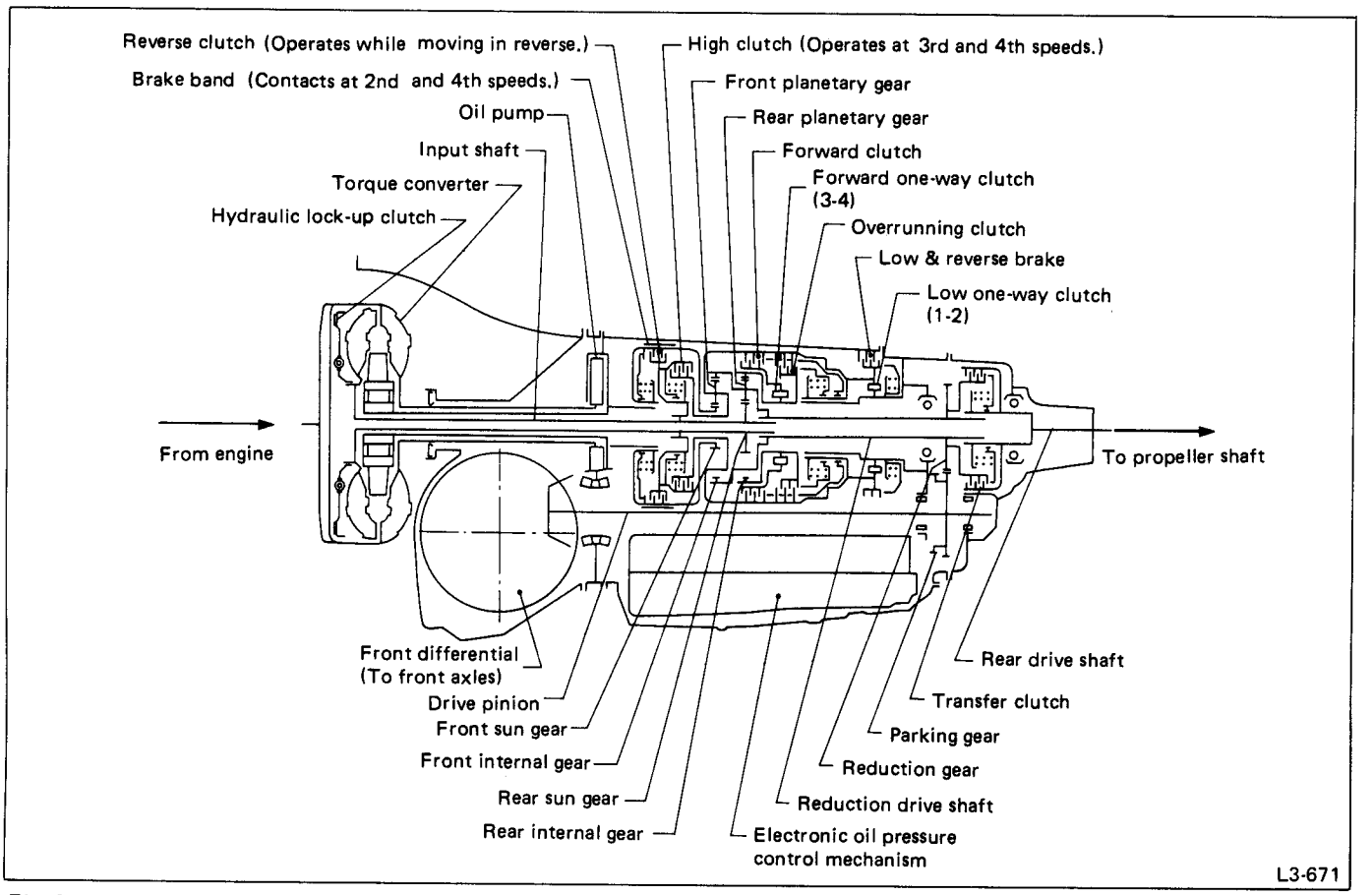


Fig. 91

1) N RANGE AND P RANGE

1) N range

Because both the forward clutch and reverse clutch are in the release positions, the power of the input shaft is not transmitted to the drive pinion or the rear drive shaft.

2) P range

All controls do not operate, just as in the N range. The parking pawl interlocked with the selector lever meshes with the parking gear to mechanically hold the output shaft stationary, thus locking the power train.

2) FIRST SPEED OF D OR 3 RANGE (D_1, 3_1)

- When the throttle is open wide, as during acceleration in the low-speed range, the forward clutch, one-way clutch (3-4) and one-way clutch (1-2) operate to prevent the rear internal gear from turning in the reverse direction.
- While coasting, the rear internal gear turns normally and the one-way clutch (3-4) is released and idles. Therefore, no power is transmitted and the engine does not provide braking action.

Operating condition of parts	Power flow (in acceleration)
• Forward clutch : Applied • One-way clutch (3-4) : Operating • One-way clutch (1-2) : Operating	• Input shaft ↓ • Rear sun gear ↓ • Rear pinion gear ↓ • Rear planetary carrier ↓ • Reduction gear ↓ • Drive pinion → • Front differential • Transfer clutch → • Rear differential

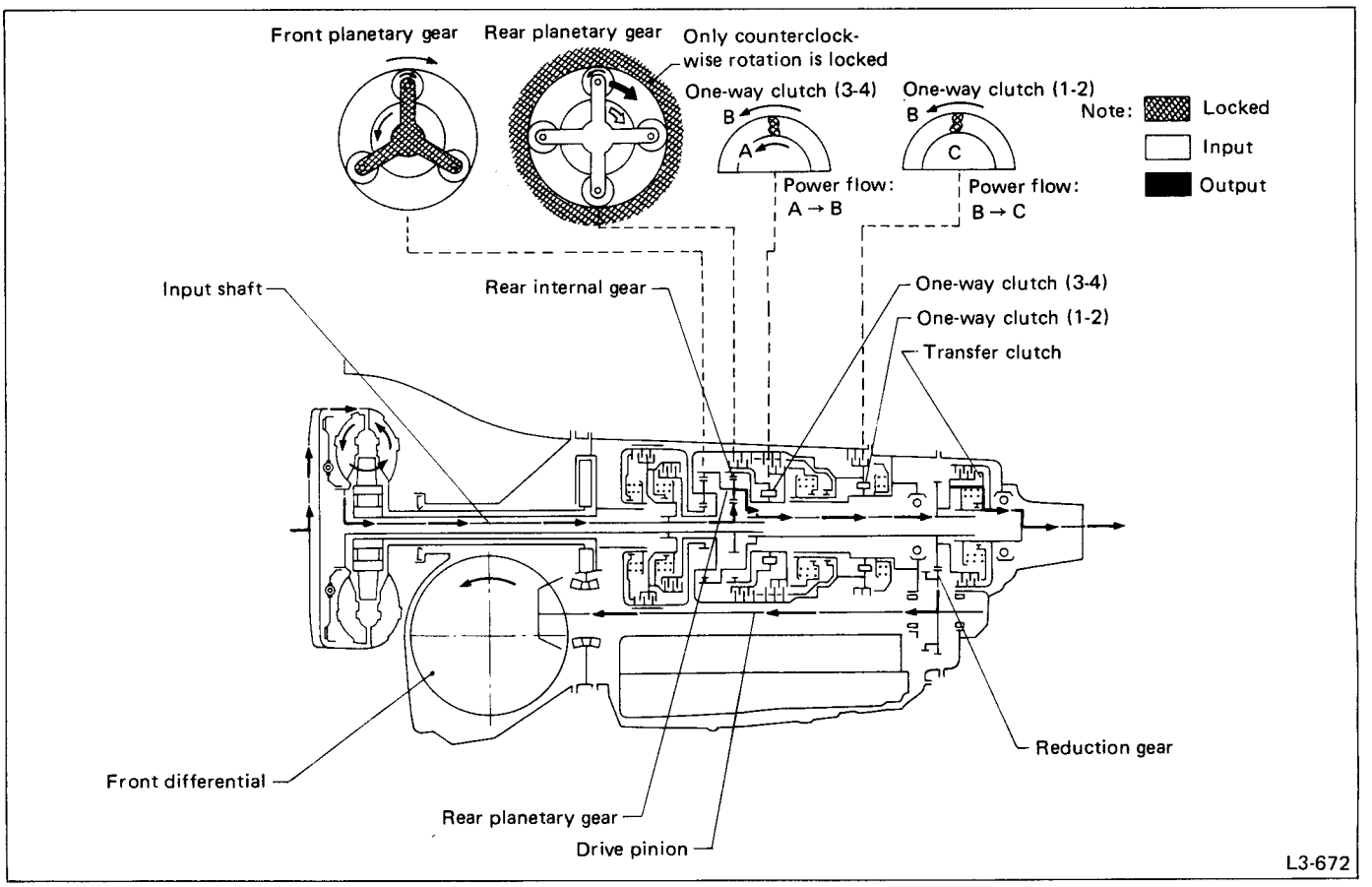


Fig. 92

3) SECOND SPEED OF D, 3, 2, OR 1ST HOLD RANGE (D_2, 3_2, 2_2, 1ST $HOLD_2$)

- During acceleration, the forward clutch is applied and connects the front planetary gear to the internal gear through the one-way clutch (3-4). Power is transmitted from the input shaft to the rear sun gear, turning the rear planetary carrier (i.e. front internal gear).
  Also, since the band brake is applied and the front sun gear is locked, the rear internal gear turns normally through the front planetary carrier and the forward clutch and one-way clutch (3-4) that are connected to that carrier. Thus, speed increases in proportion to the rotation of the rear internal gear compared with the first speed.
- Since the rear internal gear turns normally while coasting, the one-way clutch (3-4) is released and idles. Accordingly, reverse power is not transmitted to the engine and engine braking is not provided.
- During deceleration at "2" or "1st hold" range, the overrunning clutch operates to check idling of the one-way clutch (3-4). Reverse power is transmitted to the engine, providing engine braking action.

Operating condition of parts	Power flow (in acceleration)
• Brake band : Applied • Forward clutch : Applied • One-way clutch (3-4) : Operating • Overrunning clutch : Applied ("2" and "1st hold" ranges only)	Input shaft → Rear sun gear → Rear pinion gear → Rear planetary carrier → Reduction drive shaft → Reduction gear → Drive pinion → Front differential; Reduction gear → Transfer clutch → Rear differential; Rear planetary carrier → Front internal gear → Front pinion gear → Front planetary carrier → Forward clutch → One-way clutch (3-4) → Rear internal gear → Rear pinion gear

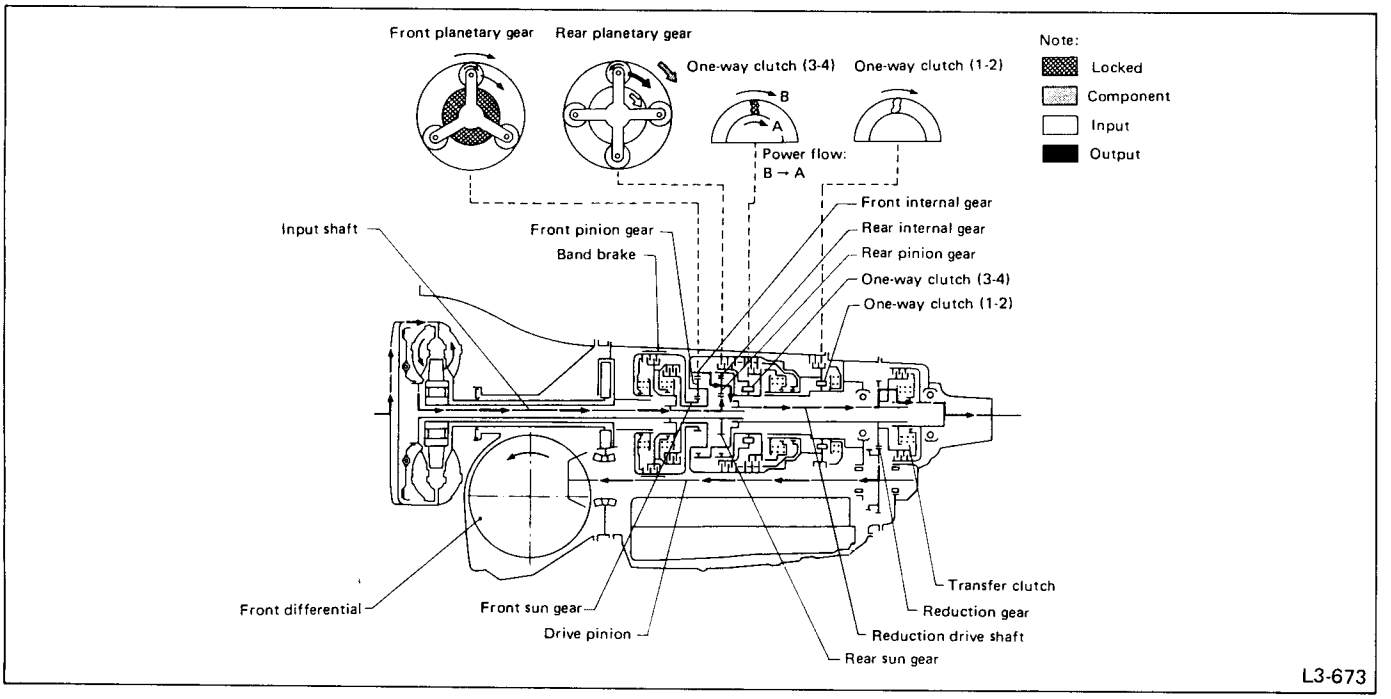


Fig. 93

4) THIRD SPEED OF D, 3, 2, OR 1ST HOLD RANGE (D_3, 3_3, 2_3, 1ST $HOLD_3$)

- During acceleration, the high clutch is applied and the input shaft and front planetary carrier are connected. Further, the forward clutch and one-way clutch (3-4) operate to connect the front planetary carrier to the rear internal gear. Power is transmitted from the input shaft to the rear sun gear and rear internal gear. The rear sun gear and rear internal gear turn normally at the same speed. Therefore, the rear planetary carrier, rear sun gear and rear internal gear rotate normally as a unit.
- While coasting at "D", because the rear internal gear turns normally, the one-way clutch (3-4) idles in a released state. Thus, reverse power is not transmitted to the engine and engine braking action is not provided.
- During deceleration, at "3", "2" or "1st hold" range, the overrunning clutch is applied and checks the reverse rotation of the one-way clutch (3-4).
  Thus, reverse power is transmitted to the engine and engine braking is performed.

Operating condition of parts	Power flow (in acceleration)
• High clutch : Applied • Forward clutch : Applied • One-way clutch (3-4) : Operating • Overrunning clutch : Applied ("3", "2" and "1st hold" ranges only)	Input shaft High clutch → Front planetary carrier → Forward clutch → One-way clutch (3-4) → Rear internal gear Rear sun gear → Rear pinion gear → Rear planetary carrier → Reduction gear Drive pinion → Front differential Transfer clutch → Rear differential

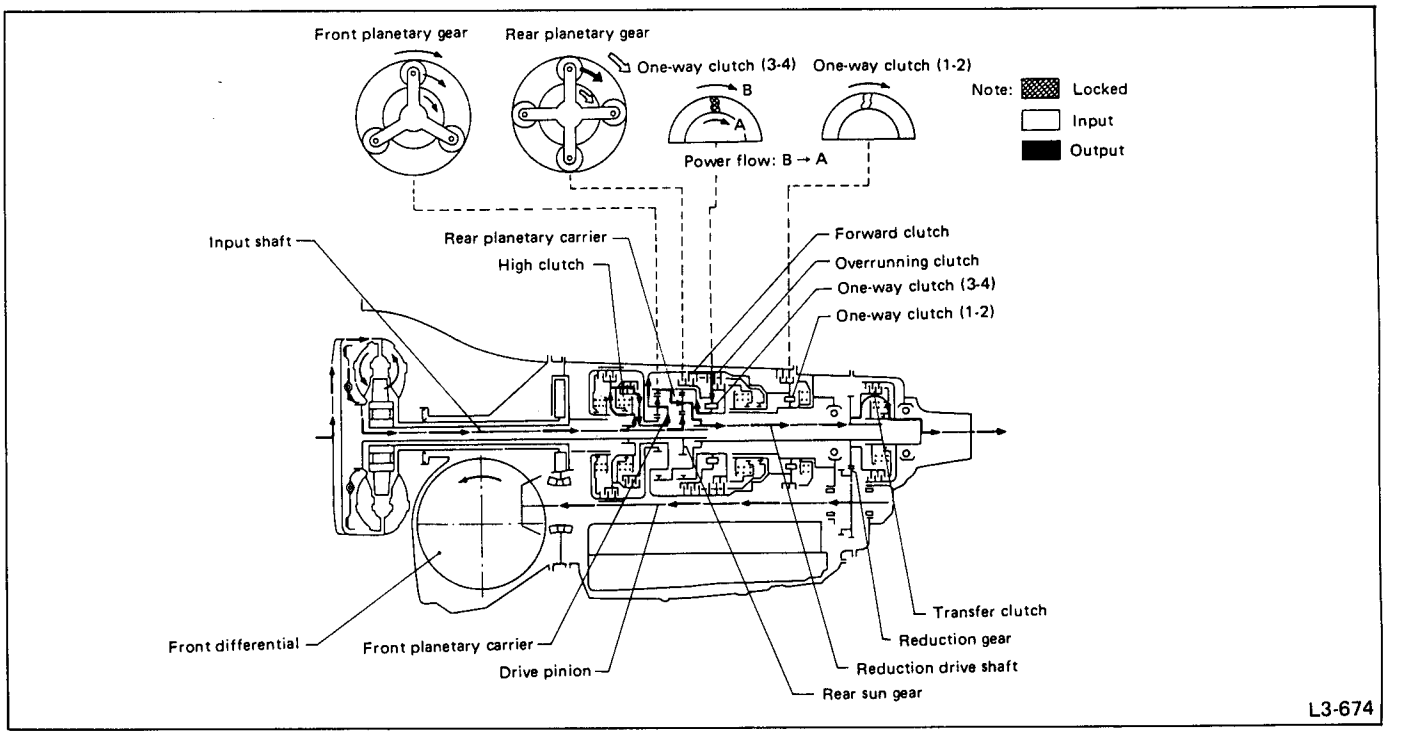


Fig. 94

5) D-RANGE FOURTH SPEED (D_4)

- During acceleration, the high clutch is applied and connects the input shaft to the front planetary carrier. Also, the forward clutch is applied, but it runs idle due to the one-way clutch (3-4) and takes no part in power transmission. Power is transmitted from the input shaft to the front planetary carrier by the function of the high clutch.

  When the front planetary carrier turns normally, because the front sun gear is held stationary by the brake band, the speed of the front internal gear increases and is delivered to the meshing reduction drive shaft in normal rotation.
- While coasting, because power transmission does not go through the one-way clutch, reverse power is transmitted to the engine and engine braking is performed.

Operating condition of parts	Power flow (in acceleration)
• High clutch : Applied • Brake band : Contracted • Forward clutch : Applied (Takes no part in power transmission.)	• Input shaft ↓ • High clutch ↓ • Front planetary carrier ↓ • Front pinion gear ↓ • Front internal gear ↓ • Rear planetary carrier ↓ • Reduction drive shaft ↓ • Reduction gear ↓ • Drive pinion → • Front differential • Transfer clutch → • Rear differential

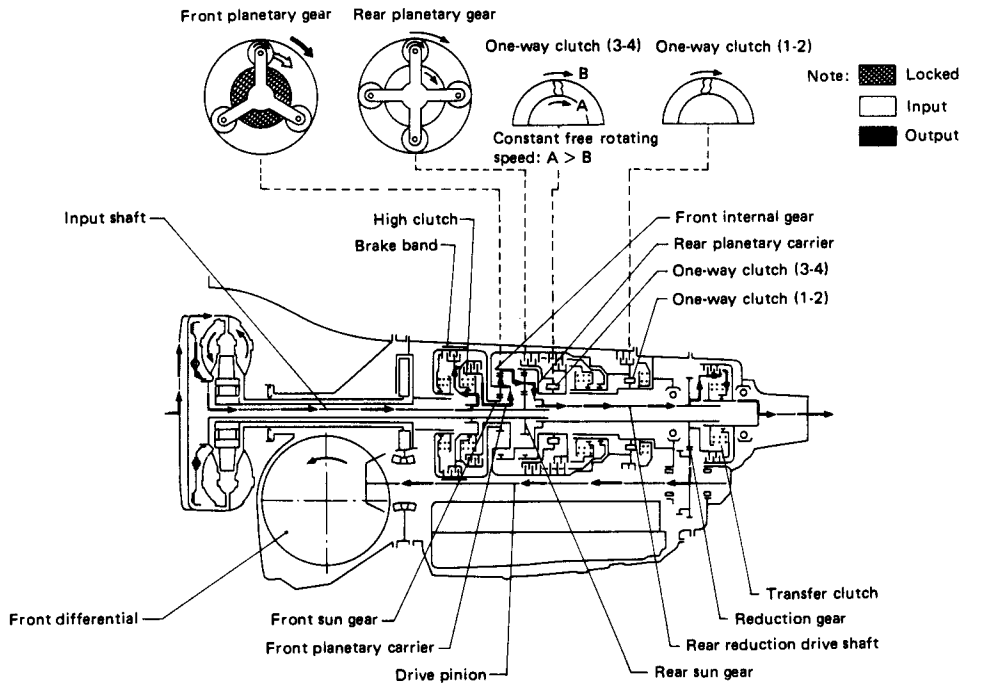


Fig. 95

6) 2-RANGE FIRST SPEED OR 1ST HOLD FIRST SPEED (2_1, 1ST HOLD)

- During acceleration, the forward clutch and overrunning clutch are applied and the front planetary carrier and rear internal gear are connected. Also, the low & reverse brake is applied so that the front planetary carrier and internal gear remain stationary.
  The power flow is the same as in the first speed of "D", "3" and "2" range (except for the following points) and engine braking is performed.
  - The low & reverse brake operates in place of the one-way clutch (1-2) and locks the rear internal gear.
- In coasting and deceleration, low & reverse brake and overrunning clutch are operating, so that reverse power is transmitted to the engine and engine braking action is provided.

Operating condition of parts	Power flow (in acceleration)
• Forward clutch : Applied • One-way clutch (3-4) : Applied (in acceleration) • Overrunning clutch : Applied • Low & reverse brake : Operating	• Input shaft ↓ • Rear sun gear ↓ • Rear pinion gear ↓ • Rear planetary carrier ↓ • Reduction gear ↓ (Drive pinion) ↓ (Transfer clutch) • Front differential • Rear differential

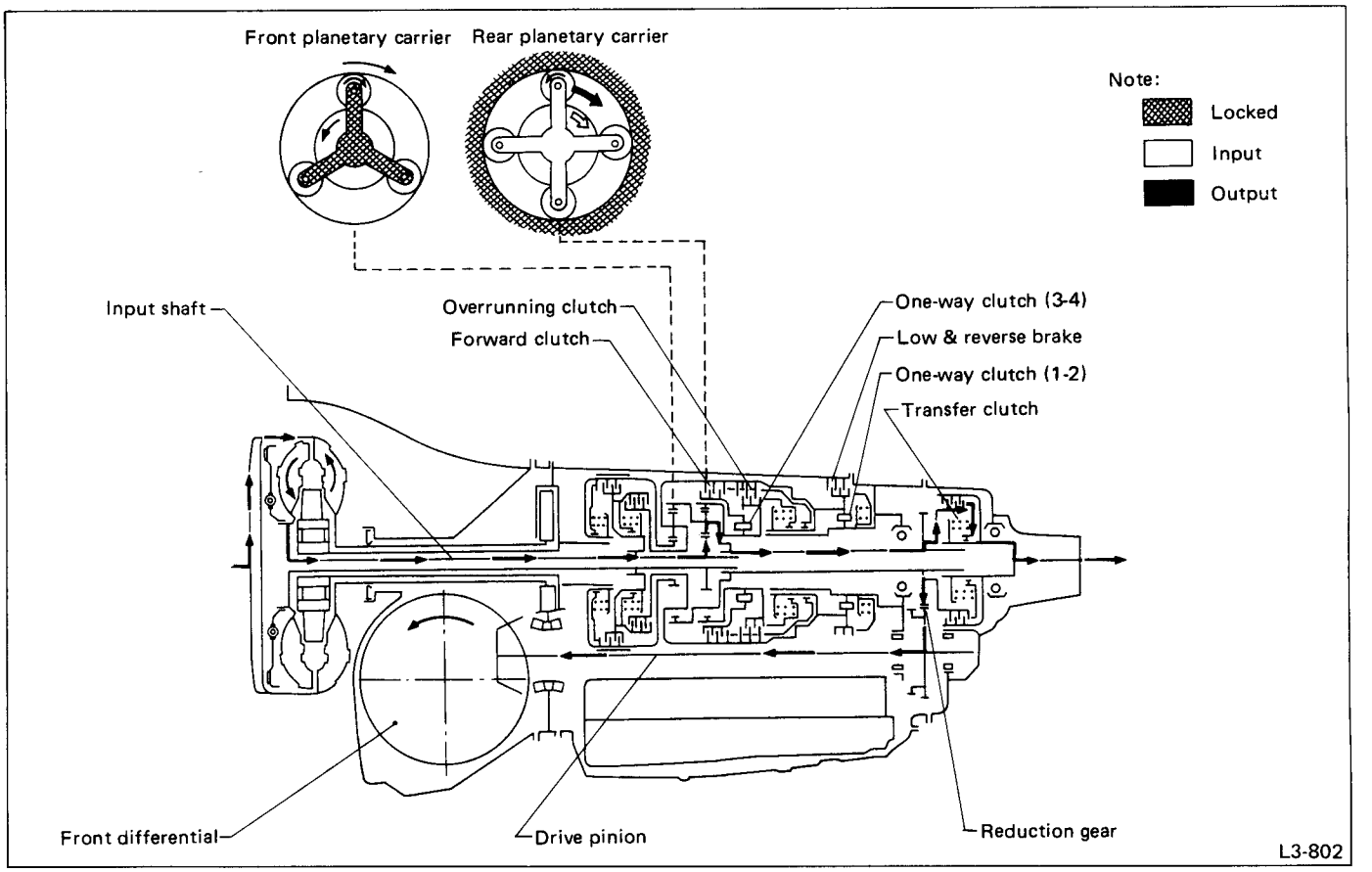


Fig. 96

7) R RANGE

The reverse clutch is applied and power is transmitted from the input shaft through the reverse clutch to the front sun gear. Also, the low & reverse brake operates to lock the front planetary carrier. Therefore, when the front sun gear turns normally, the front internal gear slows and reverses.

Operating condition of parts	Power flow
• Reverse clutch : Applied • Low & reverse brake : Operating	• Input shaft ↓ • Reverse clutch ↓ • Front sun gear ↓ • Front pinion gear ↓ • Front internal gear ↓ • Reduction drive shaft ↓ • Reduction gear ↓ • Drive pinion → • Front differential • Transfer clutch → • Rear differential

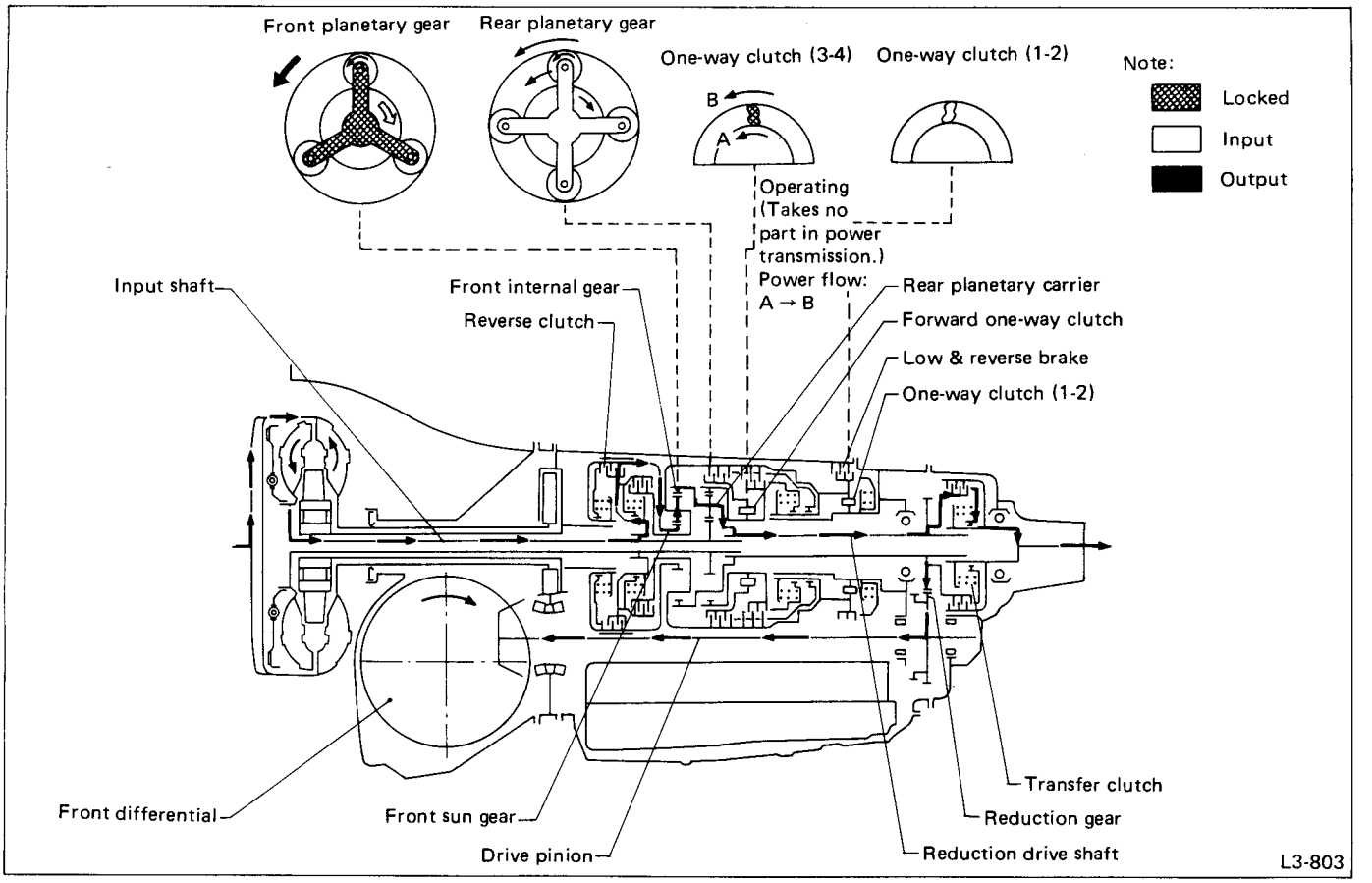
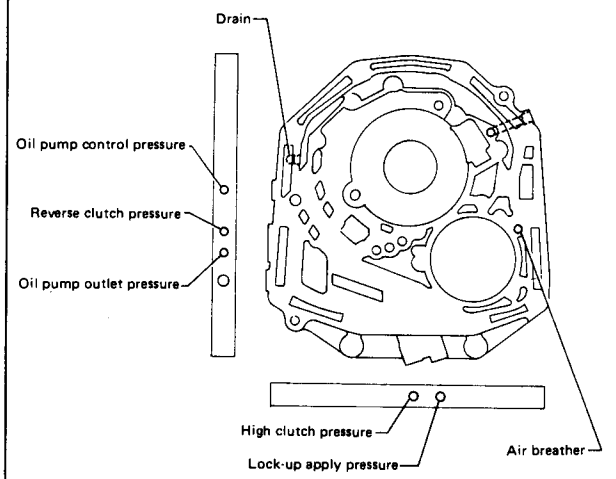


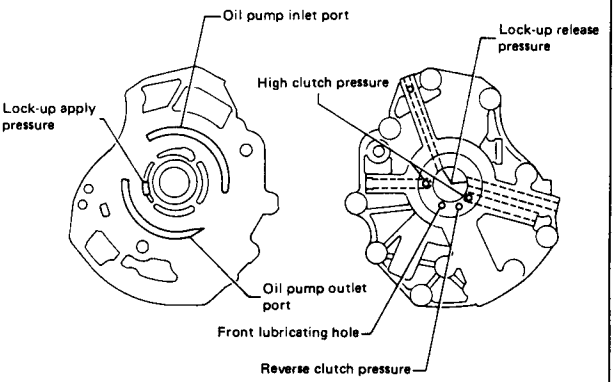
Fig. 97

5 Fluid Passages

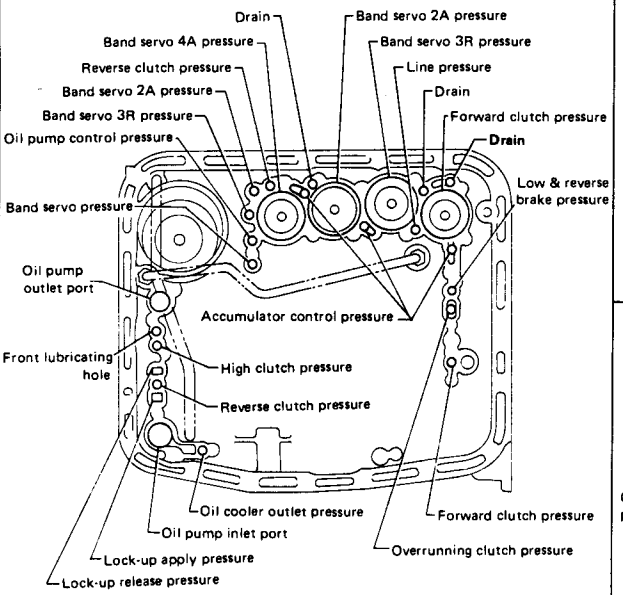
Oil pump housing



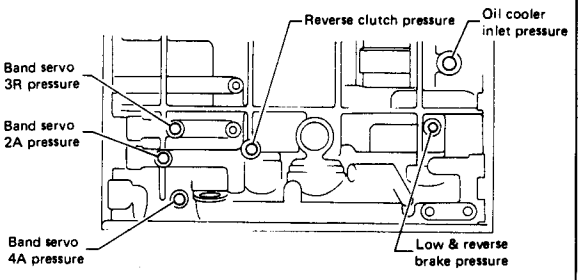
Oil pump cover



Transmission case



Transmission case LH side



Transmission case RH side

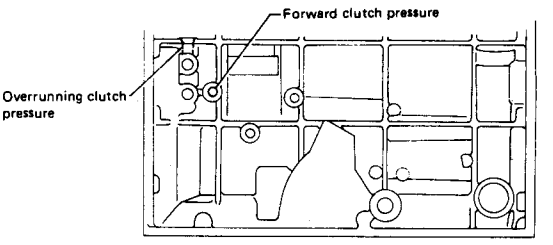


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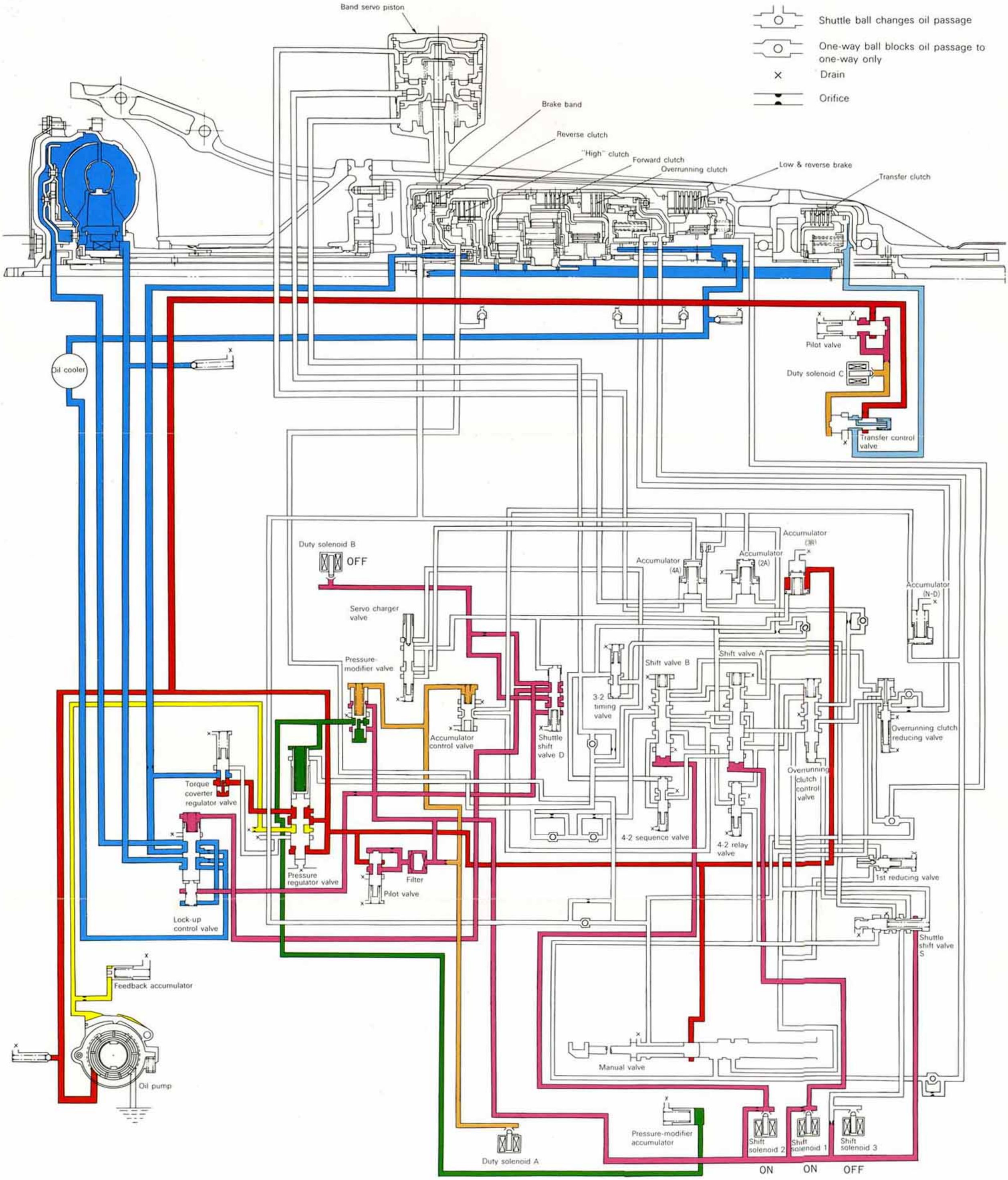
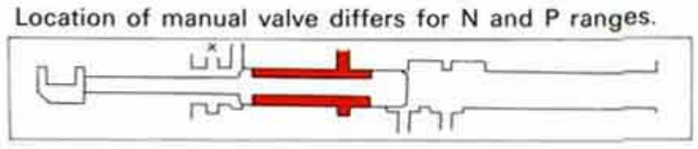
Fig. 98

1 P range and N range

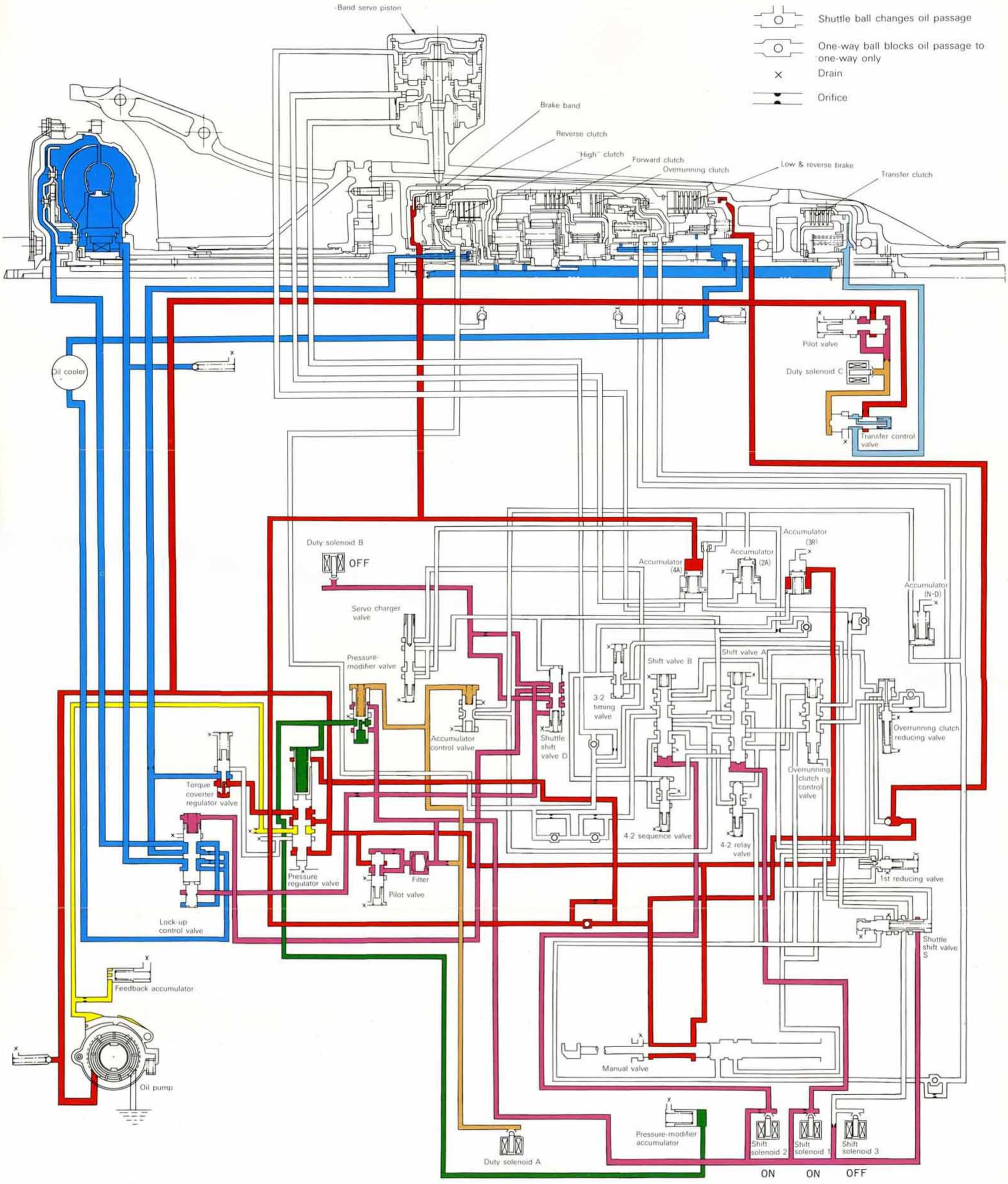


Location of manual valve differs for N and P ranges.

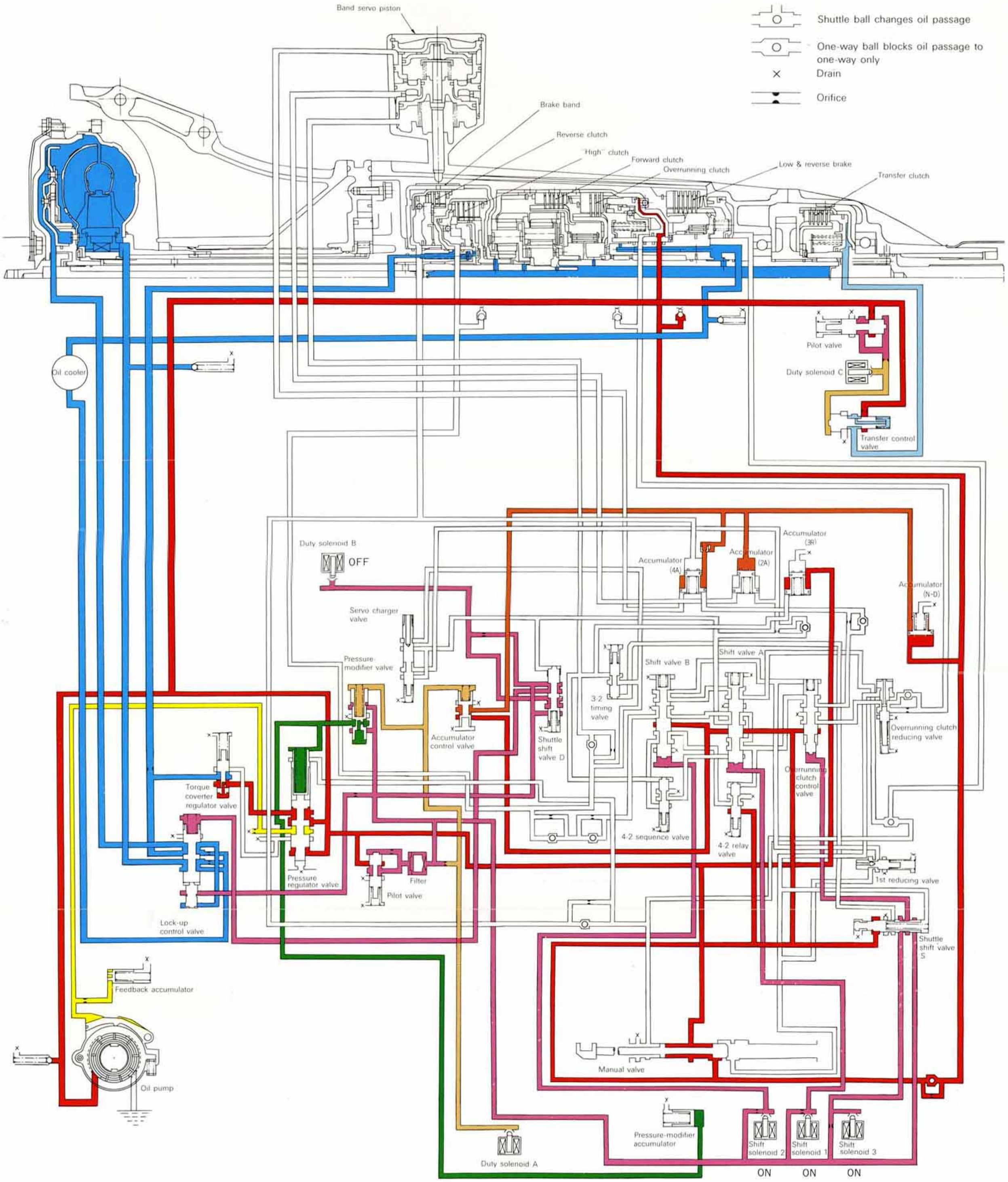


32 73b

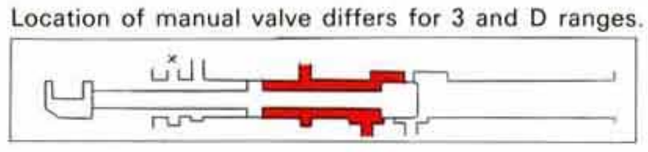
2 R range



3 First speed of D or 3 range



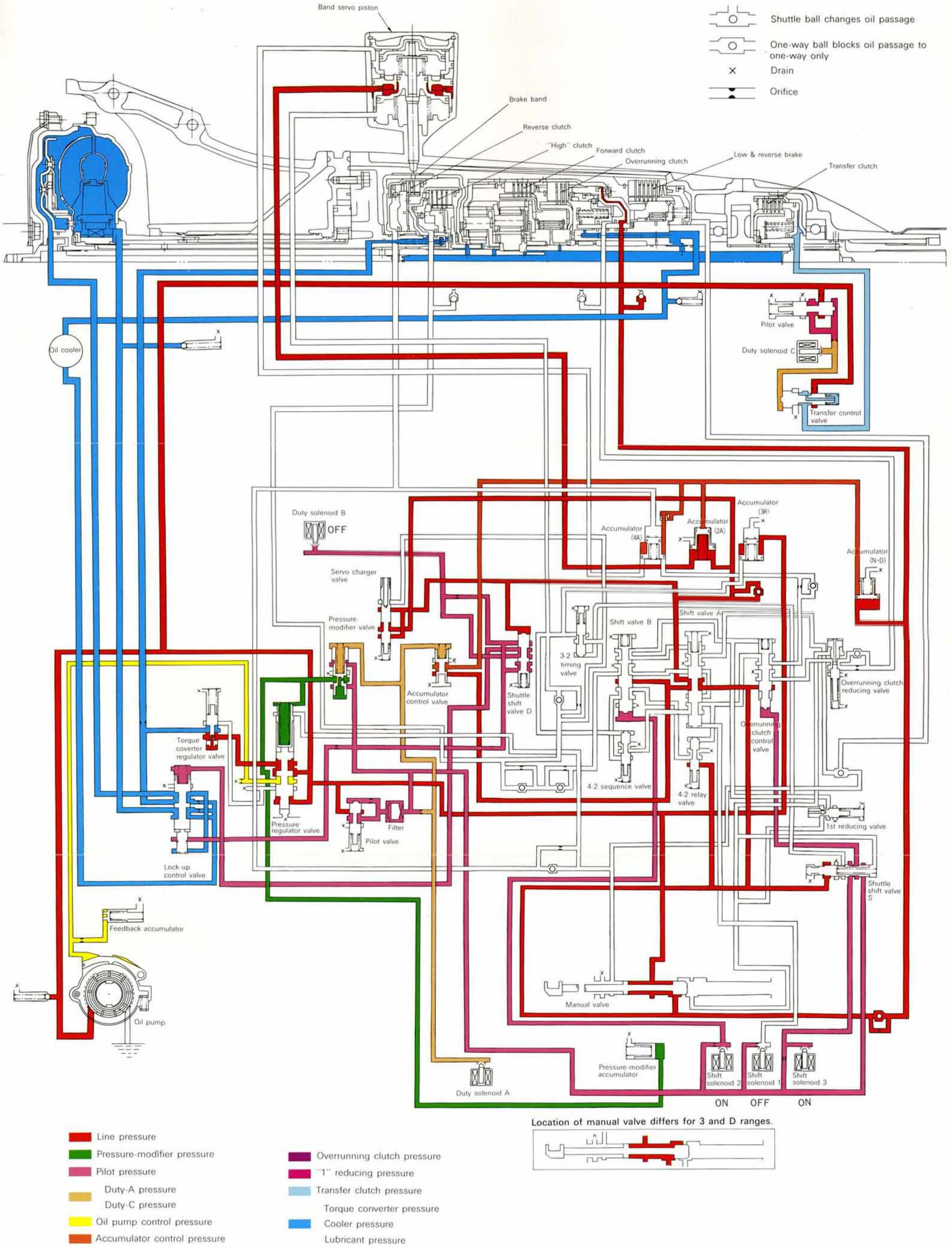
Location of manual valve differs for 3 and D ranges.



- Line pressure
- Pressure-modifier pressure
- Pilot pressure
- Duty-A pressure
- Duty-C pressure
- Oil pump control pressure
- Accumulator control pressure
- Overrunning clutch pressure
- "1" reducing pressure
- Transfer clutch pressure
- Torque converter pressure
- Cooler pressure
- Lubricant pressure

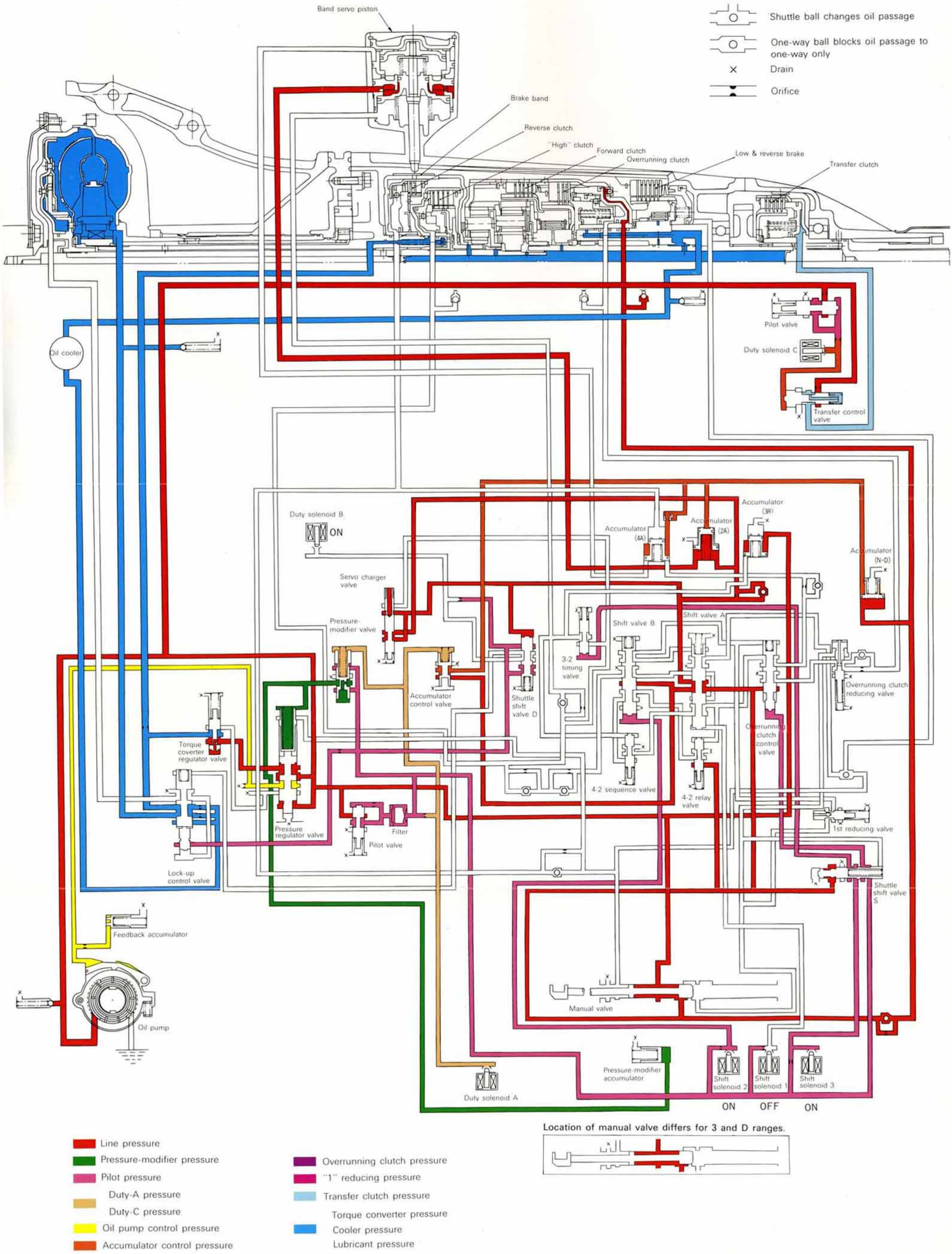
3-2 73d

4 Second speed of D or 3 range

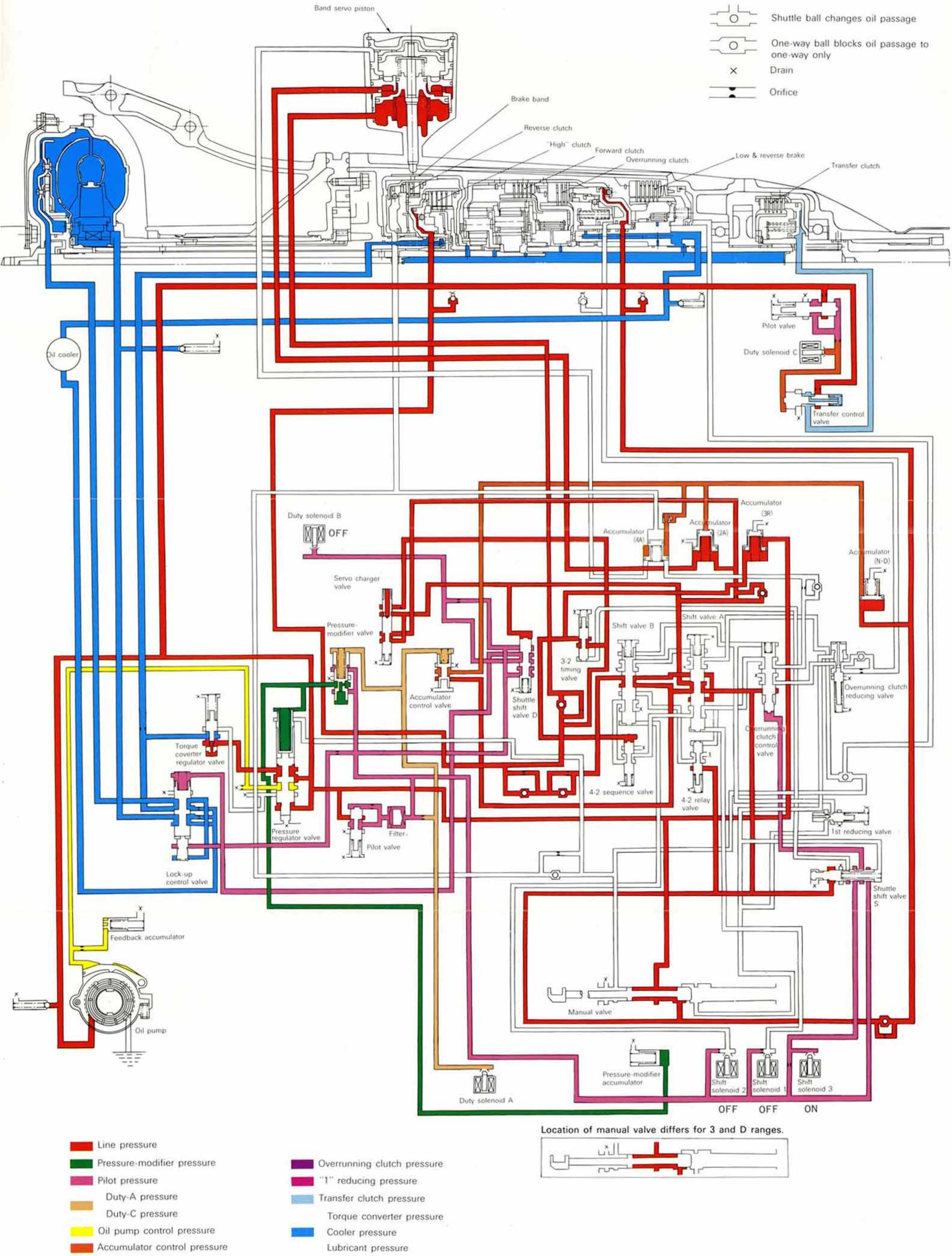


Location of manual valve differs for 3 and D ranges.

5 Second speed of D or 3 range at lock-up



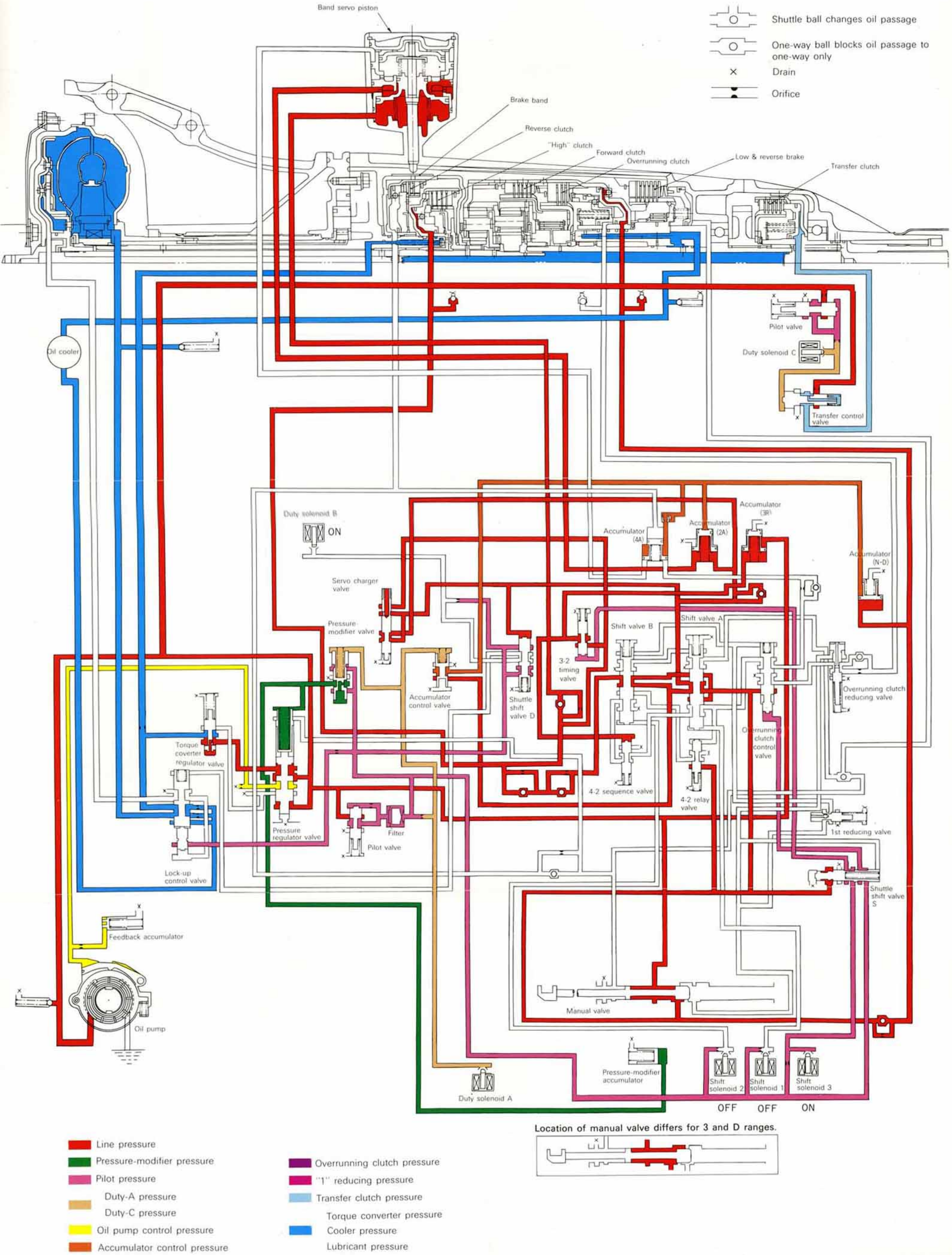
6 Third speed of D or 3 range



Location of manual valve differs for 3 and D ranges.

- Line pressure
- Pressure-modifier pressure
- Pilot pressure
- Duty-A pressure
- Duty-C pressure
- Oil pump control pressure
- Accumulator control pressure
- Overrunning clutch pressure
- "1" reducing pressure
- Transfer clutch pressure
- Torque converter pressure
- Cooler pressure
- Lubricant pressure

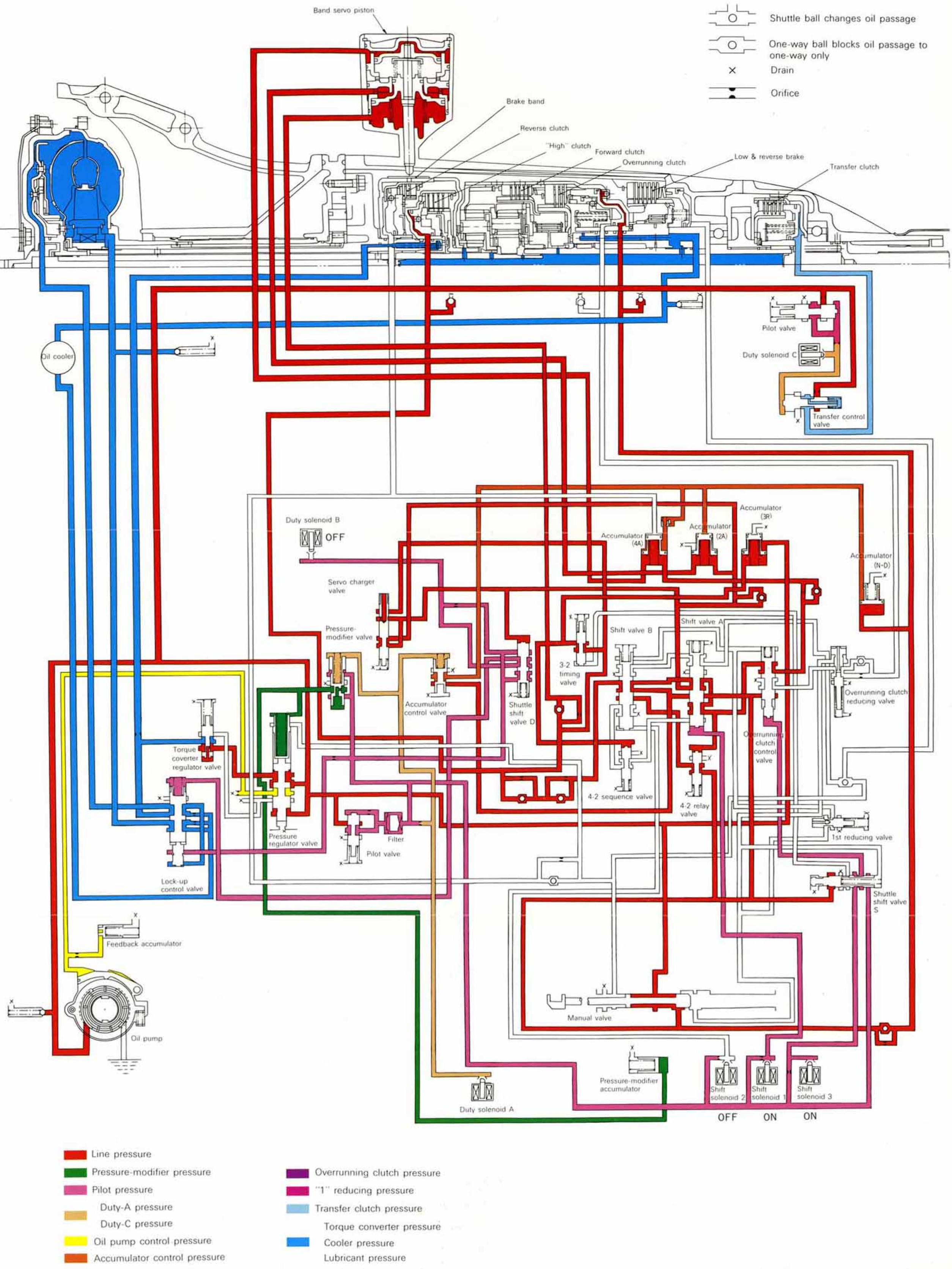
7 Third speed of D or 3 range at lock-up



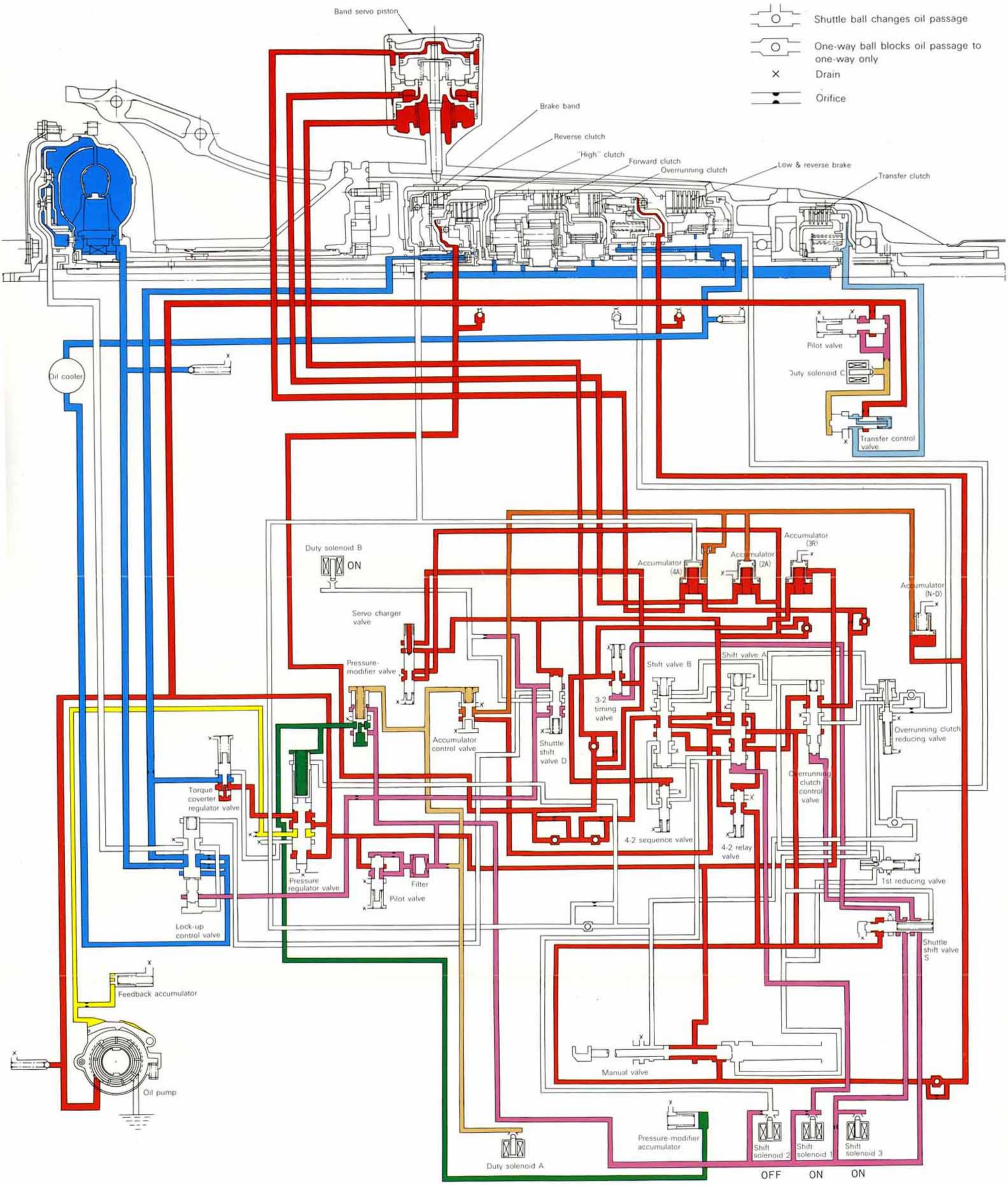
Location of manual valve differs for 3 and D ranges.

- Line pressure
- Pressure-modifier pressure
- Pilot pressure
- Duty-A pressure
- Duty-C pressure
- Oil pump control pressure
- Accumulator control pressure
- Overrunning clutch pressure
- "1" reducing pressure
- Transfer clutch pressure
- Torque converter pressure
- Cooler pressure
- Lubricant pressure

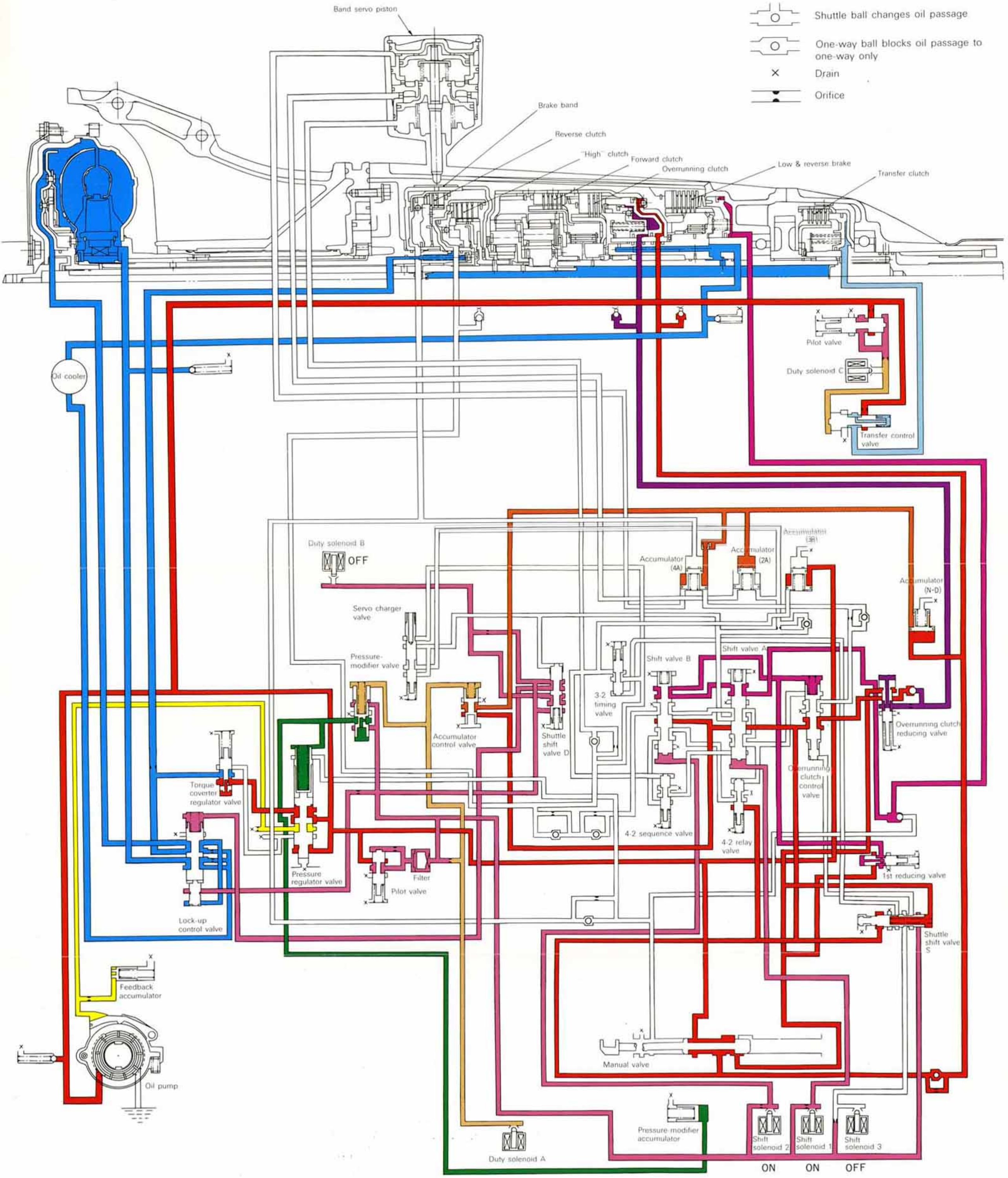
8 D range fourth speed



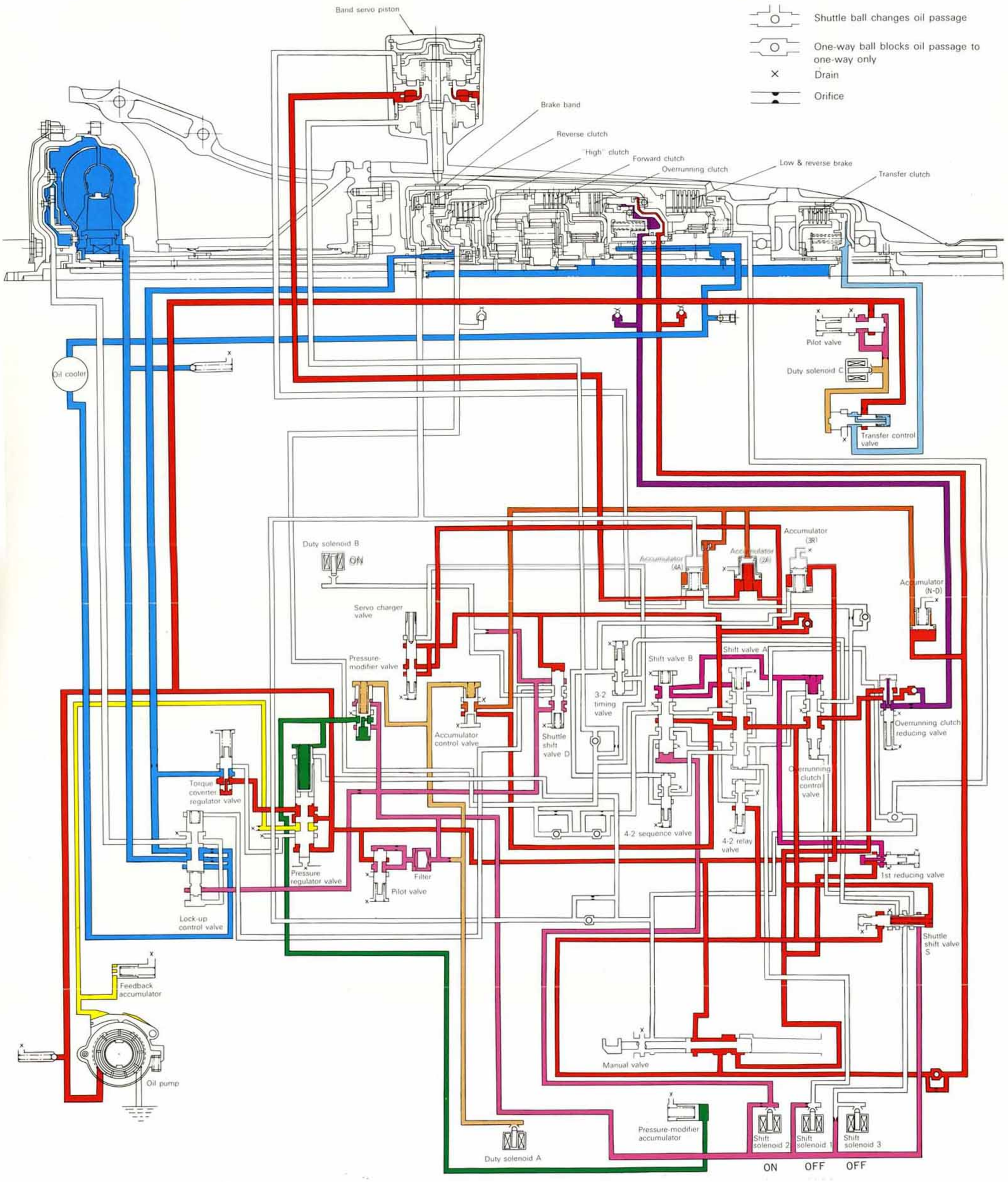
9 D range fourth speed at lock-up



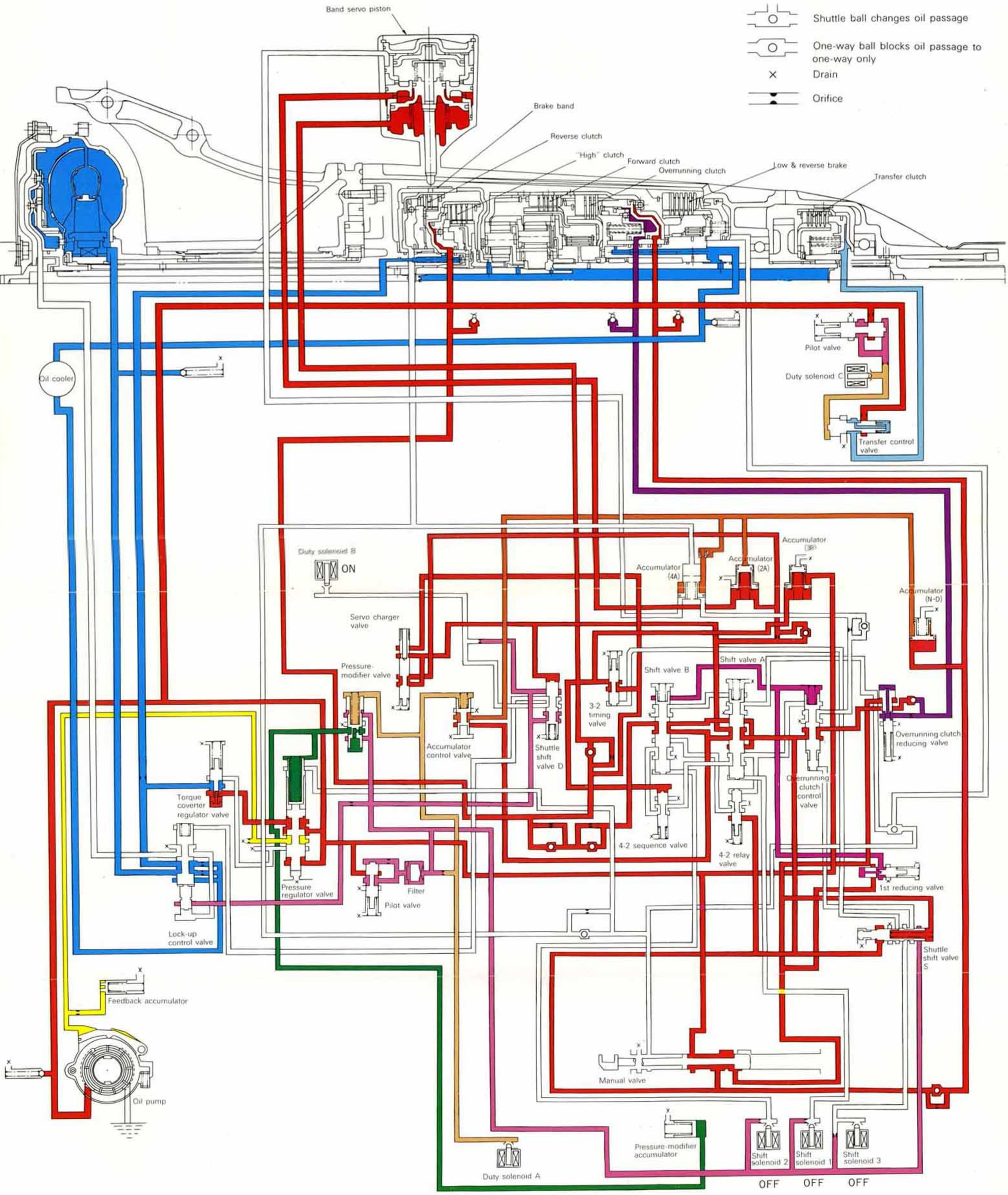
10 First speed of 2 range or 1st hold range



11 Second speed of 2 range or 1st hold at lock-up



12 Third speed of 2 range or 1st hold at lock-up



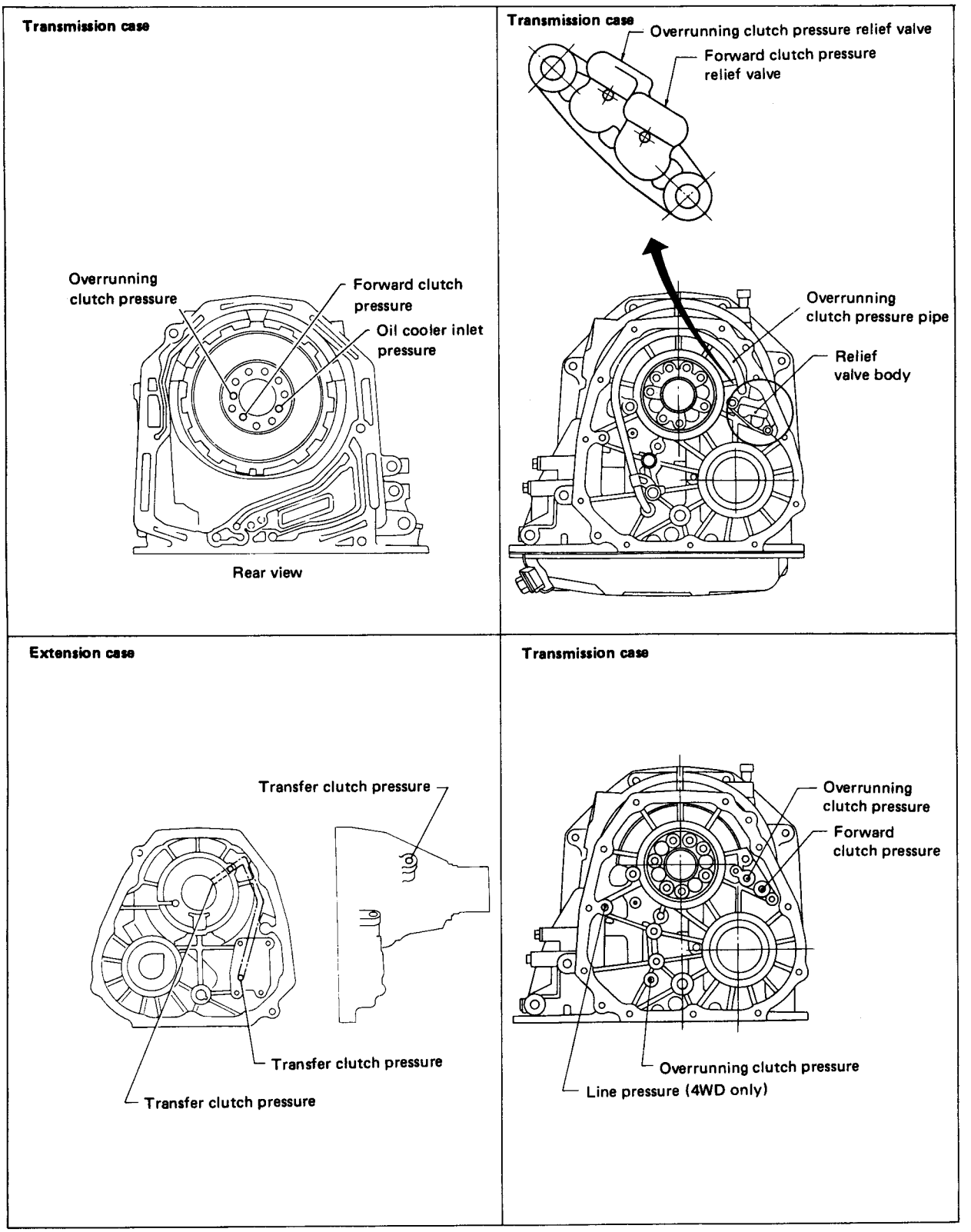


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Fig. 99 Transmission case

6 Range Select Mechanism

The range select mechanism consists of a select lever (on the floor/center console in the driver's compartment), push-pull cable, linkages, manual valve, parking pawl, etc.
When the select lever is moved either forward or backward, the push-pull cable moves in the corresponding direction. This turns the manual shaft by way of the range select lever. At this point, the pin at the end of the range select lever turns the inhibitor switch arm to transmit a range signal to the control unit.

A manual plate and manual lever are attached to the manual shaft. The manual plate is fan-shaped and is provided with six grooves on its edge corresponding to shift ranges (from "P" to "2"). A detent spring roller fits into the groove corresponding to the range selected. This regulates effort required to operate the select lever.
A hydraulically controlled manual valve is installed on the lower pin of the manual lever. It slides in response to rotation of the manual shaft, thereby selecting an oil passage inside the lower valve body in response to the position (P, R, N, D, 3 or 2) of the select lever.
A parking rod located on the upper portion of the lever mechanically holds the output shaft when the select lever is shifted to "P".

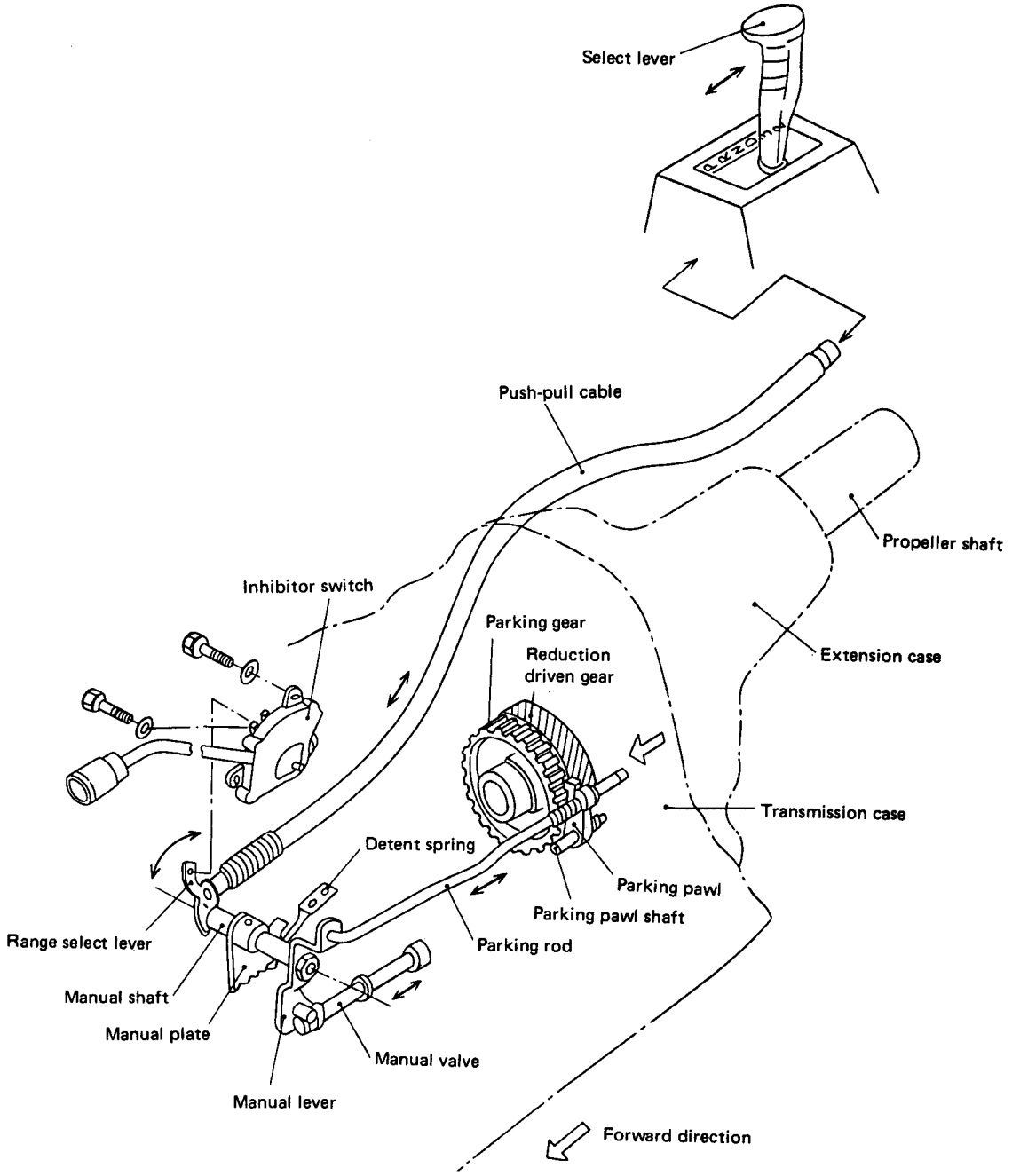


Fig. 100

7 Parking Mechanism

The end of the parking pawl engages mechanically with the gear groove of the parking gear. This gear is spline-fitted to the drive pinion shaft.
When the select lever is set to "P", the manual lever connected to the manual shaft turns, moving the parking rod backward. A cam and spring are installed on the rear of the parking rod. The parking cam slides freely on the parking rod. The parking rod and cam contact the "V" groove of the actuator (secured to the transmission case) and the back of the parking pawl.

With this arrangement, when the parking rod moves backward, the cam moves to the back of the parking pawl and the "V" groove of the actuator. The parking pawl turns in the direction of the parking gear using the parking pawl shaft as a pivot. It then engages with the parking gear groove.
If the end of the parking pawl rides over the tooth of the parking gear so that the parking cam does not move midway between the pawl and actuator, the parking rod will move to "P". This compresses the parking spring so that the parking cam is ready to move to "P". Under this condition, if the vehicle moves slightly, the parking gear will rotate to engage the pawl completely.
Except for the P range, the parking pawl is tensed by the parking pawl return spring in the direction that moves away from the parking gear.

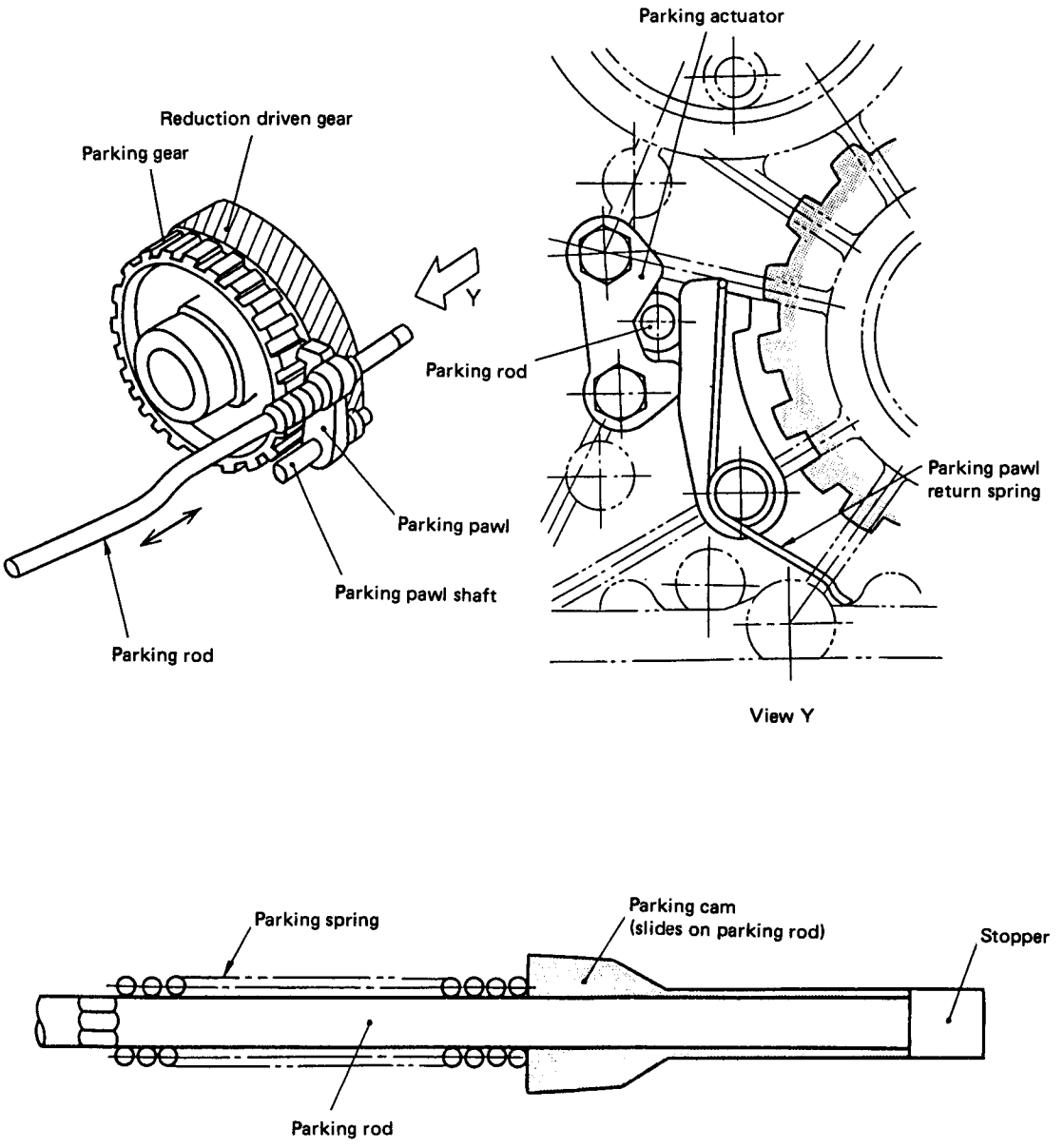
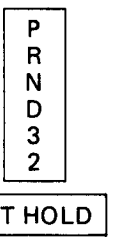


Fig. 101

SPECIFICATIONS AND SERVICE DATA

1 Specifications

				1800 cc	2700 cc
Torque converter	Type			Symmetric, 3-element, single stage, 2 phase torque converter coupling	
	Stall torque ratio			2.4 – 2.5	2.2 – 2.3
	Nominal diameter			246 mm (9.69 in)	
	Stall speed (at sea level)			2,450 – 2,850 rpm	2,400 – 2,800 rpm
	One-way clutch			Sprag type one-way clutch	
Automatic transmission	Transmission	Type		4-forward, 1-reverse, double-row planetary gears	
		Control element	Multi-plate clutch	4 sets	
			Multi-plate brake	1 set	
			Band brake	1 set	
			One-way clutch (sprag type)	2 sets	
		Gear ratio	1st	2.785	
			2nd	1.545	
			3rd	1.000	
			4th	0.694	
			Reverse	2.272	
		Tooth number of planetary gear	Front sun gear	33	
			Front pinion	21	
			Front internal gear	75	
			Rear sun gear	42	
			Rear pinion	17	
			Rear internal gear	75	
		Selector pattern			

				1800 cc	2700 cc
Automatic transmission	Transmission	Selector position	P (Park)	Transmission in neutral, output member immovable, and engine start possible	
			R (Reverse)	Transmission in reverse for backing	
			N (Neutral)	Transmission in neutral, and engine start possible	
			D (Drive)	Automatic gear change 1st ⇄ 2nd ⇄ 3rd ⇄ 4th	
			3 (3rd)	Automatic gear change 1st ⇄ 2nd ⇄ 3rd	
			2 (2nd)	Automatic gear change 1st ⇄ 2nd ← 3rd	
			1st Hold	1st gear locked (Deceleration 3rd → 2nd → 1st possible)	
		Control method		Hydraulic remote control	
	Oil pump	Type		Variable-capacity type vane pump	
		Driving method		Driven by engine	
		Number of vanes		9 pieces	
	Hydraulic control	Type		Electronic/hydraulic control [Four forward speed changes by electrical signals of car speed and accelerator (throttle) opening]	
		Fluid		Automatic transmission fluid (ATF) DEXRON II	
		Fluid capacity		9.3ℓ (9.8 US qt, 8.2 Imp qt)	FWD: 9.3ℓ (9.8 US qt, 8.2 Imp qt) 4WD: 9.5ℓ (10.0 US qt, 8.4 Imp qt)
	Lubrication	Lubrication system		Forced feed lubrication with oil pump	
		Oil		Automatic transmission fluid (above-mentioned)	
	Cooling	Cooling system		Liquid-cooled cooler incorporated in radiator	
	Harness	Inhibitor switch		11 poles	
		Transmission harness		11 poles	10 poles
		Resolution sensor		–	3 poles
Transfer	Transfer clutch			–	Hydraulic multi-plate clutch
	Control method			–	Electronic, hydraulic type
	Lubricant			–	The same Automatic transmission fluid used in Automatic transmission
	1st reduction gear ratio			1.000 (47/47)	
Final reduction	Final gear ratio		Front drive	3.900 (39/10)	3.700 (37/10)
			Rear drive	–	3.700 (37/10)
	Speedometer gear ratio			0.840 (21/25)	FWD: 0.869 (20/23) 4WD: 0.840 (21/25)
	Lubrication oil			API, GL-5	
	Oil capacity		Front drive	1.4ℓ (3.0 US pt, 2.5 Imp pt)	
			Rear drive	–	0.8ℓ (1.7 US pt, 1.4 Imp pt)
ATF cooling system	Radiation capacity			1.454 kW (1,250 kcal/h, 4,960 BTU/h)	

2 Location and Dimension of Adjusting Parts

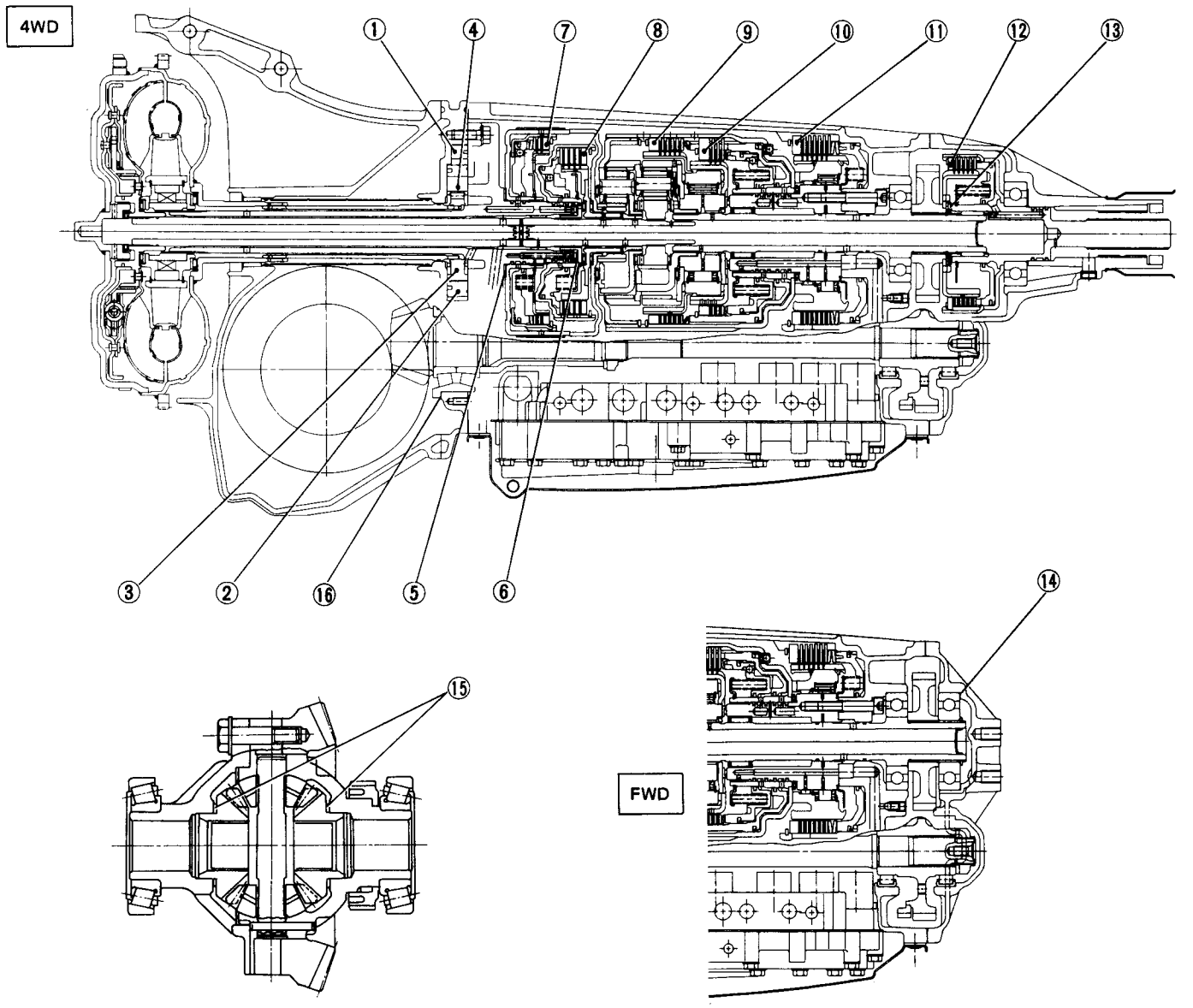
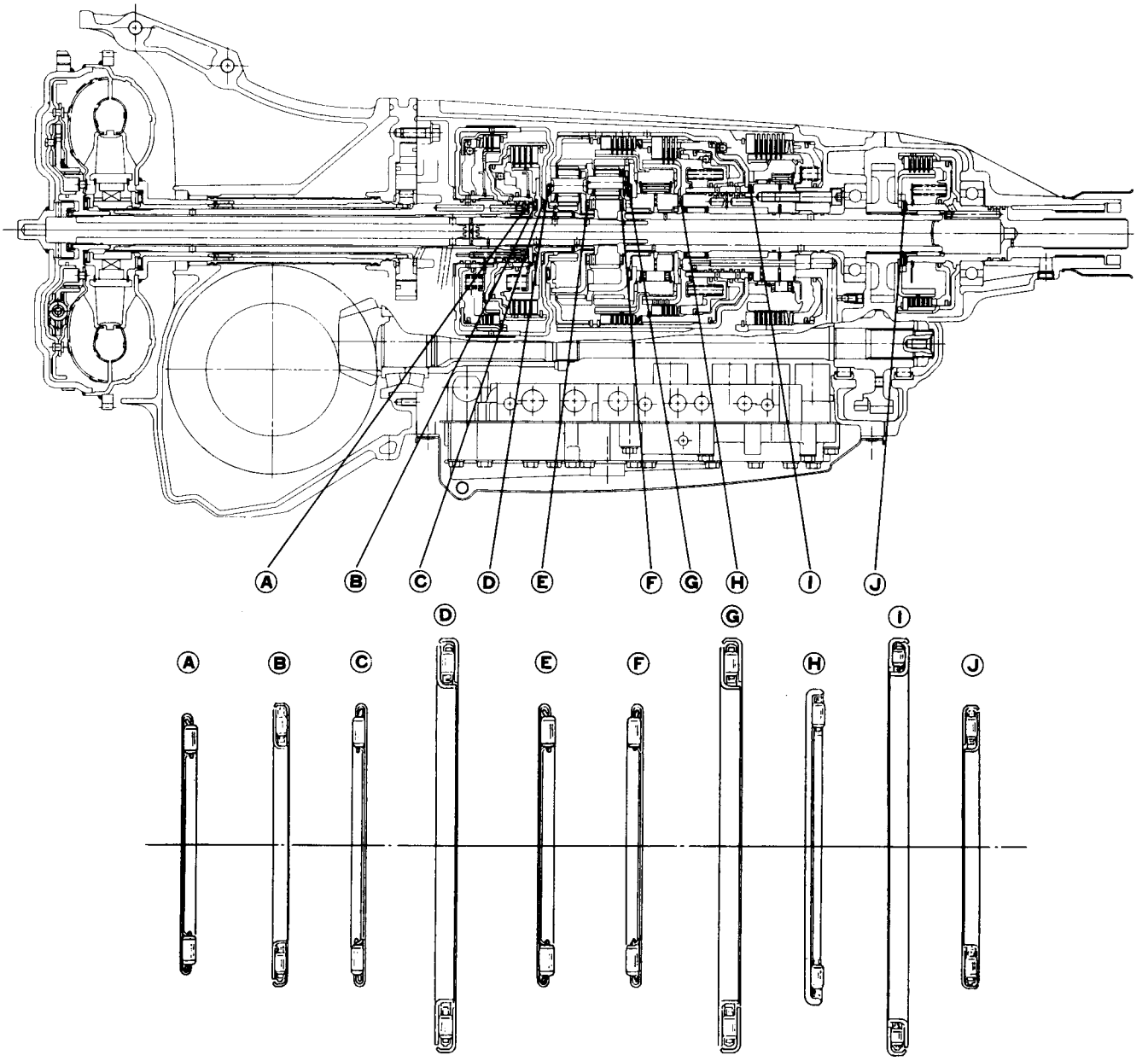


Fig. 102

No.	Part Name	Part Number	Dimension mm (in)	Application
1	CONTROL PISTON	31235AA000 – 030	$13.5\ ^{-0.030}_{-0.037}$ ($0.5315\ ^{-0.0012}_{-0.0015}$), $13.5\ ^{-0.023}_{-0.030}$ ($0.5315\ ^{-0.0009}_{-0.0012}$), $13.5\ ^{-0.016}_{-0.023}$ ($0.5315\ ^{-0.0006}_{-0.0009}$), $13.5\ ^{-0.009}_{-0.016}$ ($0.5315\ ^{-0.0004}_{-0.0006}$)	Adjusting side clearance of oil pump
2	CAM RING	31241AA000 – 030	$17\ ^{-0.010}_{-0.017}$ ($0.6693\ ^{-0.0004}_{-0.0007}$), $17\ ^{-0.003}_{-0.010}$ ($0.6693\ ^{-0.0001}_{-0.0004}$), $17\ ^{+0.004}_{-0.003}$ ($0.6693\ ^{+0.0002}_{-0.0001}$), $17\ ^{+0.011}_{+0.004}$ ($0.6693\ ^{+0.0004}_{+0.0002}$)	Adjusting side clearance of oil pump
3	VANE (Oil pump)	31243AA000 – 030	$17\ ^{-0.030}_{-0.037}$ ($0.6693\ ^{-0.0012}_{-0.0015}$), $17\ ^{-0.023}_{-0.030}$ ($0.6693\ ^{-0.0009}_{-0.0012}$), $17\ ^{-0.016}_{-0.023}$ ($0.6693\ ^{-0.0006}_{-0.0009}$), $17\ ^{-0.009}_{-0.016}$ ($0.6693\ ^{-0.0004}_{-0.0006}$)	Adjusting side clearance of oil pump
4	ROTOR (Oil pump)	31240AA000 – 030	$17\ ^{-0.030}_{-0.037}$ ($0.6693\ ^{-0.0012}_{-0.0015}$), $17\ ^{-0.023}_{-0.030}$ ($0.6693\ ^{-0.0009}_{-0.0012}$), $17\ ^{-0.016}_{-0.023}$ ($0.6693\ ^{-0.0006}_{-0.0009}$), $17\ ^{-0.009}_{-0.016}$ ($0.6693\ ^{-0.0004}_{-0.0006}$)	Adjusting side clearance of oil pump
5	THRUST WASHER (Reverse clutch)	31299AA000 – 060	0.7, 0.9, 1.1, 1.3, 1.5, 1.7, 1.9 (0.028, 0.035, 0.043, 0.051, 0.059, 0.067, 0.075)	Adjusting end play of reverse clutch drum
6	BEARING RACE	803031021 – 27	0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0 (0.031, 0.039, 0.047, 0.055, 0.063, 0.071, 0.079)	Adjusting total end play
7	RETAINING PLATE	31567AA000, 020 – 050	4.6, 4.8, 5.0, 5.2, 5.4 (0.181, 0.189, 0.197, 0.205, 0.213)	Adjusting clearance of reverse clutch
8	RETAINING PLATE	31567AA190 – 260	3.6, 3.8, 4.0, 4.2, 4.4, 4.6, .4.8, 5.0 (0.142, 0.150, 0.157, 0.165, 0.173, 0.181, 0.189, 0.197)	Adjusting clearance of high clutch
9	RETAINING PLATE	31567AA010, 060 – 110	8.0, 8.2, 8.4, 8.6, 8.8, 9.0, 9.2 (0.315, 0.323,0.331, 0.339, 0.346, 0.354, 0.362)	Adjusting clearance of forward clutch
10	RETAINING PLATE	31567AA120 – 180	8.0, 8.2, 8.4, 8.6, 8.8, 9.0, 9.2 (0.315, 0.323, 0.331, 0.339, 0.346, 0.354, 0.362)	Adjusting clearance of over-running clutch
11	RETAINING PLATE No. 2	31667AA180 – 250	6.5, 6.8, 7.1, 7.4, 7.7, 8.0, 8.2, 8.4, (0.256, 0.268, 0.280, 0.291, 0.303, 0.315, 0.323, 0.331)	Adjusting clearance of low & reverse clutch
12	PRESSURE PLATE (Front)	31593AA150 – 180	3.3, 3.7, 4.1, 4.5 (0.130, 0.146, 0.161, 0.177)	Adjusting clearance of transfer clutch
13	THRUST BEARING (35 x 53 x T)	806535020 – 090	3.8, 4.0, 4.2, 4.4, 4.6, 4.8, 5.0 (0.150, 0.157, 0.165, 0.173, 0.181, 0.189, 0.197)	Adjusting end play of transfer clutch
14	SHIM (Reduction gear)	31288AA000	0.15 (0.0059)	Adjusting end play of reduction drive gear
15	WASHER (38.1 x 50 x T)	803038021 – 023	0.95, 1.00, 1.05 (0.0374, 0.0394, 0.0413)	Adjusting backlash of differential bevel gear
16	DRIVE PINION SHIM	31451AA050 – 100	0.15, 0.175, 0.2, 0.225, 0.25, 0.275 (0.0059, 0.0069, 0.0079, 0.0089, 0.0098, 0.0108)	Adjusting drive pinion height

3 Location and Installing Direction of Thrust Needle Bearing and Washer

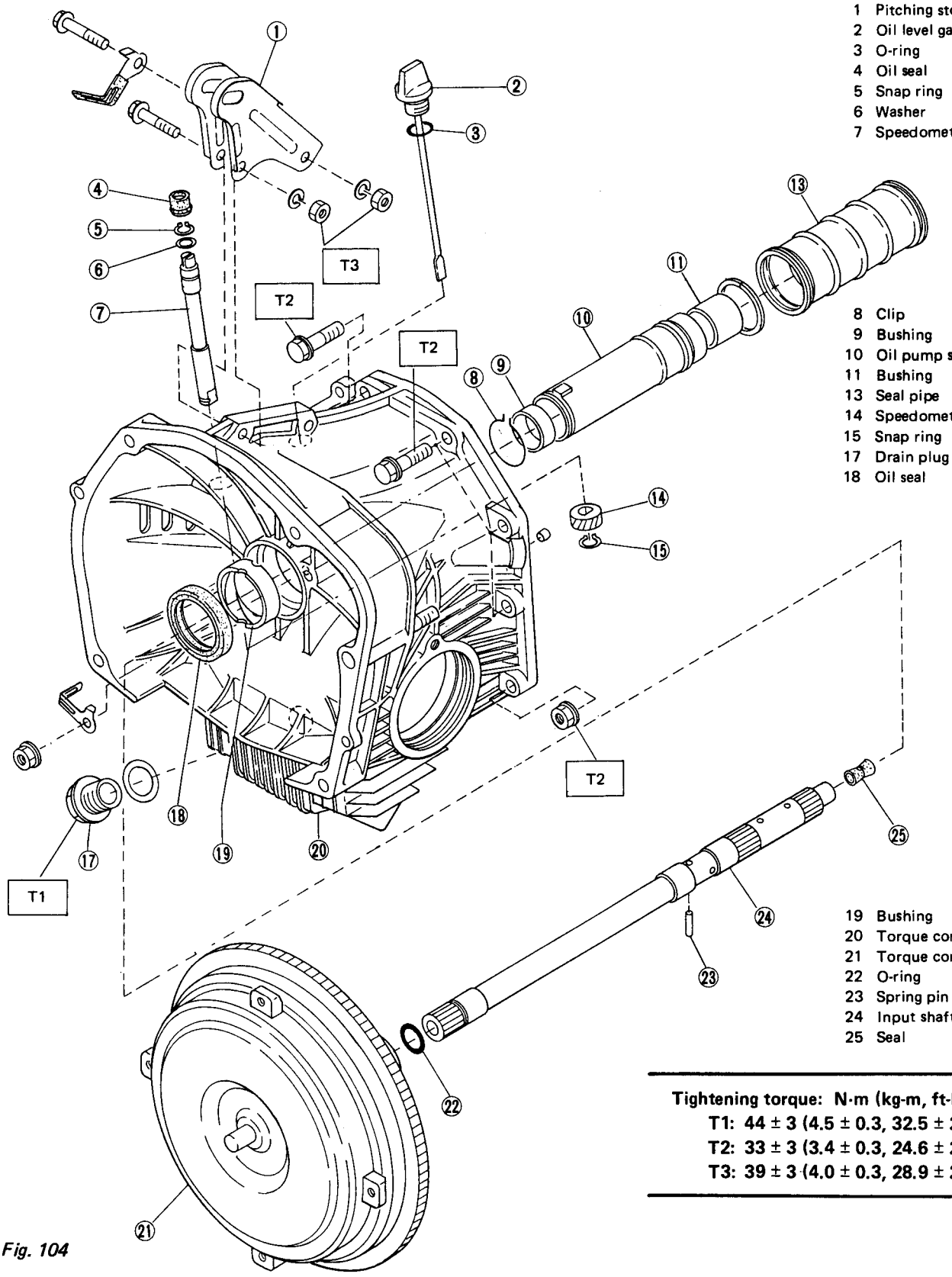


L3-954

Fig. 103

COMPONENT PARTS

Torque Converter and Converter Case



1 Pitching stopper bracket
2 Oil level gauge
3 O-ring
4 Oil seal
5 Snap ring
6 Washer
7 Speedometer shaft

8 Clip
9 Bushing
10 Oil pump shaft
11 Bushing
13 Seal pipe
14 Speedometer driven gear
15 Snap ring
17 Drain plug
18 Oil seal

19 Bushing
20 Torque converter case
21 Torque converter
22 O-ring
23 Spring pin
24 Input shaft
25 Seal

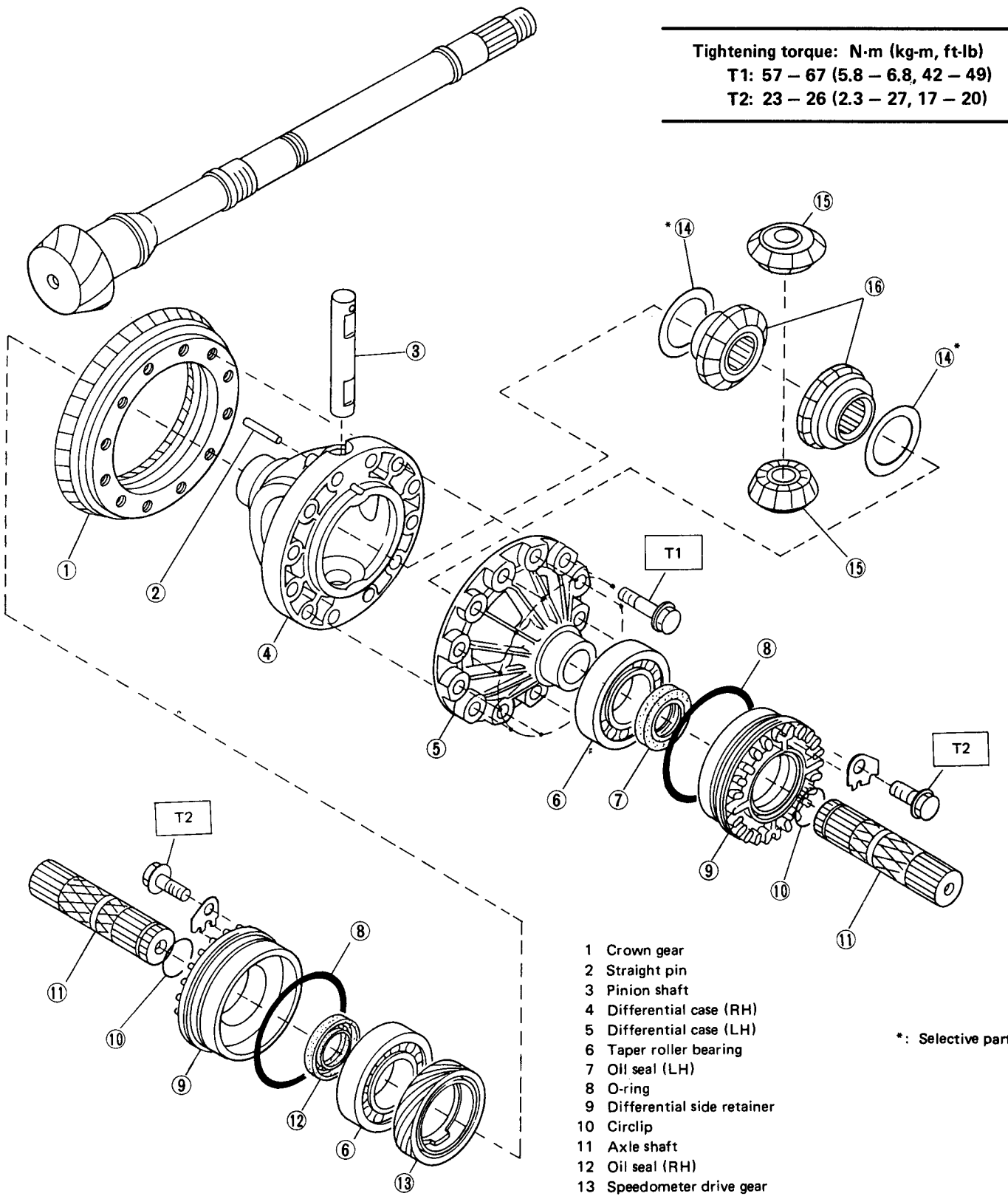
Tightening torque: N·m (kg-m, ft-lb)
T1: 44 ± 3 (4.5 ± 0.3, 32.5 ± 2.2)
T2: 33 ± 3 (3.4 ± 0.3, 24.6 ± 2.2)
T3: 39 ± 3 (4.0 ± 0.3, 28.9 ± 2.2)

Fig. 104

L3-807

Differential Case

Tightening torque: N·m (kg-m, ft-lb)
T1: 57 – 67 (5.8 – 6.8, 42 – 49)
T2: 23 – 26 (2.3 – 27, 17 – 20)



1 Crown gear
2 Straight pin
3 Pinion shaft
4 Differential case (RH)
5 Differential case (LH)
6 Taper roller bearing
7 Oil seal (LH)
8 O-ring
9 Differential side retainer
10 Circlip
11 Axle shaft
12 Oil seal (RH)
13 Speedometer drive gear
*14 Washer
15 Differential bevel pinion
16 Differential bevel gear

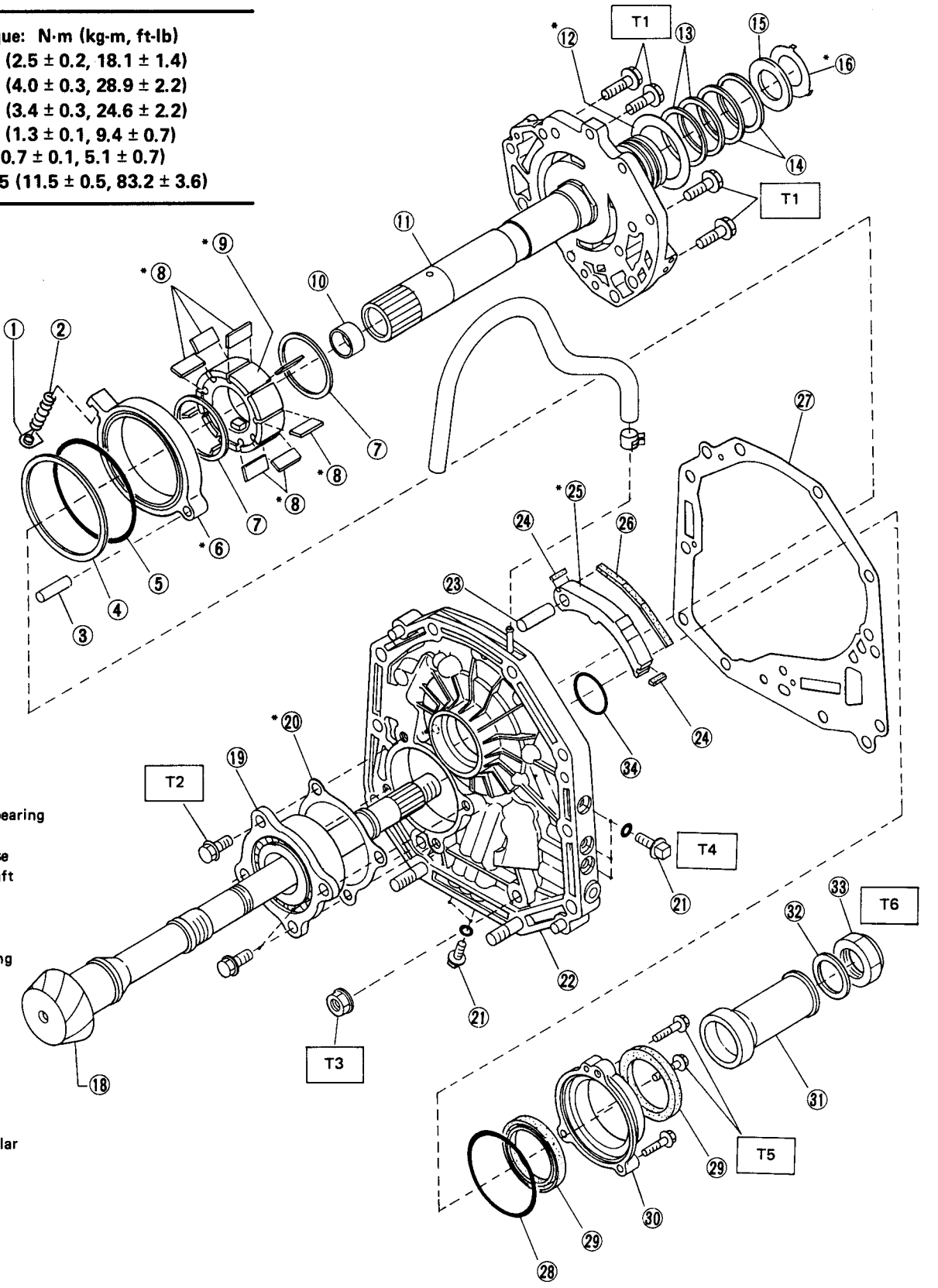
*: Selective parts

Fig. 105

L3-808

Oil Pump

Tightening torque: N·m (kg-m, ft-lb)
T1: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)
T2: 39 ± 3 (4.0 ± 0.3, 28.9 ± 2.2)
T3: 33 ± 3 (3.4 ± 0.3, 24.6 ± 2.2)
T4: 13 ± 1 (1.3 ± 0.1, 9.4 ± 0.7)
T5: 7 ± 1 (0.7 ± 0.1, 5.1 ± 0.7)
T6: 113 ± 5 (11.5 ± 0.5, 83.2 ± 3.6)

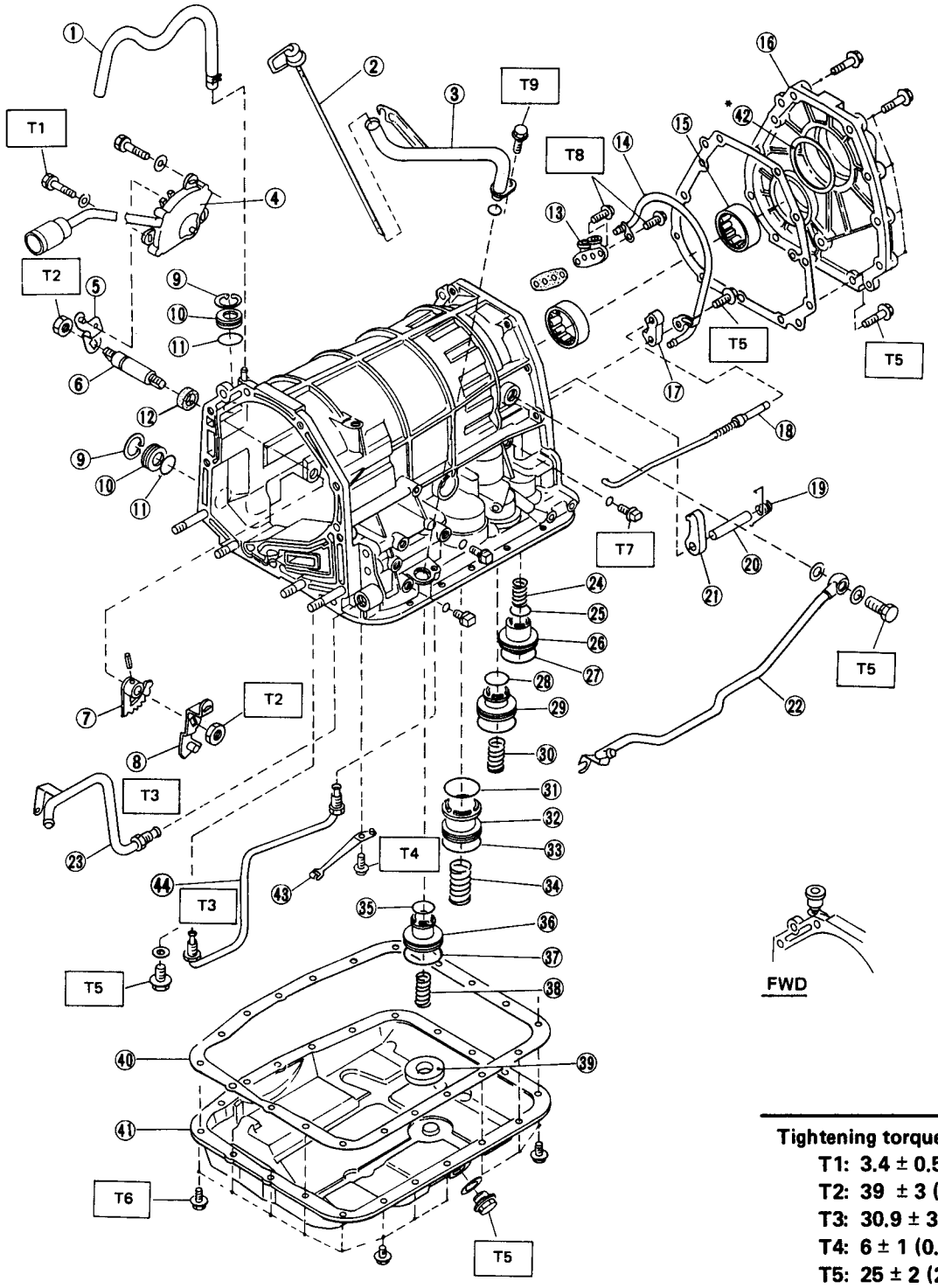


*: Selective parts

1 Retainer
2 Return spring
3 Pin
4 Friction ring
5 O-ring
*6 Cam ring
7 Vane ring
*8 Vane
*9 Rotor
10 Bushing
11 Oil pump cover
*12 Thrust washer
13 Seal ring (R)
14 Seal ring (H)
15 Thrust needle bearing
*16 Thrust washer
17 Air breather hose
18 Drive pinion shaft
19 Roller bearing
*20 Shim
21 Test plug
22 Oil pump housing
23 Pin
24 Side seal
*25 Control piston
26 Plane seal
27 Gasket
28 O-ring
29 Oil seal
30 Oil seal retainer
31 Drive pinion collar
32 Lock washer
33 Lock nut
34 O-ring

Fig. 106 L3-1017

Transmission Case, Transmission Cover and Control Device



*: Selective parts

1 Air breather hose
2 Oil level gauge
3 Oil charge pipe
4 Inhibitor switch
5 Range select lever
6 Manual shaft
7 Manual plate
8 Manual lever
9 Snap ring
10 Plug
11 O-ring
12 Oil seal
13 Releaf valve
14 Pipe
15 Roller bearing
16 Transmission cover (FWD)
17 Parking support
18 Parking rod
19 Return spring
20 Shaft
21 Parking pawl
22 Inlet pipe
23 Outlet pipe
24 Spring
25 O-ring
26 Accumulator piston (N-D)
27 O-ring
28 O-ring
29 Accumulator piston (2-3)
30 Spring
31 O-ring
32 Accumulator piston (1-2)
33 O-ring
34 Spring
35 O-ring
36 Accumulator piston (3-4)
37 O-ring
38 Spring
39 Magnet
40 Gasket
41 Oil pan
*42 Shim
43 Detent spring
44 Pipe

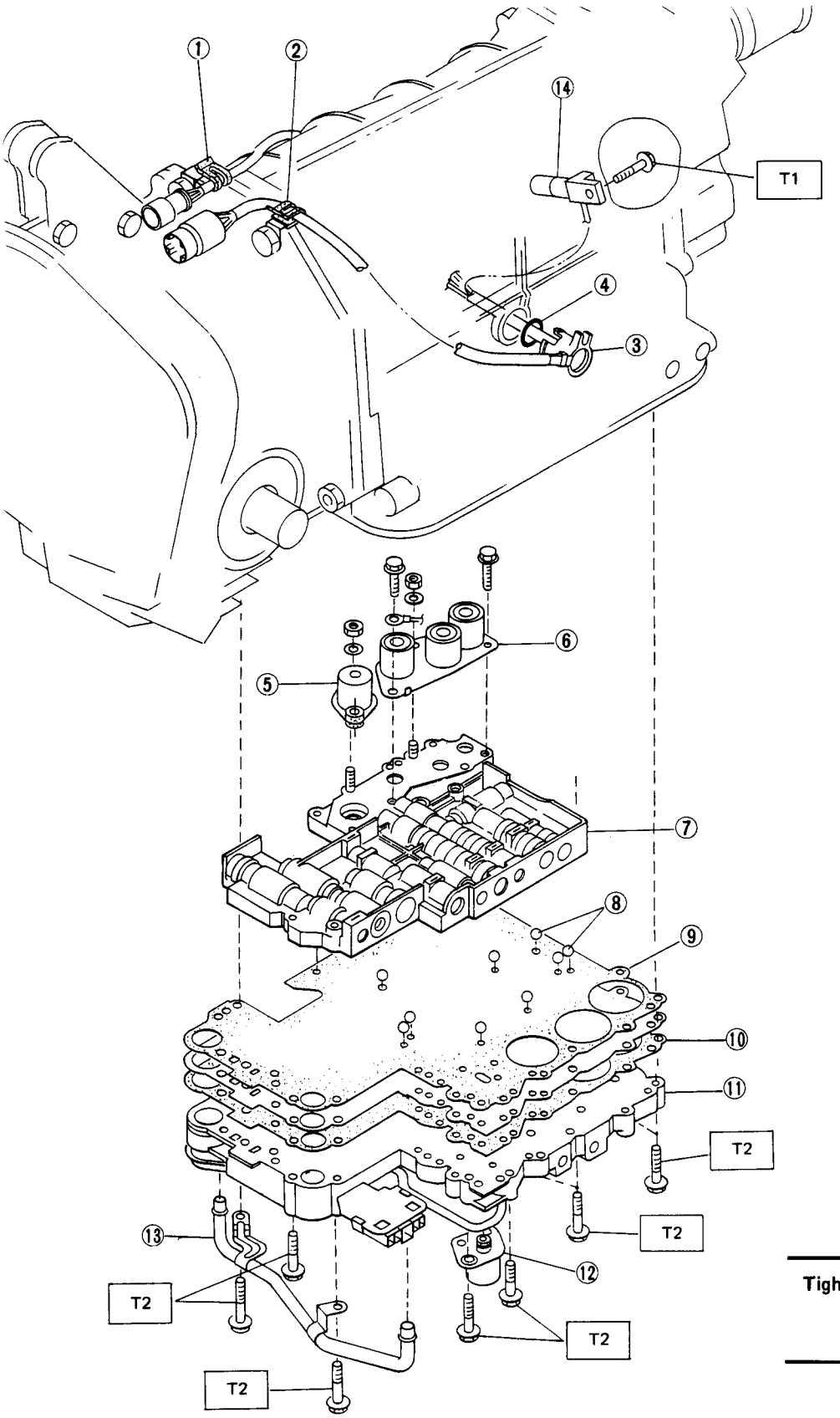
Tightening torque: N·m (kg-m, ft-lb)

T1: 3.4 ± 0.5 (0.35 ± 0.05, 2.5 ± 0.4)
T2: 39 ± 3 (4.0 ± 0.3, 28.9 ± 2.2)
T3: 30.9 ± 3.4 (3.15 ± 0.35, 22.8 ± 2.5)
T4: 6 ± 1 (0.6 ± 0.1, 4.3 ± 0.7)
T5: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)
T6: 3.9 ± 0.5 (0.4 ± 0.05, 2.9 ± 0.4)
T7: 13 ± 1 (1.3 ± 0.1, 9.4 ±0.7)
T8: 8 ± 1 (0.8 ± 0.1, 5.8 ± 0.7)
T9: 6.4 ± 0.5 (0.65 ± 0.05, 4.7 ± 0.4)

Fig. 107

L3-810

Control Valve and Harness Routing



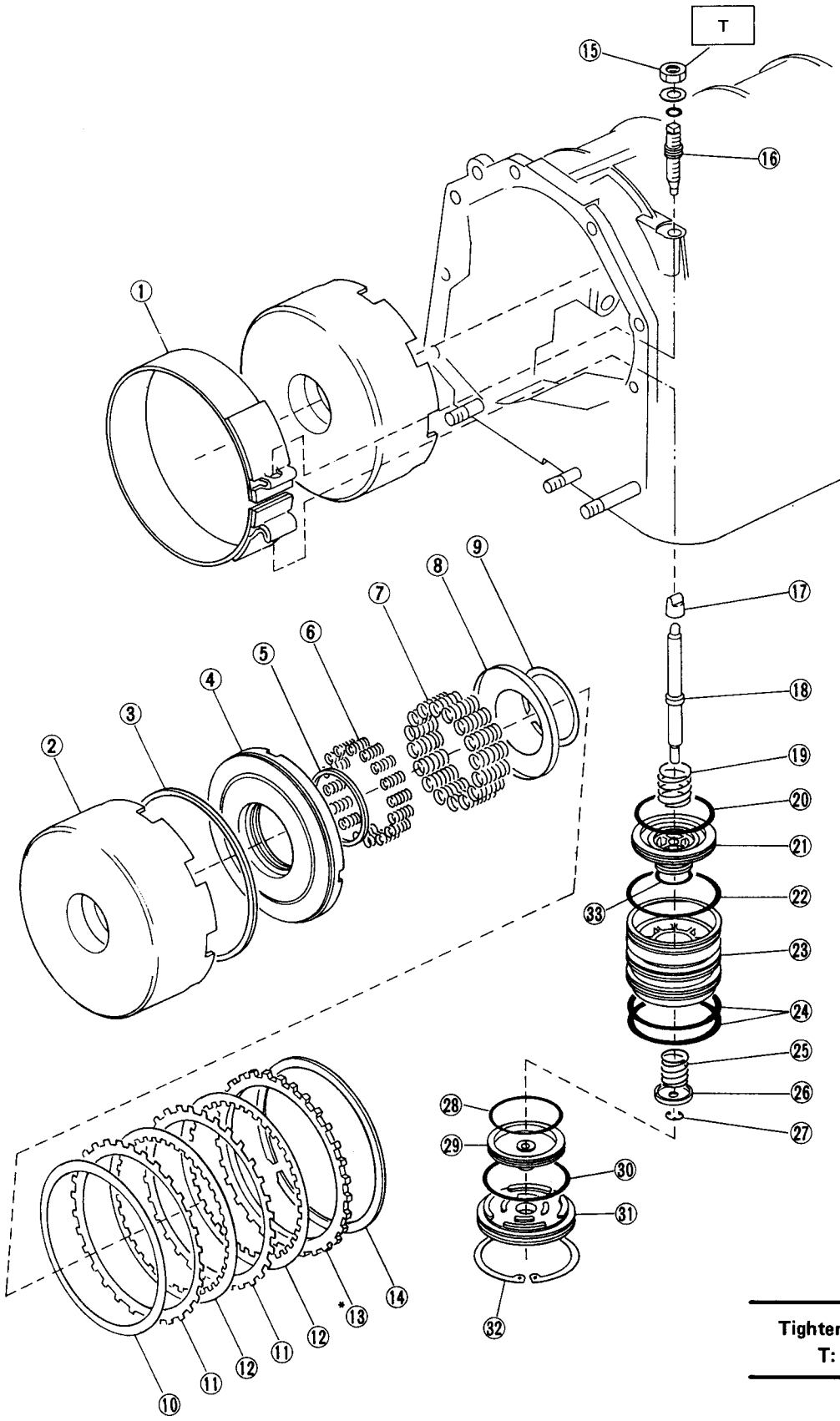
1 Clip
2 Clip
3 Transmission harness
4 O-ring
5 Duty sol. A (Line-pressure)
6 Sol. Assy
7 Upper valve body
8 Ball
9 Upper separator plate
10 Lower separator plate
11 Lower valve body
12 Duty sol. B (Lock-up)
13 Pipe
14 Revolution sensor (FWD)

Tightening torque: N·m (kg-m, ft-lb)
T1: 7 ± 1 (0.7 ± 0.1, 5.1 ± 0.7)
T2: 8 ± 1 (0.8 ± 0.1, 5.8 ± 0.7)

Fig. 108

L3-811

Reverse Clutch and Band Brake



*: Selective parts

1 Brake band
2 Reverse clutch drum
3 Lip seal
4 Piston
5 Lathe cut seal ring
6 Spring
7 Spring
8 Spring retainer
9 Snap ring
10 Dish plate
11 Driven plate
12 Drive plate
*13 Retaining plate
14 Snap ring
15 Lock nut
16 Brake band adjusting screw
17 Strut
18 Band servo piston stem
19 Spring
20 Lathe cut seal ring
21 Band servo piston (1-2)
22 O-ring
23 Retainer
24 O-ring
25 Spring
26 Retainer
27 Circlip
28 Lathe cut seal ring
29 Band servo piston (3-4)
30 O-ring
31 O.D. servo retainer
32 Snap ring
33 Lathe cut seal ring

Tightening torque: N·m (kg-m, ft-lb)
T: 25 – 28 (2.5 – 2.9, 18 ± 21)

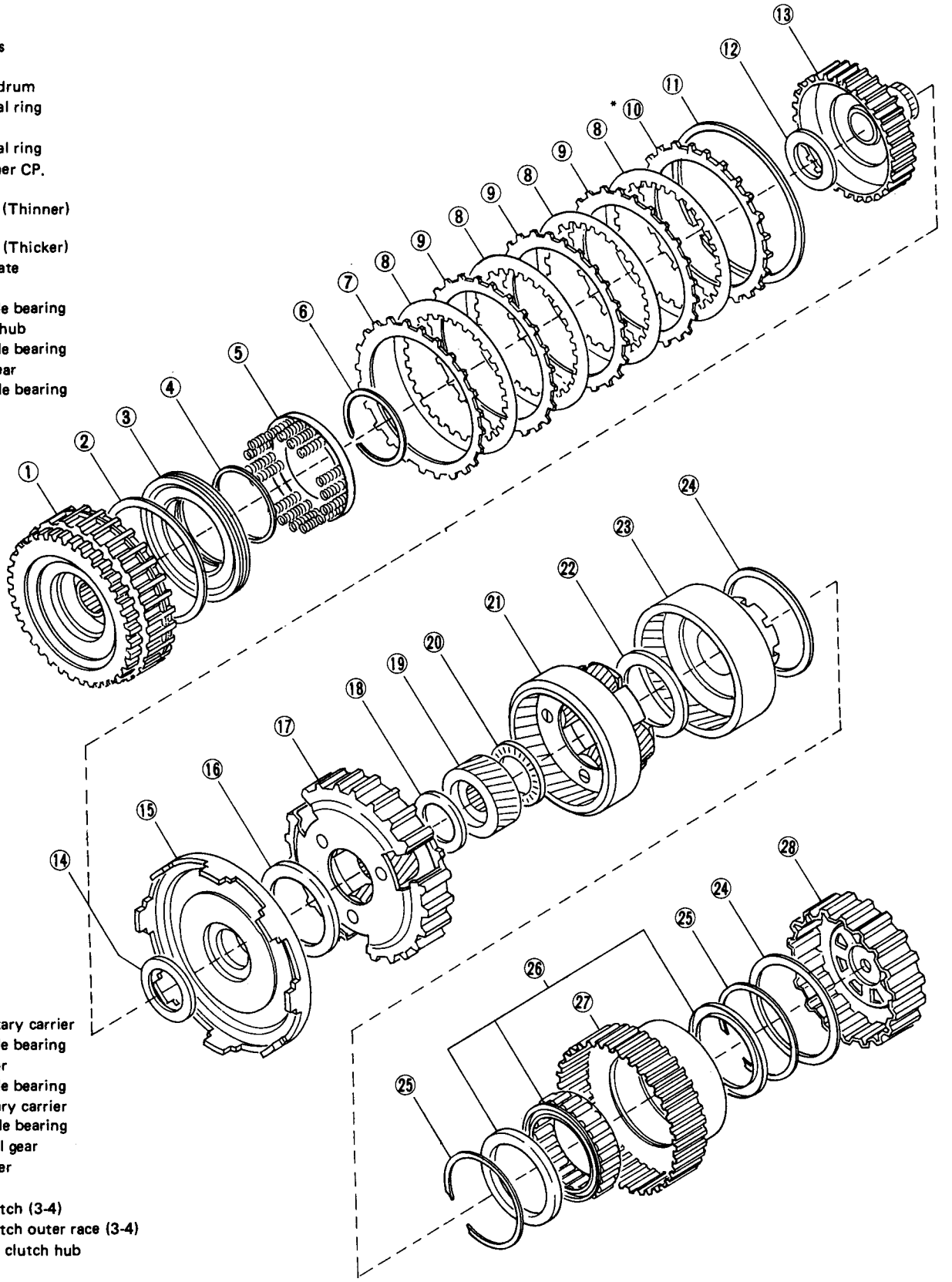
Fig. 109

L3-812

High Clutch and Planetary Gear

*: Selective parts

1 High clutch drum
2 Lathe cut seal ring
3 Piston
4 Lathe cut seal ring
5 Spring retainer CP.
6 Snap ring
7 Driven plate (Thinner)
8 Drive plate
9 Driven plate (Thicker)
*10 Retaining plate
11 Snap ring
12 Thrust needle bearing
13 High clutch hub
14 Thrust needle bearing
15 Front sun gear
16 Thrust needle bearing

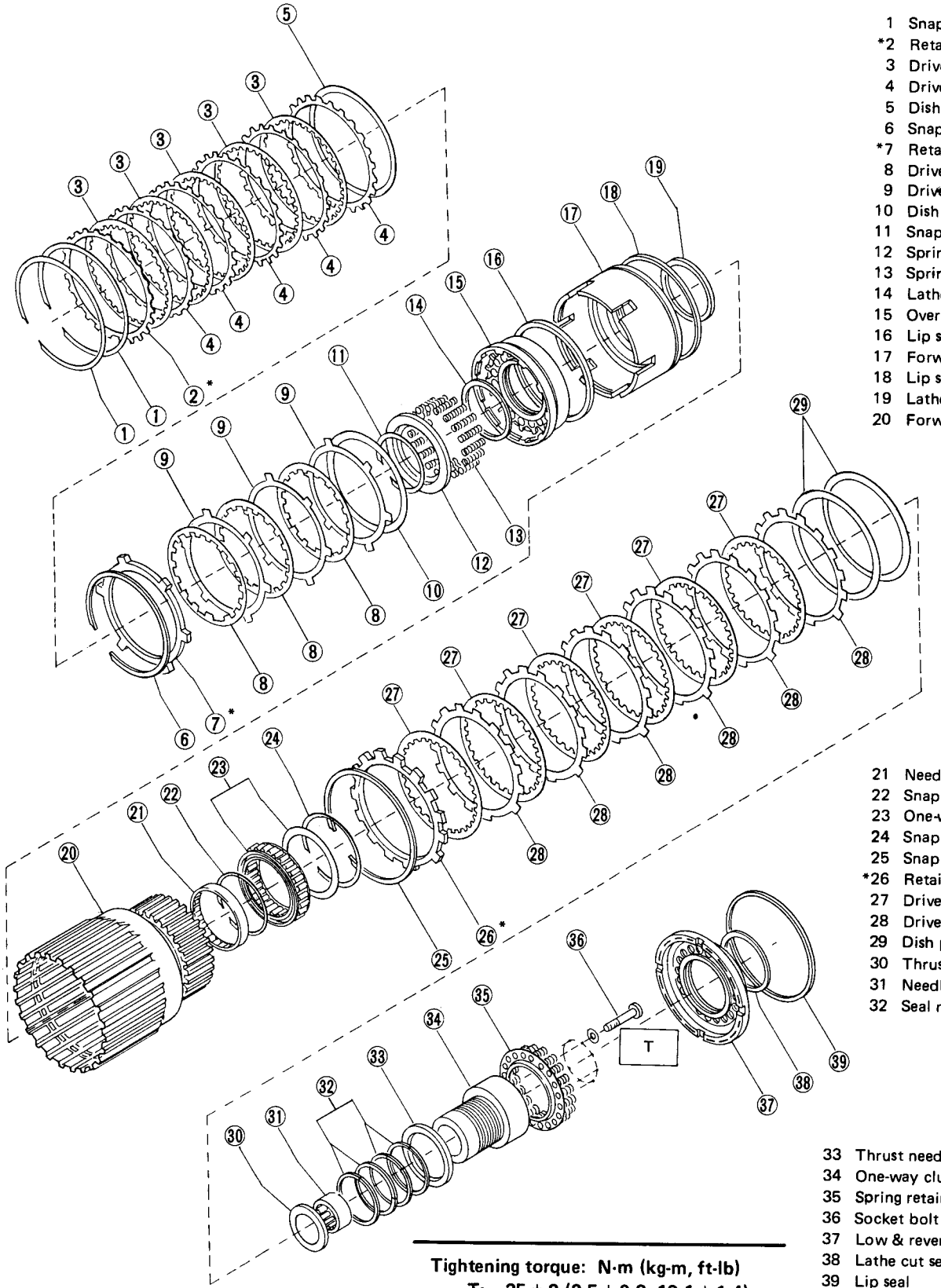


17 Front planetary carrier
18 Thrust needle bearing
19 Rear sun gear
20 Thrust needle bearing
21 Rear planetary carrier
22 Thrust needle bearing
23 Rear internal gear
24 Thrust washer
25 Snap ring
26 One-way clutch (3-4)
27 One-way clutch outer race (3-4)
28 Overrunning clutch hub

Fig. 110

L3-813

Forward Clutch and Low & Reverse Brake



1 Snap ring
*2 Retaining plate
3 Drive plate
4 Driven 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
13 Spring
14 Lathe cut seal ring
15 Overrunning piston
16 Lip seal
17 Forward piston
18 Lip seal
19 Lathe cut seal ring
20 Forward clutch drum

21 Needle bearing
22 Snap ring
23 One-way clutch (1-2)
24 Snap ring
25 Snap ring
*26 Retaining plate
27 Drive plate
28 Driven plate
29 Dish plate
30 Thrust needle bearing
31 Needle bearing
32 Seal ring

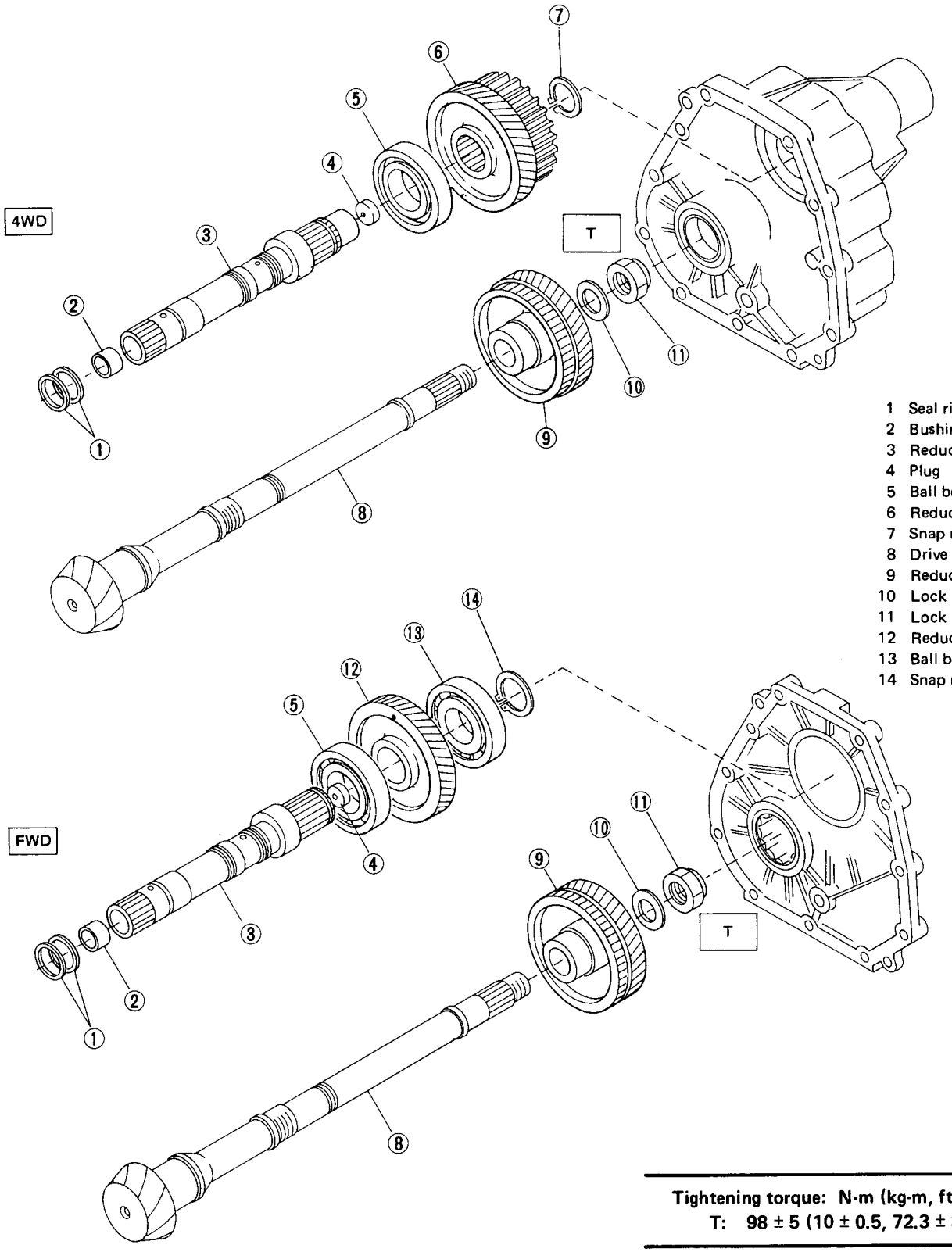
33 Thrust needle bearing
34 One-way clutch inner race (1-2)
35 Spring retainer CP.
36 Socket bolt
37 Low & reverse piston
38 Lathe cut seal ring
39 Lip seal

Tightening torque: N·m (kg-m, ft-lb)
T: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)

Fig. 111

L3-814

Reduction Gear



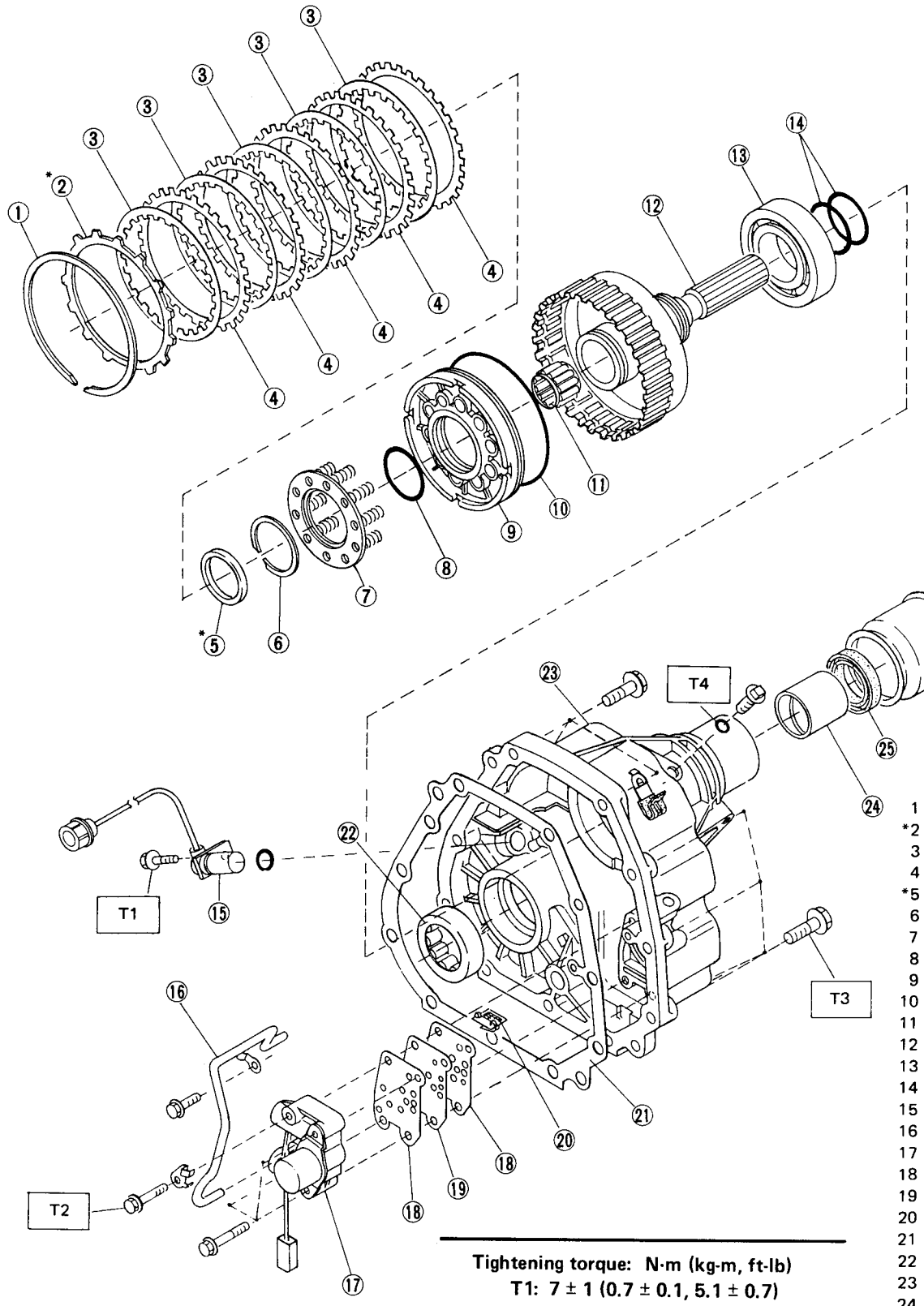
1 Seal ring
2 Bushing
3 Reduction drive shaft
4 Plug
5 Ball bearing
6 Reduction drive gear
7 Snap ring
8 Drive pinion shaft
9 Reduction driven gear
10 Lock washer
11 Lock nut
12 Reduction drive gear
13 Ball bearing
14 Snap ring

Tightening torque: N·m (kg-m, ft-lb)
T: 98 ± 5 (10 ± 0.5, 72.3 ± 3.6)

Fig. 112

L3-815

Transfer and Extension



*: Selective parts

1 Snap ring
*2 Pressure plate
3 Drive plate
4 Driven plate
*5 Thrust needle bearing
6 Snap ring
7 Spring retainer CP
8 Lathe cut seal ring
9 Transfer clutch piston
10 Lathe cut seal ring
11 Needle bearing
12 Rear drive shaft
13 Ball bearing
14 Seal ring
15 Revolution sensor (4WD)
16 Pilot valve pipe
17 Duty sol. C (transfer)
18 Gasket
19 Plate
20 Filter
21 Gasket
22 Roller bearing
23 Extension case
24 Bushing
25 Oil seal
26 Dust seal

Tightening torque: N·m (kg-m, ft-lb)
T1: 7 ± 1 (0.7 ± 0.1, 5.1 ± 0.7)
T2: 8 ± 1 (0.8 ± 0.1, 5.8 ± 0.7)
T3: 25 ± 1 (2.5 ± 0.1, 18.1 ± 0.7)
T4: 13 ± 1 (1.3 ± 0.1, 9.4 ± 0.7)

Fig. 113

L3-816

SERVICE PROCEDURE

1 General Precaution

When disassembling or assembling the automatic transmission, observe the following instructions.

1) Workshop

Provide a place that is clean and free from dust. Principally the conventional workshop is suitable except for a dusty place. In a workshop where grinding work, etc. which produces fine particles is done, make independent place divided by the vinyl curtain or the equivalent.

2) Worktable

The size of 1 x 1.5 m (40 x 60 in) is large enough to work, and it is more desirable that its surface be covered with flat plate like iron plate which is not rusted too much.

3) Cleaning of exterior

(1) Clean the exterior surface of transmission with steam and/or kerosene prior to disassembly, however it should be noted that vinyl tape be placed on the airbreather or oil level gauge to prevent infiltration of the steam into the transmission and also the cleaning job be done away from the place of disassembly and assembly.

(2) Partial cleaning will do, depending on the extent of disassembly (such as when disassembly is limited to some certain parts).

4) Disassembly, assembly and cleaning

(1) Disassemble and assemble the transmission while inspecting the parts in accordance with the Trouble-shooting.

(2) During job, don't use gloves.

Don't clean the parts with rags: Use chamois or nylon cloth.

(3) Pay special attention to the air to be used for cleaning.

Get the moisture and the dust rid of the air as much as possible.

Be careful not to scratch or dent any part while checking for proper operation with an air gun.

(4) Complete the job from cleaning to completion of assembly as continuously and speedily as possible in order to avoid occurrence of secondary troubles caused by dust. When stopping the job unavoidably cover the parts with clean chamois or nylon cloth to keep them away from any dust.

(5) Use kerosene, white gasoline or the equivalent as washing fluid.

Use always new fluid for cleaning the automatic transmission parts and never reuse. The used fluid is usable in disassemble and assemble work of engine and manual transmission.

(6) Although the cleaning should be done by dipping into the washing fluid or blowing of the pressurized washing fluid, the dipping is more desirable. (Do not rub with a brush.) Assemble the parts immediately after the cleaning without exposure to the air for a while. Besides in case of washing rubber parts, perform the job quickly not to dip them into the washing fluid for long time.

(7) Apply the automatic transmission fluid (ATF) onto the parts immediately prior to assembly, and the specified tightening torque should be observed carefully.

(8) Use vaseline if it is necessary to hold parts in the position when assembling.

(9) Drain ATF and differential gear oil into a saucer so that the conditions of fluid and oil can be inspected.

(10) Do not support axle drive shaft, stator shaft, input shaft or various pipes when moving transmission from one place to another.

(11) Always discard old oil seals and bushings, and install new ones.

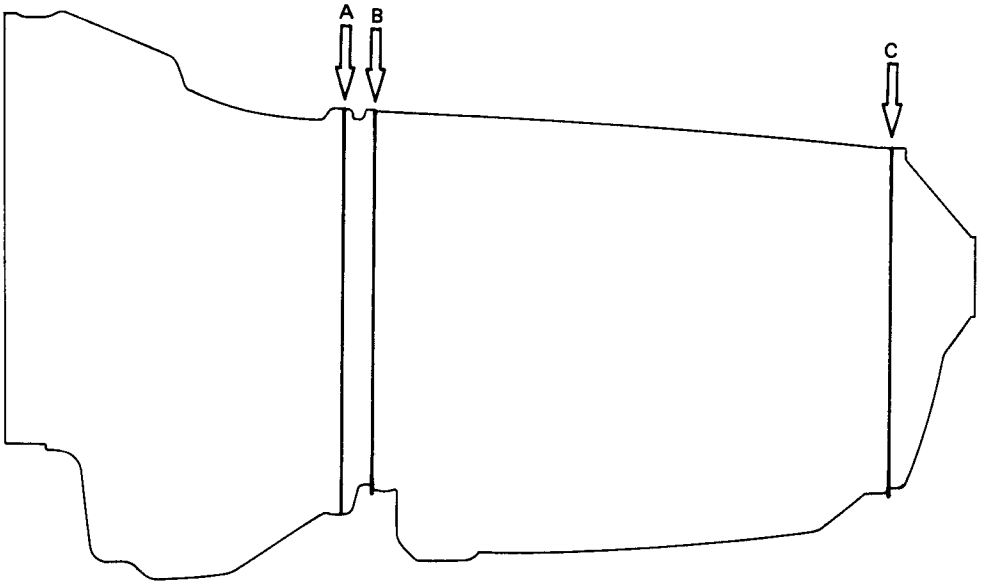
(12) Do not reuse old pipes, gaskets, plugs (1/8"), spring pins, etc.

Install new ones.

(13) Be sure to replace parts which are damaged, worn, scratched, discolored, etc.

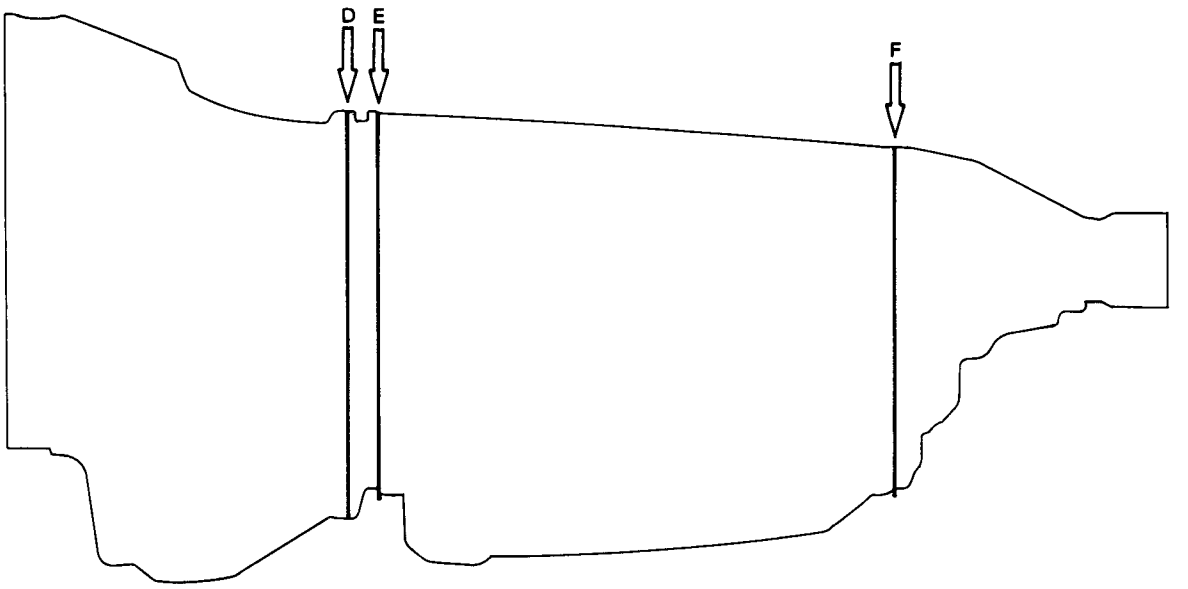
SECTIONS THAT CAN BE DETACHED/ASSEMBLED

FWD



Section A ... YES
Section B ... YES
Section C ... YES

4WD



Section D ... YES
Section E ... YES
Section F ... YES

Fig. 114

L3-833

2 Disassembly of Overall Transmission

1. External Parts

1) Place the transmission unit on a workbench, with the oil pan facing down.

Be careful not to bend or damage external parts.

2) Remove the drain plug, and drain differential oil. Tighten the plug temporarily after draining.

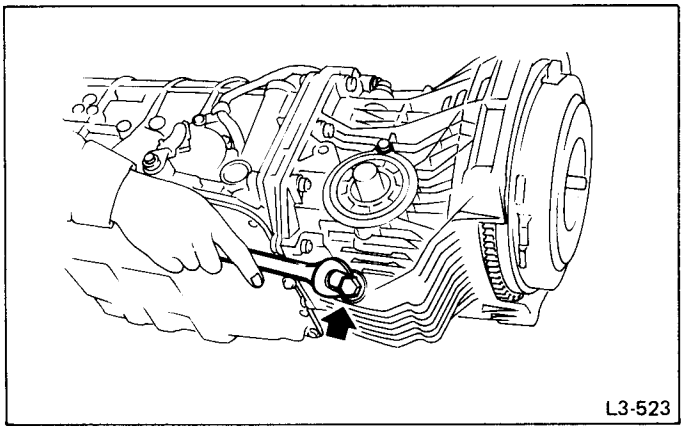


Fig. 115

3) Remove the drain plug, and drain automatic transmission fluid (ATF). Tighten the plug temporarily after draining.

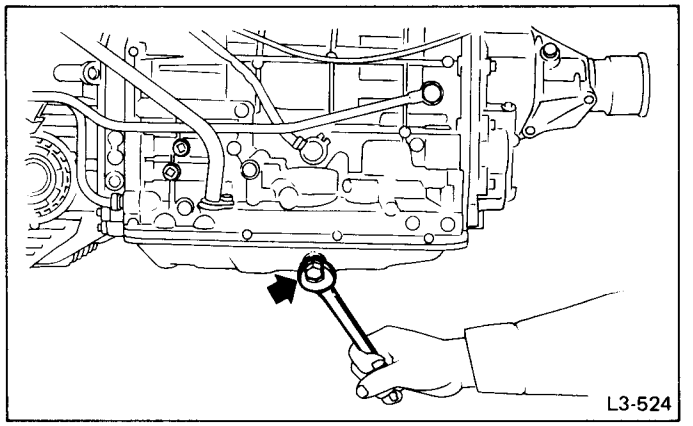


Fig. 116

4) Extract the torque converter.

a. Extract the torque converter horizontally. Be careful not to scratch the bushing inside the oil pump shaft.
b. Note that oil pump shaft also comes out.

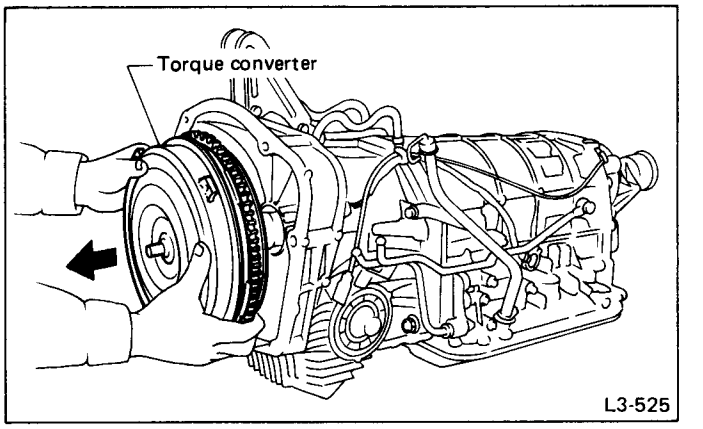


Fig. 117

5) Remove the input shaft.

Be careful not to scratch the bushing.

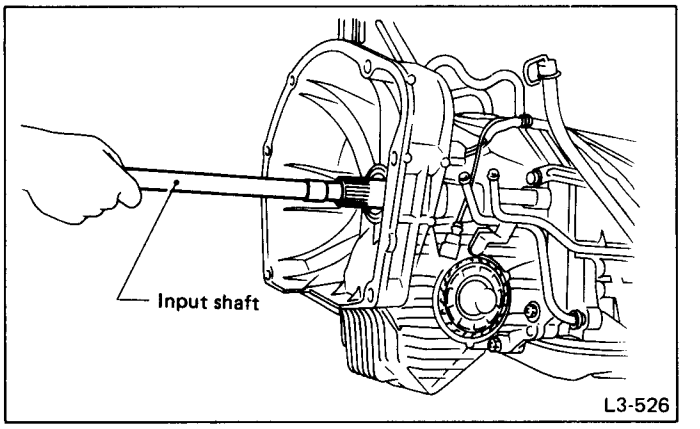


Fig. 118

6) Remove the pitching stopper bracket.

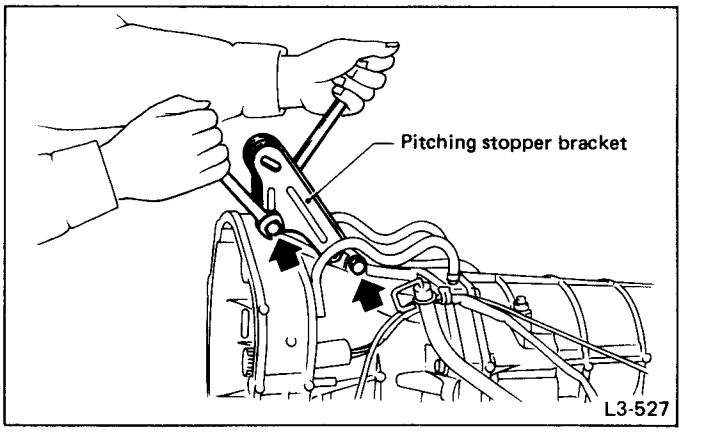


Fig. 119

7) Disconnect the air breather hose.
No. of hoses 4WD: 2
FWD: 1

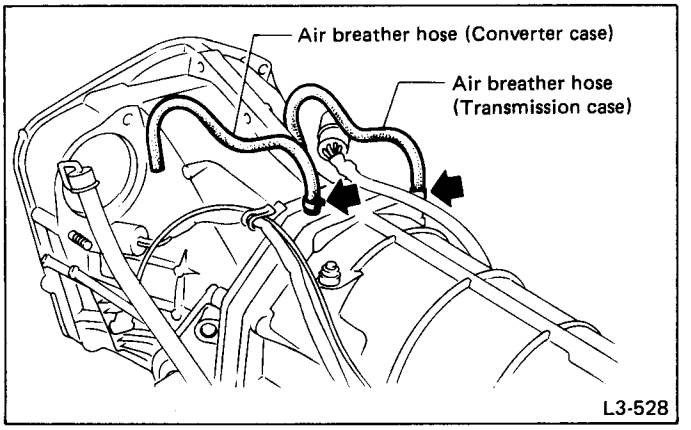


Fig. 120

8) Remove the oil charger pipe, and remove the O-ring from the flange face. Attach the O-ring to the pipe.

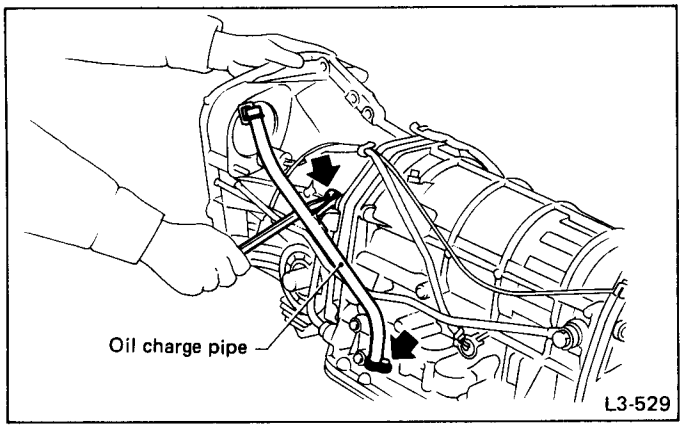


Fig. 121

9) Remove the oil cooler inlet and outlet pipes.

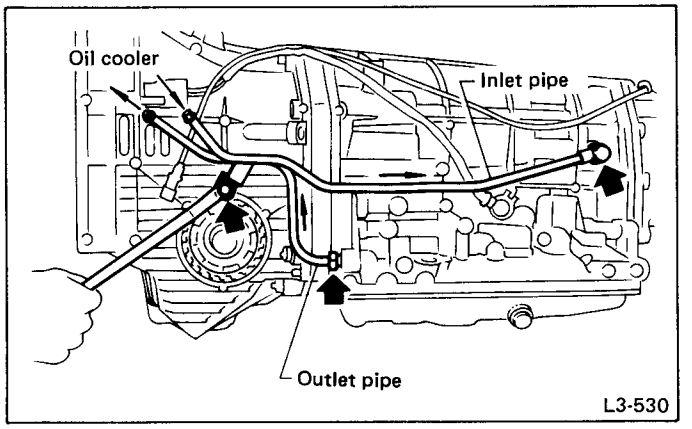


Fig. 122

10) Remove clips from the harnesses.
No. of harnesses 4WD: 3
FWD: 2

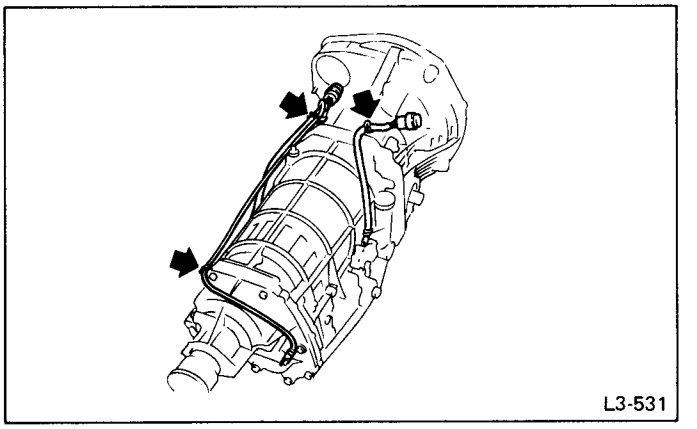


Fig. 123

2. Separation of Converter Case and Transmission Case Sections

a. Separate these cases while tapping lightly on the housing.
b. Be careful not to damage the oil seal and bushing inside the converter case by the oil pump cover.

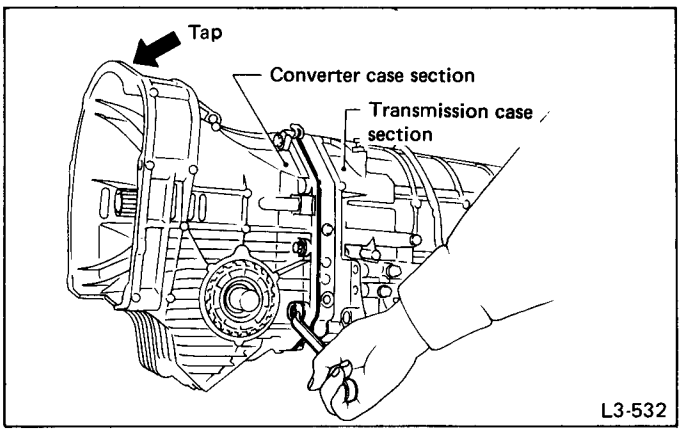


Fig. 124

3. Separation of Transmission Case and Extension Sections (4WD)/ Transmission Cover Sections (FWD)

1) Remove the revolution sensor. (4WD)

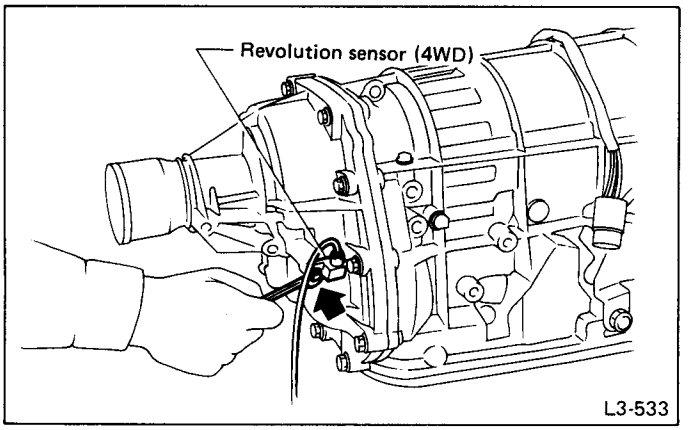


Fig. 125

2) While pulling the extension slightly, disconnect the connector for the duty solenoid C (transfer).

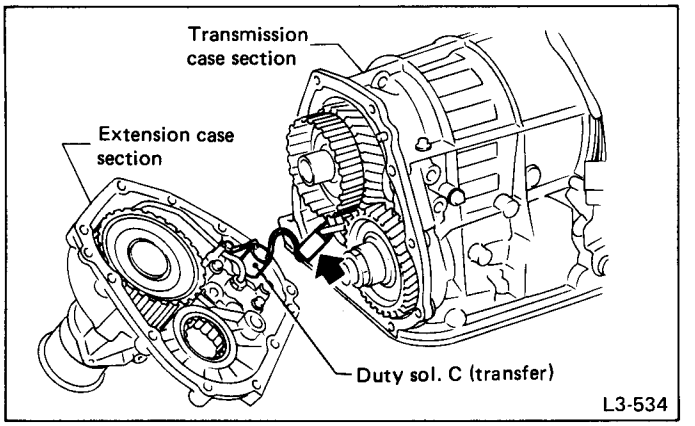


Fig. 126

3) Separate both sections.

4. Transmission Case Section

1) Remove the reduction drive gear ASSY.

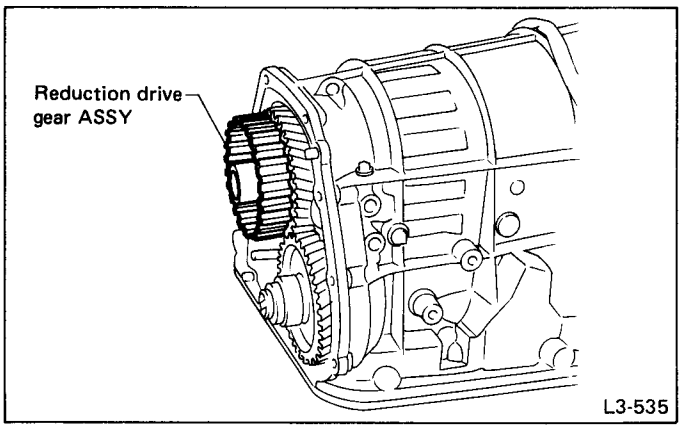


Fig. 127

2) Remove the reduction driven gear:
(1) Straighten the staked portion, and remove the lock nut.

Set the range selector lever to "P".

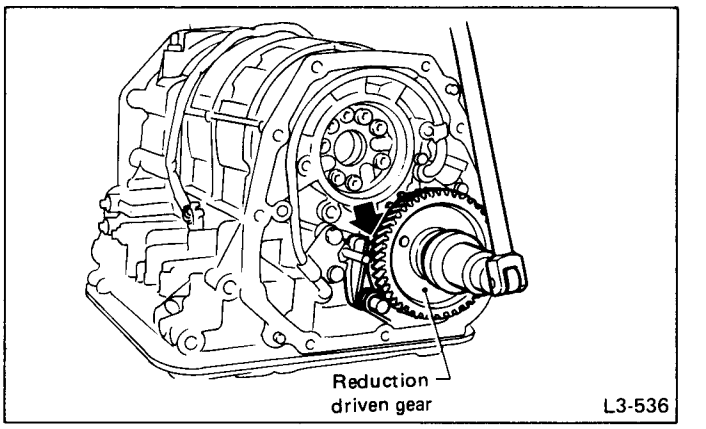


Fig. 128

(2) Using the PULLER SET (899524100), extract the reduction driven gear.

Drill two holes in the puller.

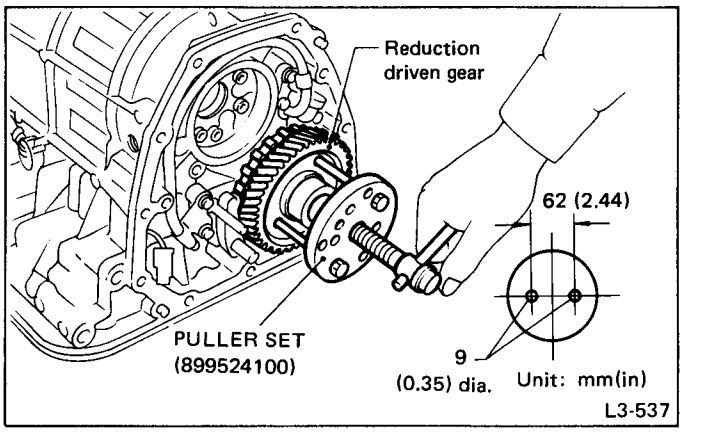


Fig. 129

3) Remove the parking pawl, return spring and shaft.

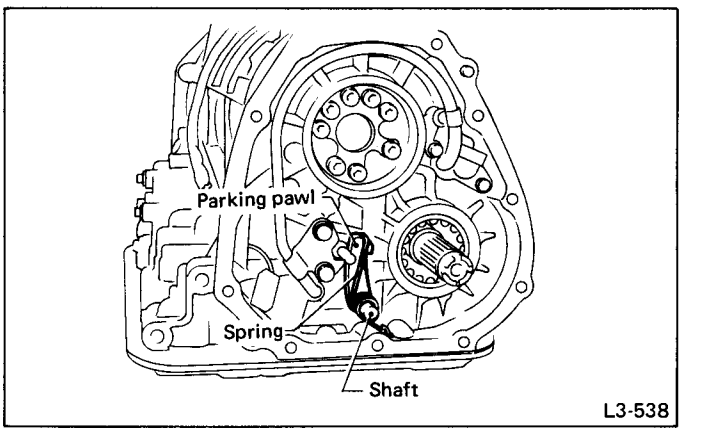


Fig. 130

4) Remove the revolution sensor. (FWD)

Keep the sensing element in the transmission case.

5) Loosen the taper roller bearing mounting bolts.

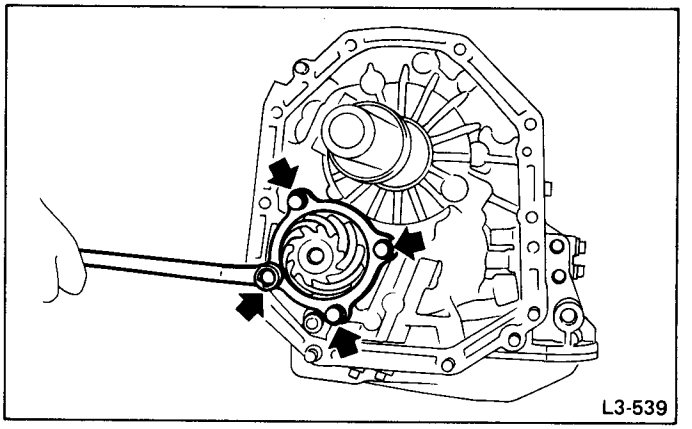


Fig. 131

6) Place two wooden blocks on the workbench, and stand the transmission case with its rear end facing down.

a. Be careful not to scratch the rear mating surface of the transmission case.
b. Note that the parking rod and drive pinion protrude from the mating surface.

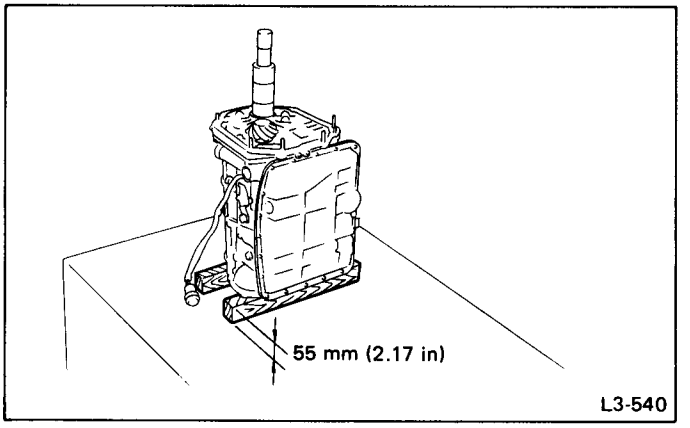


Fig. 132

7) Remove the oil pan and gasket.

Tap the corners of the oil pan when removing.

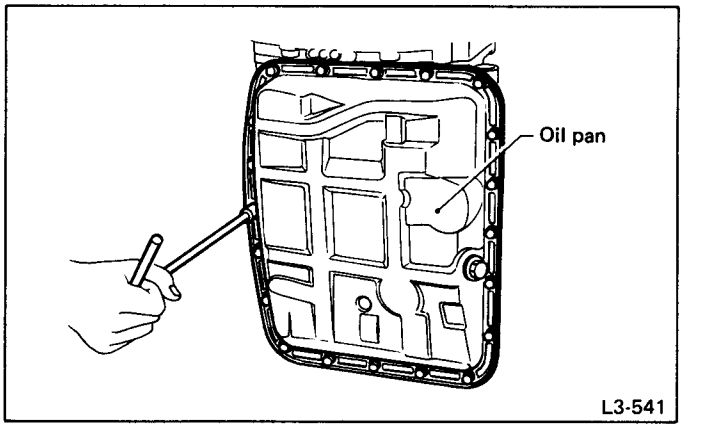


Fig. 133

8) Remove the oil cooler outlet pipe.

Be careful not to twist the pipe.

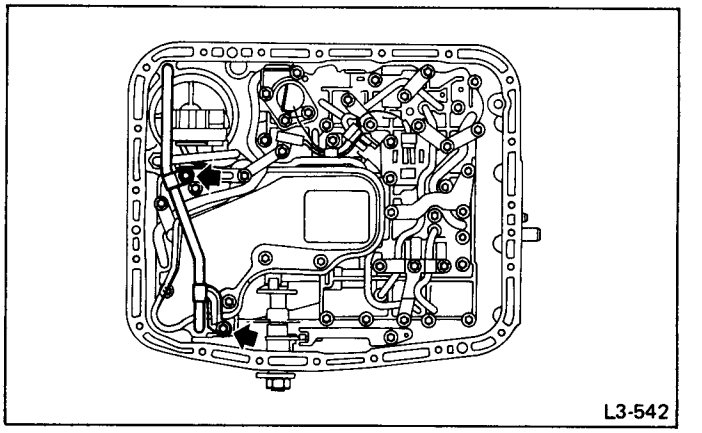


Fig. 134

9) Disconnect the harness connectors for the solenoids and duty solenoids and the ground cord.

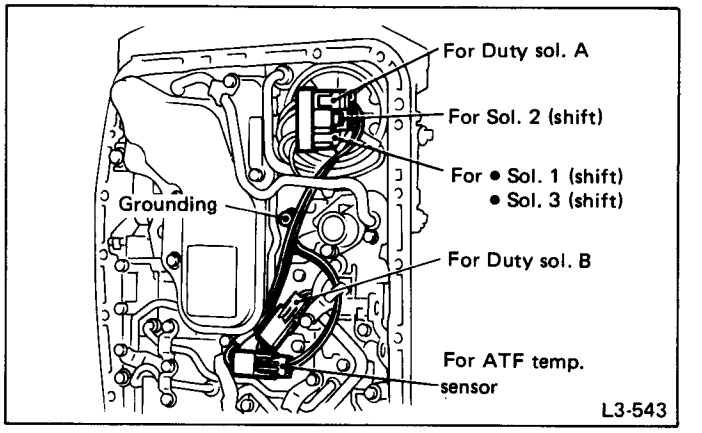


Fig. 135

10) Remove the oil strainer.

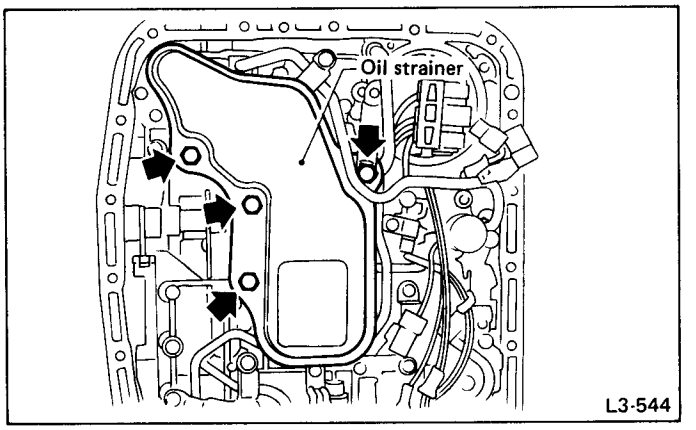


Fig. 136

Be careful not to damage O-ring on oil strainer.

11) Remove the control valve body.

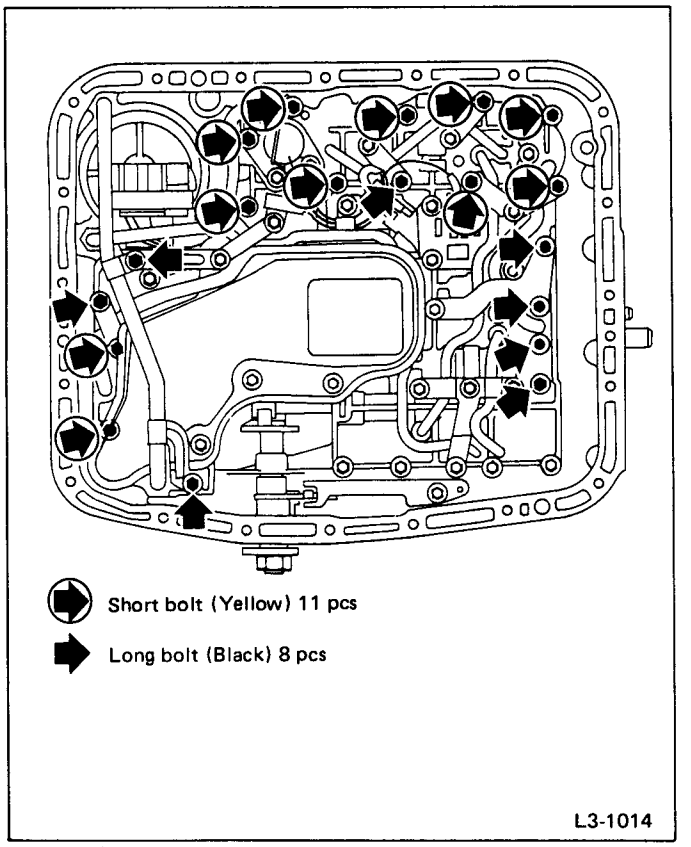


Fig. 137

12) Remove three accumulator springs.

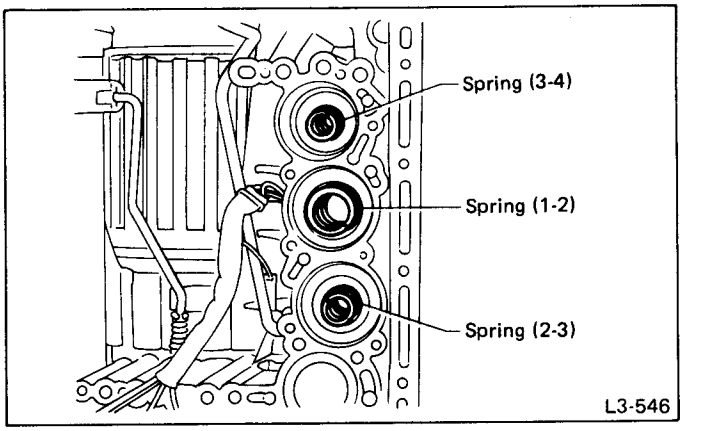


Fig. 138

13) Loosen the reverse clutch drum lightly by turning the adjusting screw. Then remove the oil pump housing.

Be careful not to lose the total end play adjusting thrust washer.

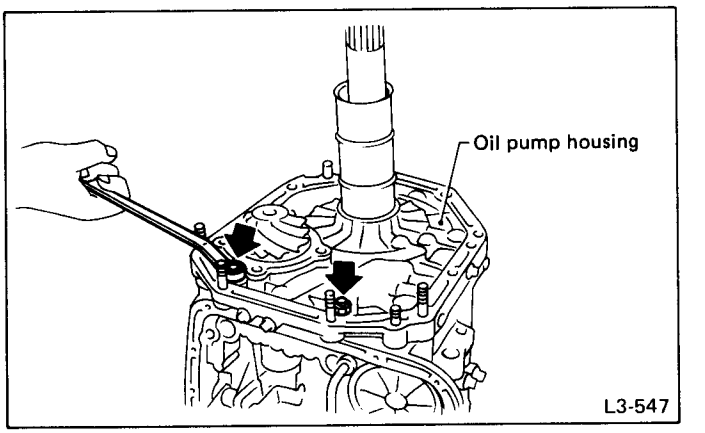


Fig. 139

14) Loosen the brake band adjusting screw, and take out the strut.

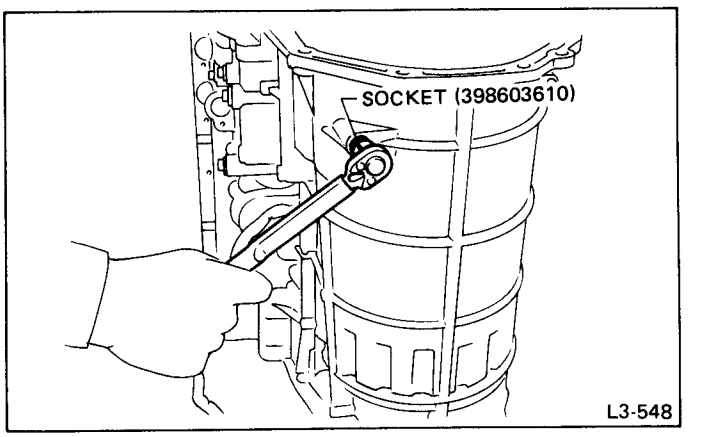


Fig. 140

15) Remove the brake band and reverse clutch.

Contract the brake band with a clip.

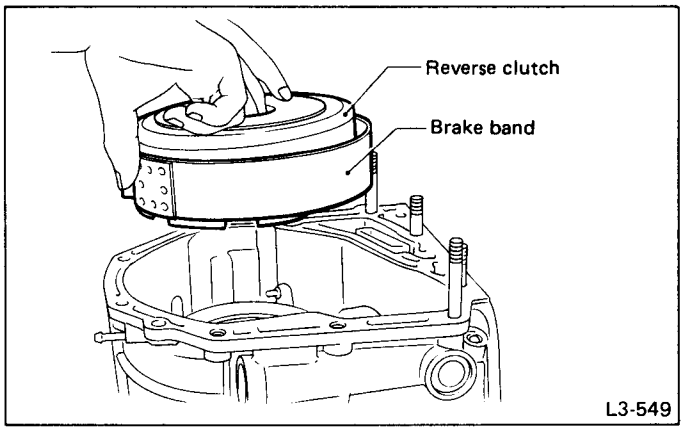


Fig. 141

16) Take out the high clutch.

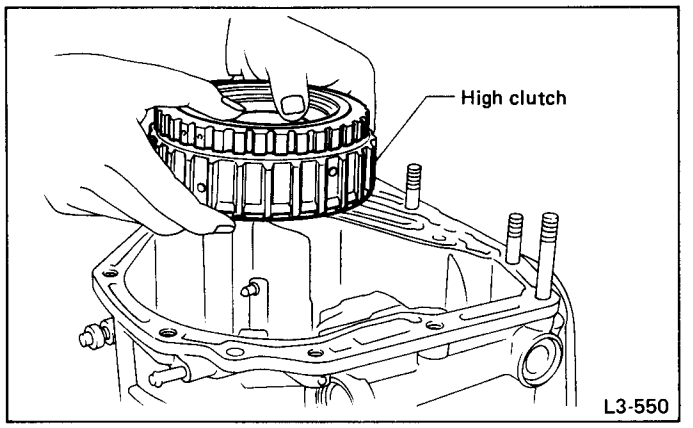


Fig. 142

17) Take out the high clutch hub.

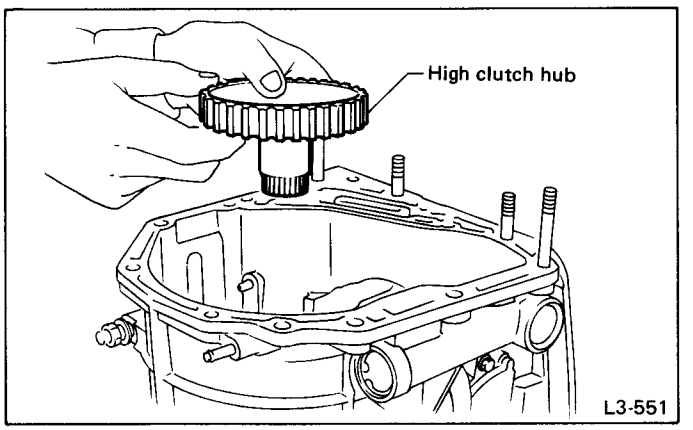


Fig. 143

18) Take out the front sun gear.

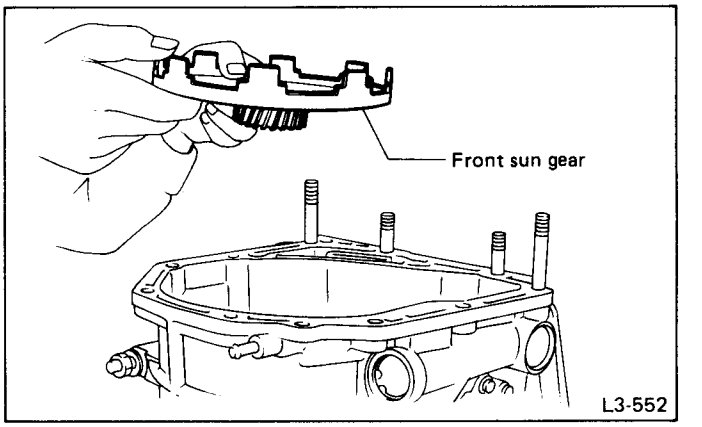


Fig. 144

19) Take out the front planetary carrier.

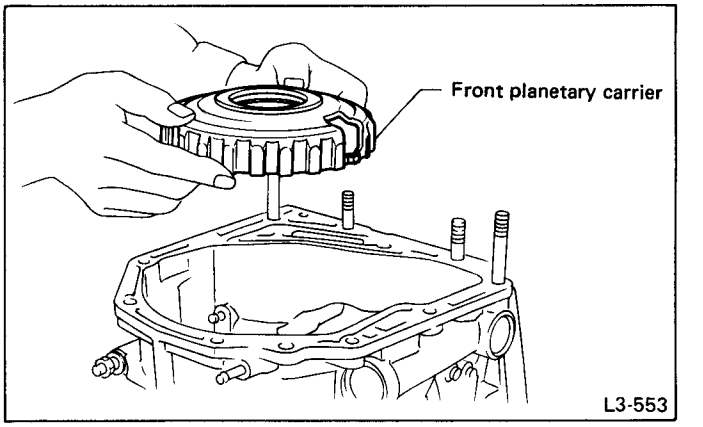


Fig. 145

20) Take out the rear planetary carrier and rear sun gear.

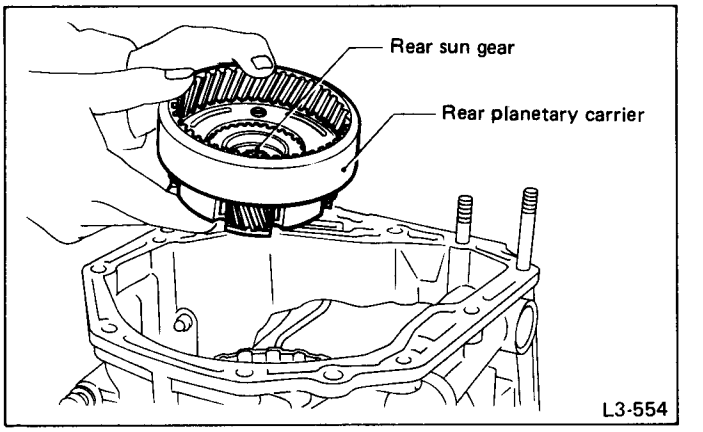


Fig. 146

21) Take out the rear internal gear.

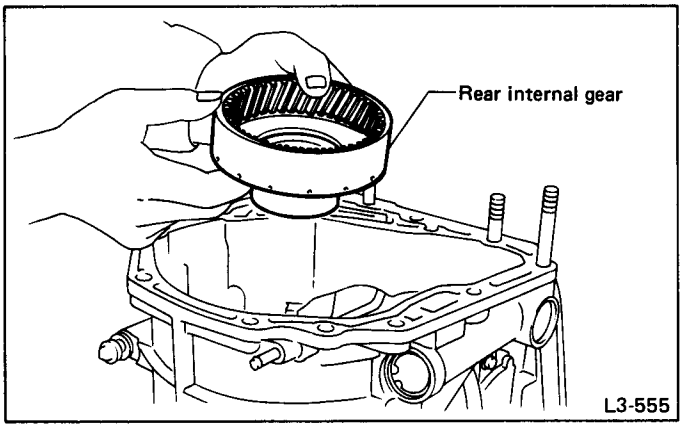


Fig. 147

22) Take out the one-way clutch outer race.

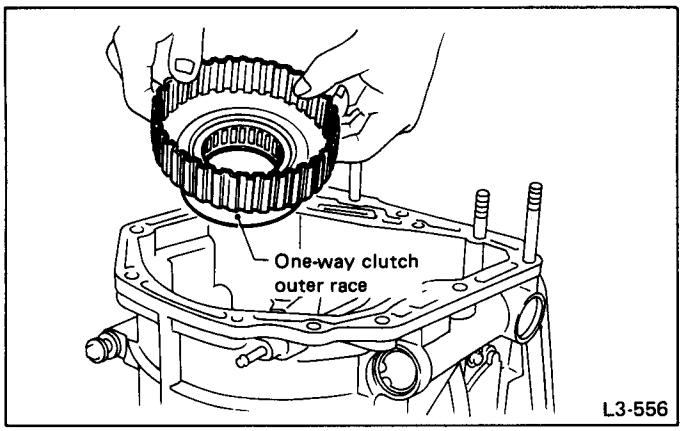


Fig. 148

23) Take out the overrunning clutch hub.

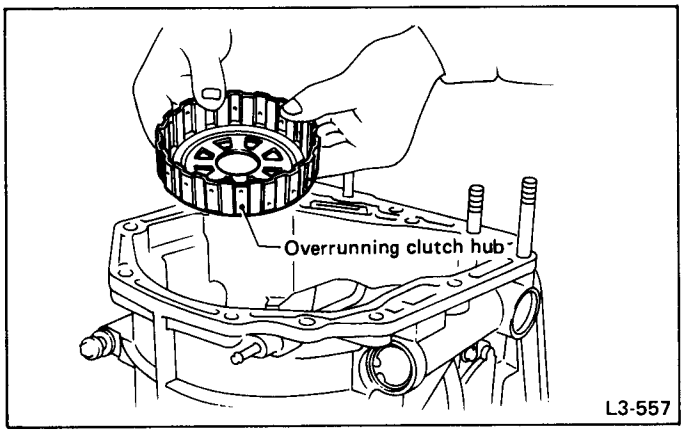


Fig. 149

24) Take out the forward clutch drum.

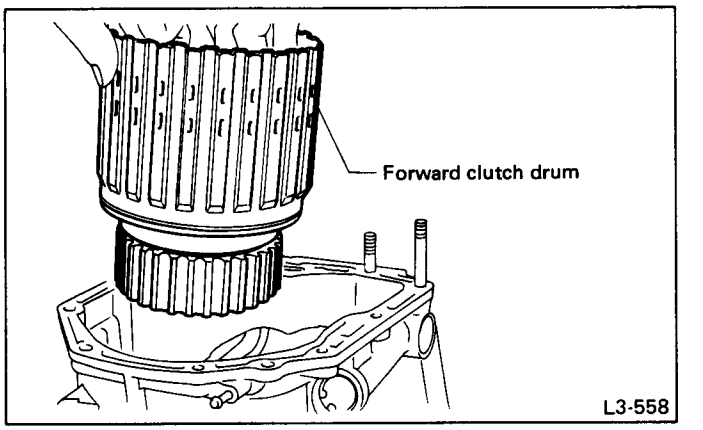


Fig. 150

25) Take out the low & reverse brake section.
(1) Remove the snap ring. Then remove the retaining plate, drive plates, driven plates, and dish plates as a unit.

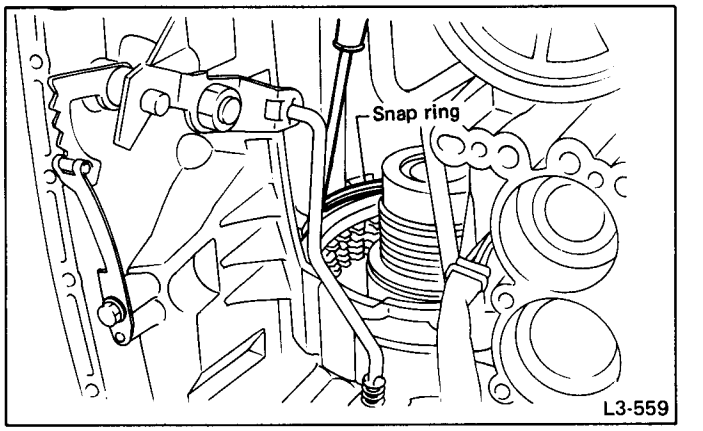


Fig. 151

(2) Turning the case upside down, take out the one-way clutch inner race and spring retainer CP.

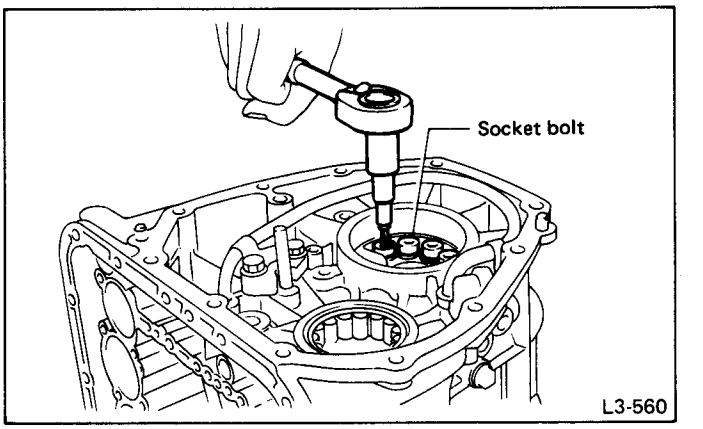


Fig. 152

(3) Take out the low & reverse piston by applying compressed air.

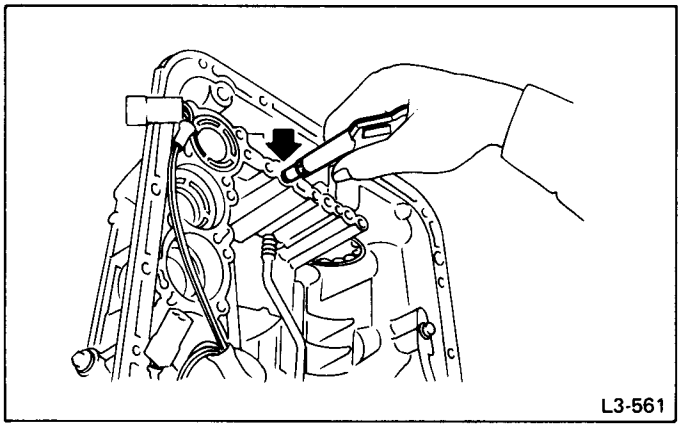


Fig. 153

26) After removing the snap ring (inner), take out the servo piston by applying compressed air from the release pressure side.

Hold the servo piston with a rag so that it will not be ejected with the air pressure. In this case, do not allow your finger to be pinched between the pipe and retainer.

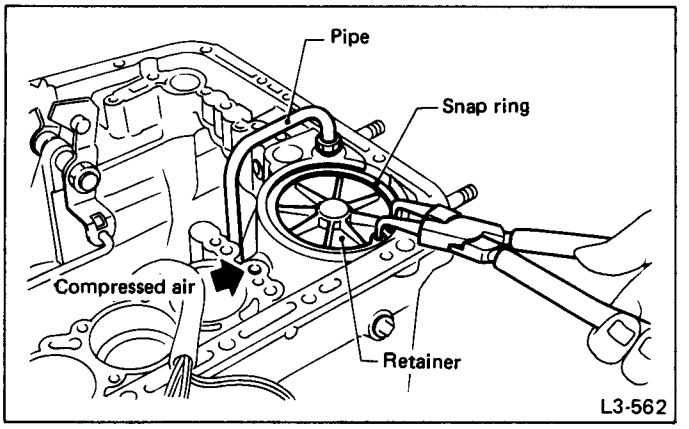


Fig. 154

27) Apply compressed air from the operating pressure side, and take out accumulator (3-4), accumulator (1-2), accumulator (2-3), and accumulator (N-D).

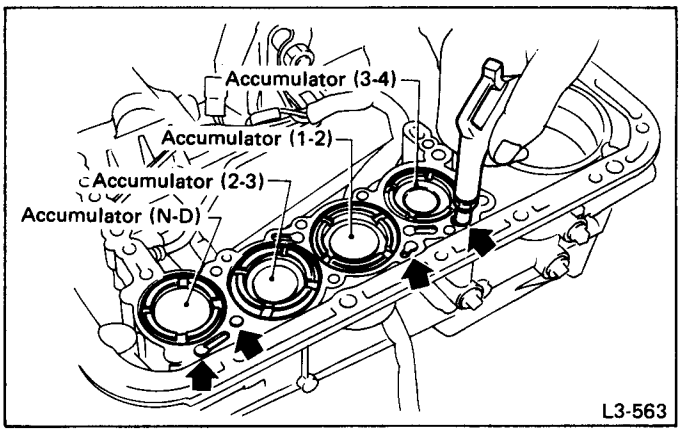


Fig. 155

28) Remove the range select lever.
29) Remove the detent spring.

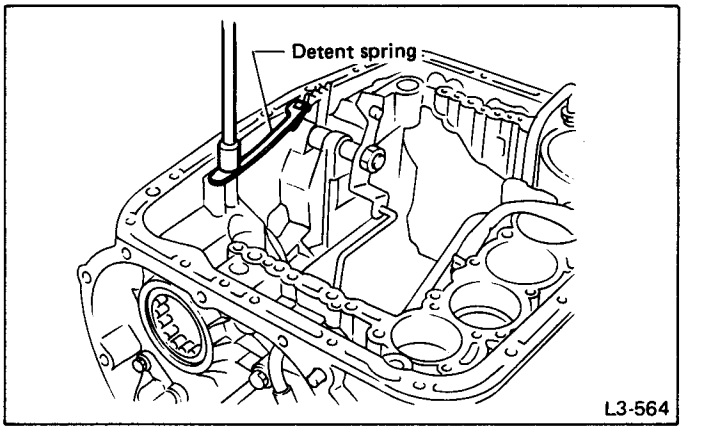


Fig. 156

30) Remove the parking rod together with the manual lever. Then remove the manual shaft by pulling off the straight pin.

Be careful not to damage the lips of the press-fitted oil seal in the case.

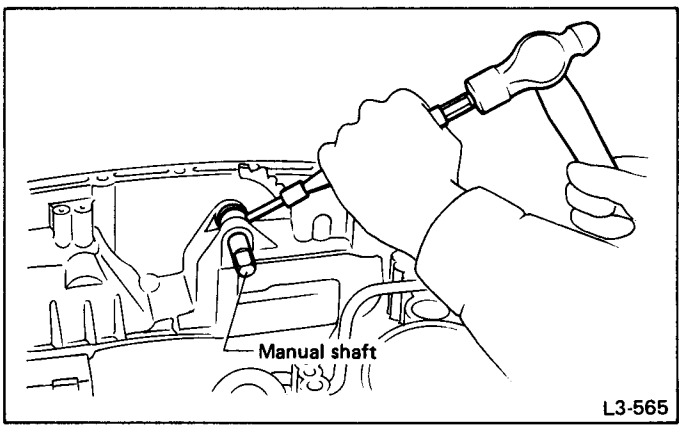


Fig. 157

31) Remove the inhibitor switch.

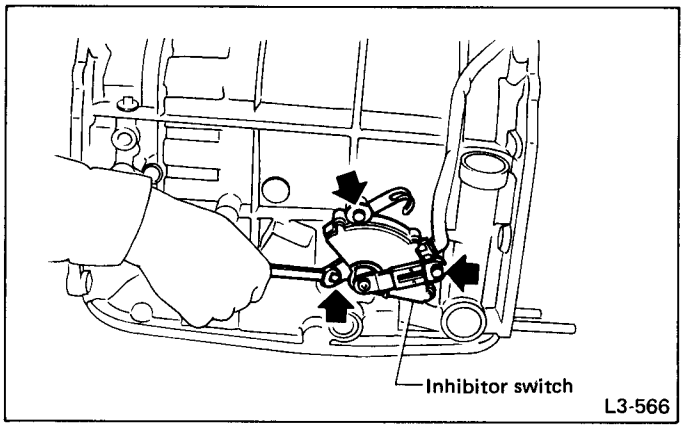


Fig. 158

32) Remove the transmission harness.

Be careful not to damage the cord insulation.

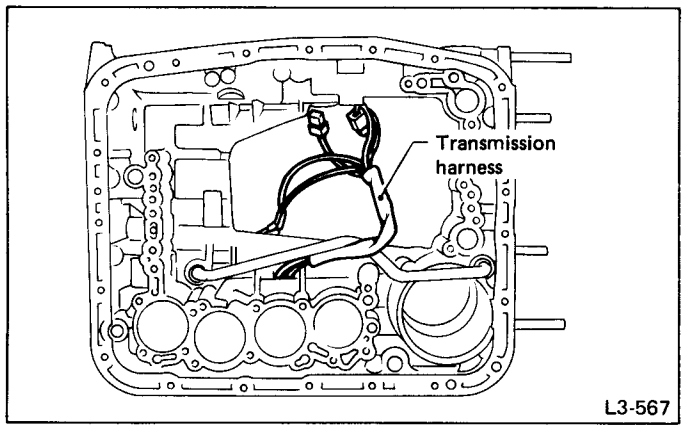


Fig. 159

5. Converter Case Section

1) Wrap the axle-shaft serration with vinyl tape.

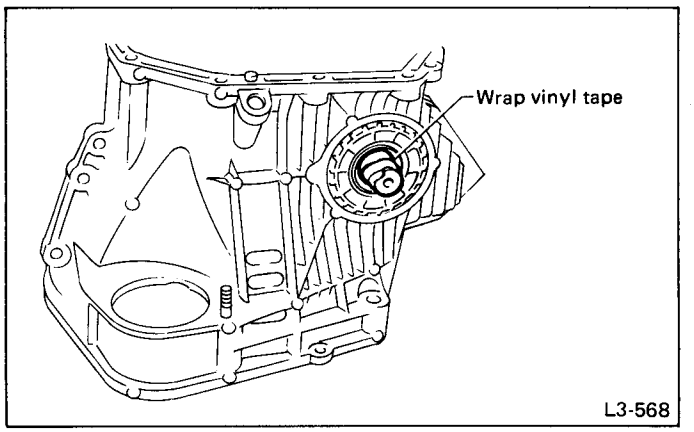


Fig. 160

2) Remove the differential side retainer.

Hold the differential case ASSY by hand to avoid damaging retainer mounting hole of the converter case and speedometer gears.

3) Extract the axle shaft.

Do not reuse the circlip.

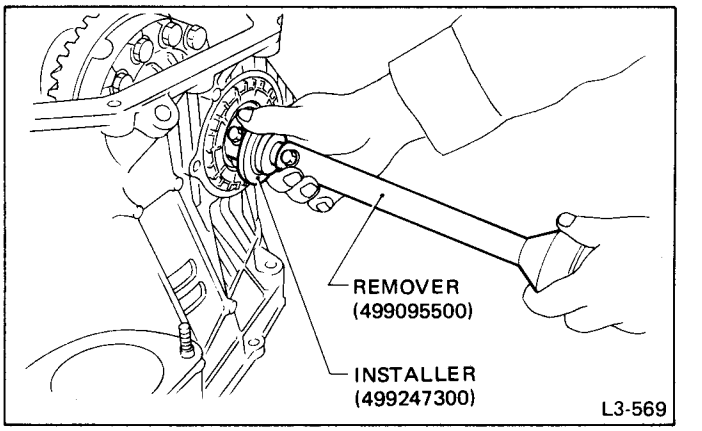


Fig. 161

4) Remove the differential case ASSY.

a. Remove the seal pipe if it is attached. (Reusing is not allowed.)
b. Be careful not to damage the retainer mounting hole of the converter case and the speedometer gears.

5) Remove the snap ring. Then remove the speedometer driven gear.

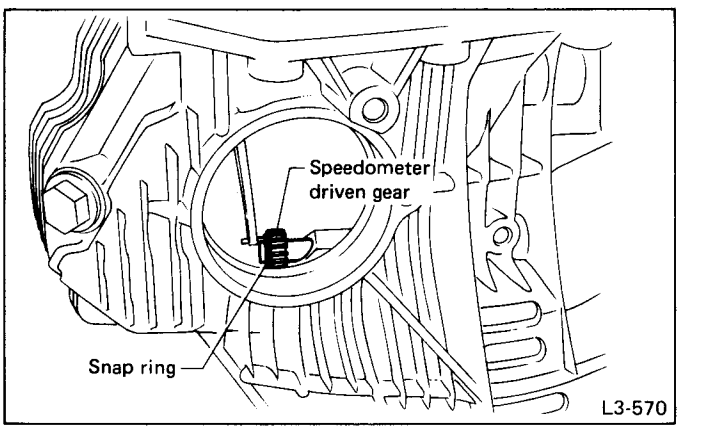


Fig. 162

6) Tap out the speedometer shaft to the outside of the case, and remove the oil seal.

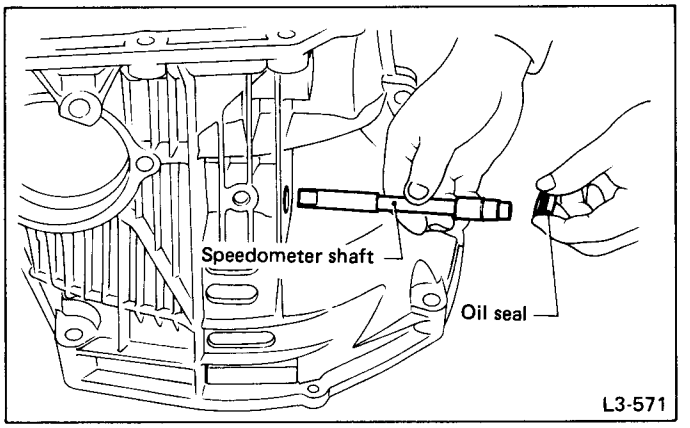


Fig. 163

6. Extension Section

1) Take out the transfer clutch by lightly tapping the end of the rear drive shaft.

Be careful not to damage the oil seal in the extension.

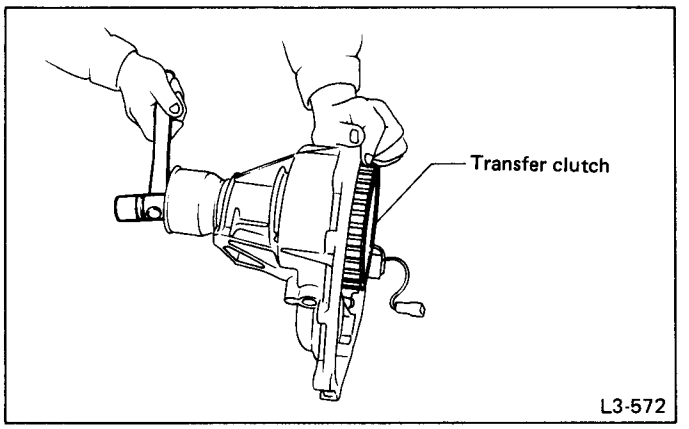


Fig. 164

2) Remove the transfer pipe.

Be careful not to bend the pipe.

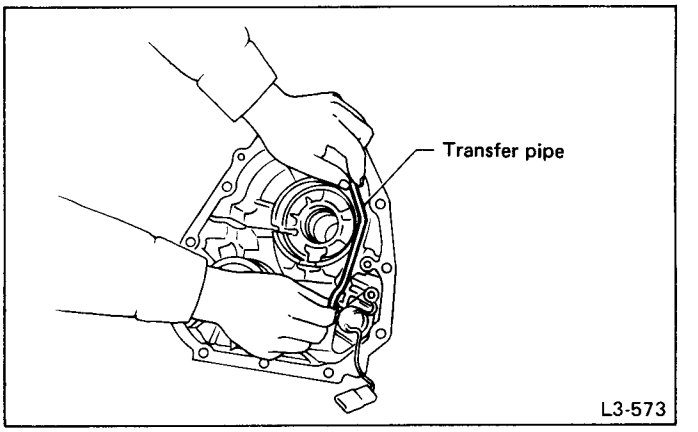


Fig. 165

3) Remove duty solenoid C and the transfer valve body.

a. Take out the inlet filter.
b. Do not damage the O-ring.

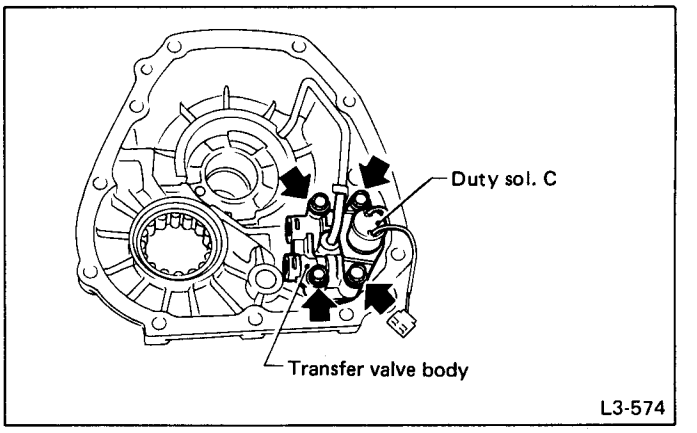


Fig. 166

4) Take out the roller bearing.

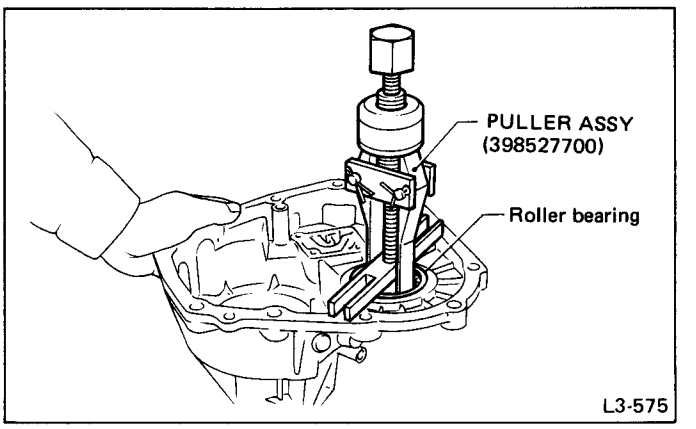


Fig. 167

3 Disassembly, Inspection and Assembly of Each Component

1. Reduction Drive Gear Assembly

DISASSEMBLY

1) Take out the seal rings.

Be careful not to damage the seal rings.

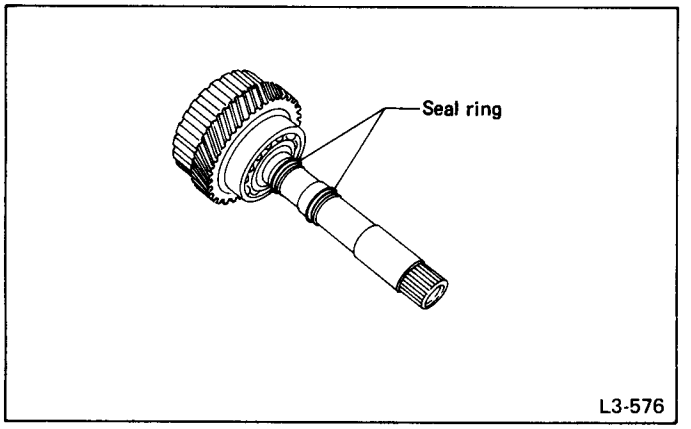


Fig. 168

2) Take out the snap ring (out).

Be careful not to damage the splines.

3) Using a press, remove the reduction drive gear.

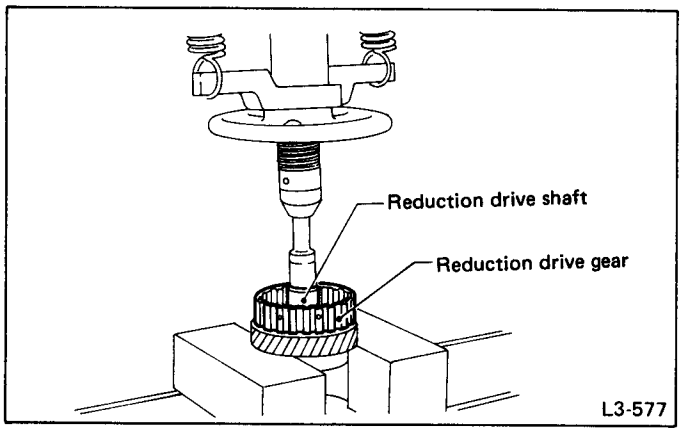


Fig. 169

4) Using a press, remove the ball bearing.

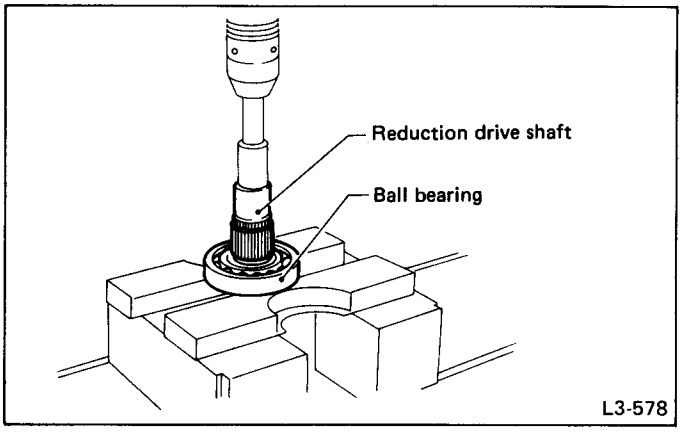


Fig. 170

INSPECTION

Make sure that each component is free of harmful gouges, cuts, or dust.

ASSEMBLY

1) Press-fit the ball bearing and reduction drive gear to the shaft.

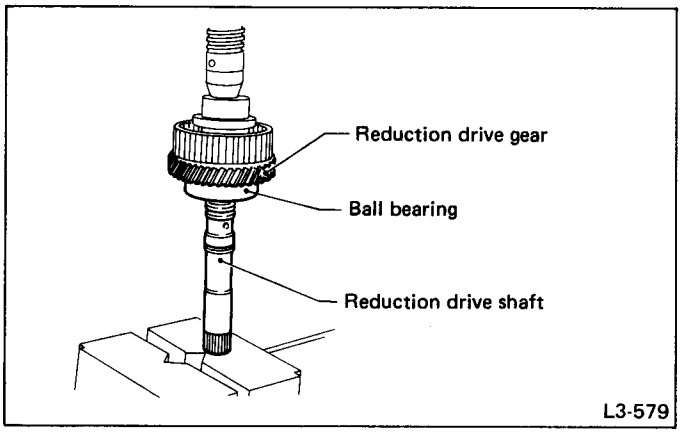


Fig. 171

2) 4WD: Fit the snap ring securely in the snap ring groove on the shaft.
FWD: Press-fit the ball bearing using a press, then fit the snap ring to the snap ring groove on the shaft.
3) Attach two seal rings.

To make subsequent assembly easier, apply vaseline to the grooves of the shaft and to the exterior of the seal ring.

2. Control Valve Body

DISASSEMBLY

1) Remove the following parts from the upper valve body.
   (1) Solenoid ASSY (shift 1-2-3)
   (2) Duty solenoid A (line pressure)

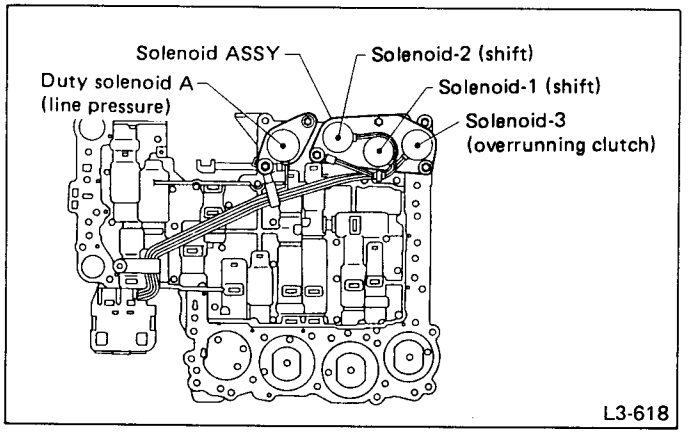


Fig. 172

2) Remove the following parts from the lower valve body.
   (1) Duty solenoid B (lock-up)
   (2) ATF temperature sensor

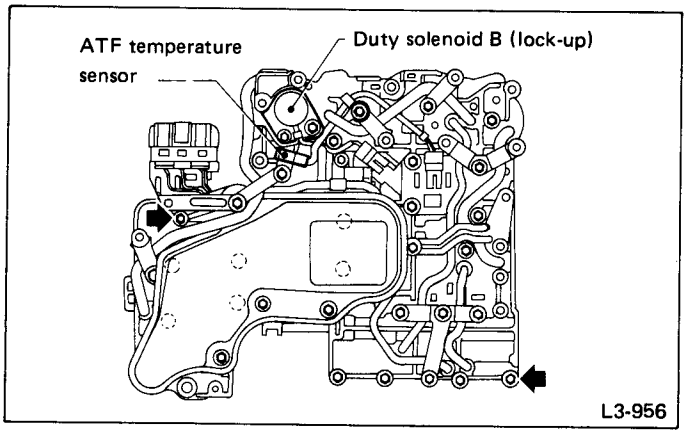


Fig. 173

3) Separate the upper valve body and lower valve body.

a. Do not lose the nine (9) steel balls contained in the upper valve body.
b. Do not lose an orifice and a strainer contained in the lower valve body.
c. Remove the upper-lower valve body tightening bolts. Then remove two locating bolts. (➡)

During ordinary servicing, clean the control valve bodies in this condition, without further disassembly.
In the event of a seized clutch or other problem, disassemble the control valve bodies further, and clean the component parts.

INSPECTION

Make sure that each component is free of harmful gouges, cuts, or dust.

ASSEMBLY

Reverse the disassembly sequence, paying attention to the following points:

a. Be sure to properly position the steel balls, orifice and strainer.

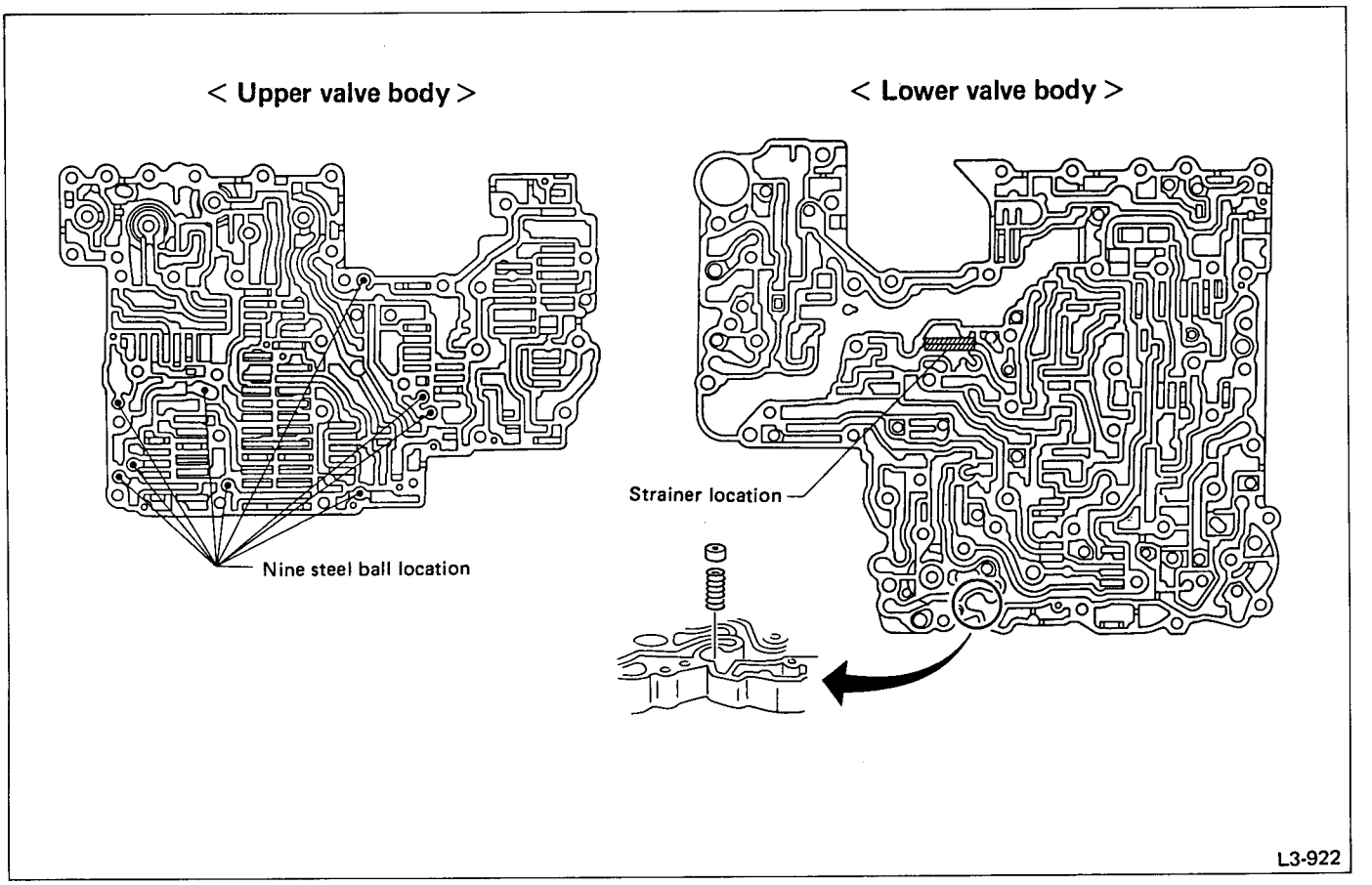


Fig. 174

b. Tighten two locating bolts. Then tighten the upper-lower valve body tightening bolts.

Tightening torque:
7 – 9 N·m (0.7 – 0.9 kg-m, 5.1 – 6.5 ft-lb)

3. Oil Pump Assembly

DISASSEMBLY

1) Remove the oil seal retainer.
Also remove the O-ring and oil seal (air breather).

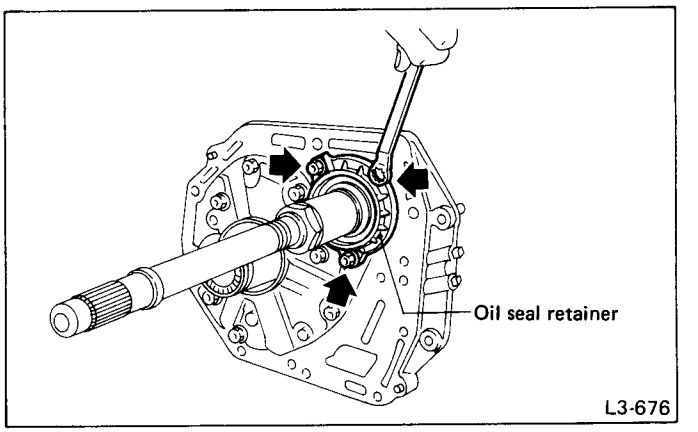


Fig. 175

2) Remove the oil pump cover.

Lightly tap the end of the stator shaft to remove the cover.

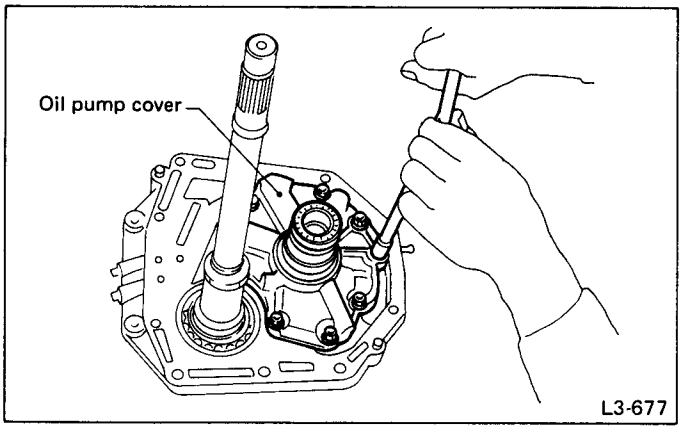


Fig. 176

3) Remove the retainer and return spring. Then remove the rotor, two vane rings and nine vanes.

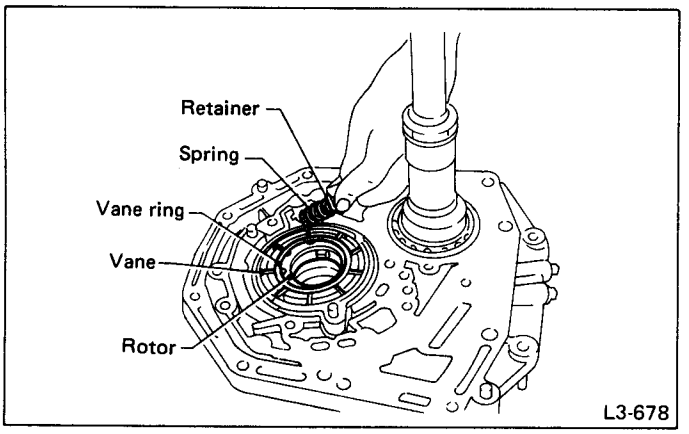


Fig. 177

4) Remove the cam ring and control piston.
Also remove the O-ring, friction ring, two side seals, and plain seal.

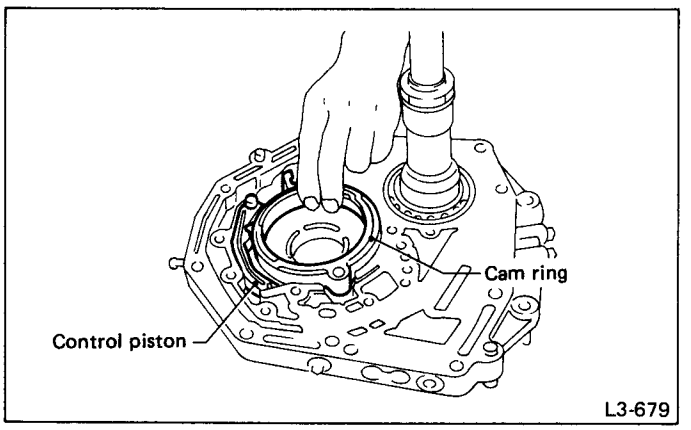


Fig. 178

5) Remove two seal rings (R) and two seal rings (H).

INSPECTION

1) Make sure that each component is free of harmful gouges, cuts, and dust.
2) Selection of oil pump components (rotor, vanes, control piston and cam ring):
(1) Using a micrometer, measure the height of the rotor, vanes, control piston and cam ring in at least four positions. (Measure the height at one place for each of the nine vanes.)

a. Remove the control piston seals when measuring.
b. Remove the friction ring from the cam ring when measuring.

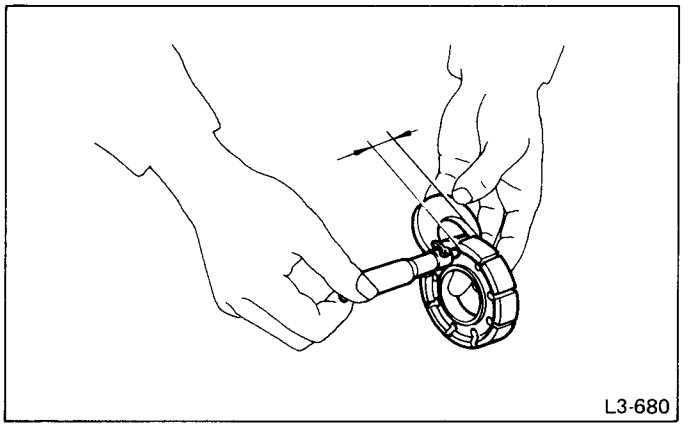


Fig. 179

(2) Using a depth gauge, measure the depth of the oil pump housing from the contact/sliding surface of the above-mentioned component parts in the same manner as above.

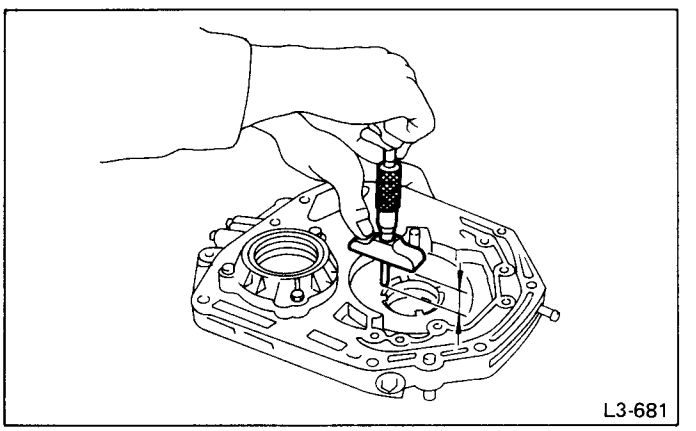


Fig. 180

(3) Make sure that the clearances are within the specified wear limits. If the wear limit is exceeded, select pump components so that the standard clearance can be obtained.

	Wear limit	Standard value
Rotor, control piston, vanes	0.054 mm (0.0021 in)	0.030 – 0.044 mm (0.0012 – 0.0017 in)
Cam ring	0.034 mm (0.0013 in)	0.010 – 0.024 mm (0.0004 – 0.0009 in)

Select vanes which are the same height as the rotor.

ASSEMBLY

1) Coat both the O-ring and friction ring with vaseline and attach to the cam ring. Then fit them into the oil pump housing.

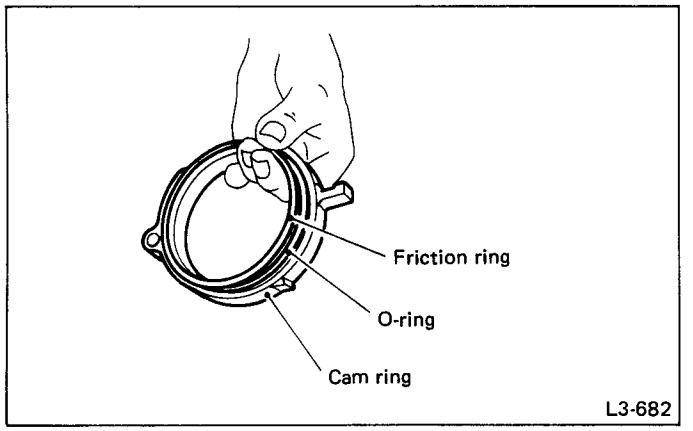


Fig. 181

2) Install the vane ring, rotor, vanes, and vane ring into the housing in this sequence.

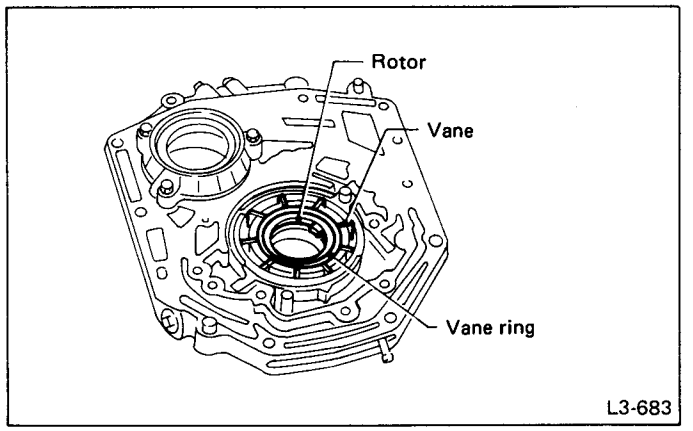


Fig. 182

3) Install the return spring and retainer between the housing and cam ring.

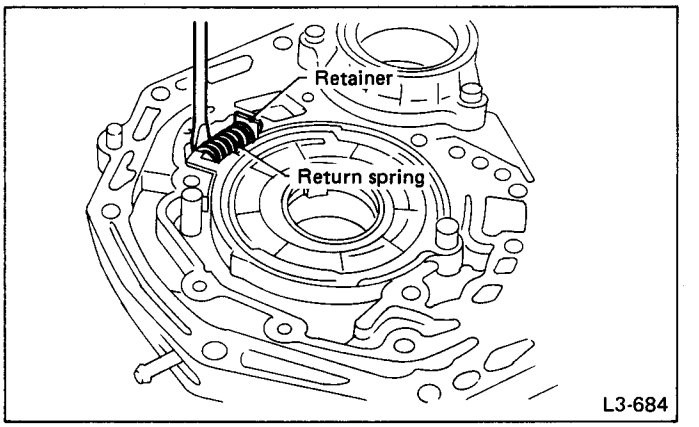


Fig. 183

4) Install the control piston to the oil pump housing.

Fit the seal in the piston groove, with the red seals facing the top side. (Two side seals and one plain seal are attached.)

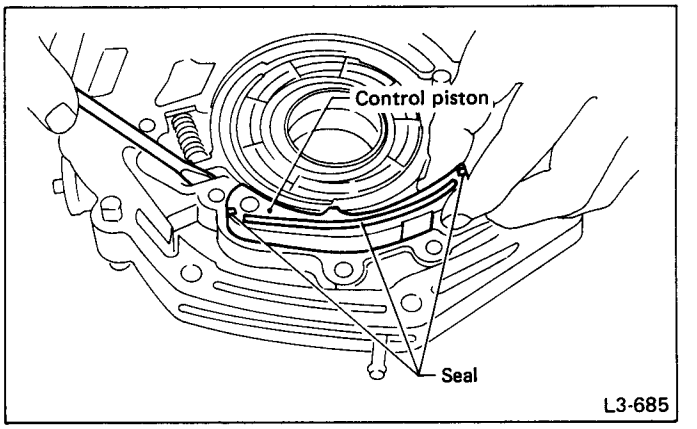


Fig. 184

5) Set the rotor at the center of the housing bore. Apply ATF abundantly to each rotary portion.
6) Install the oil pump cover.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

a. Align both pivots with the pivot holes of the cover, and install the cover being careful not to apply undue force to the pivots.
b. After assembling, turn the oil pump shaft to check for smooth rotation of the rotor.

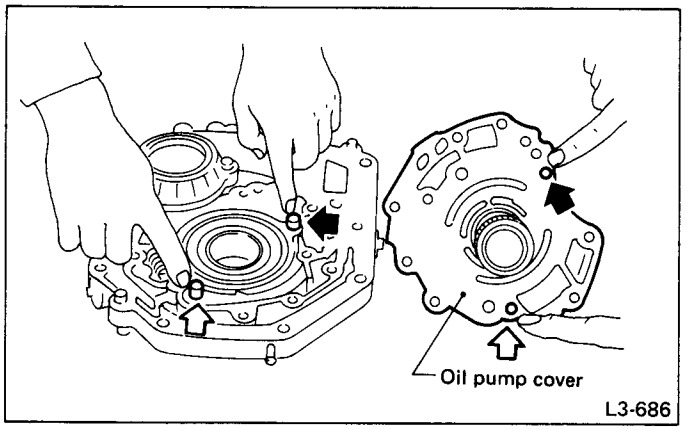


Fig. 185

Install the oil seal retainer and seal rings (R) and (H) after adjusting the drive pinion backlash and tooth contact.

4. Drive Pinion Shaft

DISASSEMBLY

1) Straighten the staked portion of the lock nut, and remove the lock nut while locking the rear spline portion of the shaft. Then pull off the drive pinion collar.

Remove the O-ring

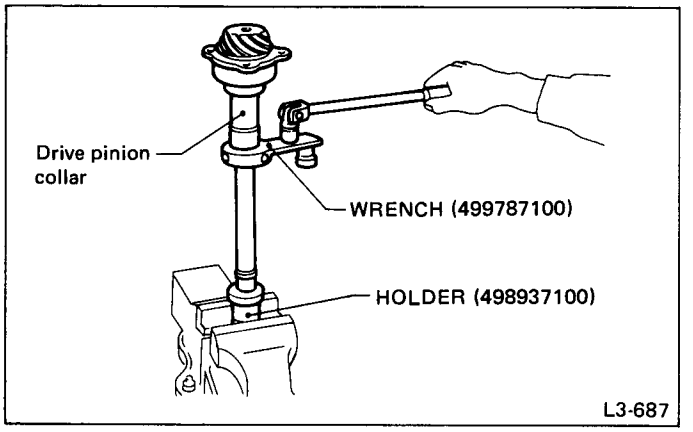


Fig. 186

2) Using a press, separate the rear roller bearing and outer race from the shaft.

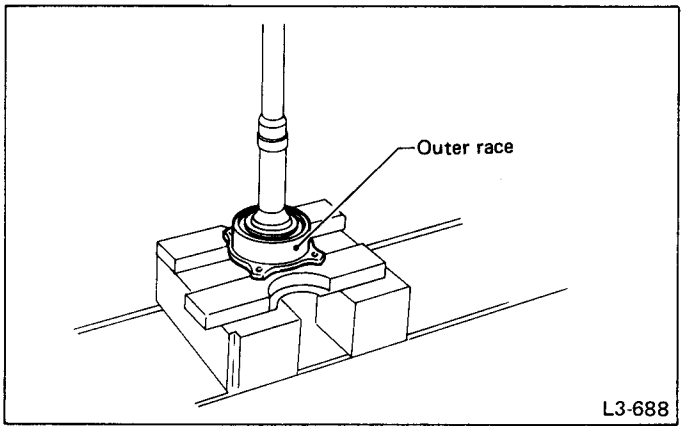


Fig. 187

3) Using a press, separate the front roller bearing from the shaft.

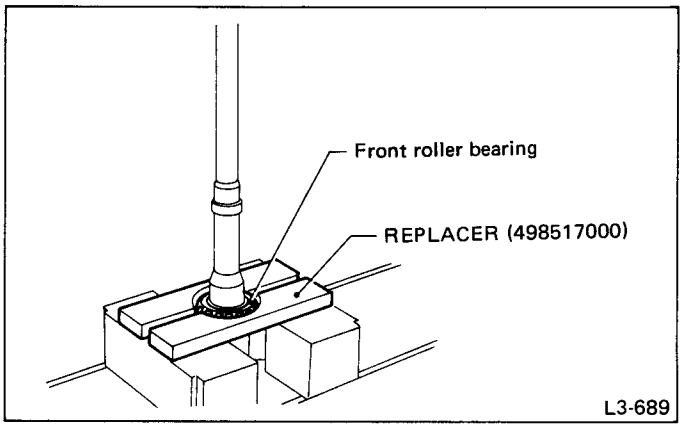


Fig. 188

INSPECTION

Make sure that all component parts are free of harmful cuts, gouges, and other faults.

ASSEMBLY

1) Measure dimension "A" of the drive pinion shaft.

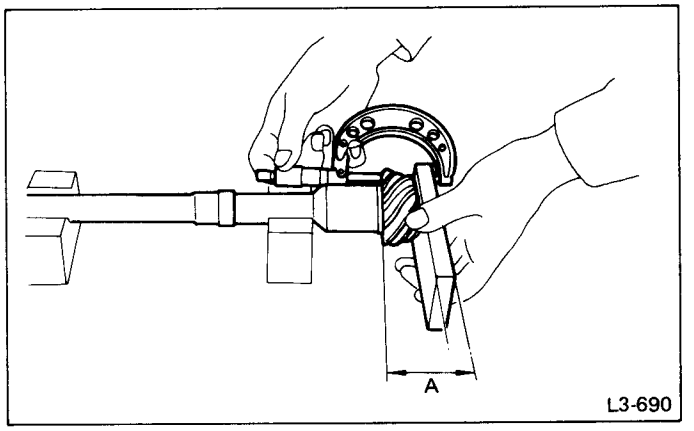


Fig. 189

2) Using a press, force-fit the roller bearing in position.

Do not change the relative positions of the outer race and bearing cone.

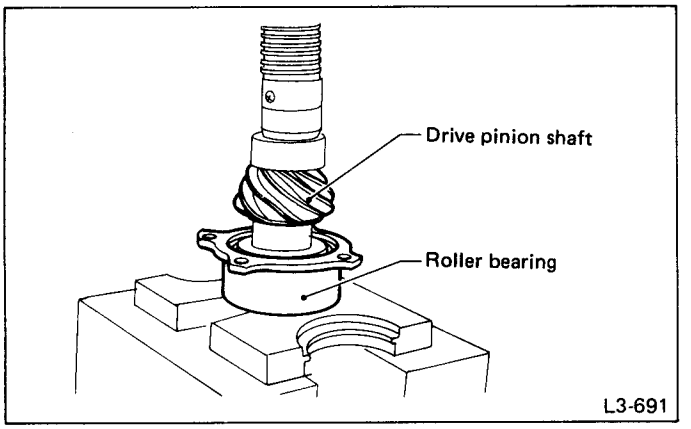


Fig. 190

3) After fitting the O-ring to the shaft, attach the drive pinion collar to the shaft. Be careful not to damage the O-ring.
4) Tighten the lock washer and lock nut.

Actual tightening torque:
113 ± 5 N·m (11.5 ± 0.5 kg-m, 83.2 ± 3.6 ft-lb)

a. Pay attention to the orientation of lock washer.
b. When using special tool WRENCH (499787100) and torque wrench, tighten it to 88 N·m (9 kg-m, 65 ft-lb).

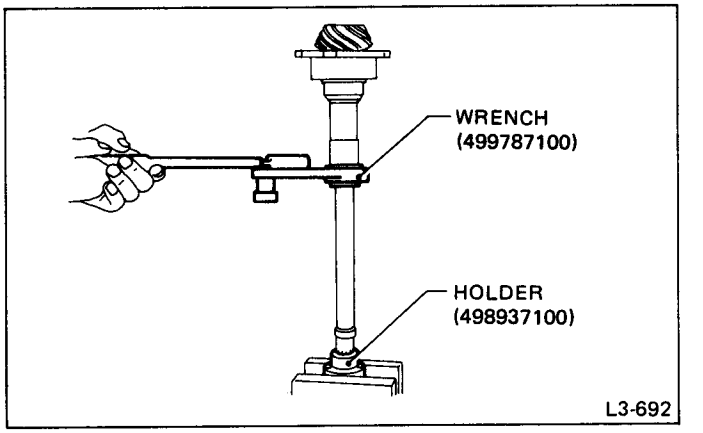


Fig. 191

5) Measure the starting torque of the bearing.
Make sure the starting torque is within the specified range. If out of the allowable range, replace the roller bearing.

Starting torque:
0.3 – 2.0 N·m (3 – 20 kg-cm, 2.6 – 16.4 in-lb)

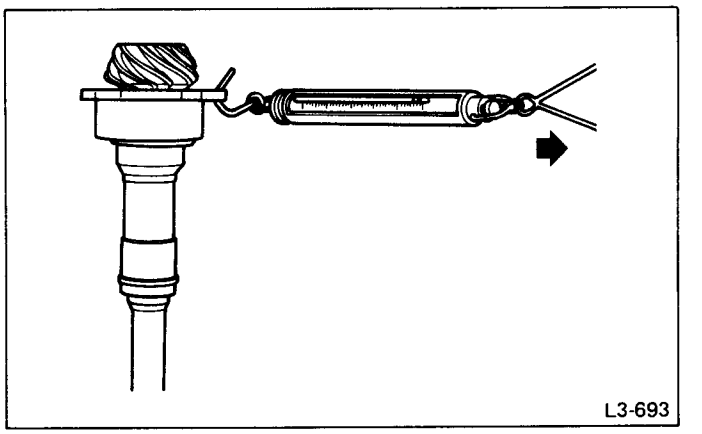


Fig. 192

6) Stake the lock nut securely at two places.
7) Measure dimension "B" of the drive pinion shaft.

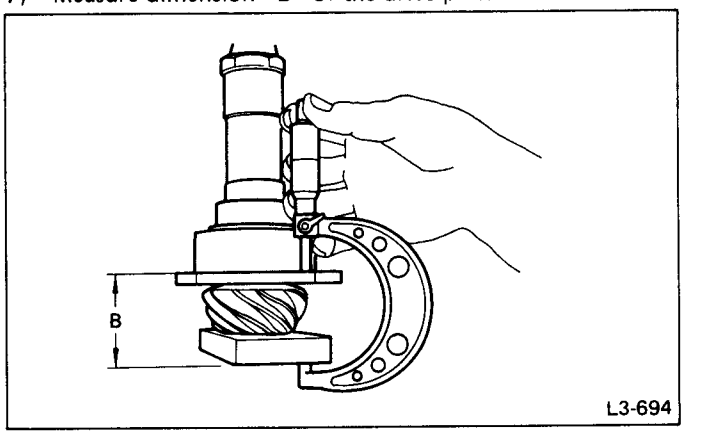


Fig. 193

8) Determine the thickness t (mm) of the drive pinion shim.

t = 6.5 ± 0.0125 – (B – A)

The number of shims must be three or less.

- **Available drive pinion shims**

Part No.	Thickness mm (in)
31451AA050	0.15 (0.0059)
31451AA060	0.175 (0.0069)
31451AA070	0.2 (0.0079)
31451AA080	0.225 (0.0089)
31451AA090	0.25 (0.0098)
31451AA100	0.275 (0.0108)

5. Reverse Clutch

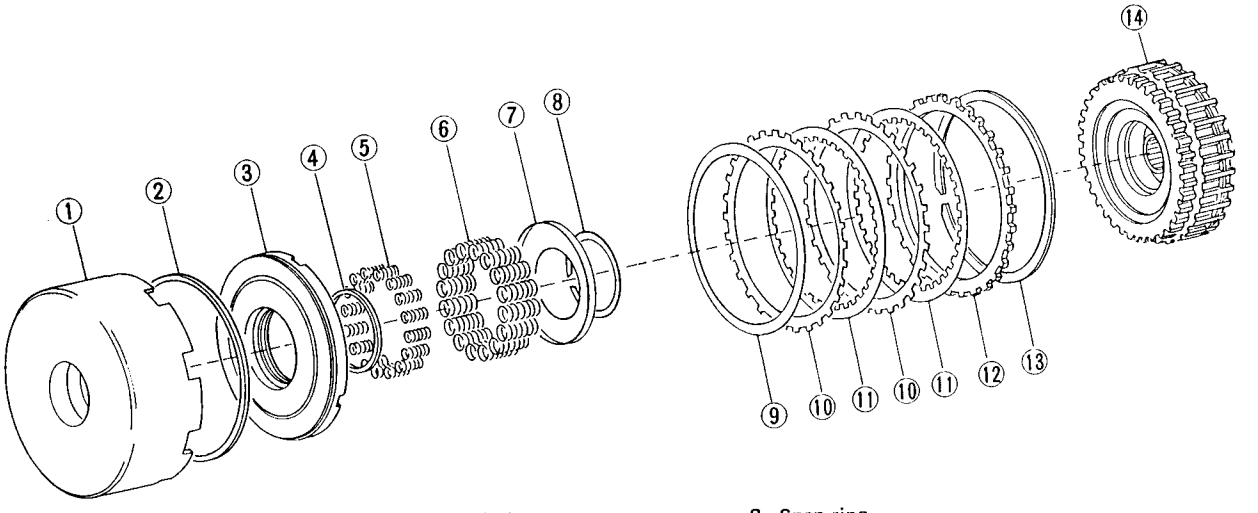
DISASSEMBLY

1) Remove the snap ring, and take out the retaining plate, drive plates, driven plates, and dish plate.
2) Using the COMPRESSOR (398673600), INSTALLER (398177700) and PLIER (399893600), remove the snap ring and take out the spring retainer and springs.
3) Take out the piston by applying compressed air.

INSPECTION

1) Drive plate facing for wear and damage
2) Snap ring for wear, return spring for breakage or setting, and spring retainer for deformation
3) Lip seal and lathe cut seal ring for damage
4) Piston check ball for operation

ASSEMBLY



1 Reverse clutch drum
2 Lip seal
3 Reverse clutch piston
4 Lathe cut seal ring
5 Spring
6 Spring
7 Spring retainer
8 Snap ring
9 Dish plate
10 Driven plate
11 Drive plate
12 Retaining plate
13 Snap ring
14 High clutch drum

L3-596

Fig. 194

1) Using the same special tools as those used in disassembling, assemble piston the return springs, spring retainer and snap ring.
2) Assemble the dish plate, driven plates, drive plates and retaining plate in that order and attach the snap ring.

Pay attention to the orientation of the dish plate.

3) Checking operation:
Apply compressed air intermittently to the oil hole, and check the reverse clutch for smooth operation.
4) Measuring clearance (Retaining plate selection).

Standard value:
0.5 – 0.8 mm (0.020 – 0.031 in)
Allowable limit: 1.2 mm (0.047 in)

Before measuring clearance, place the same thickness of shim on both sides to prevent retaining plate from tilting.

- **Available retaining plates**

Part No.	Thickness mm (in)
31567AA000	4.6 (0.181)
31567AA020	4.8 (0.189)
31567AA030	5.0 (0.197)
31567AA040	5.2 (0.205)
31567AA050	5.4 (0.213)

6. High Clutch

DISASSEMBLY

1) Remove the snap ring, and take out the retaining plate, drive plates, and driven plates.
2) Using the COMPRESSOR (398673600), INSTALLER (398177700), and PLIERS (399893600), remove the snap ring and take out the spring retainer CP.
3) Apply compressed air to the clutch drum to remove the piston.

INSPECTION

1) Drive plate facing for wear and damage
2) Snap ring for wear, return spring for setting and breakage, and spring retainer for deformation
3) Lathe cut rings (large) (small) for damage
4) Piston check ball for smooth operation

ASSEMBLY

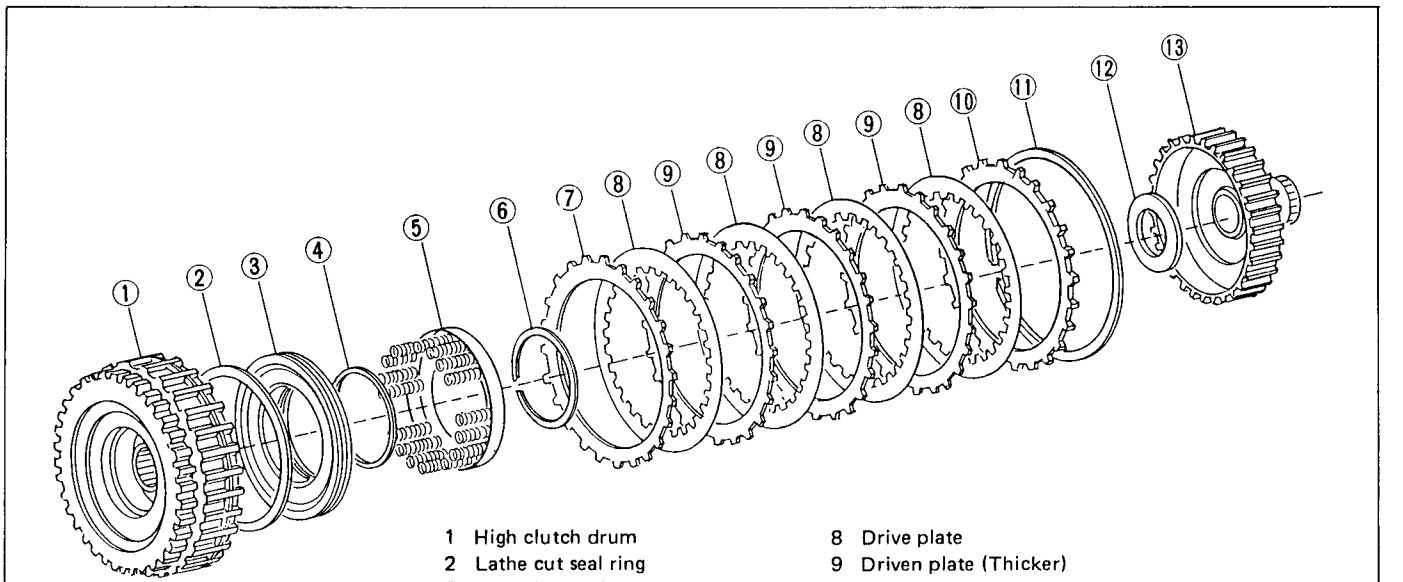


Fig. 195

1) Using the same special tools as those used in disassembling, assemble the piston, spring retainer CP, and snap ring.
2) Install the driven plate (thin), drive plates, driven plates, and retaining plate in that order. Then attach the snap ring.
3) Checking operation:
Apply compressed air intermittently to the oil hole, and check the high clutch for smooth operation.
4) Measuring clearance (Retaining plate selection).

Standard value:
1.8 – 2.2 mm (0.071 – 0.087 in)
Allowable limit: 2.6 mm (0.102 in)

Before measuring clearance, place the same thickness of shim on both sides to prevent retaining plate from tilting.

- **Available retaining plates**

Part No.	Thickness mm (in)
31567AA190	3.6 (0.142)
31567AA200	3.8 (0.150)
31567AA210	4.0 (0.157)
31567AA220	4.2 (0.165)
31567AA230	4.4 (0.173)
31567AA240	4.6 (0.181)
31567AA250	4.8 (0.189)
31567AA260	5.0 (0.197)

7. Forward Clutch Drum

DISASSEMBLY

1) Remove two snap rings from the forward clutch drum.

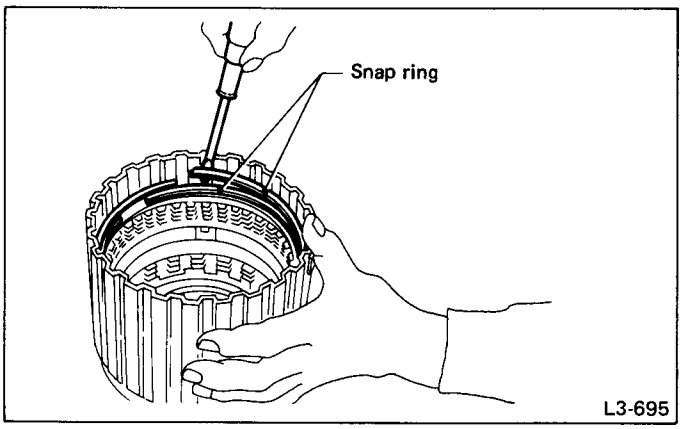


Fig. 196

2) Remove the retaining plate, drive plates, driven plates and dish plate. (Forward clutch)
3) Remove the snap ring from the forward clutch drum.

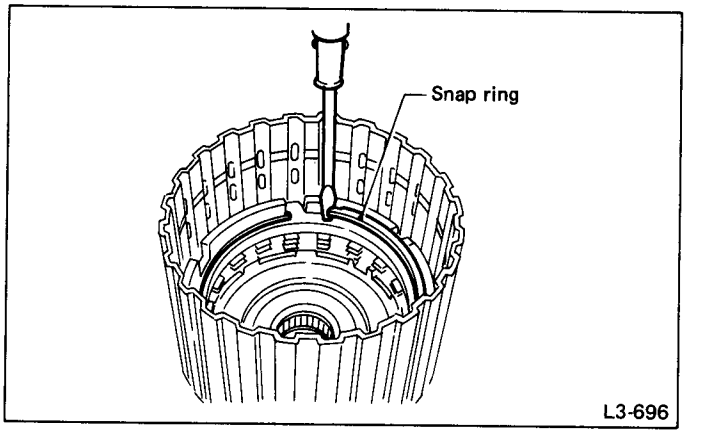


Fig. 197

4) Remove the retaining plate, drive plates, driven plates and dish plate. (Overrunning clutch)
5) Compress the spring retainer, and remove the snap ring from the forward clutch, by using SEAT (498627100) and COMPRESSOR (398673600).
6) Install the one-way clutch inner race to the forward clutch drum, and apply compressed air to remove the overrunning piston and forward piston.

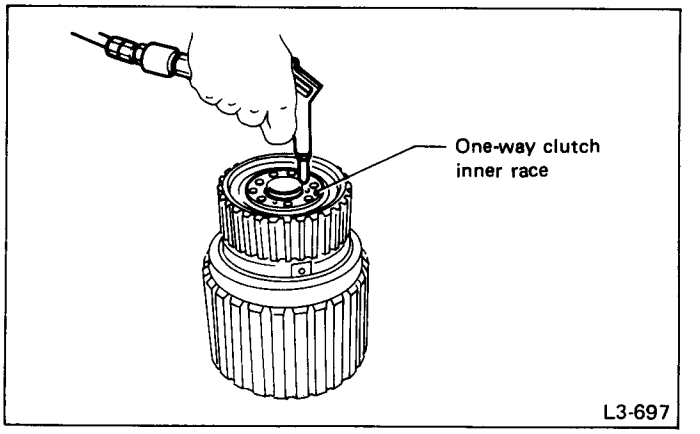


Fig. 198

7) Remove the one-way clutch after taking out the snap ring.
8) Remove the needle bearing after taking out the snap ring.

INSPECTION

1) Drive plate facing for wear and damage
2) Snap ring for wear, return spring for setting and breakage, and snap ring retainer for deformation
3) Lip seal and lathe cut ring for damage
4) Piston and drum check ball for operation

ASSEMBLY

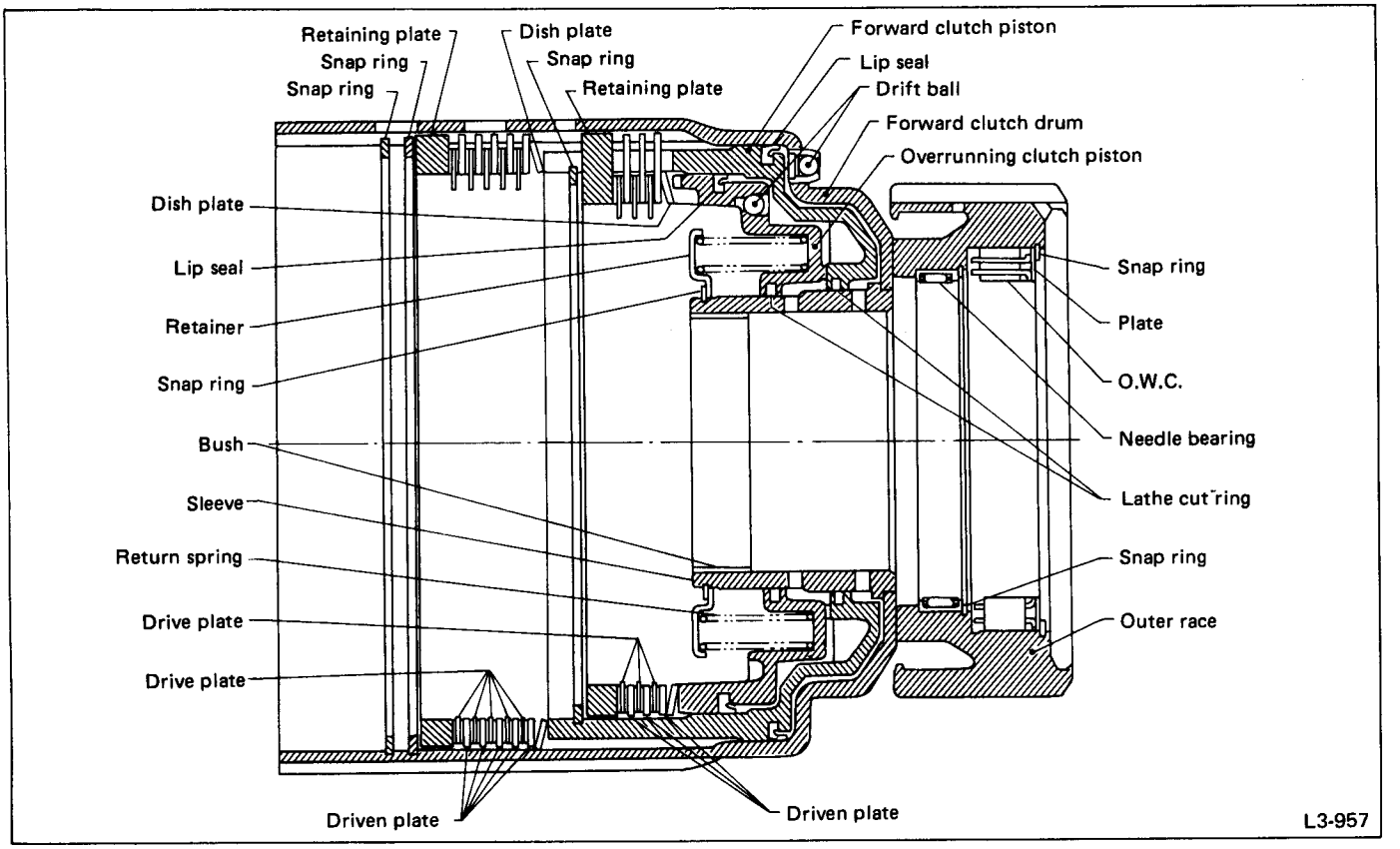


Fig. 199

1) Fit the forward piston and overrunning piston to the forward clutch drum.

Align the forward piston cut-out portion with the spline of the drum.

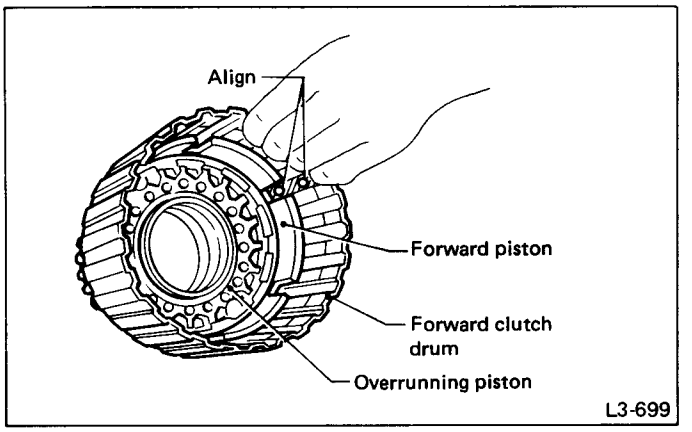


Fig. 200

2) Set the springs and retainer on the piston with a press and attach the snap ring.

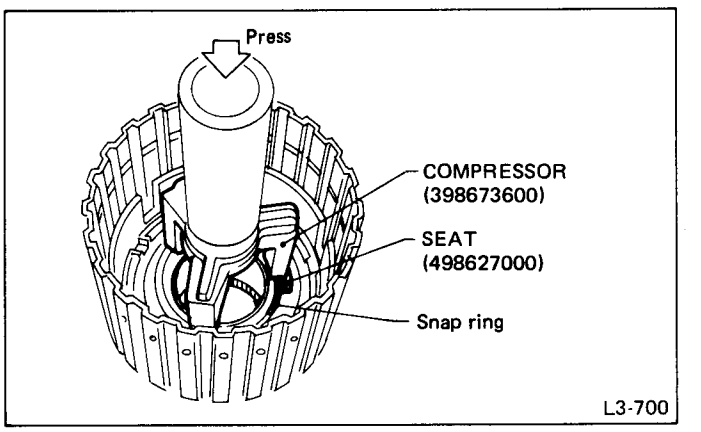


Fig. 201

3) Install the dish plate, driven plates, drive plates, and retaining plate, and secure with the snap ring. (Overrunning clutch)

Pay attention to the orientation of the dish plate.

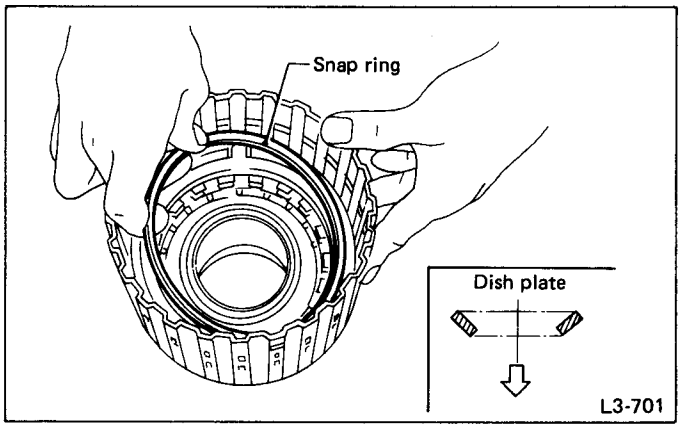


Fig. 202

4) Install the dish plates, driven plates, drive plates, and retaining plate, and secure with the snap ring. (Forward clutch)

Pay attention to the orientation of the dish plate.

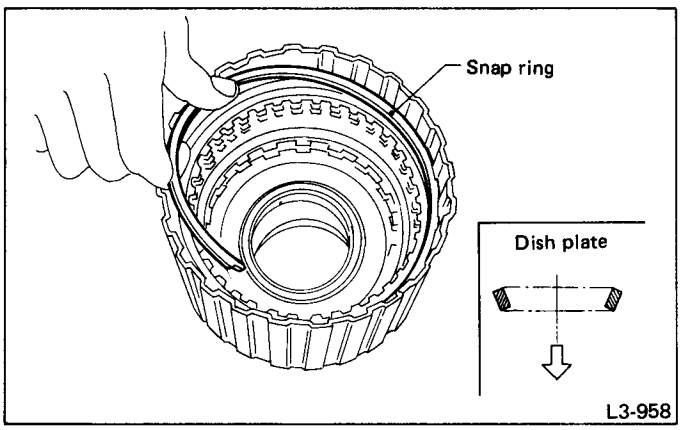


Fig. 203

5) Install the snap ring (for front planetary carrier).
6) Check the forward clutch and overrunning clutch for operation.
Set the one-way clutch inner race, and apply compressed air for checking.
7) Checking clearance:

	Standard value mm (in)	Allowable limit mm (in)
Forward clutch	0.45 – 0.85 (0.0177 – 0.0335)	1.6 (0.063)
Overrunning clutch	1.0 – 1.4 (0.039 – 0.055)	2.0 (0.079)

Before measuring clearance, place the same thickness of shim on both sides to prevent retaining plate from tilting.

If the clearance is out of the specified range, select a proper retaining plate so that the standard clearance can be obtained.

(Forward clutch)

Part No.	Thickness mm (in)
31567AA010	8.0 (0.315)
31567AA060	8.2 (0.323)
31567AA070	8.4 (0.331)
31567AA080	8.6 (0.339)
31567AA090	8.8 (0.346)
31567AA100	9.0 (0.354)

(Overrunning clutch)

Part No.	Thickness mm (in)
31567AA120	8.0 (0.315)
31567AA130	8.2 (0.323)
31567AA140	8.4 (0.331)
31567AA150	8.6 (0.339)
31567AA160	8.8 (0.346)
31567AA170	9.0 (0.354)
31567AA180	9.2 (0.362)

8) Install the needle bearing, and secure with the snap ring.

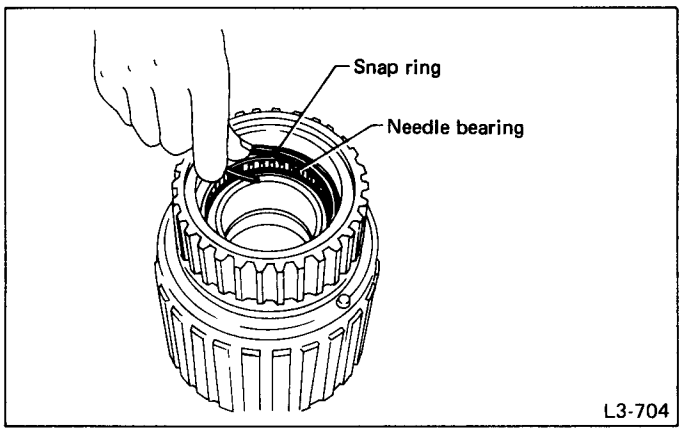


Fig. 204

9) Install the one-way clutch (1-2) and plate, and secure with the snap ring.

Set the inner race. Make sure that the forward clutch is free in the clockwise direction and locked in the counterclockwise direction, as viewed from the front of the vehicle.

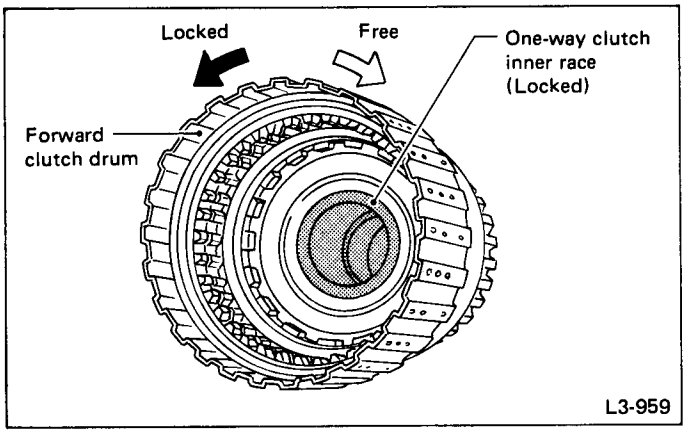


Fig. 205

8. One-Way Clutch Outer Race

DISASSEMBLY

Remove the snap ring. Then remove the one-way clutch (3-4).

INSPECTION

Check the sliding surface and one-way clutch (3-4) for any harmful cuts, damage, or other faults.

ASSEMBLY

Assemble the one-way clutch (3-4), and secure with the snap ring.

Pay attention to the orientation of the one-way clutch (3-4).

Confirm:
Assemble the rear internal gear, and secure the outer race. Make sure that the internal gear is locked in the clockwise direction, and free to rotate in the counterclockwise direction.

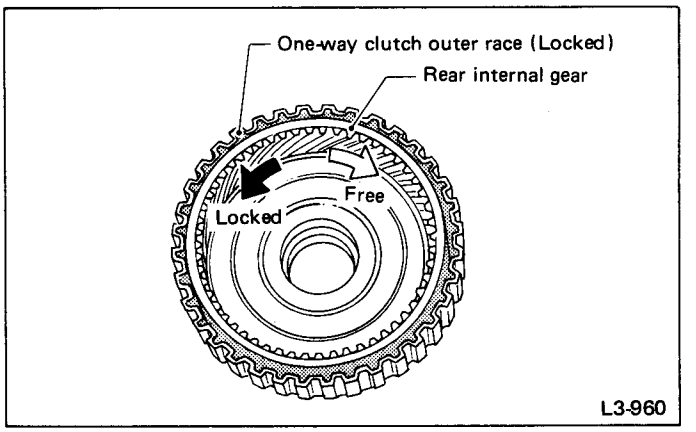


Fig. 206

9. Servo Piston

DISASSEMBLY

1) Remove the spring.
2) Remove the band servo piston (3-4).
3) While compressing the retainer from above, remove the snap ring. Then remove the retainer, spring and stem.
4) Take out the band servo piston (1-2).

INSPECTION

1) Check each component for harmful cuts, damage, or other faults.
2) Check the O-ring and lathe cut ring for damage.

ASSEMBLY

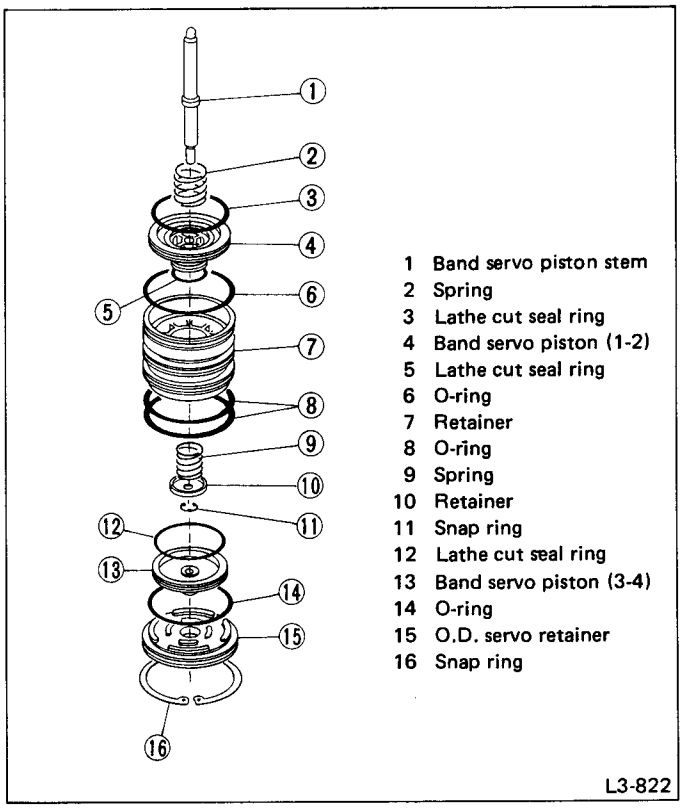


Fig. 207

1) Install the band servo piston (1-2) to the retainer, and insert the stem.
2) Put the spring and retainer on the piston. Fit the snap ring securely while compressing the spring.
3) Install the band servo piston (3-4).
4) Install the spring securely to the band servo piston (1-2).

a. Many different O-rings and lathe cut rings are used. Be careful not to confuse them when installing.
b. Be careful not to damage O-rings and lathe cut rings.

10. Differential Case Assembly

DISASSEMBLY

1) Using a press, remove the taper roller bearing.

Be careful not to damage the speedometer drive gear.

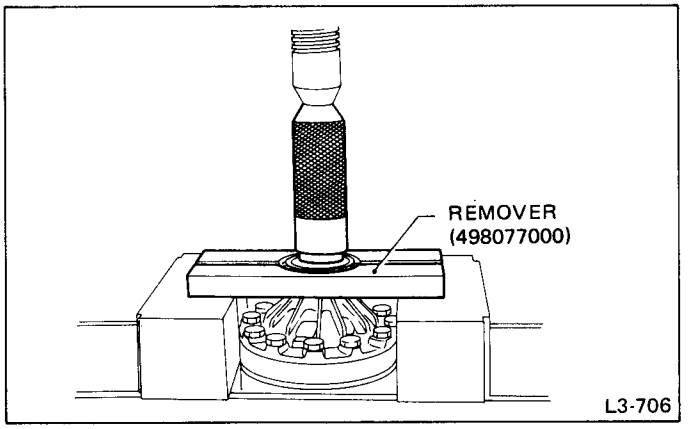


Fig. 208

2) Secure the case in a vise and remove the crown gear tightening bolts, then separate the crown gear, case (RH) and case (LH).

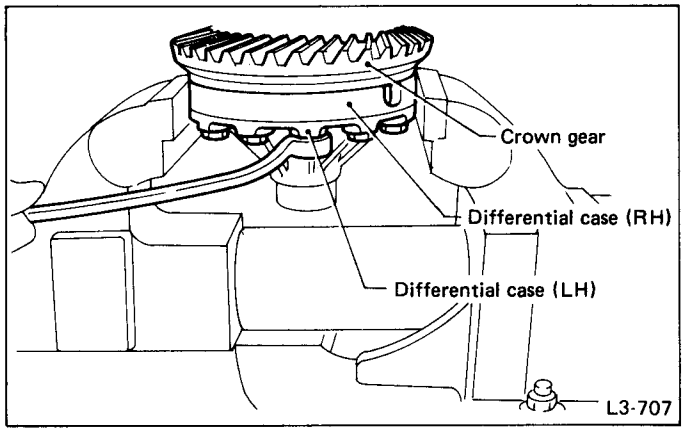


Fig. 209

3) Pull out the straight pin and shaft, and remove the differential bevel gear, washer, and differential bevel pinion.

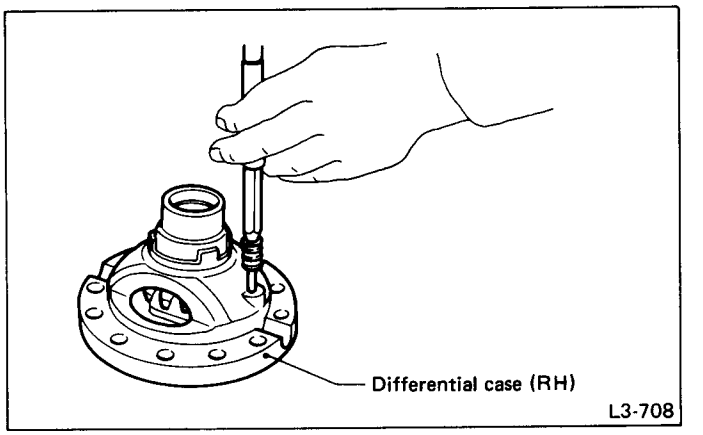


Fig. 210

INSPECTION

Check each component for harmful cuts, damage, and other faults.

ASSEMBLY

1) Install the washer, differential bevel gear, and differential bevel pinion in the differential case (RH). Insert the pinion shaft, and fit the straight pin.

Make sure that the case (RH) is staked in order to lock the straight pin.

2) Install the washer and differential bevel gear to the differential case (LH). Then put the case over the differential case (RH), and connect both cases.

3) Install the crown gear and secure by tightening the bolt.

Standard tightening torque:
57 – 67 N·m (5.8 – 6.8 kg-m, 42 – 49 ft-lb)

4) Measurement of backlash (Selection of washer).
Measure the gear backlash by inserting a dial gauge through the access window of the case.

Standard value:
0.13 – 0.18 mm (0.0051 – 0.0071 in)

Measure the backlash by applying a pinion tooth between two bevel gear teeth.

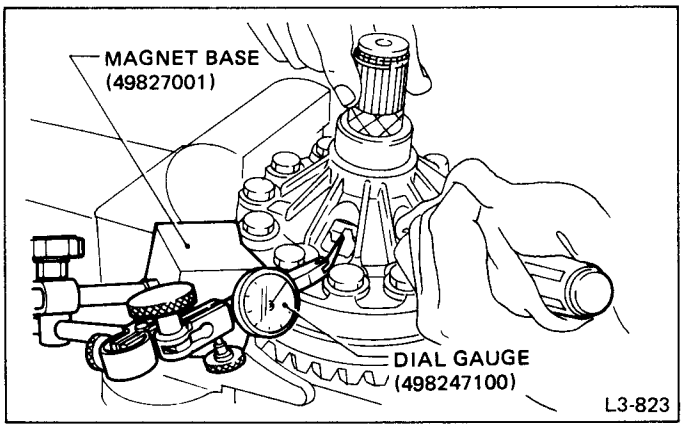


Fig. 211

5) Install the speedometer drive gear. Then force-fit the taper roller bearing with a press.

Be sure to position correctly the locking end of the speedometer drive gear.

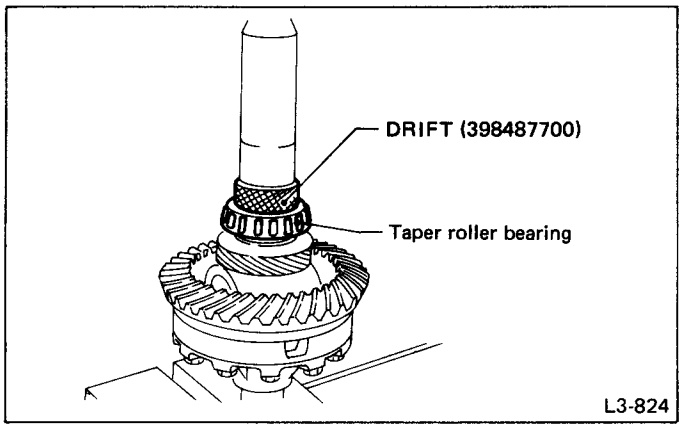


Fig. 212

11. Transfer Clutch

DISASSEMBLY

1) Remove the seal ring.

Be careful not to damage the seal ring.

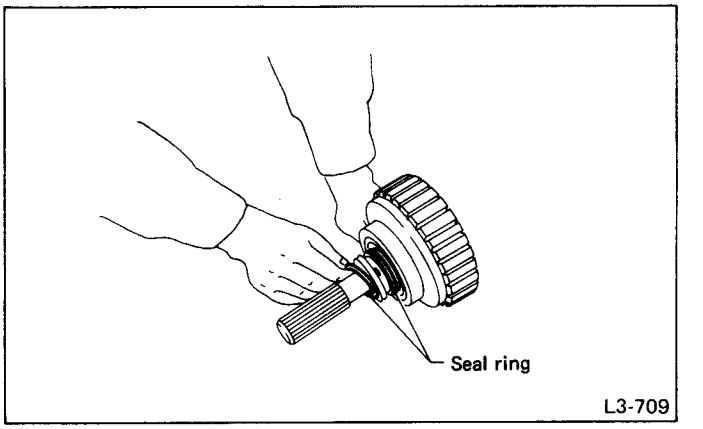


Fig. 213

2) Using a press, remove the ball bearing.

Do not reuse the bearing.

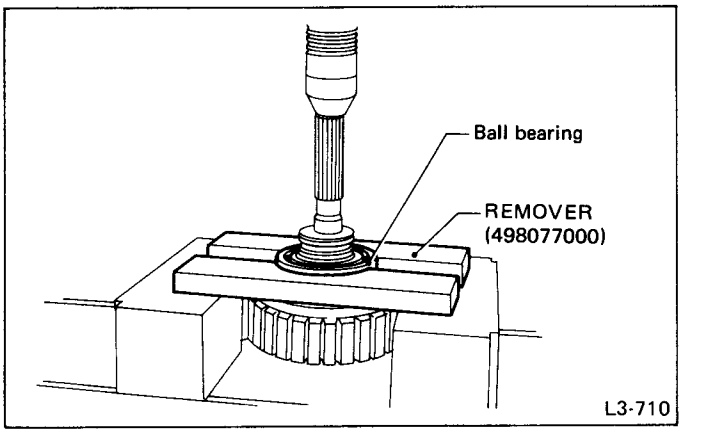


Fig. 214

3) Remove the snap ring, and take out the pressure plate, drive plates, and driven plates.

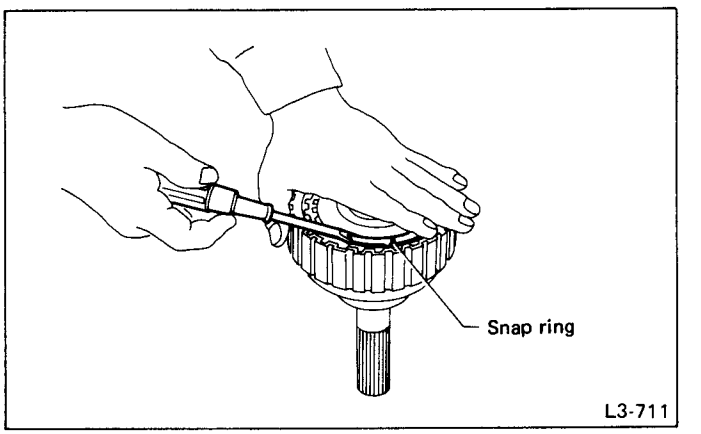


Fig. 215

4) Remove the snap ring, and take out the spring retainer CP.

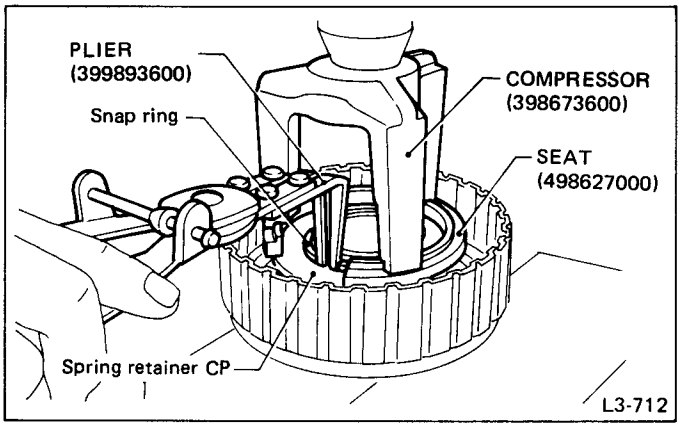


Fig. 216

5) Apply compressed air to the rear drive shaft to remove the piston.

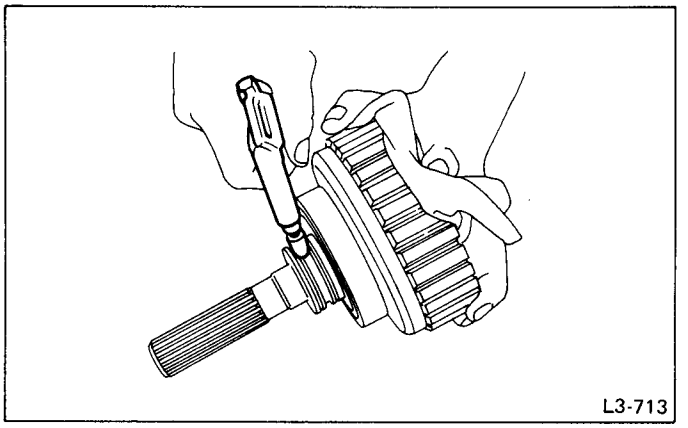


Fig. 217

INSPECTION

1) Check the drive plate facing for wear and damage.
2) Check the snap ring for wear, return spring for permanent set and breakage, and spring retainer for deformation.
3) Check the lathe cut ring for damage.

ASSEMBLY

1) Install the lathe cut seal ring to the I.D./O.D. of the transfer clutch piston.
2) Install the piston and spring retainer, and secure with a snap ring.

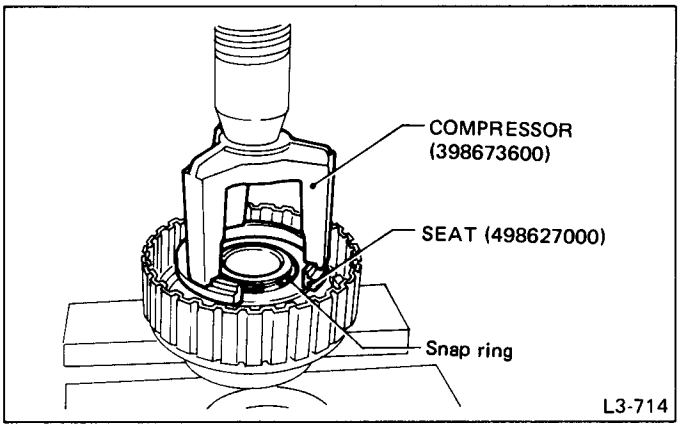


Fig. 218

3) Install the driven plates, drive plates, and pressure plate, and secure with a snap ring.
4) Apply compressed air to see if the assembled parts move smoothly.

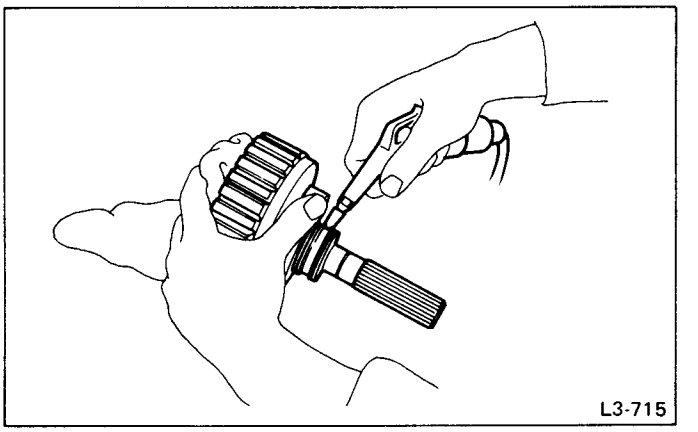


Fig. 219

5) Check the clearance:

Standard value:
0.2 – 0.9 mm (0.008 – 0.035 in)
Allowable limit: 1.6 mm (0.063 in)

If the clearance is not within the specified range, select a proper pressure plate.

Before measuring clearance, place the same thickness of shim on both sides to prevent pressure plate from tilting.

- **Available pressure plates**

Part No.	Thickness mm (in)
31593AA150	3.3 (0.130)
31593AA160	3.7 (0.146)
31593AA170	4.1 (0.161)
31593AA180	4.5 (0.177)

6) Press-fit the ball bearing.

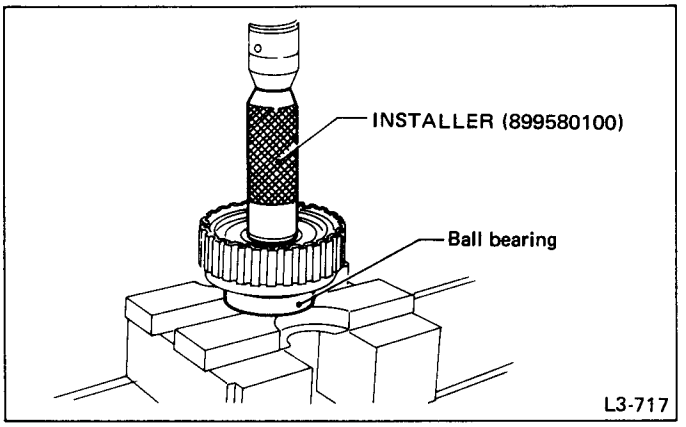


Fig. 220

7) Coat the seal ring with vaseline, and install it in the seal ring groove of the shaft.

Do not expand the seal ring excessively when installing.

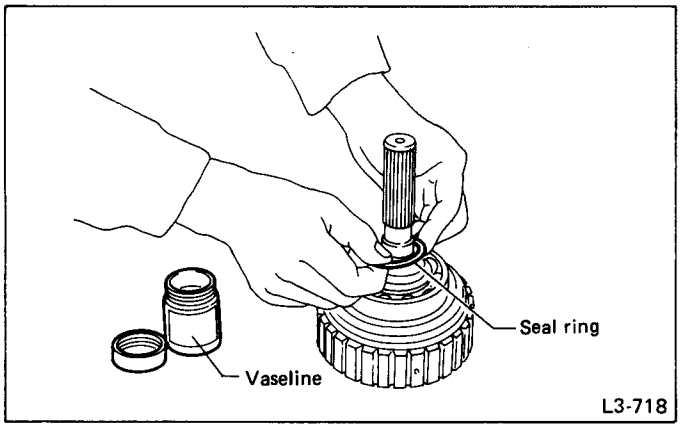


Fig. 221

12. Transfer Valve Body

DISASSEMBLY

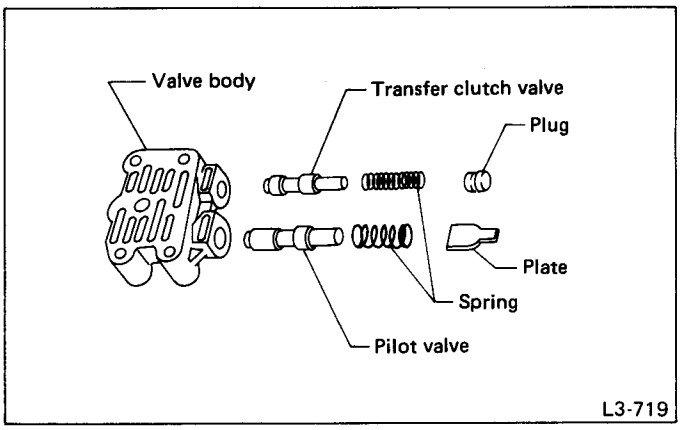


Fig. 222

1) Remove the plate. Then remove the spring and pilot valve together.
2) Remove the straight pin and pry out the plug with a screwdriver. Then extract the spring and transfer clutch valve together.

Be careful not to damage the valve and valve body.

INSPECTION

Check each component for harmful cuts, damage, or other faults.

ASSEMBLY

To assemble, reverse the removal sequence.

Make sure the valve slides smoothly after assembling.

4 Assembly of Overall Transmission

1. CONVERTER CASE SECTION

1) Check the appearance of each component and clean.

Make sure each part is free of harmful cuts, damage, and other faults.

2) Install the washer and snap ring to the speedometer shaft, and set the oil seal. Then force-fit the shaft to the converter case.

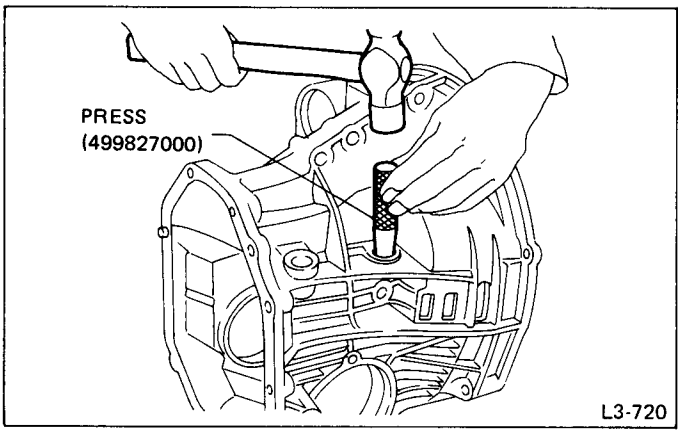


Fig. 223

3) Install the speedometer driven gear to the speedometer shaft, and secure with a snap ring.

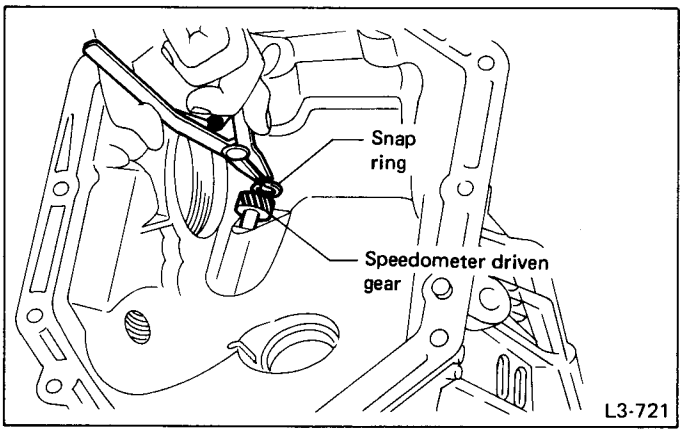


Fig. 224

4) Force-fit the oil seal to the converter case.

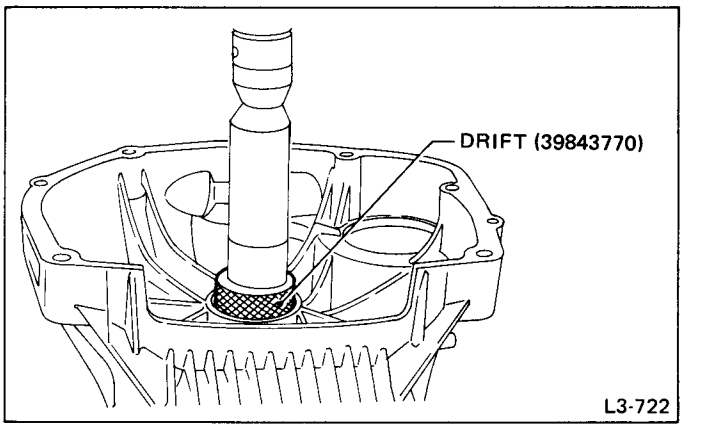


Fig. 225

5) Install the differential ASSY to the case, paying special attention not to damage the speedometer gears (drive and driven) and the inside of the case (particularly, the differential side retainer contact surface).
6) Install the snap ring to the axle shaft, insert the shaft into the differential assembly, and tap it into position with a plastic hammer.

Thrust play:
Approx. 0.3 mm – 0.5 mm (0.012 – 0.020 in)

a. If no play is felt, check whether the shaft is fully inserted. If shaft insertion is correct, replace the axle shaft.
b. Be sure to use a new snap ring.

7) Wrap vinyl tape around the splined portion of the axle shaft.
8) Install the oil seal and outer race (taper roller bearing) to the differential side retainer. Then screw in the retainer after coating the threads with oil.

a. Pay attention not to damage the oil seal lips.
b. Do not confuse the RH and LH oil seals.
c. Keep the O-ring removed from the retainer.

9) Using the HANDLE (499787000), screw in the retainer until light contact is felt.

Screw in the RH side slightly deeper than the LH side.

10) Hypoid gear backlash adjustment and tooth contact check
(1) Assemble the drive pinion assembly to the oil pump housing.

a. Be careful not to bend the shims.
b. Be careful not to force the pinion against the housing bore.

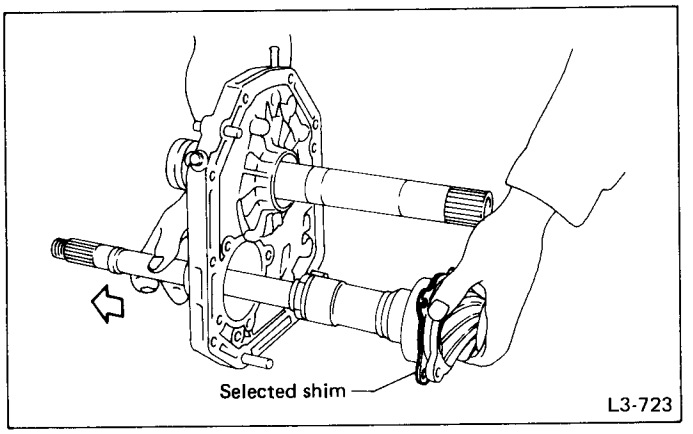


Fig. 226

(2) Tighten four bolts to secure the roller bearing.

Tightening torque:
39 ± 3 N·m (4.0 ± 0.3 kg-m, 28.9 ± 2.2 ft-lb)

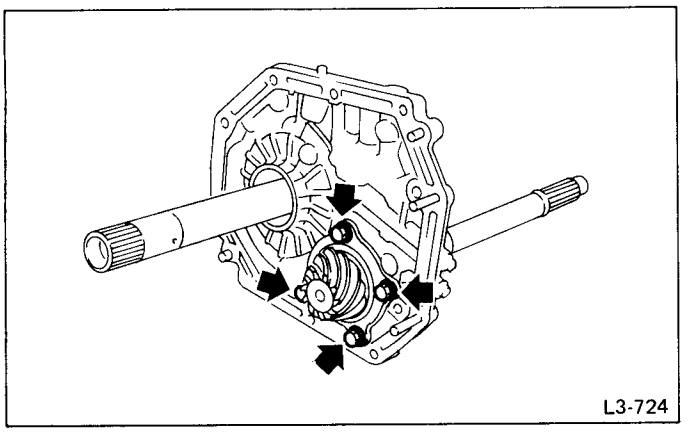


Fig. 227

(3) Install the oil pump housing assembly to the converter case, and secure evenly by tightening four bolts.

Tightening torque:
33 ± 3 N·m (3.4 ± 0.3 kg-m, 24.6 ± 2.2 ft-lb)

a. Thoroughly remove the liquid gasket from the case mating surface beforehand.
b. Use an old gasket or an aluminium washer so as not to damage the mating surface of the housing.

(4) Rotate the drive pinion several times.

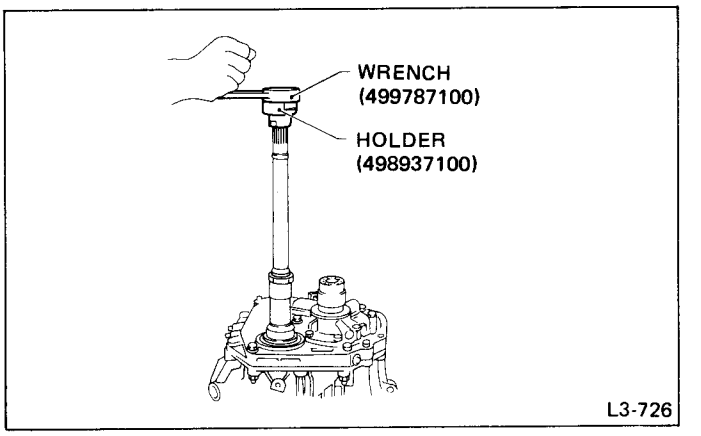


Fig. 228

(5) Tighten the LH retainer until contact is felt while rotating the shaft. Then loosen the RH retainer. Keep tightening the LH retainer and loosening the RH retainer until the pinion shaft can no longer be turned. This is the "zero" state.
(6) After the "zero" state is established, back off the LH retainer 3 notches and secure it with the locking tab. Then back off the RH retainer and retighten until it stops. Repeat this procedure several times. Tighten the RH retainer 1 3/4 notches further. This sets the preload. Finally, secure the retainer with its locking tab.

Turning the retainer by one tooth changes the backlash about 0.05 mm (0.0020 in).

(7) Turn the drive pinion several rotations and check to see if the backlash is within the standard value.

Backlash:
0.13 – 0.18 mm (0.0051 – 0.0071 in)

After confirming that the backlash is correct, check the tooth contact.

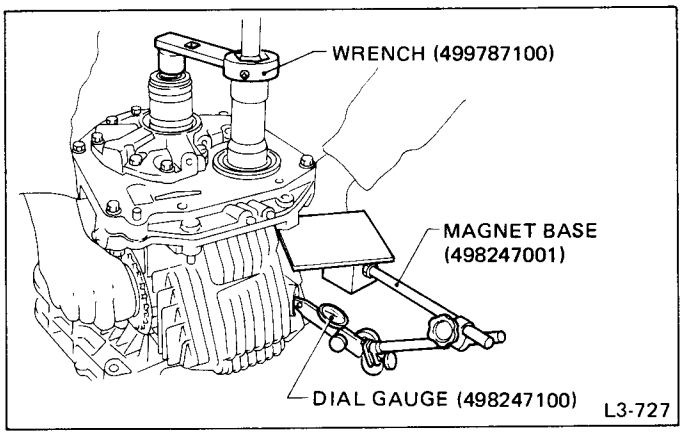


Fig. 229

(8) Apply red lead evenly to the surfaces of three or four teeth of the crown gear. Rotate the drive pinion in the forward and reverse directions several times. Then remove the oil pump housing, and check the tooth contact pattern.
If tooth contact is improper, readjust the backlash or shim thickness.

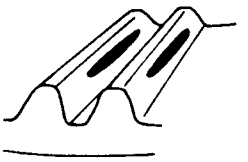
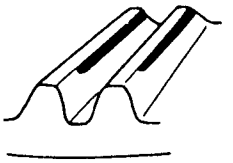
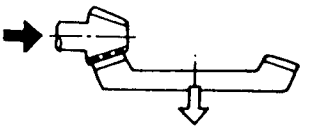
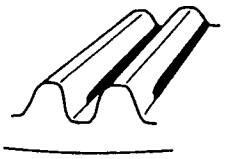
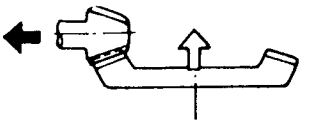
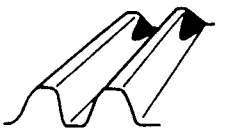
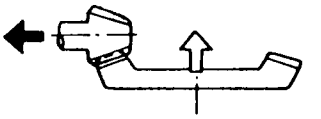
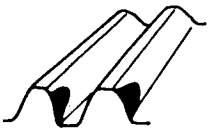
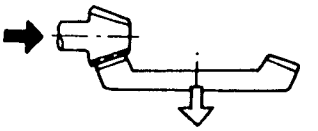
Checking item	Contact pattern	Corrective action
Correct tooth contact Tooth contact pattern slightly shifted toward toe under no-load rotation. (When loaded, contact pattern moves toward heel.)		
Face contact Backlash is too large.	 This may cause noise and chipping at tooth ends.	 Increase thickness of drive pinion hight adjusting shim in order to bring drive pinion close to crown gear.
Flank contact Backlash is too small.	 This may cause noise and stepped wear on surfaces.	 Reduce thickness of drive pinion hight adjusting shim in order to move drive pinion away from crown gear.
Toe contact (Inside end contact)	 Contact area is small. This may cause chipping at toe ends.	Adjust as for flank contact. 
Heel contact (Outside end contact)	Contact area is small. This may cause chipping at heel ends. 	Adjust as for face contact. 

Fig. 230

A13-164

(9) If tooth contact is correct, mark the retainer position and loosen it. After fitting the O-ring, screw in the retainer to the marked position. Then tighten the lock plate to the specified torque.

Tightening torque:
23 – 26 N·m (2.3 – 2.7 kg-m, 17 – 20 ft-lb)

11) Install the seal pipe to the converter case.

Be sure to use a new seal pipe.

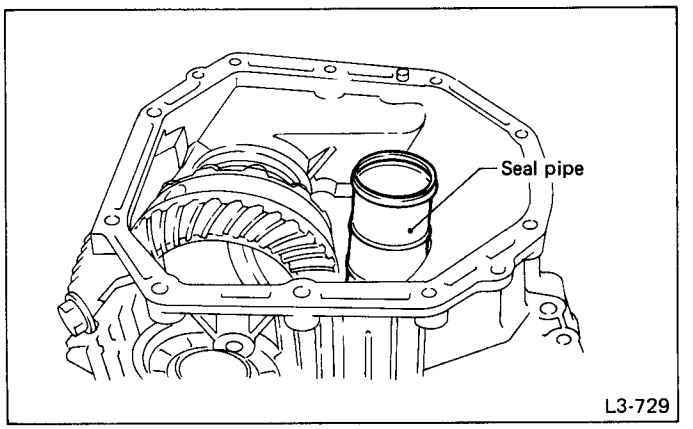


Fig. 231

12) Install two oil seals to the oil seal retainer with INSTALLER (499247300).

a. Pay attention to the orientation of the oil seals.
b. Be careful not to damage the seal lips. If any damage is found, replace with a new one.

13) Attach the O-ring to the oil seal retainer with vaseline. Install the seal to the oil pump housing bore.

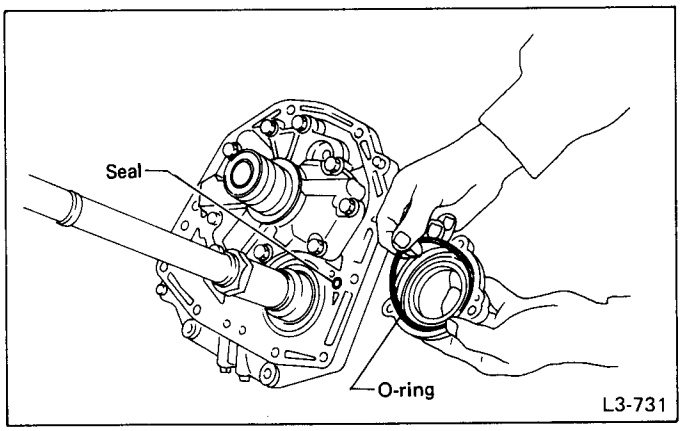


Fig. 232

14) Install the oil seal retainer taking care not to damage the oil seal lips. Then secure with three bolts.

Make sure the O-ring is fitted correctly in position.

Tightening torque:
7 ± 1 N·m (0.7 ± 0.1 kg-m, 5.1 ± 0.7 ft-lb)

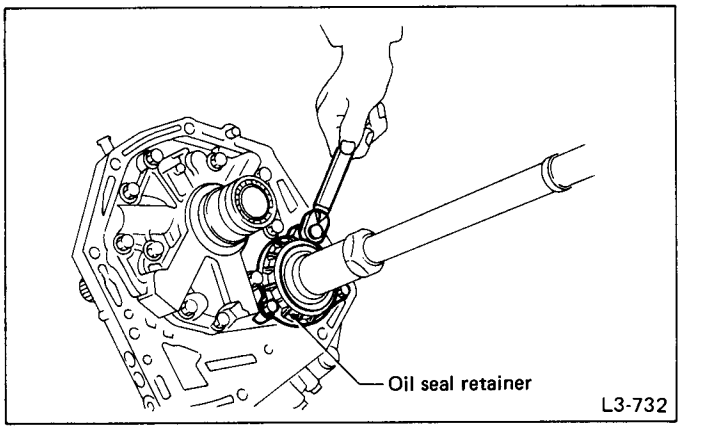


Fig. 233

15) Apply vaseline to the groove on the oil pump cover, and install two (R) seal rings and two (H) seal rings.

a. Fit the seal ring after compressing, and rub vaseline into the seal ring to avoid expansion.
b. The "R" seal ring has a large diameter, while "H" has small diameter.

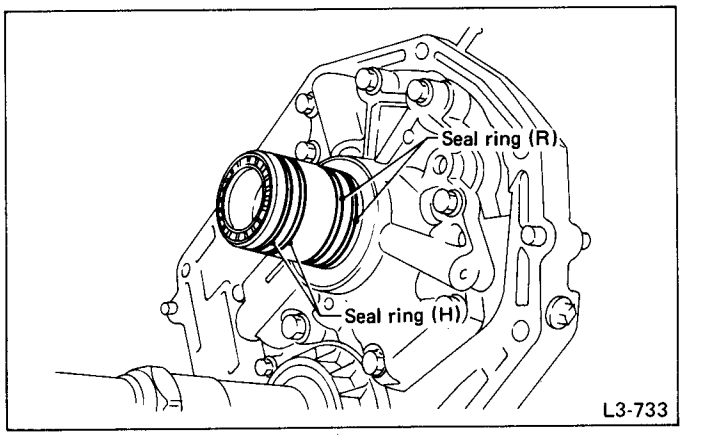


Fig. 234

16) Install the rubber seal to the converter case.

Be careful not to lose the rubber seal.

2. TRANSMISSION CASE

1) Press-fit the roller bearing to the transmission case.

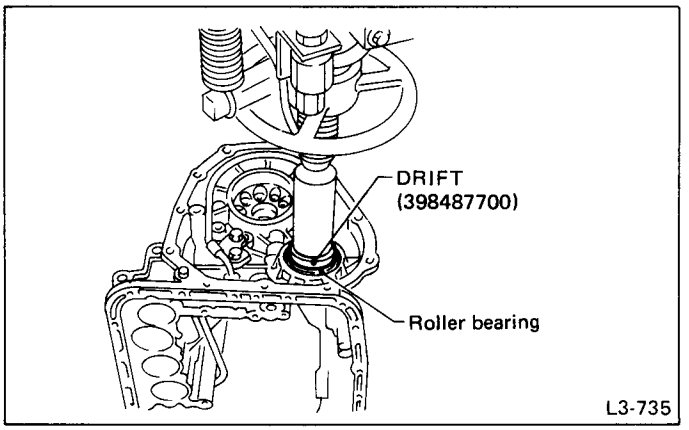


Fig. 235

2) Using a plastic hammer, force-fit the oil seal.

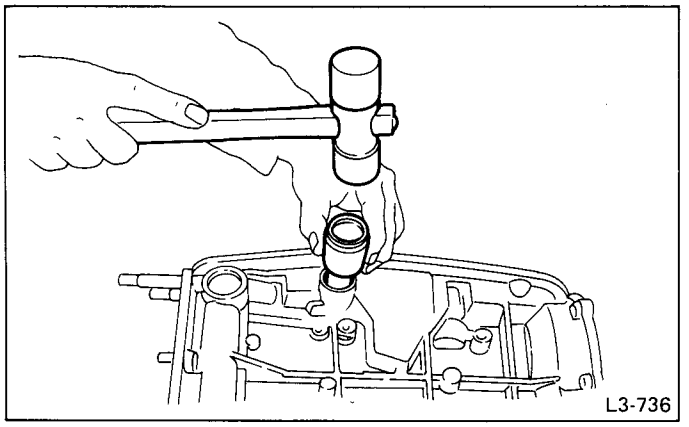


Fig. 236

3) Install the manual plate and shaft, and secure with a spring pin.

a. Be careful not to damage the oil seal lip.
b. After installation, make sure of smooth movement.

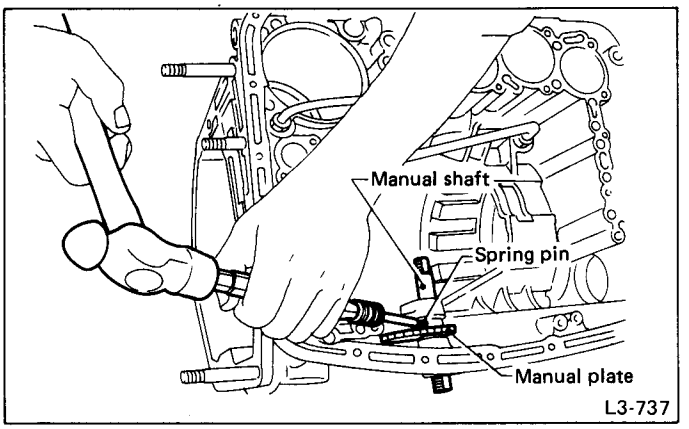


Fig. 237

4) Assemble the manual lever and parking rod to the inside shaft, and secure with a nut.

Tightening torque:
39 ± 3 N·m (4.0 ± 0.3 kg-m, 28.9 ± 2.2 ft-lb)

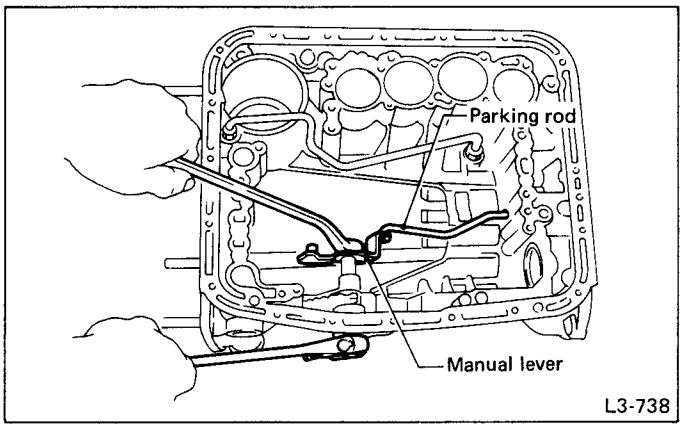


Fig. 238

5) Install the detent manual spring.

Position the spring so that its center is aligned with the center of the manual plate.

Tightening torque:
6 ± 1 N·m (0.6 ± 0.1 kg-m, 4.3 ± 0.7 ft-lb)

6) Install the lathe cut seal ring and lip seal to the I.D./O.D. of the low & reverse piston. Then install the piston into the case with a press.

a. Be careful not to tilt the piston when installing.
b. Be careful not to damage the lip seal.

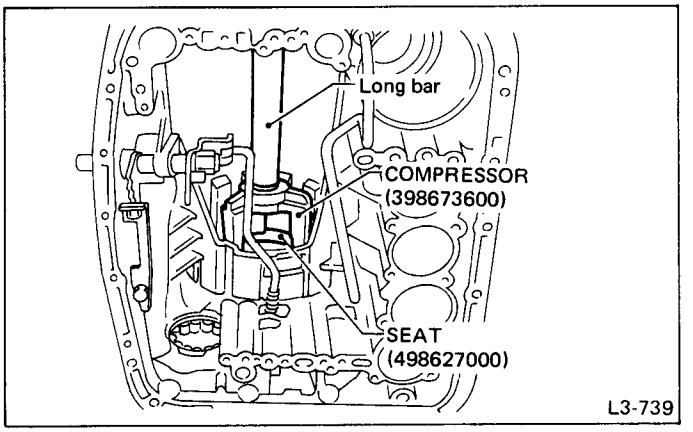


Fig. 239

7) Install the one-way clutch inner race.
(1) Using a press, install the thrust needle bearing to the inner race.

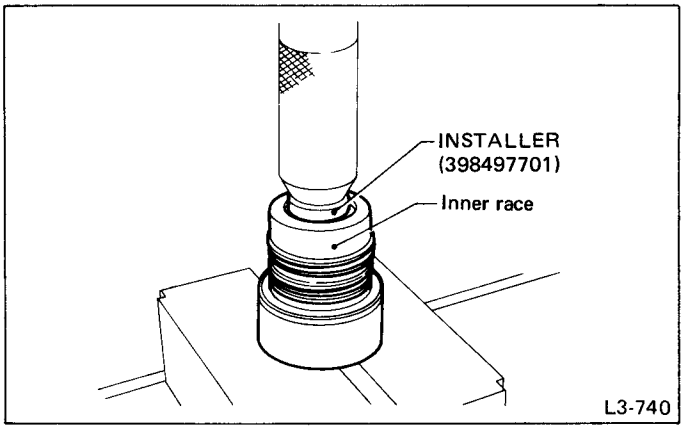


Fig. 240

Use the PULLER ASSY (398527700) when removing.

(2) Install four seal rings.

Apply vaseline to the groove of the inner race and to the seal ring after installation, so that the seal ring will not expand.

(3) Place the spring retainer CP on the inner race. Install the spring to the recessed portion of the piston. Then tighten eight socket head bolts from the rear side of the transmission case.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

Be sure to tighten evenly.

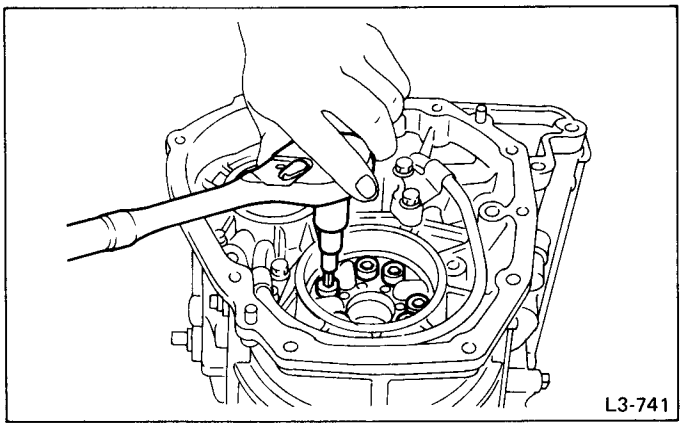


Fig. 241

8) Install the band servo sub ASSY.
9) Press the O.D. servo retainer into position, and secure with a snap ring.

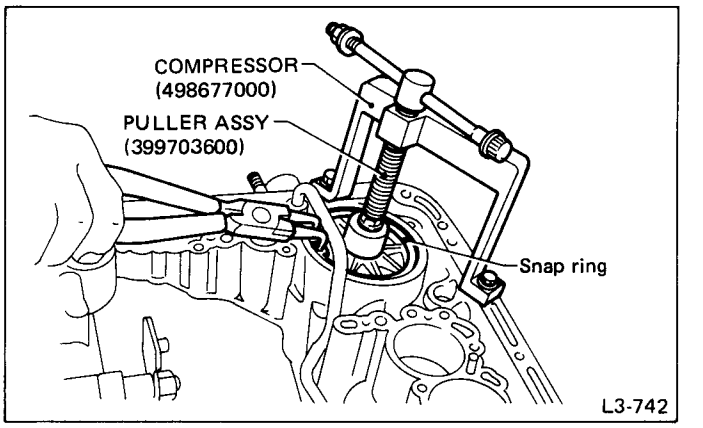


Fig. 242

*** Perform the following operations with the transmission case set vertically on wooden blocks.**

10) Installation of the low & reverse brake:

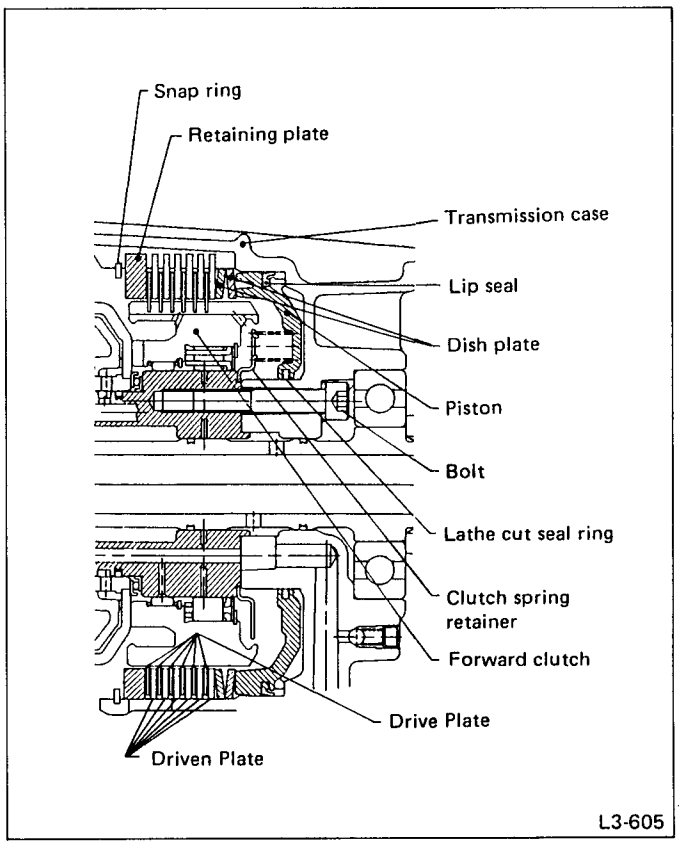


Fig. 243

(1) Install two dish plates, driven plates, drive plates, and a retaining plate, and secure with a snap ring.

a. Pay attention to the orientation of the dish plate.
b. Driven plate } 1800 : 4
Drive plate } 2700 : 6
c. Dish plate 1800 : 2
2700 : 1

(2) Apply compressed air intermittently to check for operation.

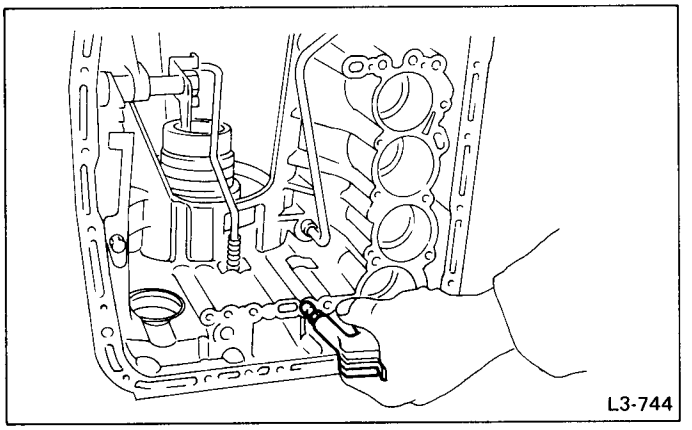


Fig. 244

(3) Check the clearance (Selection of retaining plate)

Standard value:
1.1 – 1.7 mm (0.043 – 0.067 in)
Allowable limit: 2.7 mm (0.106 in)

Before measuring clearance, place the same thickness of shim on both sides to prevent retaining plate from tilting.

- **Available retaining plates**

Part No.	Thickness mm (in)
31667AA180	6.5 (0.256)
31667AA190	6.8 (0.268)
31667AA200	7.1 (0.280)
31667AA210	7.4 (0.291)
31667AA220	7.7 (0.303)
31667AA230	8.0 (0.315)
31667AA240	8.2 (0.323)
31667AA250	8.4 (0.331)

11) Install the thrust needle bearing to the inner race.

Refer to [3] "Location and installing direction of thrust needle bearing and washer" for the orientation of the bearing. Carefully check the orientation of all parts indicated by an asterisk * in the following pages.)

12) Install the forward clutch drum ASSY.
(1) Install carefully while rotating the drum slowly paying special attention not to damage the seal ring.
(2) Installation is complete when the drum recedes 2.5 mm (0.098 in) from the inner race surface.

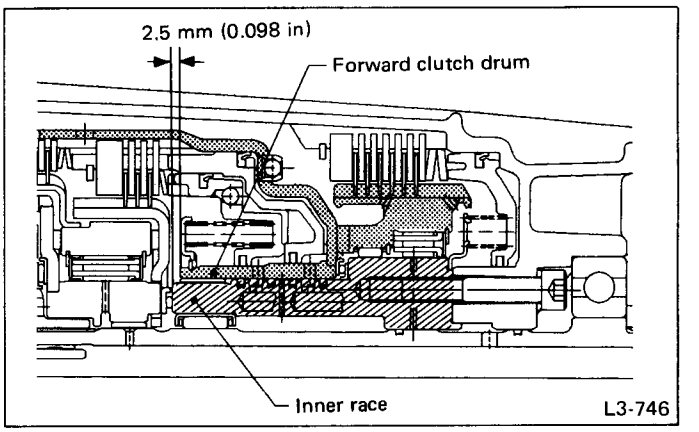


Fig. 245

13) Assemble the overrunning clutch hub.

a. Join the thrust needle bearing* and thrust washer with vaseline, and then install them together.
b. Make sure that the splines are engaged correctly.

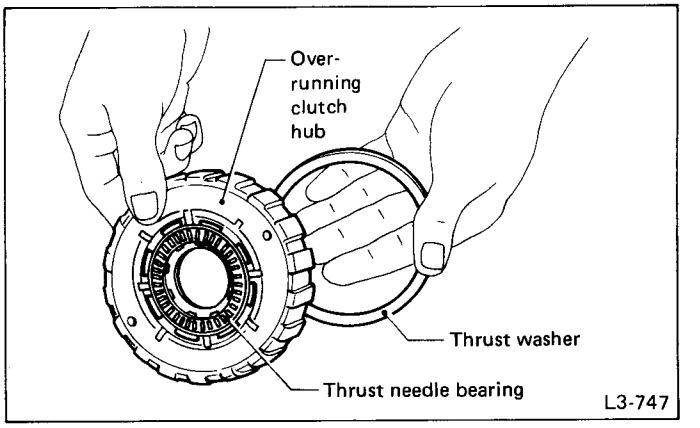


Fig. 246

14) Install the one-way clutch outer race ASSY.

Make sure the forward clutch splines are engaged correctly.

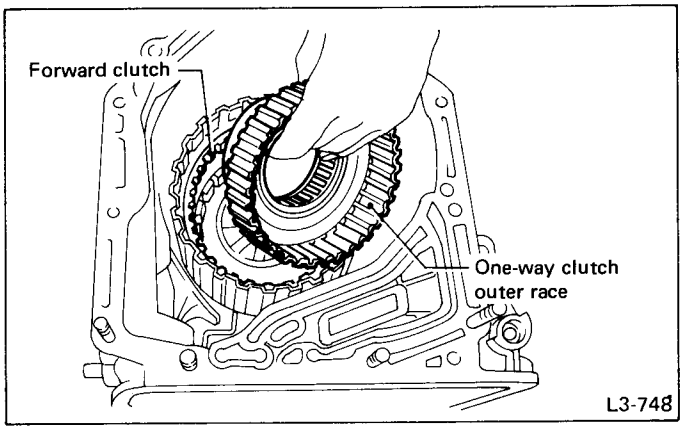


Fig. 247

15) Assemble the rear internal gear.
(1) Join the thrust needle bearing* and thrust washer to the gear with vaseline, and install the gear while rotating it.
(2) Securely engage the bearing with the dog of the over-running clutch hub.

Installation is complete when the snap ring top surface of the forward clutch drum recedes approximately 3.5 mm (0.138 in).

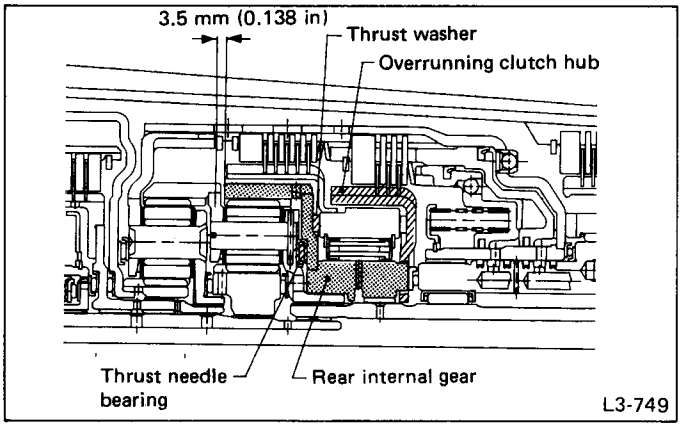


Fig. 248

16) Install the rear planetary carrier.
Attach the thrust needle bearing* to the inside of the carrier with vaseline. Then install the carrier while rotating slowly.

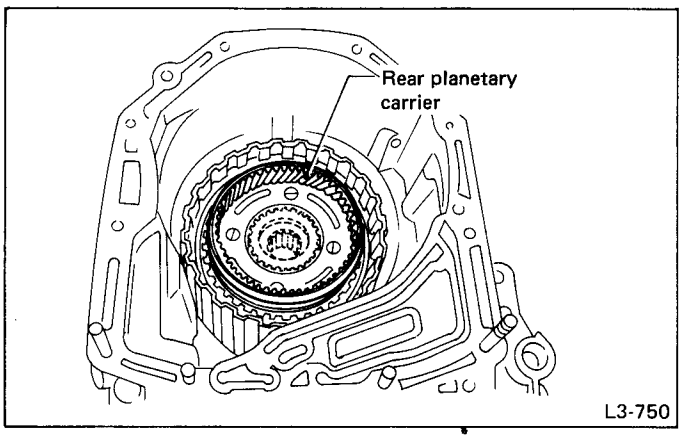


Fig. 249

17) Install the rear sun gear.

Install the gear with the oil hole facing up.

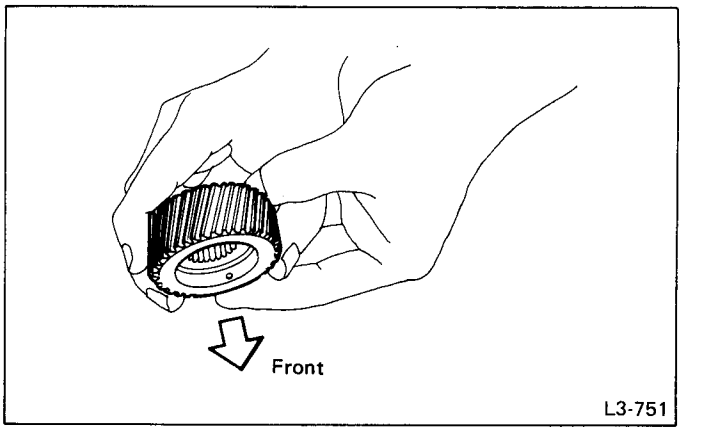


Fig. 250

18) Install the front planetary carrier.
Attach the thrust needle bearings* to both sides of the carrier with vaseline. Install the carrier carefully, while aligning with the splines of the forward clutch drum, and while rotating the pinion.

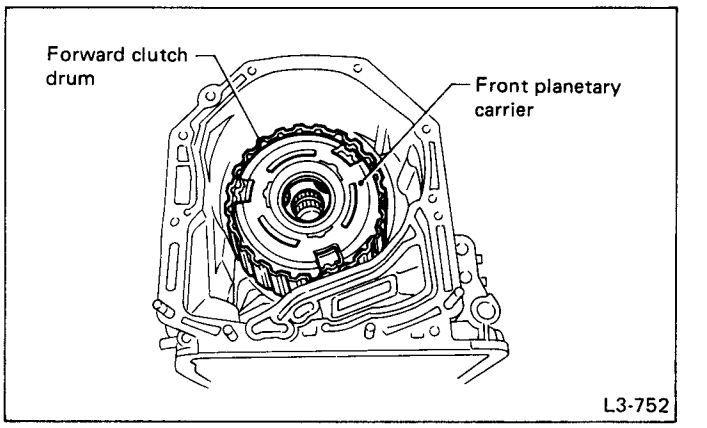


Fig. 251

19) Install the front sun gear.
Attach the thrust needle bearing* to the gear, and install the gear while turning slowly.

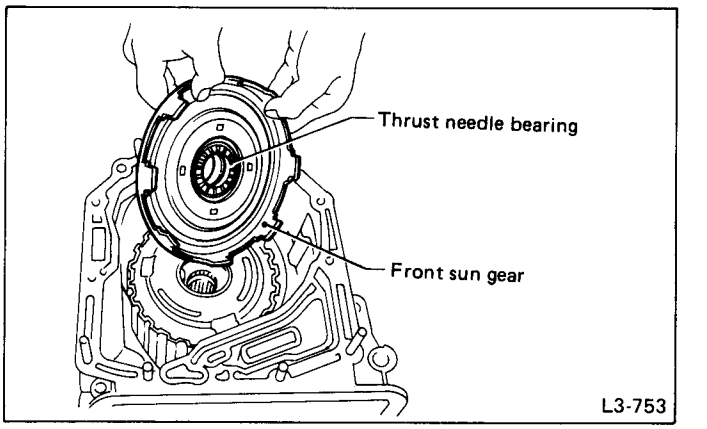


Fig. 252

20) Install the high clutch hub.
Attach the thrust needle bearing * to the hub with vaseline and install the hub by correctly engaging the splines of the front planetary carrier.

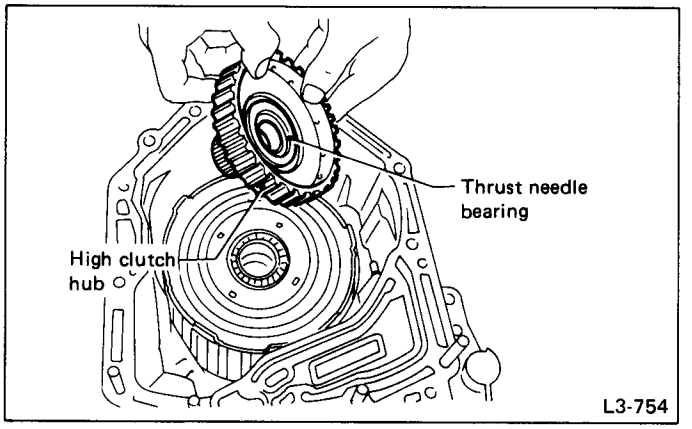


Fig. 253

21) Install the high clutch ASSY.

Correctly engage the high clutch hub and clutch splines.

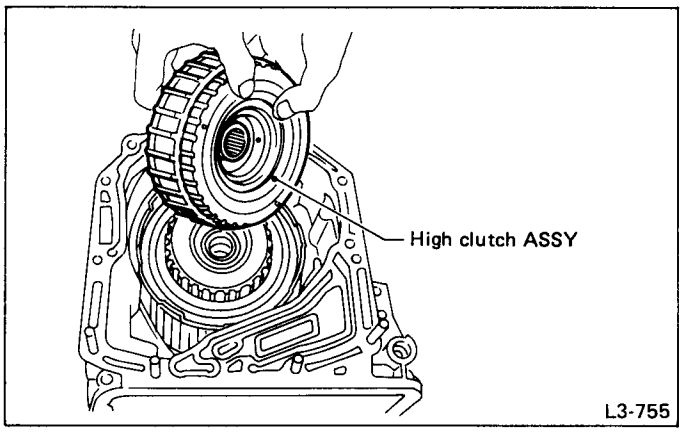


Fig. 254

22) Install the reverse clutch ASSY.

Engage the high clutch outer spline with the reverse clutch spline and the front sun gear with the cut-out portion of the reverse clutch drum correctly when installing.

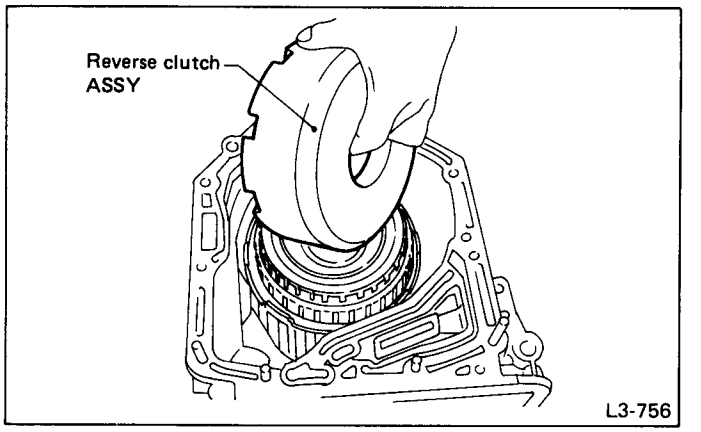


Fig. 255

23) Install the brake band ASSY.

a. Be careful not to damage the brake band when installing.
b. Install the strut to the band servo piston stem. Then tighten it temporarily to avoid tilting the band.

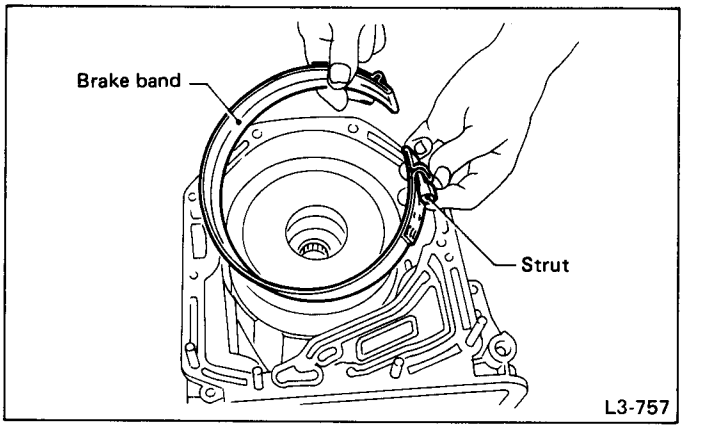


Fig. 256

24) Adjustment of total end play
(1) Measure the distance from the transmission case mating surface to the recessed portion of the high clutch drum, and the distance to the top surface of the reverse clutch drum.

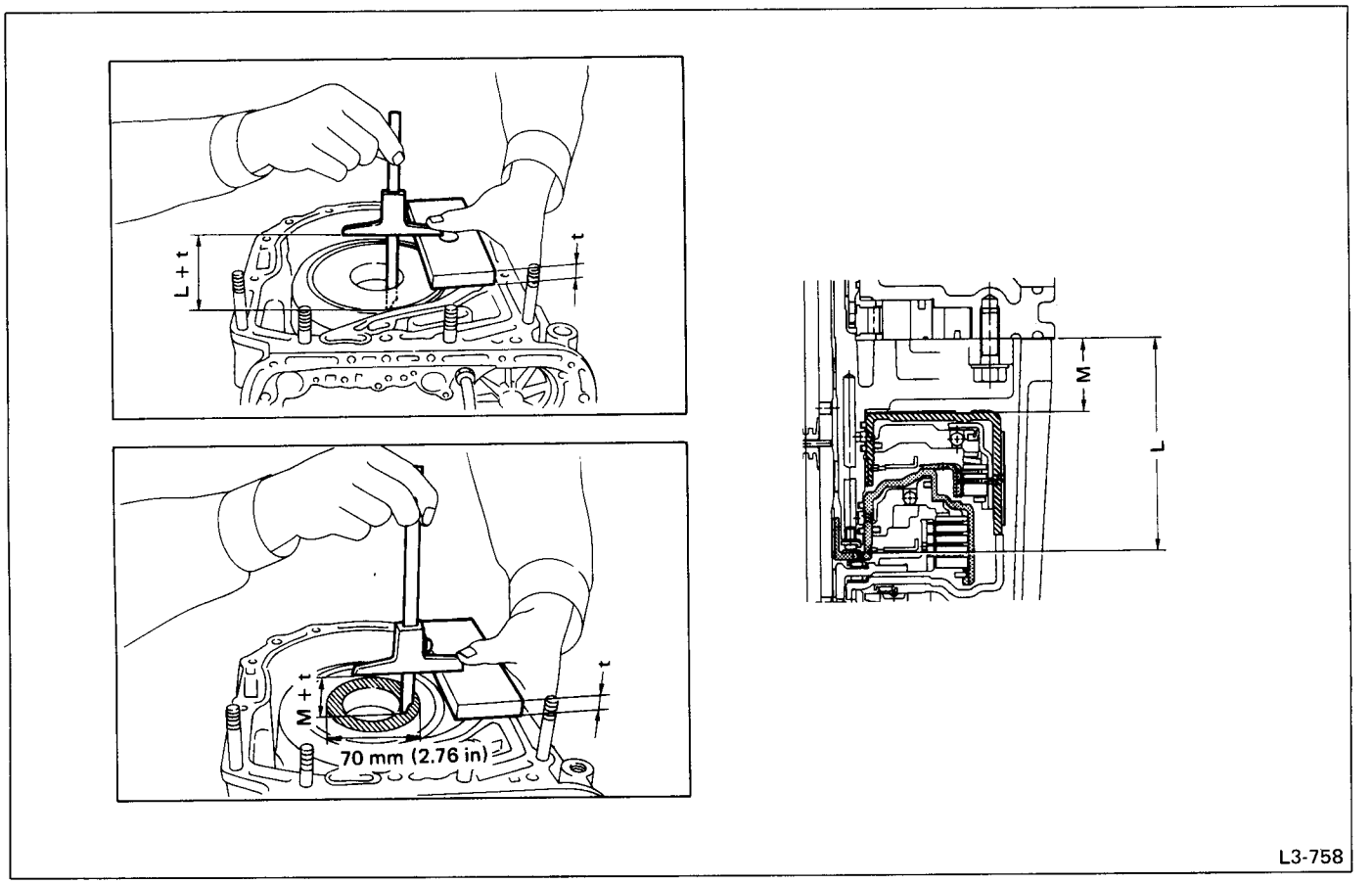


Fig. 257

(2) Measure the distance from the oil pump housing mating surface to the top surface of the oil pump cover with needle bearing, and to the thrust surface of the reverse clutch.

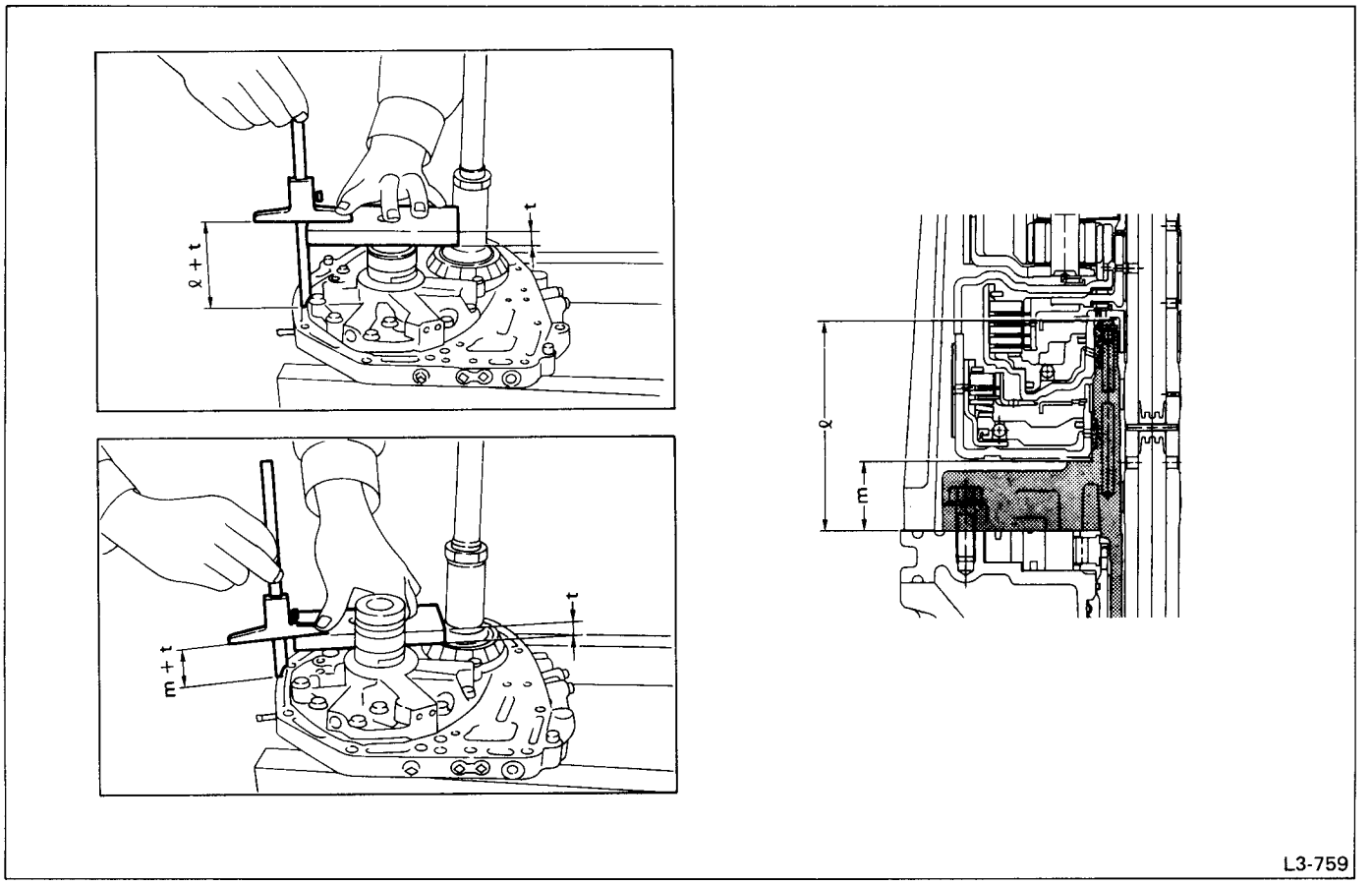


Fig. 258

(3) Equation for calculation Unit: mm

$$T = (L + 0.4) - \ell - (0.25 \text{ to } 0.55)$$

T: Thickness of bearing race
L: Depth of the recess of high clutch drum from case mating surface
ℓ: Height of top surface of the oil pump cover with needle bearing from the mating surface of the housing
0.4: Thickness of gasket
0.25 to 0.55: Total end play standard value

Part No.	Thickness mm (in)
803031021	0.8 (0.031)
803031022	1.0 (0.039)
803031023	1.2 (0.047)
803031024	1.4 (0.055)
803031025	1.6 (0.063)
803031026	1.8 (0.071)
803031027	2.0 (0.079)

$$t = (M + 0.4) - m - (0.55 \text{ to } 0.9)$$

t: Thickness of thrust washer
M: Depth of top surface of reverse clutch drum from case mating surface
m: Height of reverse clutch thrust surface from housing mating surface.
0.4: Thickness of gasket
0.55 to 0.9: Total end play standard value

Part No.	Thickness mm (in)
31299AA000	0.7 (0.028)
31299AA010	0.9 (0.035)
31299AA020	1.1 (0.043)
31299AA030	1.3 (0.051)
31299AA040	1.5 (0.059)
31299AA050	1.7 (0.067)
31299AA060	1.9 (0.075)

25) Install the oil pump housing ASSY.
(1) After completing end play adjustment, insert the bearing race* in the recess of the high clutch. Attach the thrust washer to the oil pump cover with vaseline.

(2) After correctly installing the gasket to the case mating surface, carefully install the oil pump housing ASSY. Be careful to avoid hitting the drive pinion against the inside of the case.

a. Be careful not to damage the seal ring.
b. Be sure to use a new gasket.

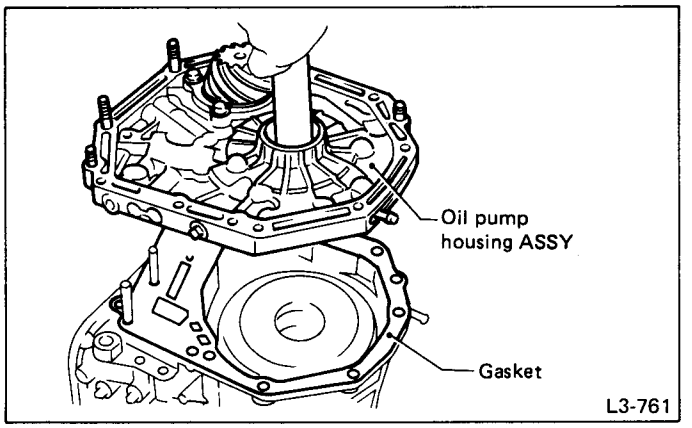


Fig. 259

(3) Install both parts with dowel pins aligned. Make sure no clearance exists at the mating surface.

Any clearance suggests a damaged seal ring.

(4) Secure the housing with two nuts.

Tightening torque:
33 ± 3 N·m (3.4 ± 0.3 kg-m, 24.6 ± 2.2 ft-lb)

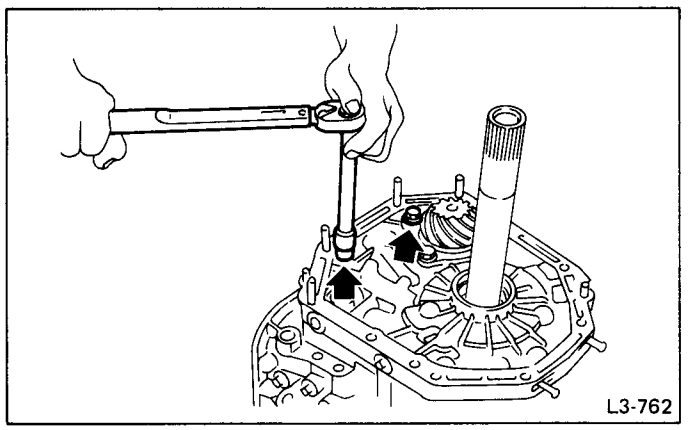


Fig. 260

3. CONNECTION OF CONVERTER CASE AND TRANSMISSION CASE

1) Apply proper amount of liquid gasket (Three-bond #1215) to the entire converter case mating surface.

Make sure that the rubber seal and seal pipe are fitted in position.

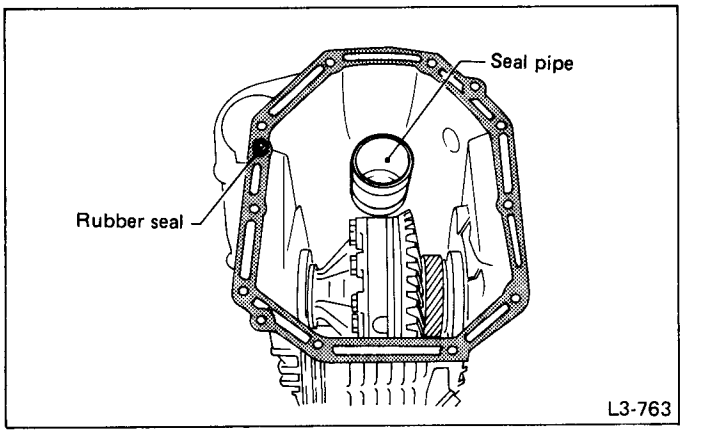


Fig. 261

2) Install the converter case ASSY to the transmission case ASSY, and secure with six bolts and four nuts.

Tightening torque:
33 ± 3 N·m (3.4 ± 0.3 kg-m, 24.6 ± 2.2 ft-lb)

When installing, be careful not to damage the converter case bushing and oil seal.

4. INSTALLATION OF CONTROL VALVE AND OIL PAN

1) Install four accumulators.

Be careful not to confuse the springs and installation positions.

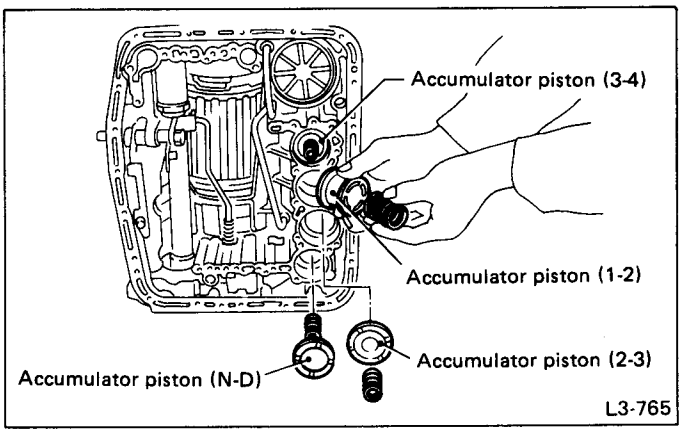


Fig. 262

Spring spec.

mm (in)

Accumulator spring	Outer diameter	Free length
1-2	28.5 (1.122)	44.5 (1.752)
2-3	20.5 (0.807)	31.0 (1.220)
3-4	17.3 (0.681)	43.7 (1.720)
N-D	17.8 (0.701)	36.5 (1.437)

2) Install and route the transmission harness.

Be careful not to damage the harness.

3) Install the control valve ASSY.
   (1) Set the select lever in range "2".
   (2) Install the control valve by engaging the manual valve and manual lever, then tighten the 19 bolts.

Tightening torque:
8 ±1 N·m (0.8 ± 0.1 kg-m, 5.8 ± 0.7 ft-lb)

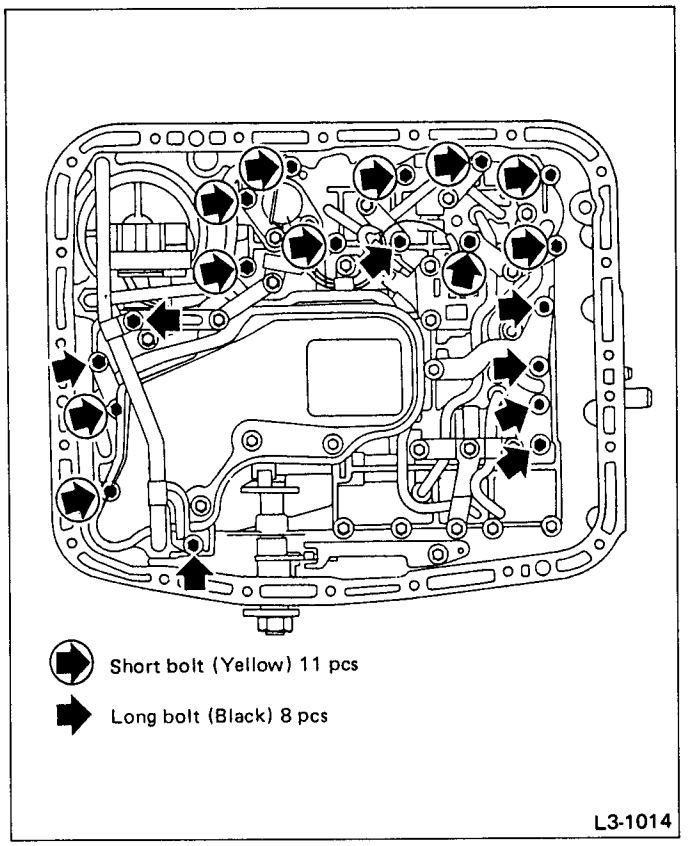


Fig. 263

a. Be careful not to pinch the harness roll the gasket.
b. Tighten the control valve mounting bolts evenly.

4) Install the oil strainer to the control valve. Be careful not to cut or break the O-ring. Then tighten bolts.

Tightening torque:
8 ± 1 N·m (0.8 ± 0.1 kg-m, 5.8 ± 0.7 ft-lb)

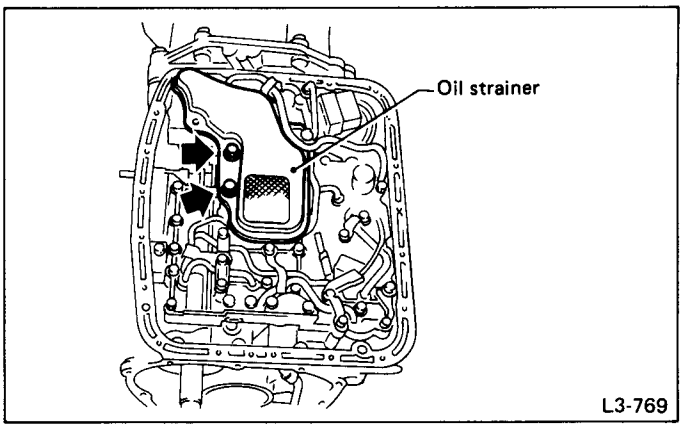


Fig. 264

5) Secure five connectors.

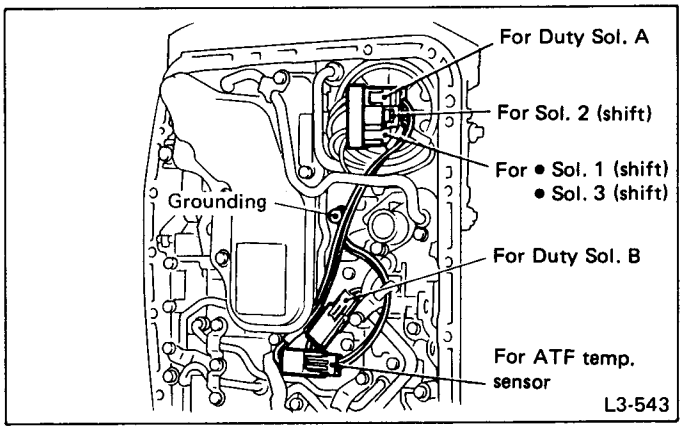


Fig. 265

6) Install the oil cooler outlet pipe, and secure with two bolts.

Tightening torque:
8 ± 1 N·m (0.8 ± 0.1 kg-m, 5.8 ± 0.7 ft-lb)

Fit the pipe into position. Be careful to avoid twisting.

7) Install the oil pan.
   (1) Attach the magnet at the specified position.

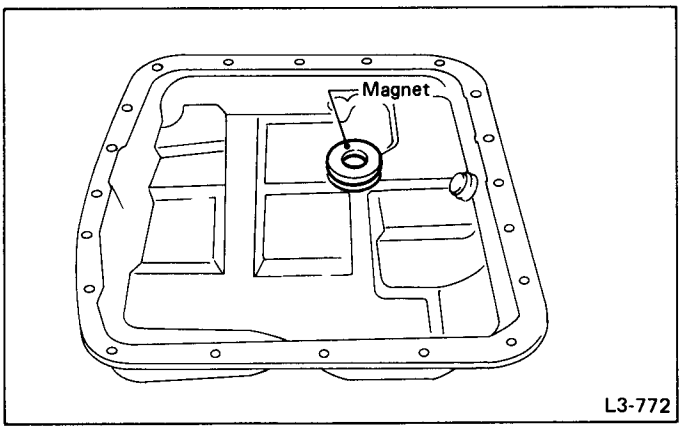


Fig. 266

(2) With gasket inserted, secure the oil pan by tightening 20 bolts.

Tightening torque:
3.9 ± 0.5 N·m (0.4 ± 0.05 kg-m, 2.9 ± 0.4 ft-lb)

Tighten the bolts evenly.

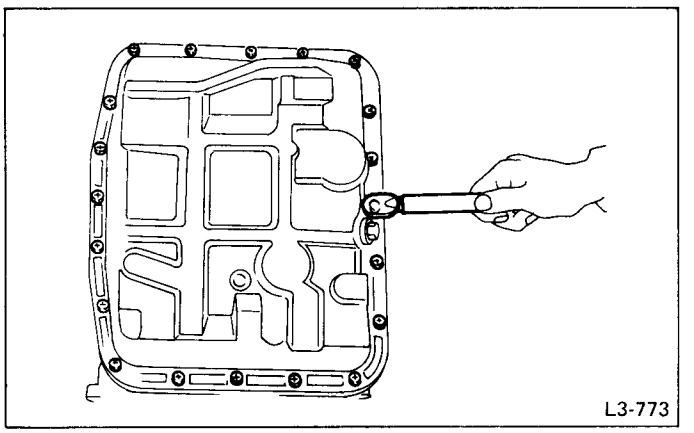


Fig. 267

5. EXTENSION CASE

1) Install the filter in the extension case.

Pay attention to the orientation of the filter.

2) Install the transfer clutch valve ASSY, and secure with four bolts.

Tightening torque:
8 ± 1 N·m (0.8 ± 0.1 kg-m, 5.8 ± 0.7 ft-lb)

a. Be sure to tighten the going lead with one of these bolts.
b. Be sure to use a new gasket.

3) Install the pipe, and clamp securely.
4) Install the transfer clutch assembly to the case.

a. Be careful not to damage the seal rings.
b. Insert the clutch assembly fully into position until the bearing shoulder bottoms.

6. CONNECTION BETWEEN EXTENSION CASE AND TRANSMISSION CASE

1) Install the revolution sensor to the transmission case with one bolt. (FWD model only)

Tightening torque:
7 ± 1 N·m (0.7 ± 0.1 kg-m, 5.1 ± 0.7 ft-lb)

2) Install the reduction driven gear.
3) Install the parking pawl and shaft, set the select lever in the "P" range and tighten the drive pinion lock nut.

Tightening torque:
98 ± 5 N·m (10 ± 0.5 kg-m, 72.3 ± 3.6 ft-lb)

After tightening, stake the lock nut securely.

4) Install the reduction drive gear ASSY.

Insert it fully into position until the bearing shoulder bottoms.

5) Adjustment of extension end play:
(1) Measure the distance from the transmission case mating surface to the reduction drive gear end surface.

FWD model: Measure the distance from the transmission case mating surface to the bearing end face.

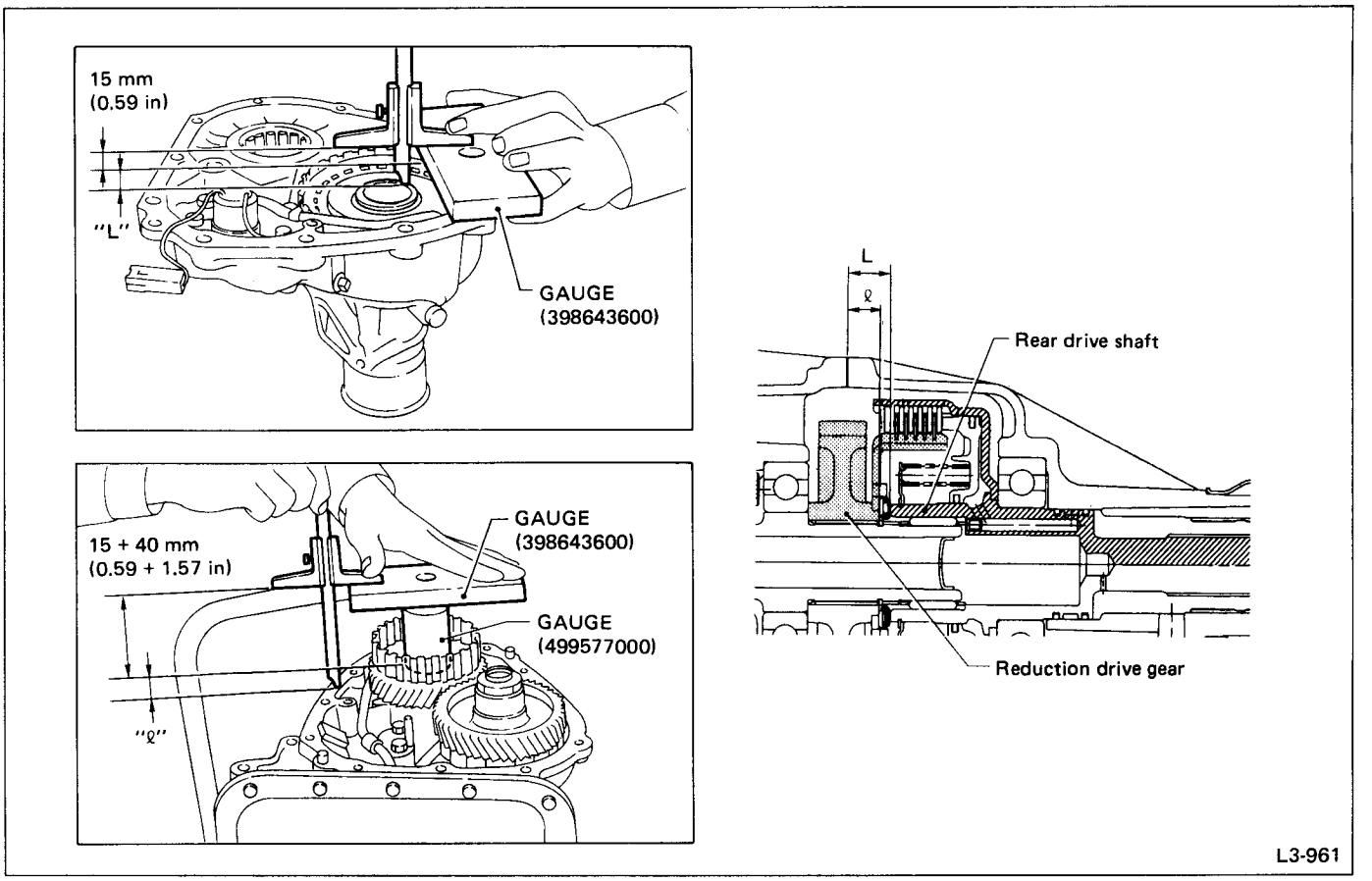


Fig. 268

(2) Measure the distance from the extension case mating surface to the rear drive shaft end face.

FWD model: Measure the distance from the cover case mating surface to the bearing mounting surface.

(3) Calculation equation: Unit (mm)

$$T = (L + 0.4) - \ell - (0.05 \text{ to } 0.25)$$

T: Thickness of thrust bearing
(FWD model: Thickness of Al washer)
L: Distance of rear drive shaft end face from extension case mating surface
(FWD model: Depth of bearing mounting face from cover case mating surface)
ℓ: Height of reduction drive gear end surface from transmission case mating surface
(FWD model: Height of bearing end face from transmission case mating surface)
0.4: Thickness of gasket
0.05 to 0.25: Standard value of end play

Part No.	Thickness mm (in)
806535020	3.8 (0.150)
806535030	4.0 (0.157)
806535040	4.2 (0.165)
806535050	4.4 (0.173)
806535060	4.6 (0.181)
806535070	4.8 (0.189)
806535090	5.0 (0.197)

6) Installation of extension case 4WD, cover case FWD and transmission case.

4WD model:

(1) Attach the selected thrust needle bearing* to the end-surface of reduction drive gear with vaseline.

(2) Set the parking return spring.

(3) Remove the transfer clutch from the extension case. Set the needle bearing on the reduction drive shaft and then install transfer clutch to the transfer clutch hub.

Be sure to engage the spline teeth correctly.

(4) With gasket inserted between them, install the extension case to the transmission case. (Be sure to use a new gasket.)

a. After inserting the extension case halfway, connect the connector for duty sol. C. Be careful not to jam the cord in the case.
b. Be careful not to damage the rear drive shaft seal ring.

(5) Tighten bolts to secure the case.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

FWD model:
(1) Attach the selected aluminum washer to the cover case with vaseline.
(2) Set the parking return spring.
(3) With gasket inserted between them, install the cover case to the transmission case.

a. Be sure to use a new gasket.
b. Install the case while ensuring proper alignment of the bearing, parking shaft, and reduction driven gear.

(4) Tighten bolts to secure the case.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

7. INSTALLATION OF EXTERIOR PARTS

1) Install the revolution sensor. (4WD only)

Tightening torque:
7 ± 1 N·m (0.7 ± 0.1 kg-m, 5.1 ± 0.7 ft-lb)

2) Installation and adjustment of inhibitor switch:
(1) Install the inhibitor switch to the transmission case. Fit the projecting portion of the switch in the recessed portion of the case, and tighten three bolts temporarily.
(2) Insert the range selector lever into the shaft, and tighten the nut.

Tightening torque:
39 ± 3 N·m (4.0 ± 0.3 kg-m, 28.9 ± 2.2 ft-lb)

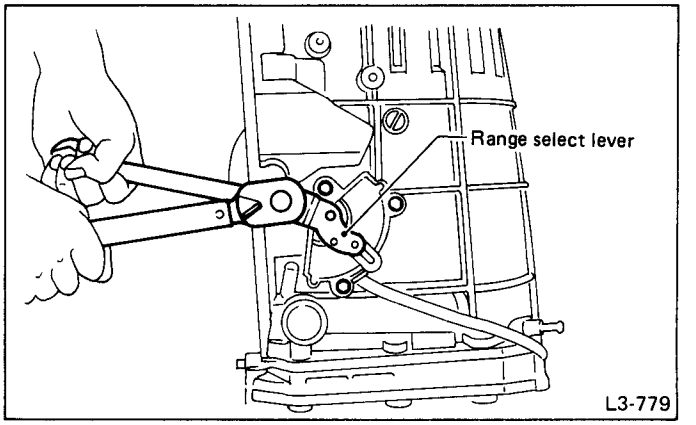


Fig. 269

(3) With the selector lever set to "N" adjust the inhibitor switch so that the hole of range selector lever is aligned with the inhibitor switch hole.

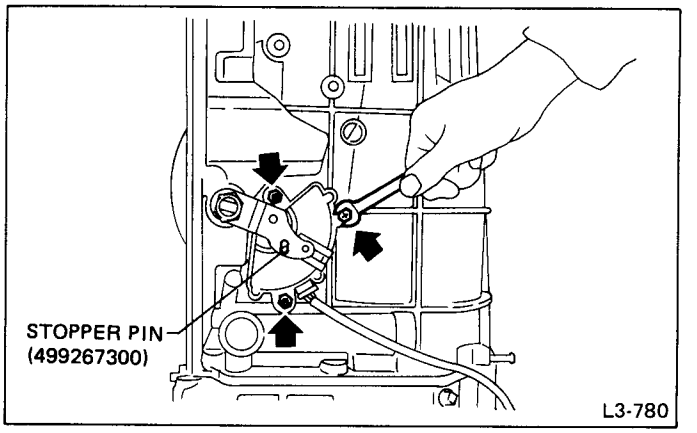


Fig. 270

(4) With hole aligned, tighten three bolts to secure the inhibitor switch.

Tightening torque:
3.4 ± 0.5 N·m (0.35 ± 0.05 kg-m, 2.5 ± 0.4 ft-lb)

3) Clip the following cords and harness:
(1) Transmission harness
(2) Inhibitor switch cord
(3) Revolution sensor cord (4WD only)
4) Install the oil cooler outlet pipe.

Tightening torque:
30.9 ± 3.4 N·m (3.15 ± 0.35 kg-m, 22.8 ± 2.5 ft-lb)

5) Install the oil cooler inlet pipe.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

Be sure to use a new aluminum washer.

6) Install the oil charge pipe.

Tightening torque:
30.9 ± 3.4 N·m (3.15 ± 0.35 kg-m, 22.8 ± 2.5 ft-lb)

Be careful not to damage the O-ring.

7) Adjustment of brake band:
(1) After tightening the brake band adjusting screw to 9 N·m (0.9 kg-m, 6.5 ft-lb) torque, back it off three turns. Then secure with a lock nut.

Lock nut tightening torque:
25 – 28 N·m (2.5 – 2.9 kg-m, 18 – 21 ft-lb)

When tightening the lock nut, be careful not to turn the adjusting screw.

8) Install the pitching stopper.

Tightening torque:
39 ± 3 N·m (4.0 ± 0.3 kg-m, 28.9 ± 2.2 ft-lb)

9) Tighten the drain plugs.

Tightening torque:
Diff.
44 ± 3 N·m (4.5 ± 0.3 kg-m, 32.5 ± 2.2 ft-lb)
ATF
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

10) Install the air breather hose.
11) Insert the input shaft while turning lightly by hand.

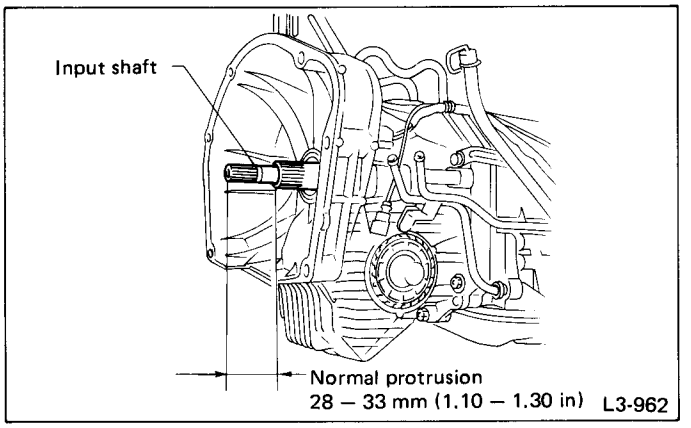


Fig. 271 Inserting input shaft

Be careful not to damage the bushing.

12) Install the torque converter assembly.
(1) Install the oil pump shaft to the torque converter.

Make sure the clip fits securely in its groove.

(2) Holding the torque converter assembly by hand, carefully install it to the converter case. Be careful not to damage the bushing. Also, to avoid undue contact between the oil pump shaft bushing and stator shaft portion of the oil pump cover.
(3) Rotate the shaft lightly by hand to engage the splines securely.

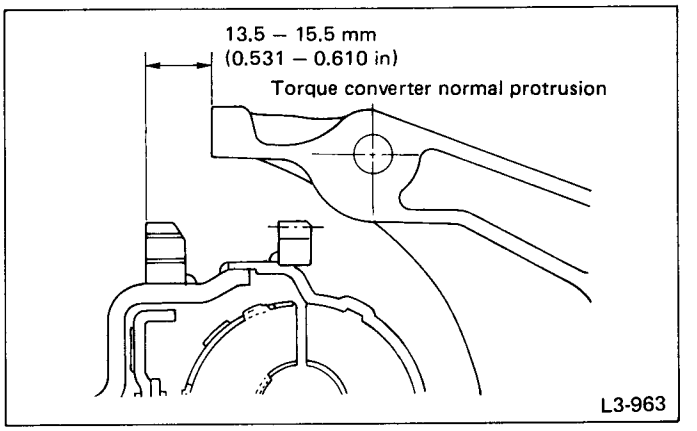


Fig. 272 Protrusion of torque converter

13) Add oil:

Specified quantity ℓ (US qt, Imp qt)
Diff.
1.3 – 1.5 (1.4 – 1.6, 1.1 – 1.3)
ATF
FWD: 9.3 (9.8, 8.2)
4WD: 9.5 (10.0, 8.4)

After adding oil, insert the oil level gauge into the oil inlet.

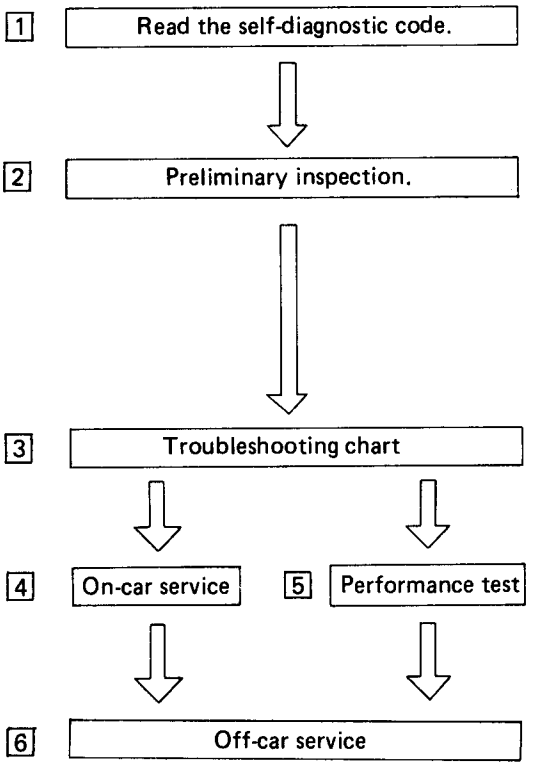
TROUBLESHOOTING

GENERAL NOTES

1) Problems in the electronic-controlled automatic transmission may be caused by failure of the engine, the electronic control system, the transmission proper, or by a combination of these. These three causes must be distinguished clearly when troubleshooting.

2) Troubleshooting should be conducted by rotating with simple, easy operations and proceeding to complicated, difficult operations. The most important thing in troubleshooting is to understand the customer's complaint, and distinguish between the three causes.

3) The general flow of troubleshooting is shown below:



Read the trouble code on the "POWER" indicator, and perform operation according to the code.

Check the following items:

- Fluid level
- Idling speed
- Inhibitor switch
- Shift linkage
- Fluid leakage, etc.

See "Service Procedure".

1 Troubleshooting for Electrical Transmission Control System

1) WIRING DIAGRAM

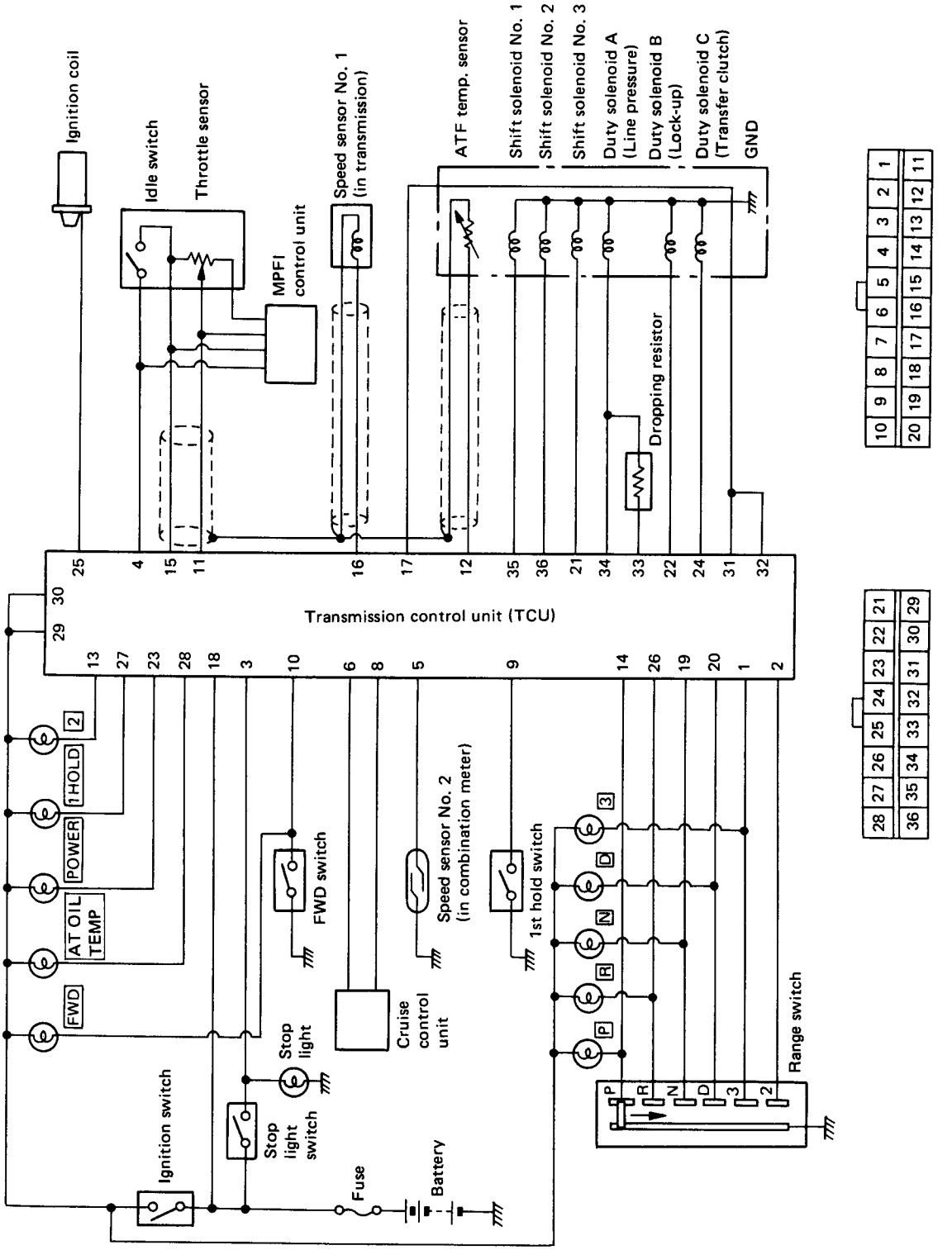


Fig. 273

L3-964

2) FUNCTION OF SELF-DIAGNOSIS

(1) Self-diagnosis Items

The following items can be checked for improper operation using the self-diagnosis system.

- Vehicle-revolution sensor No. 1 (on transmission)
- Vehicle-revolution sensor No. 2 (in combination meter)
- Shift solenoid No. 1
- Shift solenoid No. 2
- Shift solenoid No. 3
- Duty solenoid A (Line-pressure)
- Duty solenoid B (Lock-up)
- Duty solenoid C (Transfer clutch)
- Throttle sensor

(2) Troubleshooting Chart

	Trouble	Possible cause
1	No shift	① Shift solenoid No. 1 and/or No. 2 • Severed or short circuit ② Speed sensor No. 1 and No. 2 • Defective or severed ③ Power source and grounding • Severed or short circuit
2	Shift point too high or too low	① Throttle sensor • Defective, severed or short circuit ② Speed sensor No. 1 • Defective or severed
3	No up-shift to overdrive (after warm-up)	① Range switch • Severed or short circuit ② ATF temp sensor • Defective or severed ③ Cruise control unit • Operation unusual or short circuit
4	No back-up (after warm-up)	① Duty solenoid B • Severed or short circuit ② ATF temp sensor • Defective, severed or short circuit ③ Ignition pulse • Severed wire harness ④ Idle switch • Severed or short circuit
5	No engine braking effect at "3" range	① Shift solenoid No. 3 • Severed or short circuit ② Throttle sensor • Defective, severed or short circuit ③ Range switch • Severed or short circuit
6	Excessive shift shock	① Duty solenoid A • Severed or short circuit ② Throttle sensor • Defective, severed or short circuit
7	Excessive tight corner braking	① Duty solenoid C • Severed or short circuit ② Throttle sensor • Defective, severed or short circuit ③ Speed sensor No. 1 • Defective, severed or short circuit

(3) Indication of Malfunctioning Self-diagnosis Items

Malfunctioning self-diagnosis items are indicated on the POWER indicator in terms of "trouble codes".

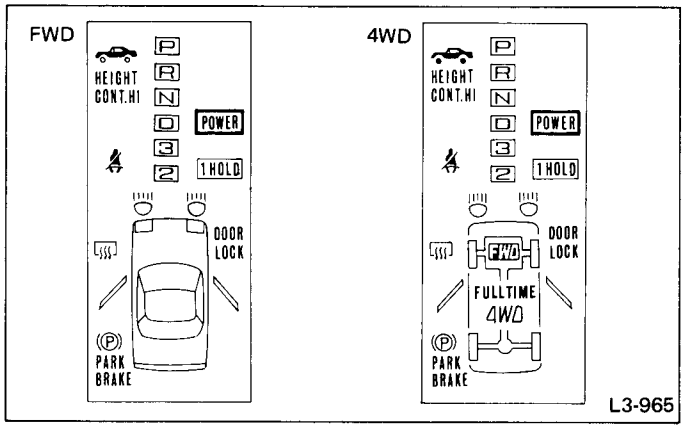


Fig. 274

Indicator signal is as follows:

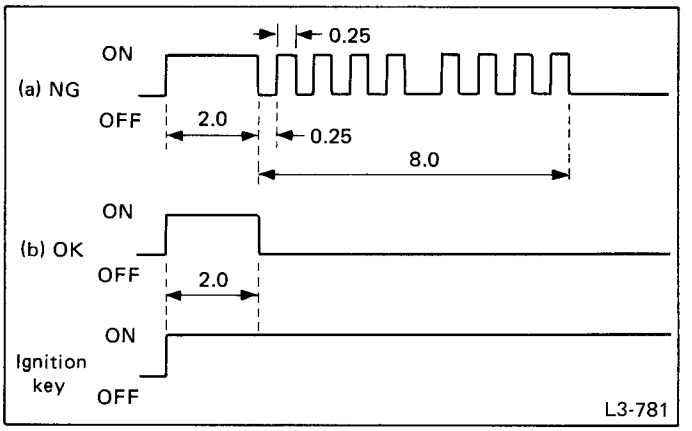


Fig. 275 POWER indicator signal (unit: second)

Warning can be noticed only when the ignition switch is initilly turned to ON.

(4) Checking the Trouble History

Trouble history of self-diagnosis items is indicated on the POWER indicator in terms of "trouble codes" using the following method ① or ② as applicable.

① 4WD. . . . Insert fuse into FWD switch.

② FWD. . . . Ground self-diagnosis terminal of check connector (17-pin connector).

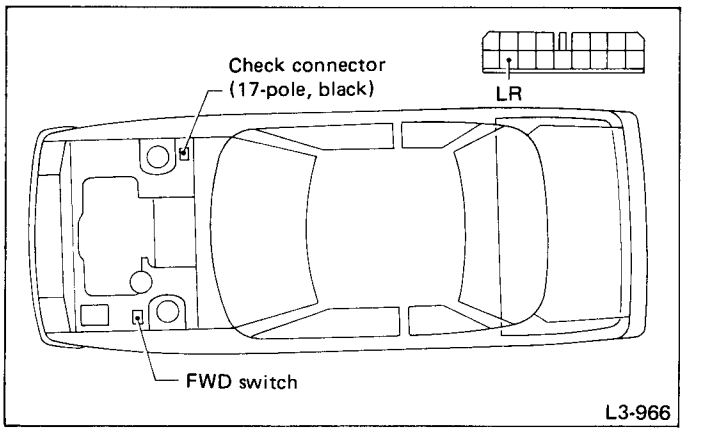
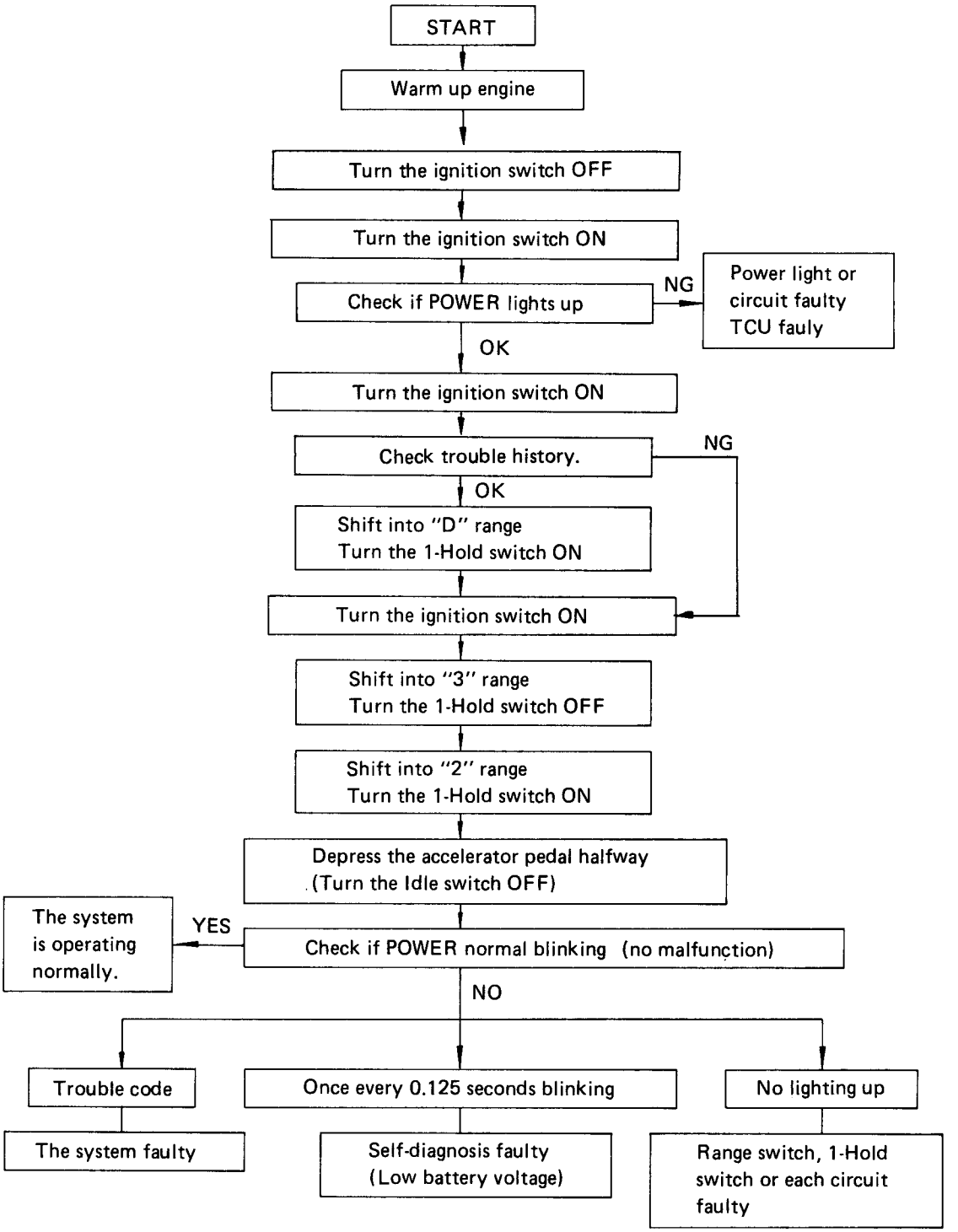


Fig. 276

(5) Calling up Trouble Codes

A malfunctioning self-diagnosis item can be determined using the procedure outlined in the flowchart below.

Low battery voltage will cause faulty operation of the diagnosis system. Therefore, always be sure to check the battery voltage first.



(6) How to Read Trouble Code

In case of malfunction, trouble code will be observed by the specified signal of POWER indicator. The sequence of blinking shows each faulty system and the term of long segment (0.6 sec) blink means its own faulty system code.

Example: Shift solenoid No. 1 fault

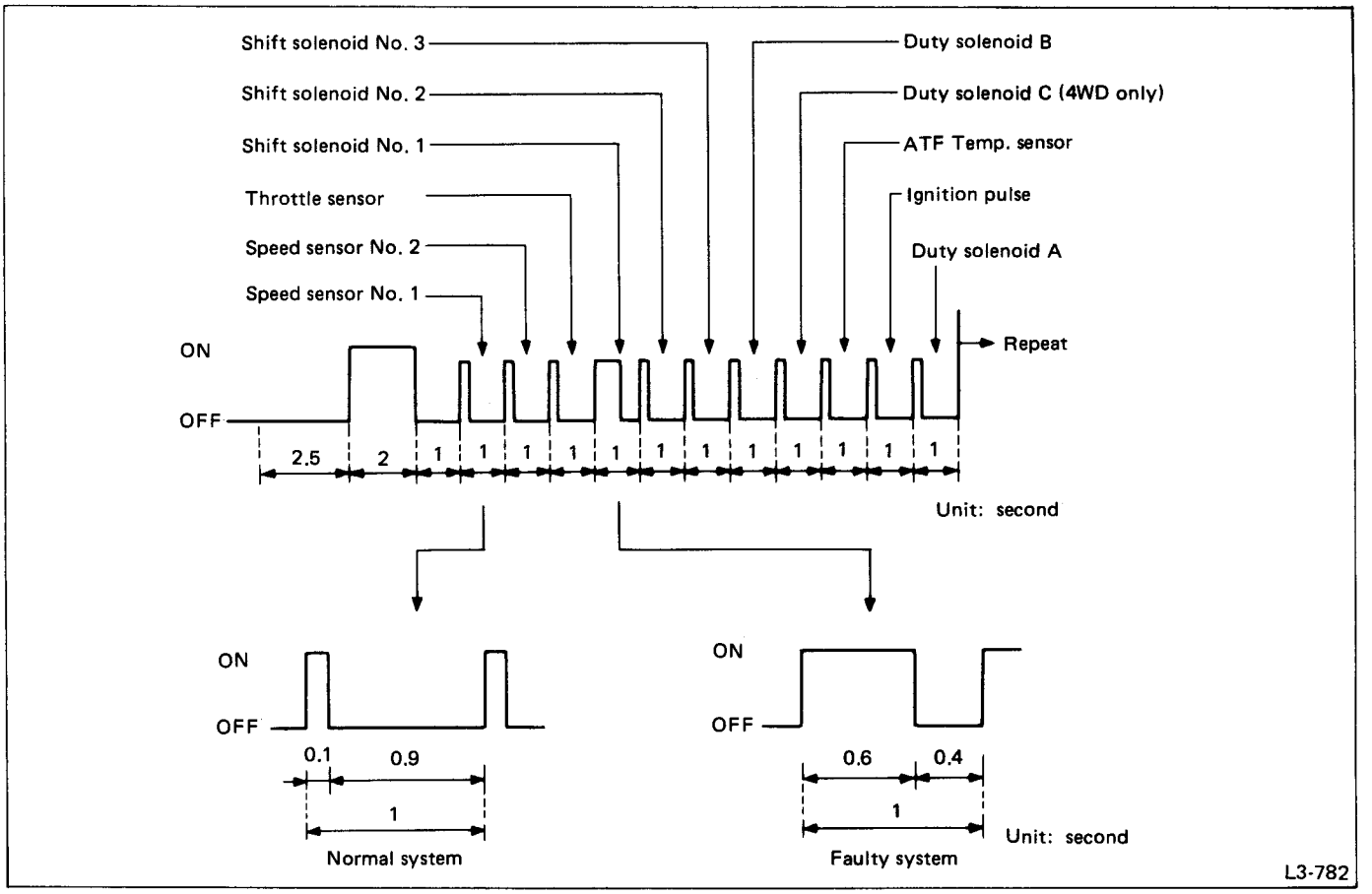
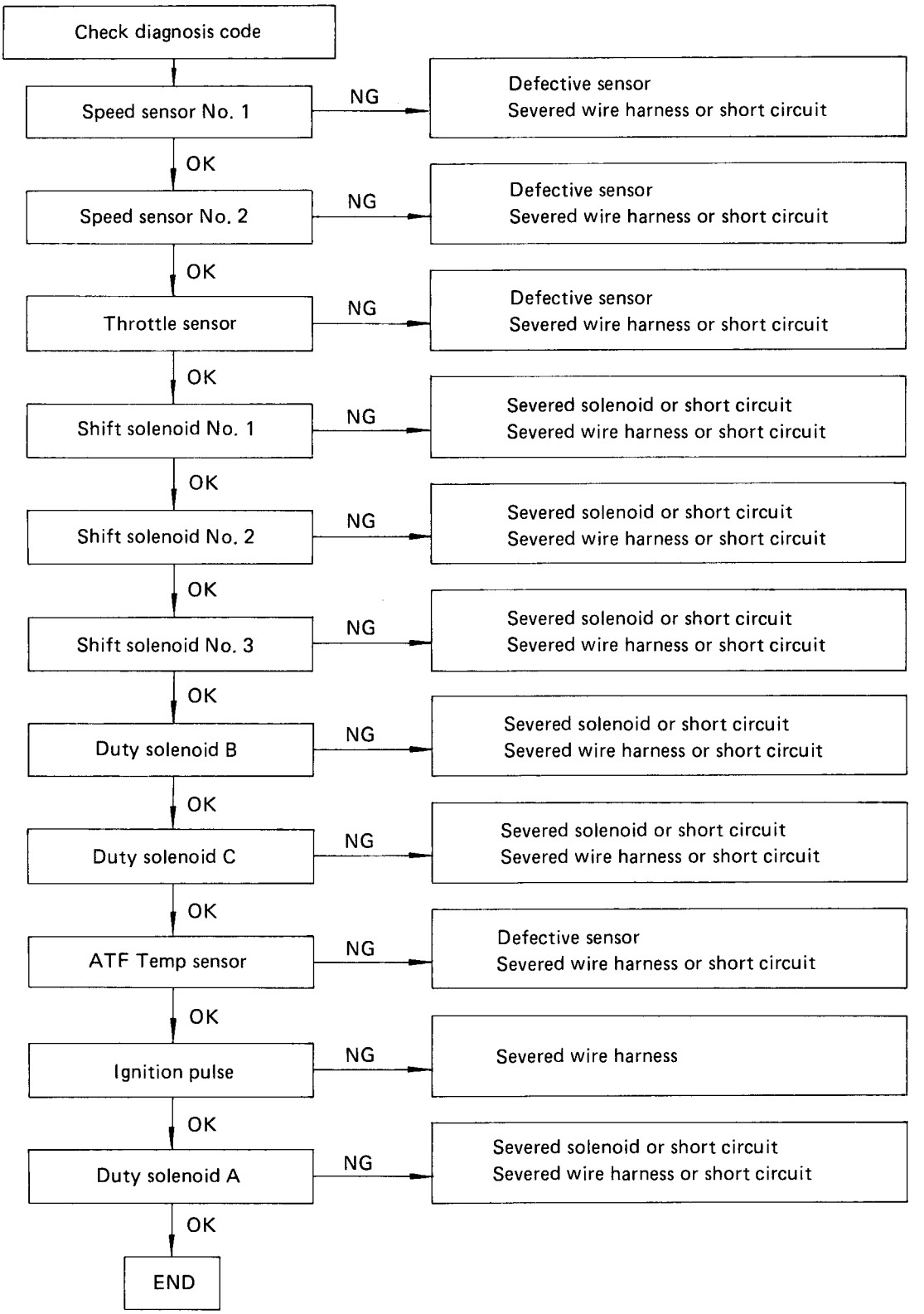


Fig. 277

(7) Troubleshooting for Electronic Control System



(8) Cancelling the Trouble Code

Trouble codes are cancelled after self-diagnosis; however, those in the trouble history remain in the memory of the control unit after the ignition switch is turned OFF. After repairs, a trouble code can be cancelled by turning the ignition switch OFF and disconnecting the connector from the control unit.

2 Preliminary Inspection

No.	Item to check	Judgment standard
1.	Idling rpm	1800 cc 800±100 rpm 2700 cc 750±100 rpm
2.	Idling boost (intake manifold)	More than −53.3 kPa (−400 mmHg, −15.75 inHg)
3.*	Stall rpm	1800 cc 2,450 – 2,850 rpm 2700 cc 2,400 – 2,800 rpm
4.	Operation of linkage between accelerator pedal and throttle body	Throttle valve must open and close fully in response to accelerator pedal movement.
5.	Inhibitor switch circuit	Must be in good condition.
6.	ATF	Must be maintained at specified level.
7.	Differential gear oil	Must be maintained at specified level.
8.	ATF leakage	Must not occur at ATF cooling circuit or other parts.
9.	Oil leakage	Must not occur from any part of transmission.

*** Check before engine is adjusted.**

3 Troubleshooting Chart

Symptom	Reference No.		Probable cause
	On-car check	Unit check	
Starter runs in R, D or 2 range, but not in P or N range.	1, 2, 6, 7, 9		Transmission exterior parts: 1. Inhibitor switch out of adjustment 2. Faulty inhibitor switch 3. Faulty control unit 4. Faulty car-revolution sensor 1 5. Faulty car-revolution sensor 2 6. Select cable out of adjustment 7. Faulty select lever 8. FWD fuse remains installed 9. Faulty starter motor or harness 10. Faulty throttle sensor 11. Faulty 1st hold switch Parts inside oil pan: 12. Faulty N-D accumulator 13. Faulty 2A accumulator 14. Faulty 4A accumulator 15. Faulty 3R accumulator 16. Faulty ATF temperature sensor 17. Clogged strainer 18. Faulty duty solenoid A 19. Faulty duty solenoid B 20. Faulty shift solenoid 1 21. Faulty shift solenoid 2 22. Faulty shift solenoid 3 23. Valve sticking 24. Faulty detent spring 25. Faulty manual plate 25a. Faulty strainer seal Parts inside extension case: 26. Faulty transfer clutch 27. Transfer valve sticking 28. Transfer pilot valve sticking 29. Faulty transfer pipe 30. Faulty duty solenoid C 31. Noisy duty solenoid C 32a. Faulty forward clutch relief ball 32b. Faulty overrunning clutch relief ball
Noise is emitted in N or P range.	72, 65, 31	40	
Noise (shudder) is emitted when car starts.	72		
Noise is emitted in D_1 range.	73	37, 60, 61	
Noise is emitted in D_2 range.	73	37, 60, 61	
Noise is emitted in D_3 range.	73	37, 61	
Noise is emitted in D_4 range.	73	37, 60, 61	
Engine stalls while shifting to any range.	23, 76	77	
Engine stalls in P range and driving in N range.		42	
Shock is felt when shifting from N to D range.	70, 12, 23, 3		
Lengthy time lag when shifting from N to D range.	23, 32a	41	
Shock is felt when shifting from N to R range.	23, 14, 70		
Lengthy time lag when shifting from N to R range.	23	49, 51	
Car does not move in any range though engine revs up.	72, 17, 23	64, 65, 56, 57, 33, 34, 35, 36, 60, 40	
Engine stalls in all ranges.		62	
Car does not move in R range though engine revs up.	23	49, 51	
Engine stalls in R range.		42, 48	
Car does not move in D or 3 range though engine revs up.		53, 54	
Car does not move in D, 3 or 2 range though engine revs up.		41, 32a	

Symptom	Reference No.		Probable cause
	On-car check	Unit check	
Engine stalls in D, 3 or 2 range.		52	Parts inside differential case: 33. Drive pinion broken 34. Crown gear broken 35. Axle shaft broken 36. Differential gear broken 37. Poor/improper contact of final gear 38. Faulty seal pipe 39. Faulty speedometer gear Parts inside transmission: 40. Oil pump seized or broken or foreign matter in pump 41. Forward clutch slippage 42. Forward clutch seized 43. Overrunning clutch slippage 44. Overrunning clutch seized 45. High clutch slippage 46. High clutch seized 47. Band & servo slippage 48. Band seized 49. Low & reverse brake slipping 50. Low & reverse brake seized 51. Reverse clutch slippage 52. Reverse clutch seized 53. Faulty O.W.C. (1-2) 54. Faulty O.W.C. (3-4) 55. Faulty double oil seal 56. Input shaft broken 57. Reduction drive shaft broken 58. Planetary gear broken 59. Reduction gear broken 60. Poor/improper contact of planetary gear 61. Poor/improper contact of reduction gear 62. Faulty parking brake mechanism
Car does not move in D, 3 or 2 range though engine revs up.	23, 3	54	
Poor acceleration: • High stall rpm • Low stall rpm • Proper stall rpm (Poor acceleration in D, 3 or 2 range) • Proper stall rpm (Poor acceleration in R range)	 72, 23 3, 23 23	 41, 51 76, 66, 40 46, 48 46, 48, 44	
No shifts: • 1 → 2 • 2 → 3 • 3 → 4 • K/D	 3, 23 3, 23 3, 23, 16 3, 10	 47 45 47	
No engine braking in: • 3 range only • 3, 2 or 1 range • 1 range only	 3, 23, 10 32b 3, 23	 43 49	
Erroneous shift points	3, 23, 10	47	
No lock-up operation	3, 23, 16, 10	68	
No power mode in D range	3, 10		
Power mode not released in D range	3, 10		
Parking brake failure: • No braking • Dragging or failure to release	 6, 7 6, 7	 62 62	
Unusual select force: • Considerable effort required • No or light effort required	 7, 24, 25 24, 25		
Fluid overflow • ATF • Differential oil	 74 75		
Unusual changes in differential oil level		38, 55	
Odor from oil supply pipe	70	41, 43, 45, 47 49, 51	

Symptom	Reference No.		Probable cause
	On-car check	Unit check	
Abnormalities during shifting: • Shock in 1 → 2 shift	3, 23, 13, 10, 70, 76		Other parts: 63. Faulty torque converter ring gear 64. Faulty drive plate 65. Improper installation of drive plate 66. Torque converter or OWC burned or broken 67. Worn parts in torque converter 68. Lock-up facing worn 69. Faulty lock-up damper 70. Deterioration of ATF 71. Deterioration of differential oil 72. ATF level too low 73. Differential oil level too low 74. ATF level too high 75. Differential oil level too high 76. Poor engine performance 77. Lock-up clutch seized
• Slippage in 1 → 2 shift	3, 23, 13, 10	47	
• Shock in 2 → 3 shift	3, 23, 10, 70, 15, 76	47, 45	
• Slippage in 2 → 3 shift	3, 23, 15, 10	47, 45	
• Shock in 3 → 4 shift	3, 23, 10, 70, 14, 76	43	
• Slippage in 3 → 4 shift	3, 23, 14, 10	47	
• Shock in 3 → 2 shift	3, 23, 10, 70	43, 47	
• Shock in D → 3 shift	3, 23, 10, 70	43	
• Shock in 2 → 1 shift	3, 23, 10, 70	49, 43	
Shock is felt when accelerator pedal is released at medium speed or above.	3, 23, 10, 76	69, 77	
Vibration in straight-forward driving	3	69, 77	
Select lever slips out of detents during acceleration or on rough roads.	6, 24, 25		
During 4WD operation: • Vibration in tight corner	4, 70, 10, 3, 11	29, 26, 27, 28, 30	
• Front tires slip on start.	5, 10, 3, 11	29, 26, 27, 28, 30	
• Failure to shift into FWD mode	3, 10, 8	26, 27, 28, 29, 30	

4 On-Car Service

INSPECTION AND ADJUSTMENT

1. ATF LEVEL

1) Raise the ATF temperature to 60 to 80°C (140 to 176°F). [This temperature may be attained by running a distance of 5 to 10 km (3 to 6 miles)].

The level of ATF varies with fluid temperature. Pay attention to the fluid temperature when checking oil level. A change in the ATF level by oil temperature is shown in the following figure.

2) Ensure the vehicle is level. After selecting all positions (P, R, N, D, 3, 2), set the selector lever in "P" range. Measure fluid level with the engine idling.

After running, idle the engine for one or two minutes before measurement.

3) If the fluid level is below the center between upper and lower marks, add the recommended ATF until the fluid level is found within the specified range (above the center between upper and lower marks). When the transmission is hot, the level should be above the center of upper and lower marks, and when it is cold, the level should be found below the center of these two marks.

Use care not to exceed the upper limit level.

■ ATF level

1) ATF level varies with temperature as shown in figure. Remember that the addition of fluid to the upper limit mark when the transmission is cold will result in the overfilling of fluid.

2) Fluid temperature rising speed

- By idling the engine
  Time for rising temperature to 60°C (140°F) with atmospheric temperature of 0°C (32°F): More than 25 minutes

(Reference)

Time for temperature rise to 30°C (86°F) with atmospheric temperature of 0°C (32°F): Approx. 8 minutes

- By running the vehicle
  Time for temperature rise to 60°C (140°F) with atmospheric temperature of 0°C (32°F): More than 10 minutes

3) Method for checking fluid level upon delivery or at periodic inspection.

Check fluid level after a warm-up run of approx. 10 minutes. During the warm-up period, the automatic transmission functions can also be checked.

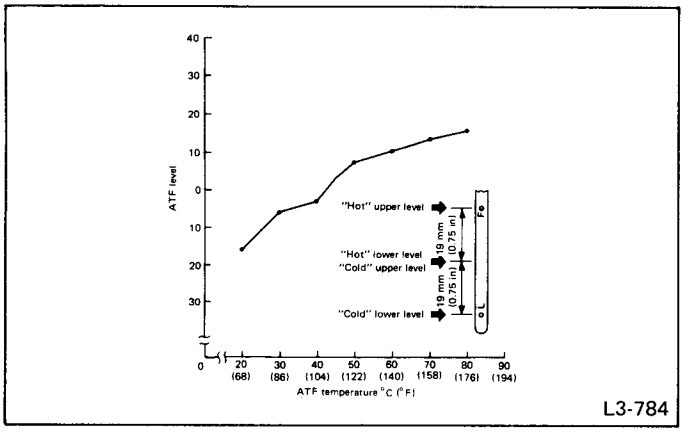


Fig. 278

2. DIFFERENTIAL GEAR OIL LEVEL

1) Ensure the vehicle

Do not check the oil level nor add oil to the case with the front end of the vehicle jacked up; this will result in an incorrect reading of the oil level.

2) Check whether the oil level is between the upper (F) and lower (L) marks. If it is below the lower limit mark, add oil until the level reaches the upper mark.

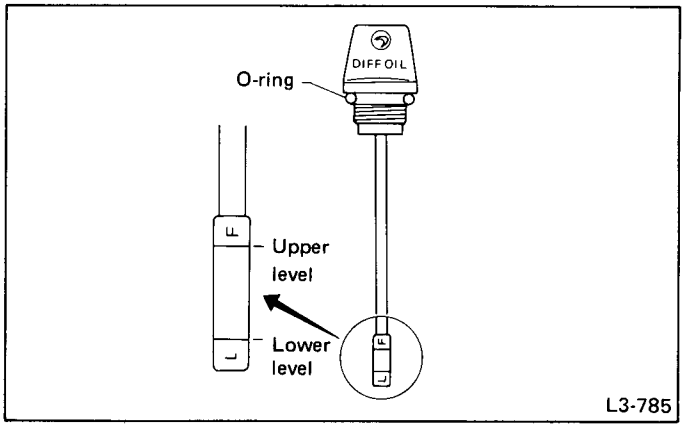


Fig. 279

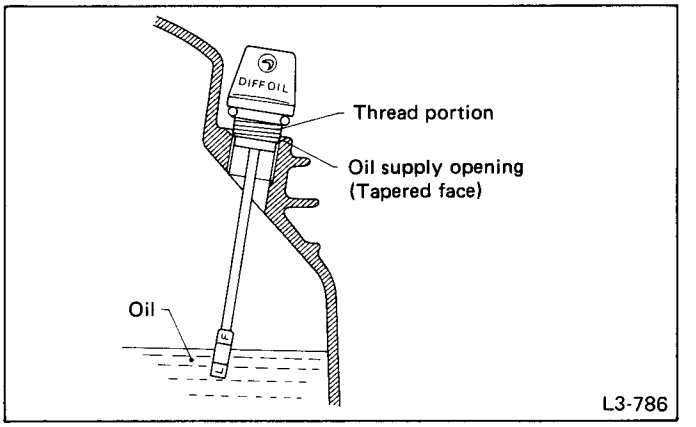


Fig. 280

3. OIL LEAKAGE CHECK POINTS

It is difficult to accurately determine the precise position of a oil leak, since the surrounding area also becomes wet with oil. The places where oil seals and gaskets are used are as follows:

<Jointing portion of the case>

- Transmission case and oil pump housing jointing portion
- Converter case and oil pump housing jointing portion
- Transmission case and transmission cover jointing portion (FWD)
- Transmission case and extension case jointing portion (4WD)

Converter housing

- Engine crankshaft oil seal
- Torque converter impeller sleeve oil seal
- ATF cooler pipe connector
- Torque converter

Converter case

- Converter case
- Axle shaft oil seal
- O-ring on the outside diameter of axle shaft oil seal holder
- O-ring on the differential oil gauge
- Differential oil drain plug
- Speedometer cable mounting portion
- Location of steel balls

Oil pump housing

- Oil pump housing (Defective casting)
- O-ring on the test plugs
- Checking blind plugs
- Differential gear breather

Automatic transmission case

- Transmission case (Defective casting)
- Mating surface of oil pan
- O-ring on the test plugs
- Checking blind plugs (steel balls)
- Oil supply pipe connector
- ATF cooler pipe connector and gasket
- Oil pan drain plug
- O-ring on the transmission harness holder
- O-ring on the oil pump plugs
- ATF breather
- Shift lever oil seal

Extension case

- Extension case (Defective casting)
- O-ring on the revolution sensor
- Rear drive shaft oil seal
- Checking blind plugs (steel ball)
- O-ring on the test plug

Transmission cover

- Transmission cover (Defective casting)

The point listed above should be checked for fluid leak. Checking method is as follows:

(1) Place the vehicle in the pit, and check whether the leaking oil is ATF or not. The ATF is wine red in color, and can be discriminated easily from engine oil and gear oil.

(2) Wipe clean the leaking oil and dust from a suspectable area, using a noninflammable organic solvent such as carbon tetrachloride.

(3) Run the engine to raise the fluid temperature, and set the selector lever to "D" in order to increase the fluid pressure and quickly detect a leaking point.

4. ENGINE IDLING SPEED

Excessively low engine idling rpm will lead to rough engine operation and excessively high idling rpm will lead to a sudden shift shock or creeping when shifting from N to D or R.

Idling rpm for automatic transmission cars (N or P range):
1800: 800±100 rpm
2700: 750±100 rpm

5. BRAKE BAND

If the following abnormal shifting conditions are noted in a road test, the brake band must be adjusted.

■ Shift state and adjustment

1) The 2nd gear state and 4th gear state can be achieved but:

- the engine rpm increase excessively shifting up from 2nd to 3rd.
- a shift delay (over 1 sec) accompanies at kickdown from 3rd to 2nd.

If any of these problems occurs, it is attributable to excessive clearance between the reverse clutch drum and brake band: Tighten the adjust screw by turning it clockwise.

2) The 2nd gear state and 4th gear state can be achieved, but:

- a braking phenomenon is noted when shifting up from 2nd to 3rd.

If this phenomenon is noted, it is attributable to excessively small brake band clearance: Loosen the adjust screw by turning it counterclockwise.

3) When accelerating, direct shift up from 1st to 3rd occurs: . . . . . Excessively large clearance.
When shifting up from 2nd to 3rd, tire slip occurs: . . . . . Excessively small clearance.

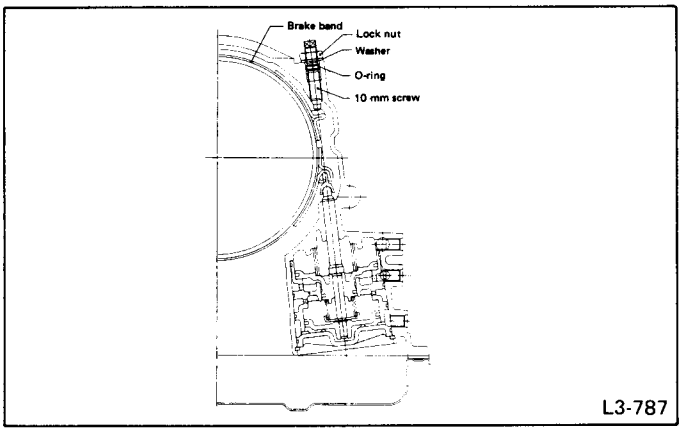


Fig. 284

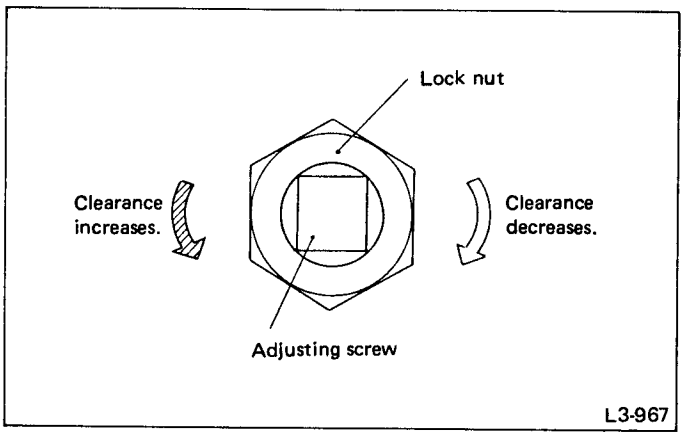


Fig. 281 Clearance control

■ Adjustment of the adjusting screw

1) Using a socket wrench, immobilize the end of the 10 mm screw projecting on the left side of the transmission case, and loosen the nut with a double-end wrench.

In the case of occurrence of problems 1) and 2) mentioned previously, perform the adjustment by loosening or tightening the nut within a range of 3/4 turn from this state.

Tool No.	Tool Name
398603610	SOCKET WRENCH

Do not loosen excessively; otherwise, the band strut on the servo piston will drop off.

2) In case of the occurrence of problem 3) mentioned previously, perform the adjustment as follows:

Adjusting procedure: Tighten adjust screw to 9 N·m (0.9 kg-m, 6.5 ft-lb) torque, then back off three turns.

Do not tighten the adjusting screw with an excessively large torque.

3) With the adjusting screw immobilized, tighten the lock nut to 26±2 N·m (2.7±0.2 kg-m, 20±1.4 ft-lb) torque.

<Inspection>

(1) Separate the cable end from the range select lever.

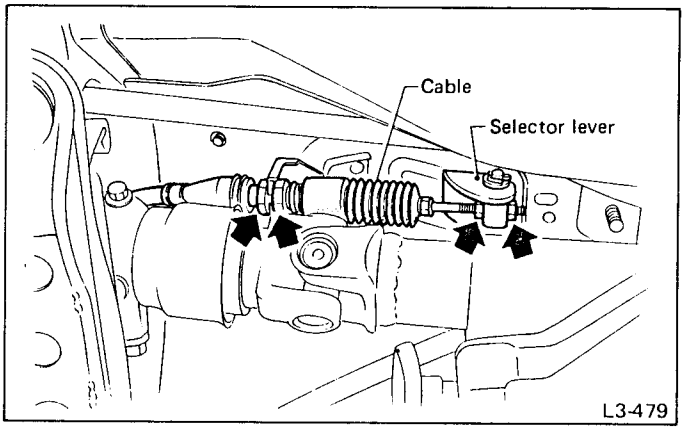


Fig. 282

(2) Using a circuit tester, check continuity in the connectors (for P, R, N, D, 3 and 2 ranges) at the inhibitor switch.

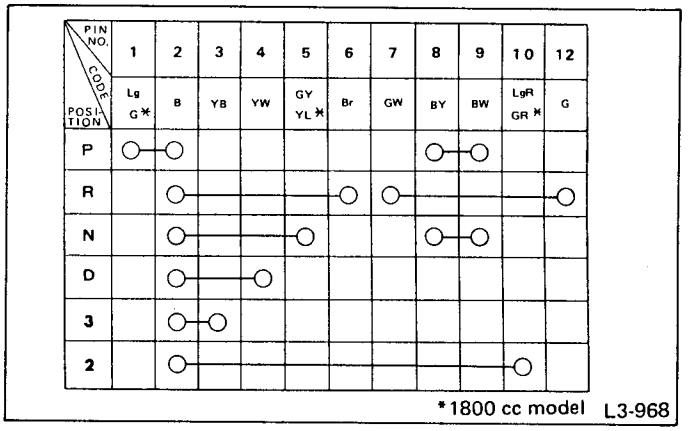


Fig. 283

Also check that continuity in ignition circuit does not exist when selector lever is in R, D, 3 and 2 ranges.

6. INHIBITOR SWITCH

The inhibitor switch allows the back-up lights to turn on when the select lever is in the R range and the starter motor to start when the lever is in the N or P range. It also monitors the input signal electronically controlled for each range and turns on the corresponding range light on the instrument panel.

When light operation, driving condition or starter motor operation is erroneous, first check the shift linkage for improper operation. If the shift linkage is functioning properly, check the inhibitor switch.

(3) Check if there is continuity at equal points when the select lever is turned 1.5° in both directions from the N range.

If there is continuity in one direction and the continuity in the other or if there is continuity at unequal points, adjust the inhibitor switch.

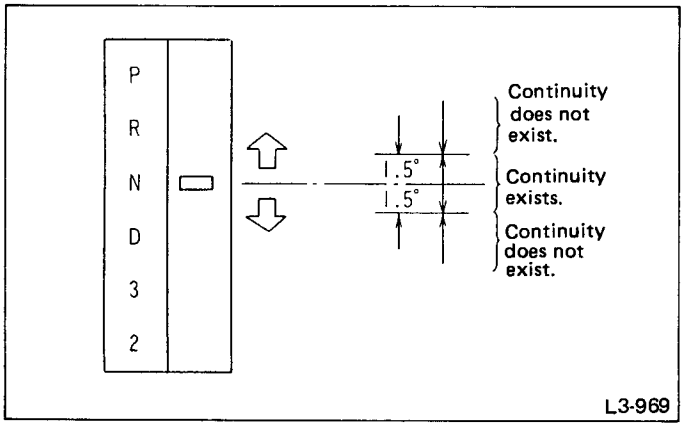


Fig. 285

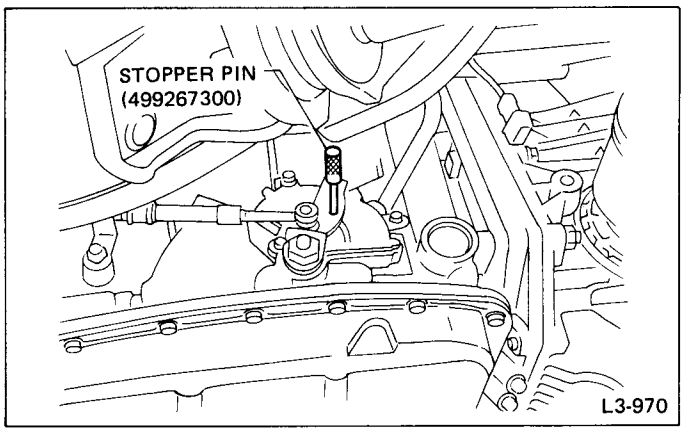


Fig. 286

<Adjustment>

(1) Loosen the three inhibitor switch securing bolts.
(2) Shift the select lever to the N range.
(3) Insert STOPPER PIN (499267300) as vertical as possible into the holes in the inhibitor switch lever and switch body.
(4) Tighten the three inhibitor switch bolts.

Tightening torque:
2.0 – 2.5 N·m
(0.20 – 0.26 kg-m, 1.4 – 1.9 ft-lb)

(5) Repeat the above checks. If the inhibitor switch is determined to be "faulty," replace it.

7. TRANSMISSION HARNESS

1) Check resistance and/or continuity in sensor, solenoid and ground circuits at connector.
2) Also check terminals for shortcircuits.

a. Remove oil pan before checking continuity between multi-connector and 2-pin or 1-pin connector.
b. Remove extension before checking continuity between duty solenoid C and 1-pin connector.

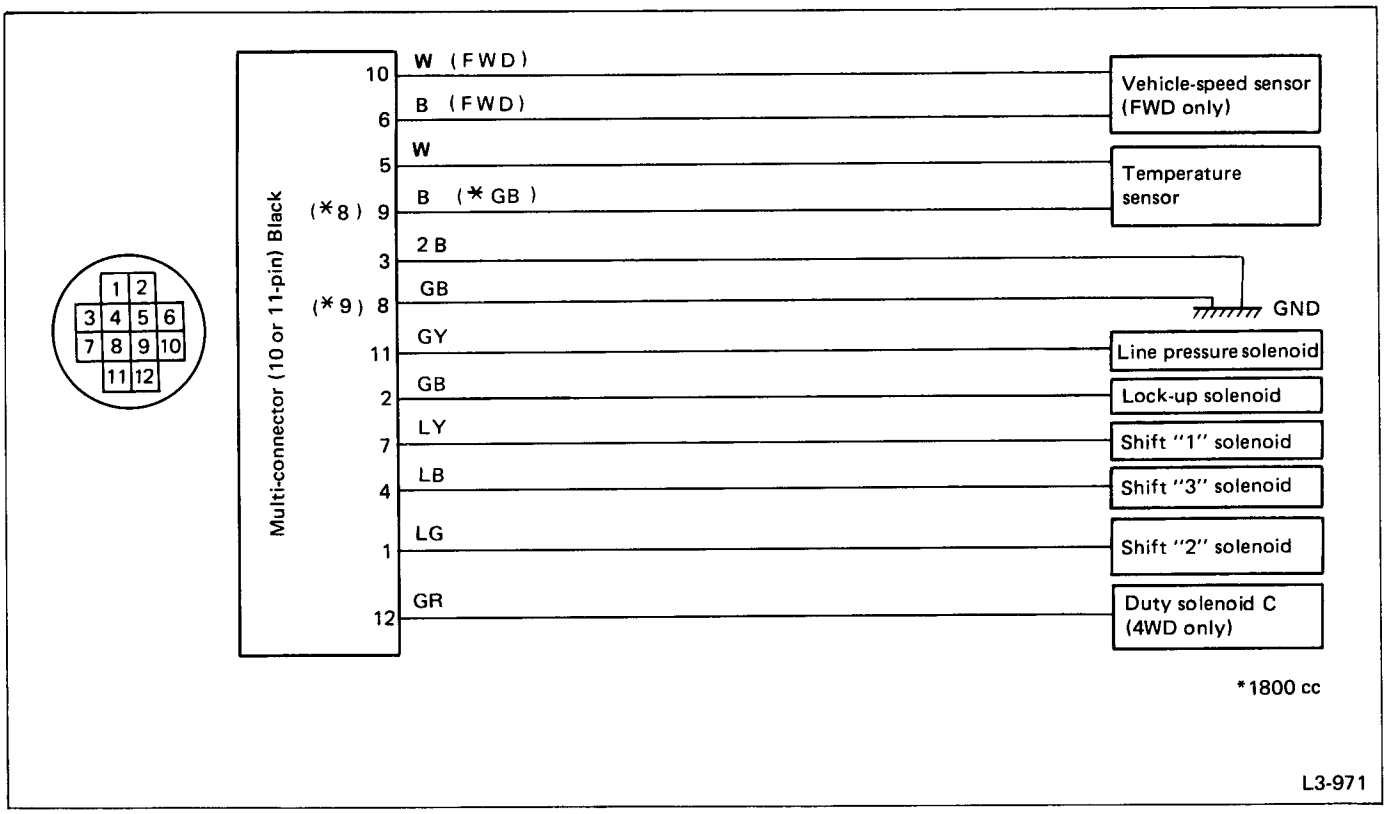


Fig. 287

- **Standard values**

Part name	Resistance (Ω)
Vehicle-revolution sensor	Approx. 600
Temperature sensor	100 – 6 k, 2.5 k/20°C (68°F)
Line-pressure solenoid	Approx. 3
Lock-up solenoid	Approx. 10
Shift solenoid 1	Approx. 25
Shift solenoid 2	Approx. 25
Shift solenoid 3	Approx. 25
Duty solenoid C	Approx. 10

If part is faulty, its resistance value will be different from the standard value indicated above.

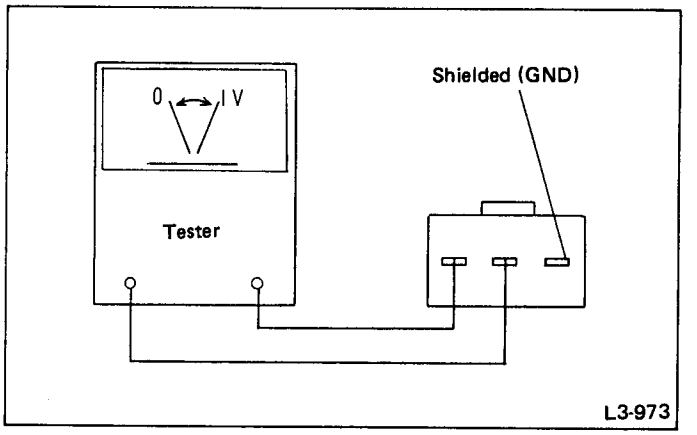


Fig. 289

8. VEHICLE REVOLUTION SENSOR

1) Disconnect connector.

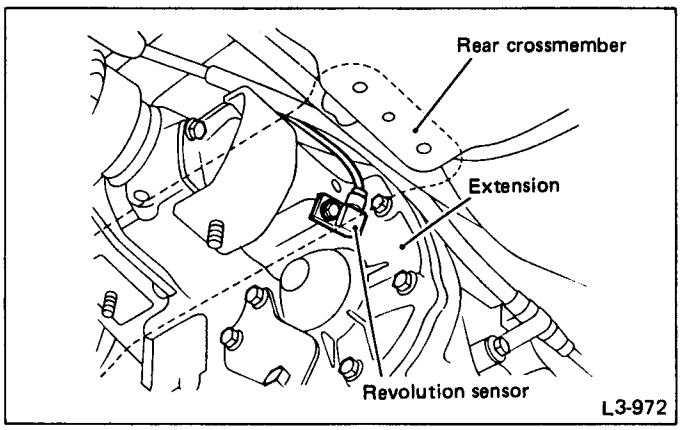


Fig. 288

2) Connect tester to connector.
3) Drive vehicle at approx. 10 km/h (6 MPH).
4) Check that tester registers approx. 1 volt.

For reference: Approx. 500 Ω resistance between revolution sensor connectors.

REMOVAL AND INSTALLATION

1. SHIFT SOLENOID, DUTY SOLENOID AND VALVE BODY

- **Removal**

1) Clean transmission exterior.
2) Drain ATF completely.

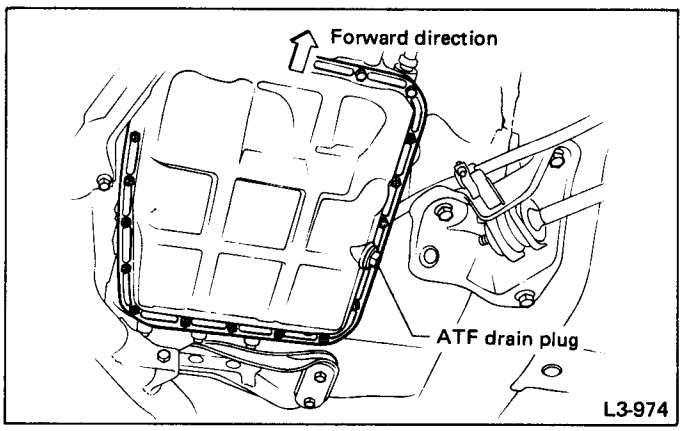


Fig. 290

Tighten ATF drain plug after draining ATF.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)

3) Remove oil pan and gasket.

Drain oil into a container

4) Disconnect solenoid valve connectors.
Remove connectors from clips and disconnect connectors at 5 places.

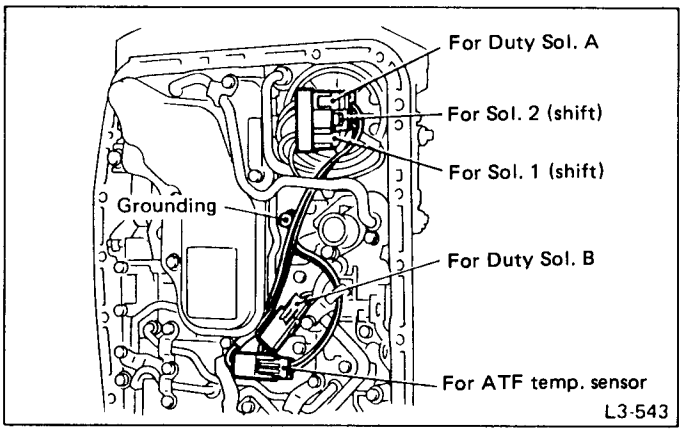


Fig. 291

5) Remove duty solenoid B.
(1) Remove the four bolts.
(2) Remove solenoid.

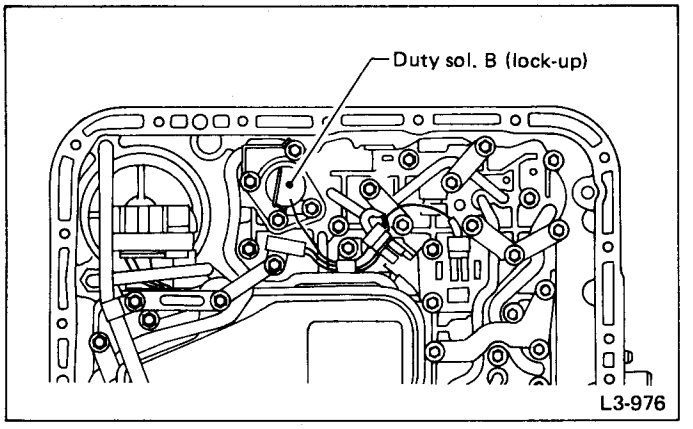


Fig. 292

6) Remove oil strainer.
(1) Disconnect oil pipe by removing the two bolts.
(2) Remove four bolts and oil strainer.

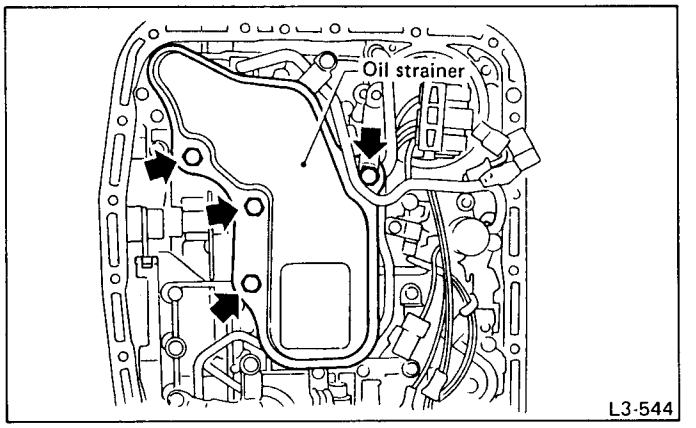


Fig. 293

Be careful because oil flows from oil strainer.

7) Remove valve body.
(1) Remove 8 long bolts (Black).
(2) Remove 11 short bolts (Yellow).

Be careful because oil flows from valve body.

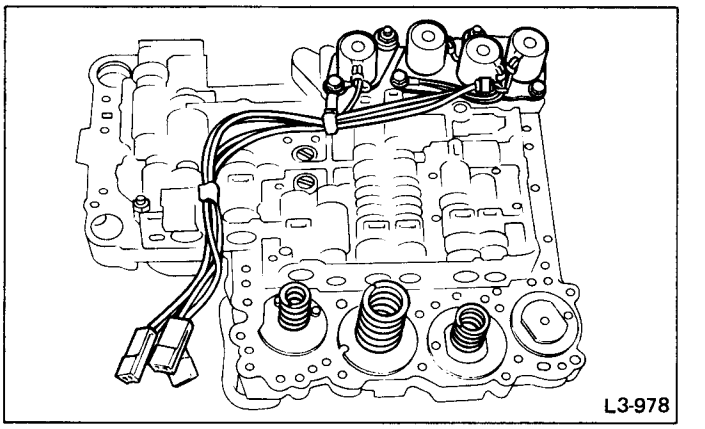


Fig. 294

8) Remove shift solenoids 1, 2, and 3, and duty solenoid A.

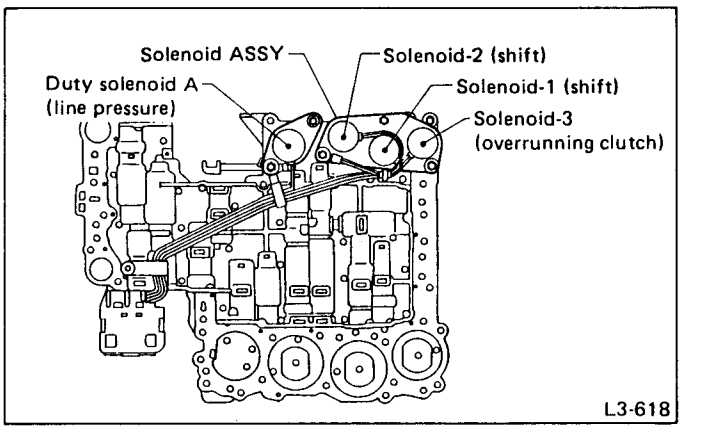


Fig. 295

• Installation

1) Install duty solenoid B (lock-up).

Tighten bolts shown by solid arrows. The two bolts and brackets shown by arrows " ⬅ " must be tightened later.

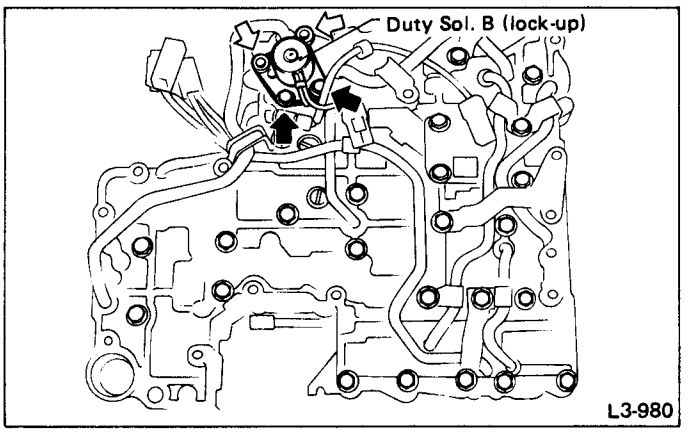


Fig. 296

2) Install solenoid valves.
   (1) Shift solenoids, 1, 2 and 3.
   (2) Duty solenoid A (line pressure).

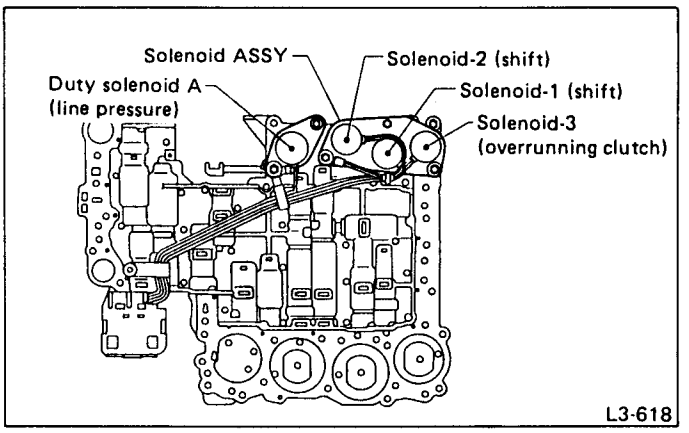


Fig. 297

3) Install valve body.

Tightening torque:
8 N·m (0.8 kg-m, 5.8 ft-lb)

- **Secure accumulator springs using vaseline.**
- **Align manual valve connections.**
- **Tighten duty solenoid B (lock-up) bracket and two bolts (also used to tighten valve body).**

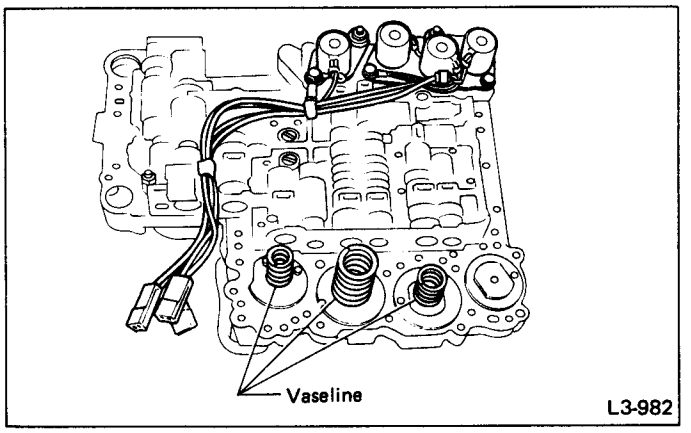


Fig. 298

4) Install oil strainer.
Also install oil pipe and harness connector bracket.

Tightening torque:
2.9 ± 0.5 N·m (0.3 ± 0.05 kg-m, 2.2 ± 0.4 ft-lb)

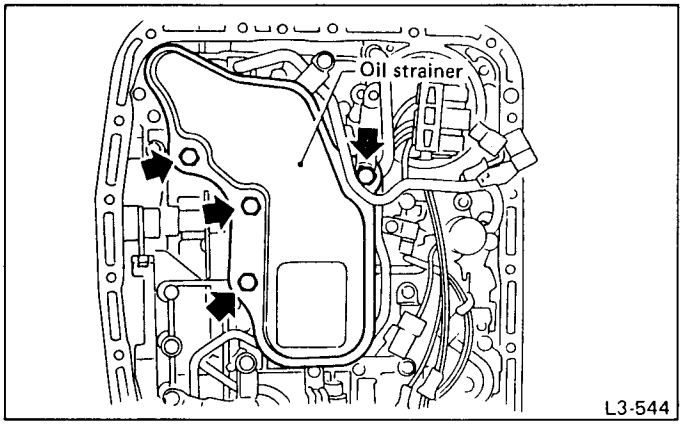


Fig. 299

5) Connect harness connectors at 5 places.
   (1) Connect connectors of same color.
   (2) Secure connectors to valve body using clips.

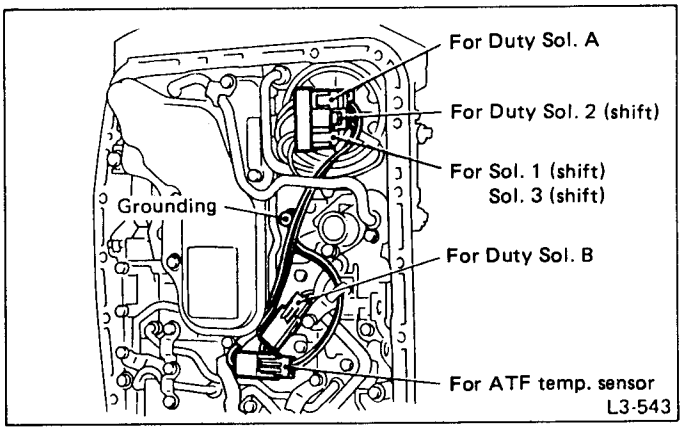


Fig. 300

6) Install oil pan & gasket.

Tightening torque:
3.9±0.5 N·m (0.4±0.05 kg-m, 2.9±0.4 ft-lb)

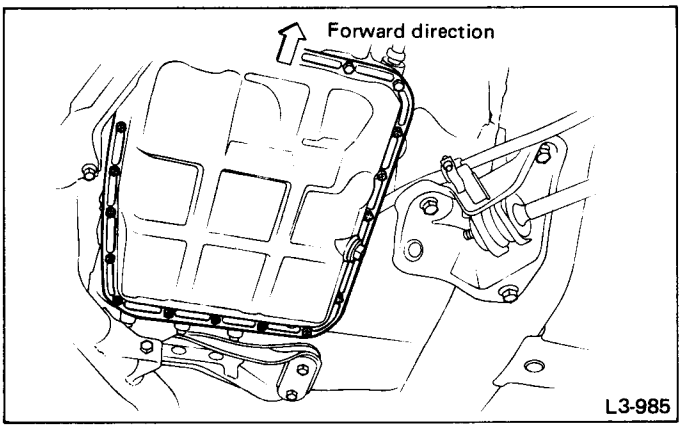


Fig. 301

7) Add and check ATF.

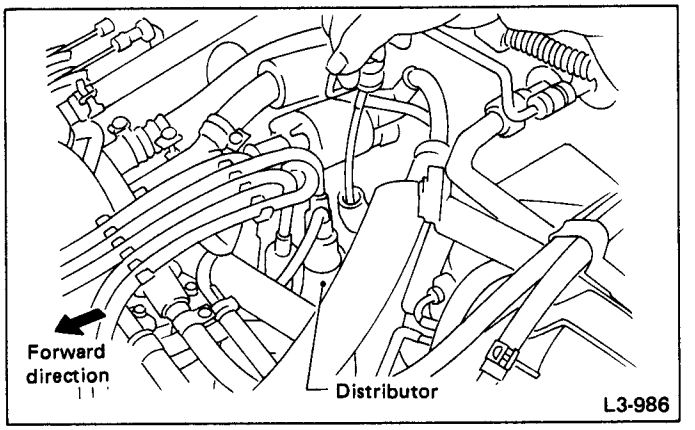


Fig. 302

2. DUTY SOLENOID C AND TRANSFER VALVE BODY

- **Removal**

1) Remove transmission pitching stopper.

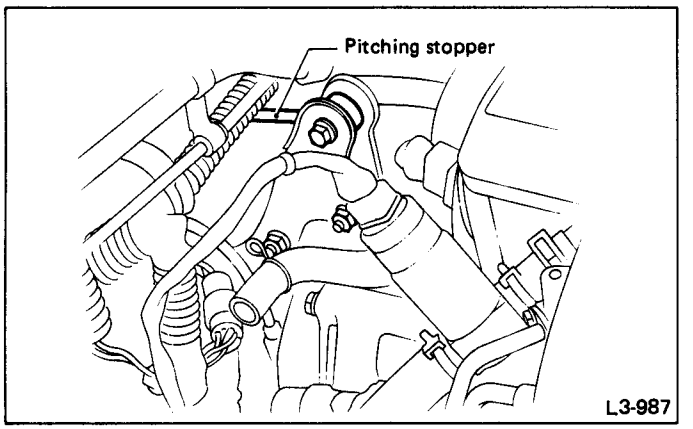


Fig. 303

2) Raise car and drain ATF.

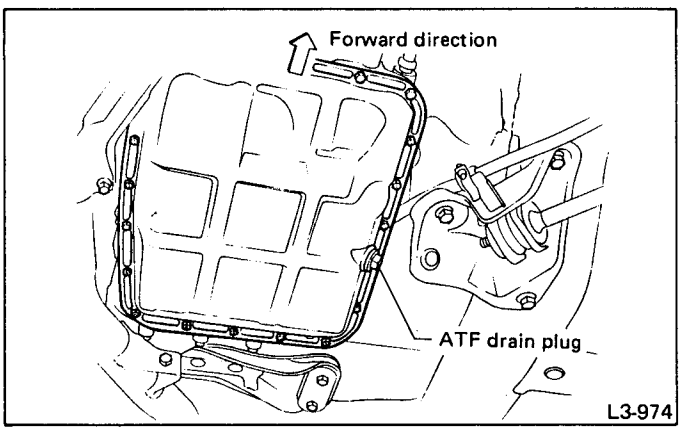


Fig. 304

3) Remove exhaust pipe (F).
   (1) Disconnect O_2 sensor connector.
   (2) Remove bolts shown by arrows in Figure.

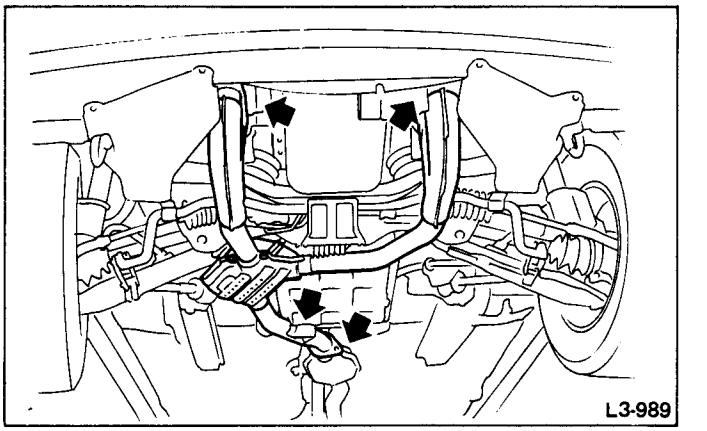


Fig. 305

4) Remove propeller shaft.

Before removing propeller shaft, scribe alignment marks on propeller shaft and rear differential coupling.

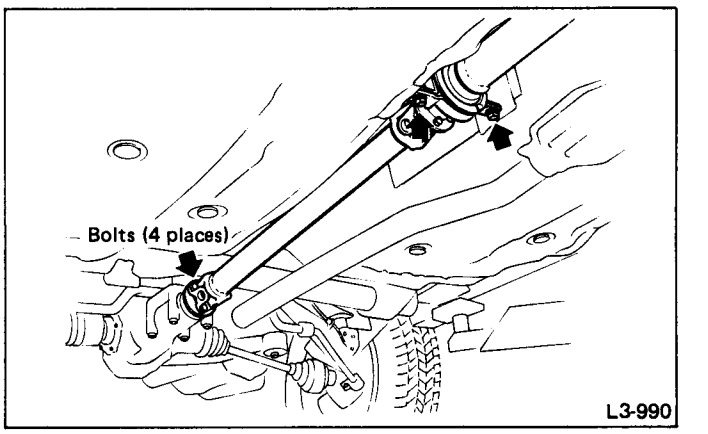


Fig. 306

5) Remove rear crossmember.
   (1) Support transmission using a transmission jack and raise slightly.
   (2) Remove bolts and nuts as shown in Figure.

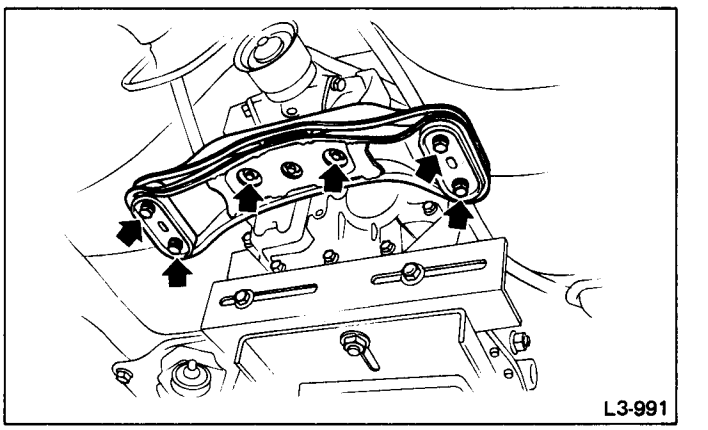


Fig. 307

6) Remove revolution sensor.

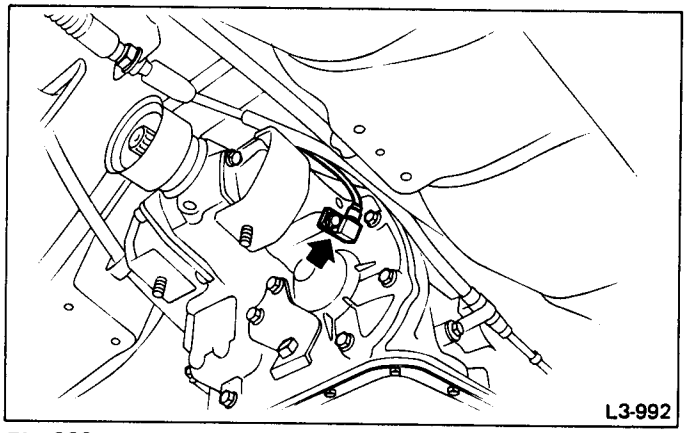


Fig. 308

7) Remove extension & gasket.
   (1) Remove gear select cable nut.
   (2) Move gear select cable so that extension bolts can be removed.

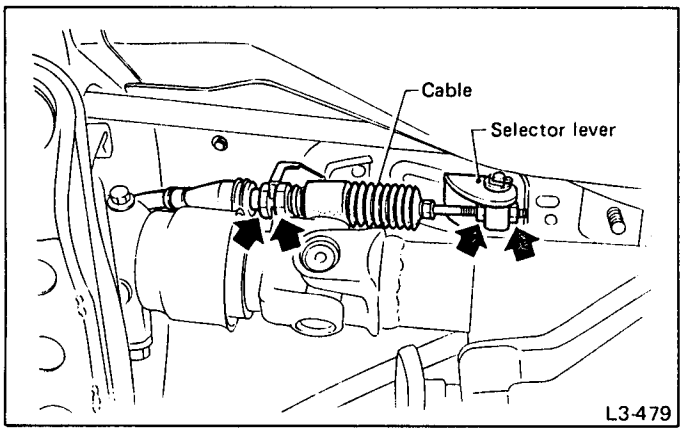


Fig. 309

   (3) Remove bolts.
   (4) Remove extension and disconnect duty solenoid C connector.

a. Use a container to catch oil flowing from extension.
b. Do not force extension back before disconnecting solenoid connector. Otherwise, harness may be damaged.

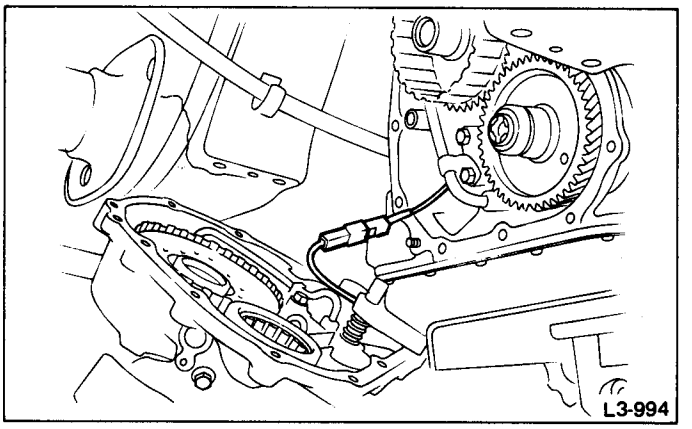


Fig. 310

8) Remove duty solenoid C & transfer valve body from extension.
   (1) Remove transfer clutch drum.

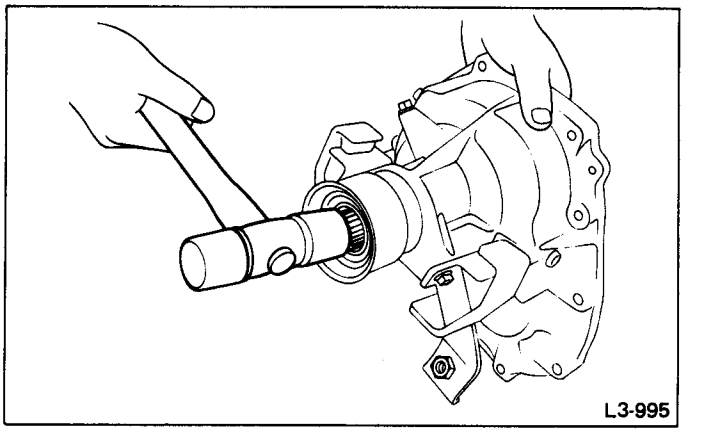


Fig. 311

   (2) Remove clamp which secures pipe.
   (3) Remove bolts.

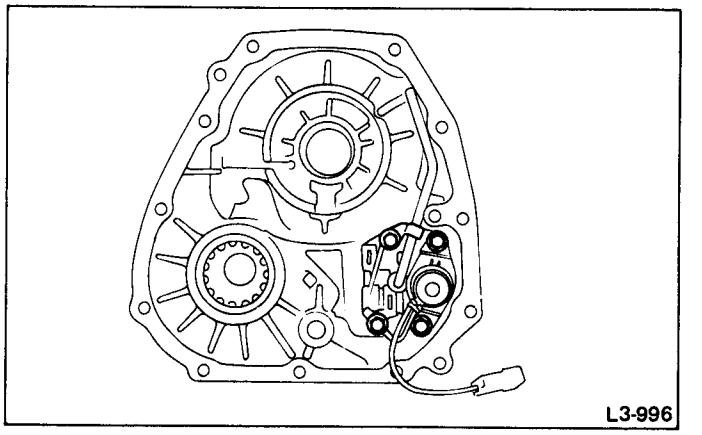


Fig. 312

• Installation

1) Install duty solenoid C & transfer valve body.
   (1) Install duty solenoid C & transfer valve body.
   (2) Install pipe and clamp.

Tightening torque:
8 ± 1 N·m (0.8 ± 0.1 kg-m, 5.8 ± 0.7 ft-lb)

(3) Install clutch drum.

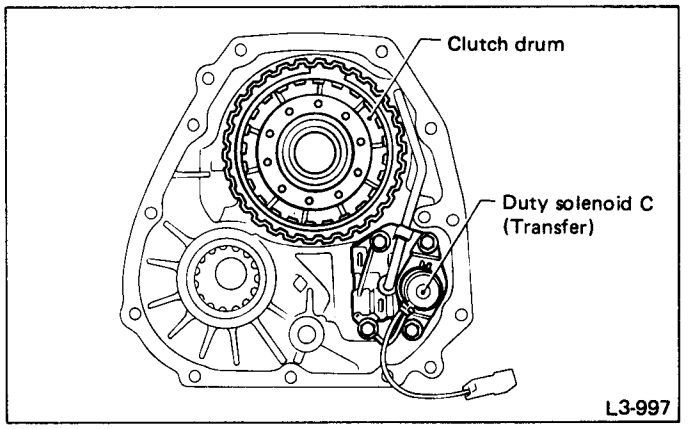


Fig. 313

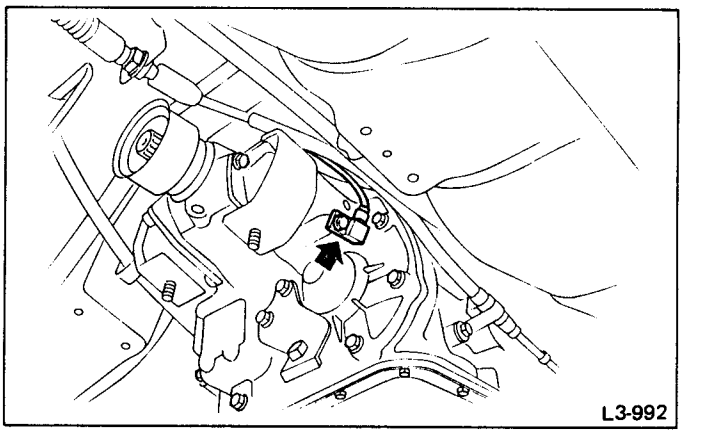


Fig. 315

2) Install extension.
   (1) Connect connector.
   (2) Tighten 11 bolts.

Tightening torque:
25 N·m (2.5 kg-m, 18 ft-lb)

(3) Connect gear shift cable.

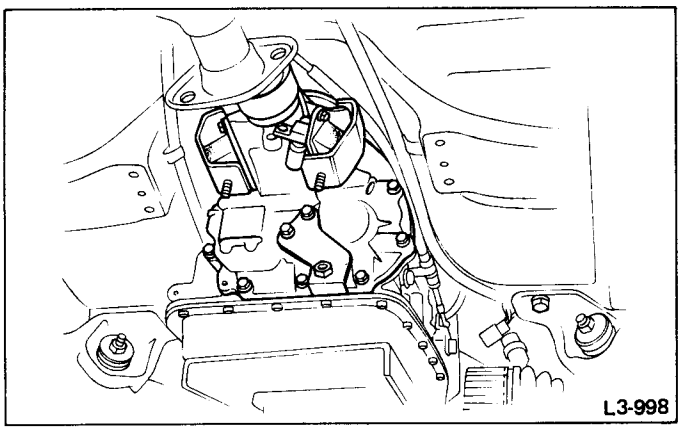


Fig. 314

3) Install revolution sensor.

Tightening torque:
8 N·m (0.8 kg-m, 5.8 ft-lb)

4) Install rear crossmember.
   (1) Tighten bolts.

Tightening torque:
37 ± 10 N·m (3.8 ± 1.0 kg-m, 27 ± 7 ft-lb)

(2) Lower and remove transmission jack.

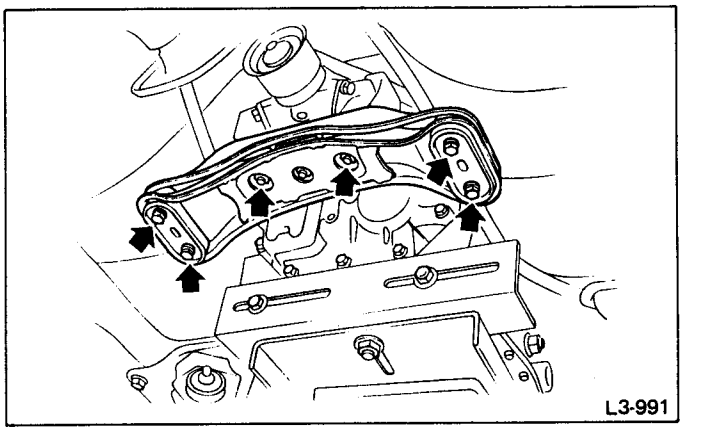


Fig. 316

5) Install propeller shaft.

Tightening torque:
N·m (kg-m, ft-lb)
A 21.1 ± 3.4 (2.15 ± 0.35, 15.6 ± 2.5)
B 39 ± 10 (4.0 ± 1.0, 29 ± 7)

Align marks on propeller shaft and rear differential coupling.

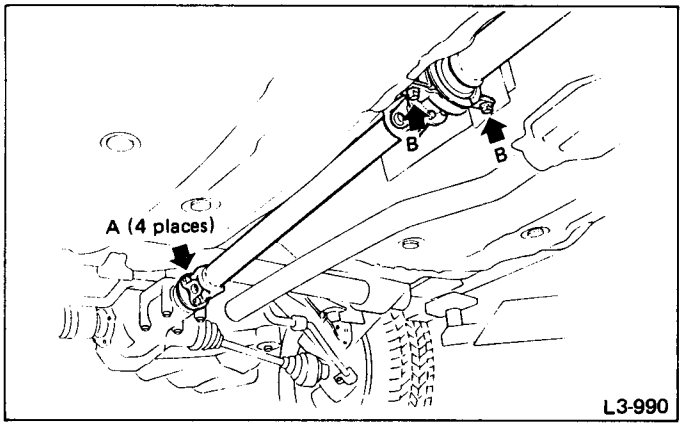


Fig. 317

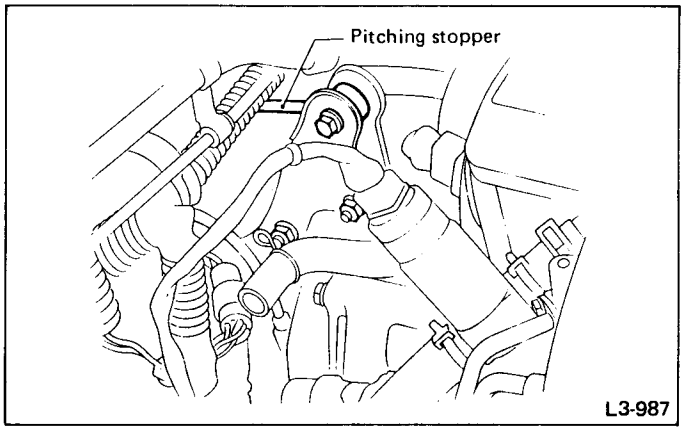


Fig. 319

10) Replenish ATF and check oil level. Check for leaks.

6) Install exhaust pipe F.

Tightening torque:
N·m (kg-m, ft-lb)
C 27 ± 7 (2.8 ± 0.7, 20.3 ± 5.1)
D 29 ± 5 (3.0 ± 0.5, 21.7 ± 3.6)
E 14 ± 4 (1.4 ± 0.4, 10.1 ± 2.9)

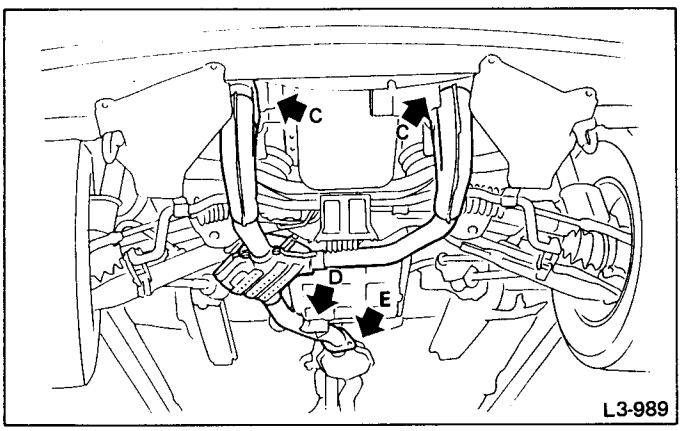


Fig. 318

7) Lower and remove jack.
8) Connect the following parts:
   (1) O_2 sensor connector
   (2) Revolution sensor connector
   (3) Multi-connector
9) Install transmission pitching stopper.

Tightening torque:
N·m (kg-m, ft-lb)
52 ± 15 (5.3 ± 1.5, 38 ± 11) (Body side)
49 ± 5 (5.0 ± 0.5, 36.2 ± 3.6) (Engine side)

5 Performance Test

- NECESSARY TEST GAUGES

1) Tachometer (It is desirable to be able to read to 50 rpm.)
2) Vacuum gauge (It is used for measuring intake manifold vacuum.)
3) OIL PRESSURE GAUGE (398573600).
4) OIL PRESSURE ADAPTER (498897100).
5) Stop watch.

1. STALL TEST

The stall test is of extreme importance in diagnosing the condition of the automatic transmission and the engine. It should be conducted to measure the engine stall speeds in all shift ranges except the P and N ranges.

Purposes of the stall test

1) To check the operation of the automatic transmission clutch and brake band.
2) To check the operation of the torque converter.
3) To check engine performance.

Test Methods

- **Preparations before test**

① Check that throttle valve opens fully.
② Check that engine oil level is correct.
③ Check that coolant level is correct.
④ Check that ATF level is correct.
⑤ Check that differential gear oil level is correct.
⑥ Increase ATF temperature to 60 – 80°C (140 – 176°F) by idling the engine for approximately 30 minutes (with select lever set to "N" or "P").

1) Install an engine tachometer at a location visible from the driver's compartment and mark the stall speed range on the tachometer scale.
2) Place the wheel chocks at the front and rear of all wheels and engage the parking brake.

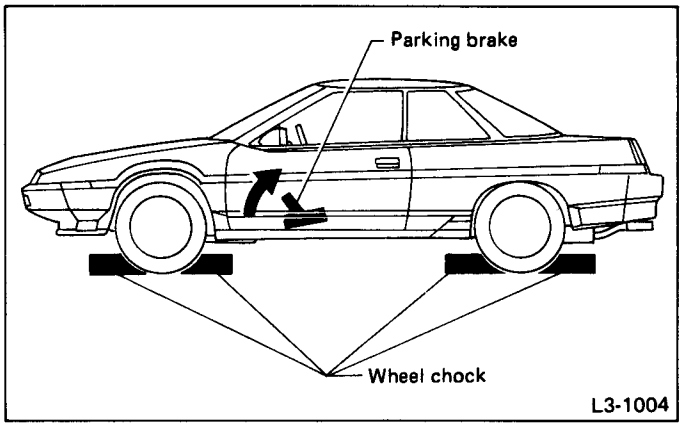


Fig. 320

3) Move the manual linkage to ensure it operates properly, and shift the select lever to the D range.
4) While forcibly depressing the foot brake pedal, gradually depress the accelerator pedal until the engine operates at full throttle.

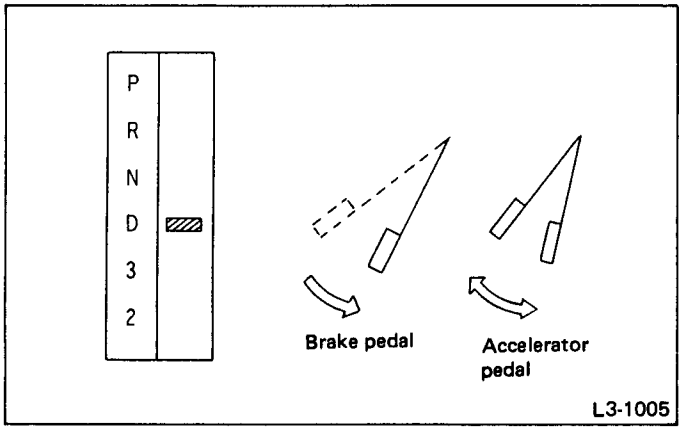


Fig. 335 Stall test

5) When the engine speed is stabilized, read that speed quickly and release the accelerator pedal.
6) Shift the select lever to Neutral, and cool down the engine by idling it for more than one minute.
7) Record the stall speed.
8) Perform the stall tests with the select lever in the 3, 2 and R ranges.

a. Do not continue the stall test for MORE THAN FIVE SECONDS at a time (from closed throttle, fully open throttle to stall speed reading). Failure to follow this instruction causes the engine oil and ATF to deteriorate and the clutch and brake band to be adversely affected.
Be sure to cool down the engine for at least one minute after each stall test with the select lever set in the P or N range and with the idle speed lower than 1,200 rpm.
b. If the stall speed is higher than the specified range, attempt to finish the stall test in as short a time as possible, in order to prevent the automatic transmission from sustaining damage.

Stall speed (at sea level):
1800 cc
2,450 – 2,850 rpm
2700 cc
2,400 – 2,800 rpm

Interpretation of stall test results

Stall speed (at sea level)	Assessment	Cause	Remarks
Higher than 2,850 rpm (1800 cc) or 2,800 rpm (2700 cc)	Slippage of automatic transmission clutch, brake band, etc. (Further stall tests are not necessary.)	• Low line pressure (If stall speed is higher than specified range at any shift position). • One-way clutch slippage. (If stall speed is higher than specified range only in the D range.) • Slippage of Forward clutch. (If stall speed is higher than specified range in D, 3, 2, 1ST Hold range. • *1: Slippage of low & reverse brake or reverse clutch. (If stall speed is higher than specified range only in the R range.)	*1: Slippage of reverse clutch/ low & reverse brake can be judged by road tests. If engine compression can be used as a brake with select lever in the 1 range, reverse clutch is slipping; if it cannot be used, low & reverse brake is slipping.
2,450 – 2,850 rpm (1800 cc) or 2,400 – 2,800 rpm (2700 cc)	• Control members are in good order in the D, 3, 2 and R ranges. • Engine in good order.		• One-way clutch can be checked for condition by road tests.**
Lower than 2,450 rpm (1800 cc) or 2,400 rpm (2700 cc)	• Throttle not fully opened. • Erroneous engine operation or torque converter one-way clutch slippage.		
** Road test	• Acceleration is not properly made up to 50 km/h (31 MPH). • Car speed does not attain more than 80 km/h (50 MPH). • Operation is not proper at all car speeds.	One-way clutch slippage. *3: One-way clutch jamming. Erroneous engine operation.	*3: Abnormal temperature rise occurs.

2. TIME LAG TEST

If the shift lever is shifted while the engine is idling, there will be a certain time elapse or lag before the shock can be felt. This is used for checking the condition of the forward clutch, reverse clutch, low & reverse brake, forward one-way clutch and low one-way clutch

CAUTION:
(a) Perform the test at normal operation fluid temperature (50 to 80°C or 122 to 176°F).
(b) Be sure to allow a one minute interval between tests.
(c) Make three measurements and take the average value.

Measure time lag

1) Fully apply the parking brake.
2) Start the engine.

Check idling speed (A/C OFF)

"N" range: 1800: 800 ± 100 rpm
2700: 750 ± 100 rpm

3) Shift the shift lever from "N" to "D" range.

Using a stop watch, measure the time it takes from shifting the lever until the shock is felt.

Time lag: Less than 1.2 seconds

4) In same manner, measure the time lag for "N" → "R".

Time lag: Less than 1.5 seconds

Evaluation

1) If "N" → "D" time lag is longer than specified:
   - Line pressure too low
   - Forward clutch worn
   - Low one-way clutch not operating properly
2) If "N" → "R" time lag is longer than specified:
   - Line pressure too low
   - Reverse clutch worn
   - Low & Rev. clutch worn

3. LINE PRESSURE TEST

If the clutch or the brake band shows a sign of slippage or shifting sensation is not correct, the line pressure should be checked.

- Excessive shocks during upshifting or shifting takes place at a higher point than under normal circumstances, may be due to the line pressure being too high.
- Slippage or inability to operate the car may, in most cases, be due to loss of oil pressure for the operation of the clutch, brake band or control valve.

1) Line pressure measurement (under no load)

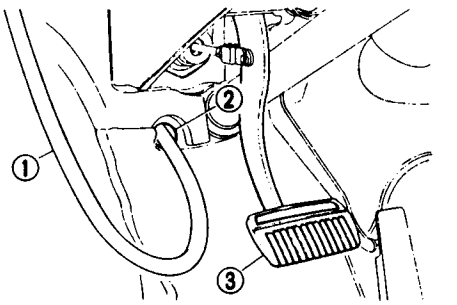
a. Before measuring line pressure, jack-up front wheels (front-wheel-drive model) or all wheels (4-wheel drive model).
b. Maintain temperature of ATF at approximately 60 to 80°C (140 to 176°F) during measurement.
(ATF will reach the above temperature after idling the engine for approximately 30 minutes with shift lever in "N" or "P".)

2) Line pressure measurement (under heavy load)

a. Before measuring line pressure, apply both foot and parking brakes with all wheels chocked (Same as for "stall" test conditions).
b. Measure line pressure for 5 to 10 seconds. Before measuring it again, idle the engine for 2 to 5 minutes.
c. Before measuring line pressure, always shift the lever from "D" to "2".
d. Maintain the temperature of ATF at approximately 60 to 80°C (140 to 176°F) during measurement. (ATF will reach the above temperature after idling the engine for approximately 30 minutes with the shift lever in "N" or "P".)

Measuring the line pressure

1) Temporarily attach the OIL PRESSURE GAUGE (398573600) to a suitable place in the driver's compartment, remove the blind plug located in front of the toeboard and pass the hose of the GAUGE (398573600) to the engine compartment.

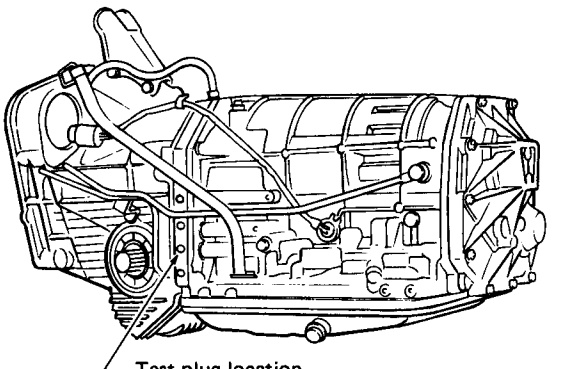


1 Pressure gauge hose
2 Hole in toe board (blank cap hole)
3 Brake pedal

A13-223

Fig. 322

2) Remove the test plug and install OIL PRESSURE GAUGE ADAPTER (498897100) instead.



L3-1006

Fig. 323

3) Start the engine and warm it up by driving the car for at least 10 to 15 minutes.
4) Stop the engine. Connect the OIL PRESSURE ADAPTER (498897100) and the tip end of the GAUGE (398573600).
5) Check line pressure in accordance with the following chart.

< Standard line pressure >

Unit: kPa (kg/cm^2, psi)

Range	Min. line pressure 600 – 800 rpm	Max. line pressure Stall rpm
P	441 – 569 (4.5 – 5.8, 64 – 82)	–
R	588 – 686 (6.0 – 7.0, 85 – 100)	1,422 – 1,589 (14.5 – 16.2, 206 – 230)
N	441 – 569 (4.5 – 5.8, 64 – 82)	–
D	441 – 569 (4.5 – 5.8, 64 – 82)	1,128 – 1,255 (11.5 – 12.8, 164 – 182)
3	441 – 569 (4.5 – 5.8, 64 – 82)	1,128 – 1,255 (11.5 – 12.8, 164 – 182)
2	441 – 569 (4.5 – 5.8, 64 – 82)	1,128 – 1,255 (11.5 – 12.8, 164 – 182)
Accelerator pedal	Fully-closed	Fully-open

Measuring transfer clutch pressure

Check transfer clutch pressure in accordance with the following chart in the same manner as with line pressure.

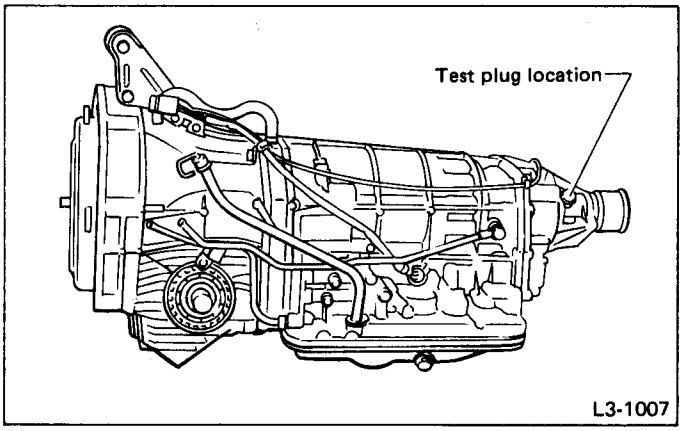


Fig. 324

Unit: kPa (kg/cm^2, psi)

Range	4WD mode		FWD mode
	Low pressure side	High pressure side	High pressure side
	600 – 800 rpm	Stall rpm	Stall rpm
R	49 – 78 (0.5 – 0.8, 7 – 11)	716 – 785 (7.3 – 8.0, 104 – 114)	0 (0, 0)
D	49 – 78 (0.5 – 0.8, 7 – 11)	716 – 785 (7.3 – 8.0, 104 – 114)	0 (0, 0)
Accelerator pedal	Fully-closed	Fully-open	Fully-open

If oil pressure is not produced or if it does not change in the 4WD mode, the duty solenoid C or transfer valve assembly may be malfunctioning. If oil pressure is produced in the FWD mode, the problem is similar to that in the 4WD mode.

4. ROAD TEST

Road tests should be conducted to properly diagnose the condition of the automatic transmission.

When performing test, do not exceed posted speed limit.

Speed change characteristics

The standard speed change characteristics are indicated in the following table.

1800 cc

		Throttle fully-open km/h (MPH)					
		1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
D range	NORMAL	50±2.5 (31±2)	94±2.5 (58±2)	144±2.5 (89±2)	134±2.5 (83±2)	84±2.5 (52±2)	40±2.5 (25±2)
	POWER	56±2.5 (35±2)	104±2.5 (65±2)	155±2.5 (96±2)	145±2.5 (90±2)	94±2.5 (58±2)	45±2.5 (28±2)
3 range		56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	45±2.5 (28±2)
2 range	1st hold S/W OFF	56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	45±2.5 (28±2)
	1st hold S/W ON	56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	50±2.5 (31±2)

		Throttle fully-closed km/h (MPH)					
		1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
D range	NORMAL	15±2.5 (9±2)	30±2.5 (19±2)	45±2.5 (28±2)	40±2.5 (25±2)	15±2.5 (9±2)	10±2.5 (6±2)
	POWER	15±2.5 (9±2)	30±2.5 (19±2)	50±2.5 (31±2)	40±2.5 (25±2)	20±2.5 (12±2)	10±2.5 (6±2)
3 range		15±2.5 (9±2)	30±2.5 (19±2)	–	–	20±2.5 (12±2)	10±2.5 (6±2)
2 range	1st hold S/W OFF	15±2.5 (9±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	10±2.5 (6±2)
	1st hold S/W ON	56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	50±2.5 (31±2)

2700 cc

		Throttle fully-open km/h (MPH)					
		1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
D range	NORMAL	55±2.5 (34±2)	107±2.5 (66±2)	165±2.5 (103±2)	156±2.5 (97±2)	98±2.5 (61±2)	45±2.5 (28±2)
	POWER	55±2.5 (34±2)	107±2.5 (66±2)	165±2.5 (103±2)	156±2.5 (97±2)	98±2.5 (61±2)	45±2.5 (28±2)
3 range		55±2.5 (34±2)	107±2.5 (66±2)	–	–	98±2.5 (61±2)	45±2.5 (28±2)
2 range	1st hold S/W OFF	55±2.5 (34±2)	105±2.5 (65±2)	–	–	100±2.5 (62±2)	45±2.5 (28±2)
	1st hold S/W ON	57±2.5 (35±2)	105±2.5 (65±2)	–	–	100±2.5 (62±2)	40±2.5 (25±2)

		Throttle fully-closed km/h (MPH)					
		1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
D range	NORMAL	13±2.5 (8±2)	18±2.5 (11±2)	38±2.5 (24±2)	33±2.5 (21±2)	15±2.5 (9±2)	10±2.5 (6±2)
	POWER	17±2.5 (11±2)	30±2.5 (19±2)	55±2.5 (34±2)	40±2.5 (25±2)	20±2.5 (12±2)	10±2.5 (6±2)
3 range		17±2.5 (11±2)	30±2.5 (19±2)	–	–	20±2.5 (12±2)	10±2.5 (6±2)
2 range	1st hold S/W OFF	17±2.5 (11±2)	105±2.5 (65±2)	–	–	100±2.5 (62±2)	10±2.5 (6±2)
	1st hold S/W ON	57±2.5 (35±2)	105±2.5 (65±2)	–	–	100±2.5 (62±2)	40±2.5 (25±2)

Shift characteristics

Pay careful attention to ensure the shift is made smoothly at the proper car speed at which shifting begins.

1) Shifting shocks are encountered or smooth shifting does not occur.

2) Shifting occurs slowly in response to the condition of the engine throttle.

The above two problems are due to incorrect line pressure or other factors involved in line pressure.

Checking for shift patterns

1) In the D range, shifting should be made as $D_1 \rightarrow D_2 \rightarrow D_3 \rightarrow D_4$ smoothly and vice versa; it should not be made in the R range.

2) Kick down should activate properly.

3) When the select lever is shifted from the D range to the 3 or 2 range, shifting should be made as 3 → 2 → 1. Engine compression can be utilized as a brake at 2 and 1st hold range.

4) With the shift lever in the 2 range, shifting should be made as 1 → 2 → 3 smoothly.

5) When pushing 1st hold switch, shifting should be made as 1 → 2 or 3 → 2 → 1.

6) The select lever should be locked when placed in the P range.

In road tests, if any abnormality is noticed, it is necessary to adjust the brake band. If by inspection the brake band is in good order, check the servo piston for any sign of oil leakage from the seal.

AUTOMATIC SHIFT CHARACTERISTICS

1800 cc

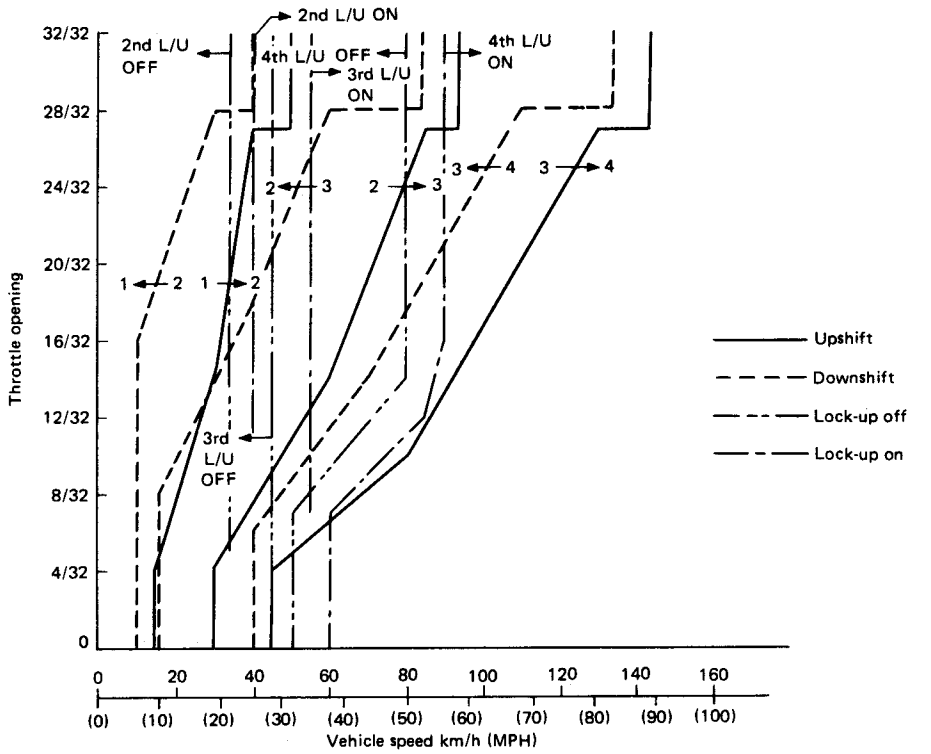


Fig. 325 "D" range (Normal pattern)

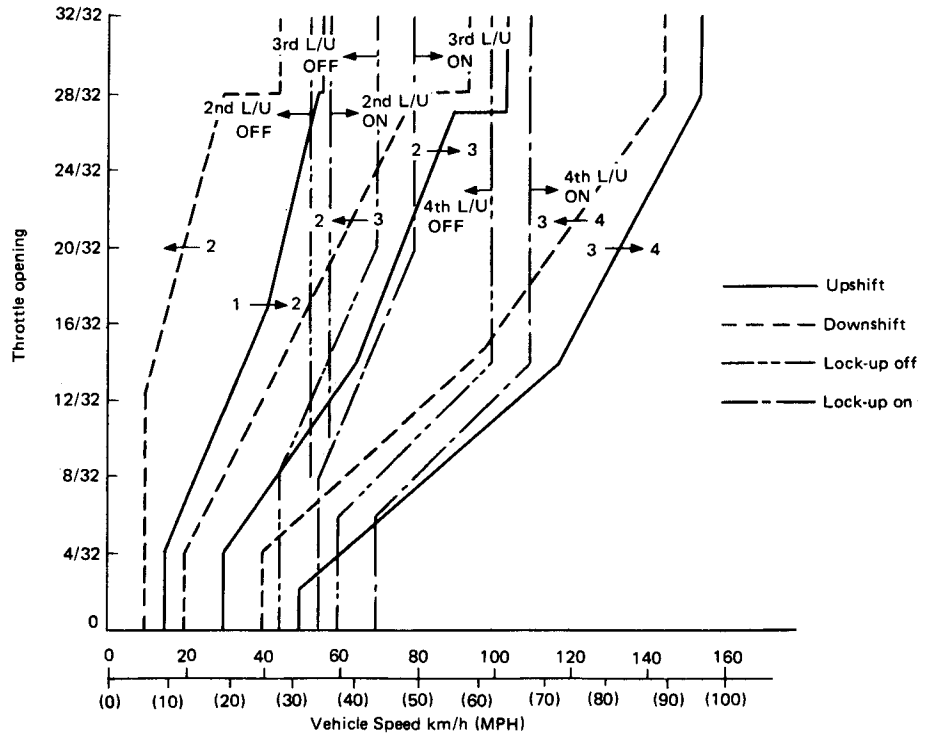


Fig. 326 "D" range (Power pattern)

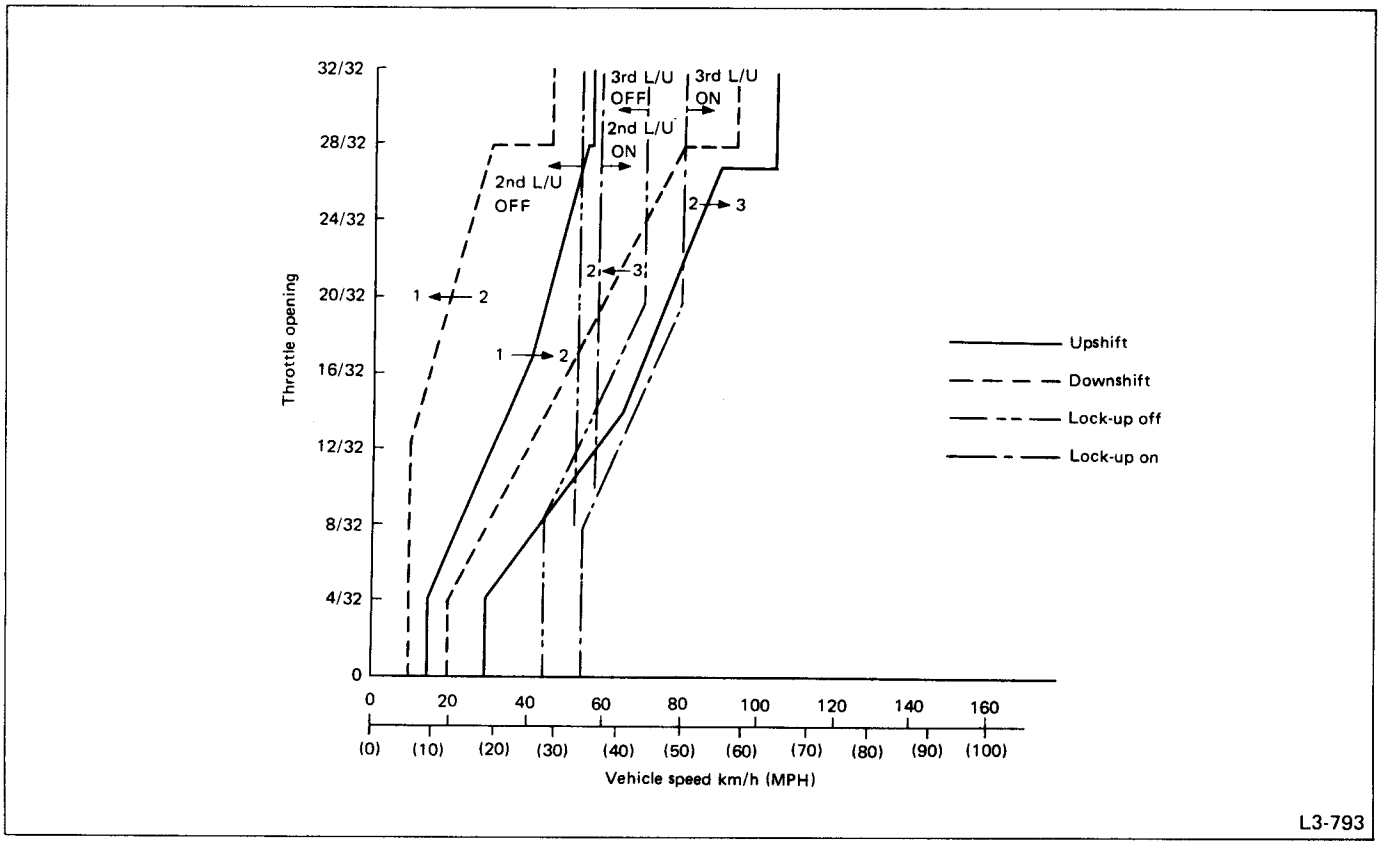


Fig. 327 "3" range

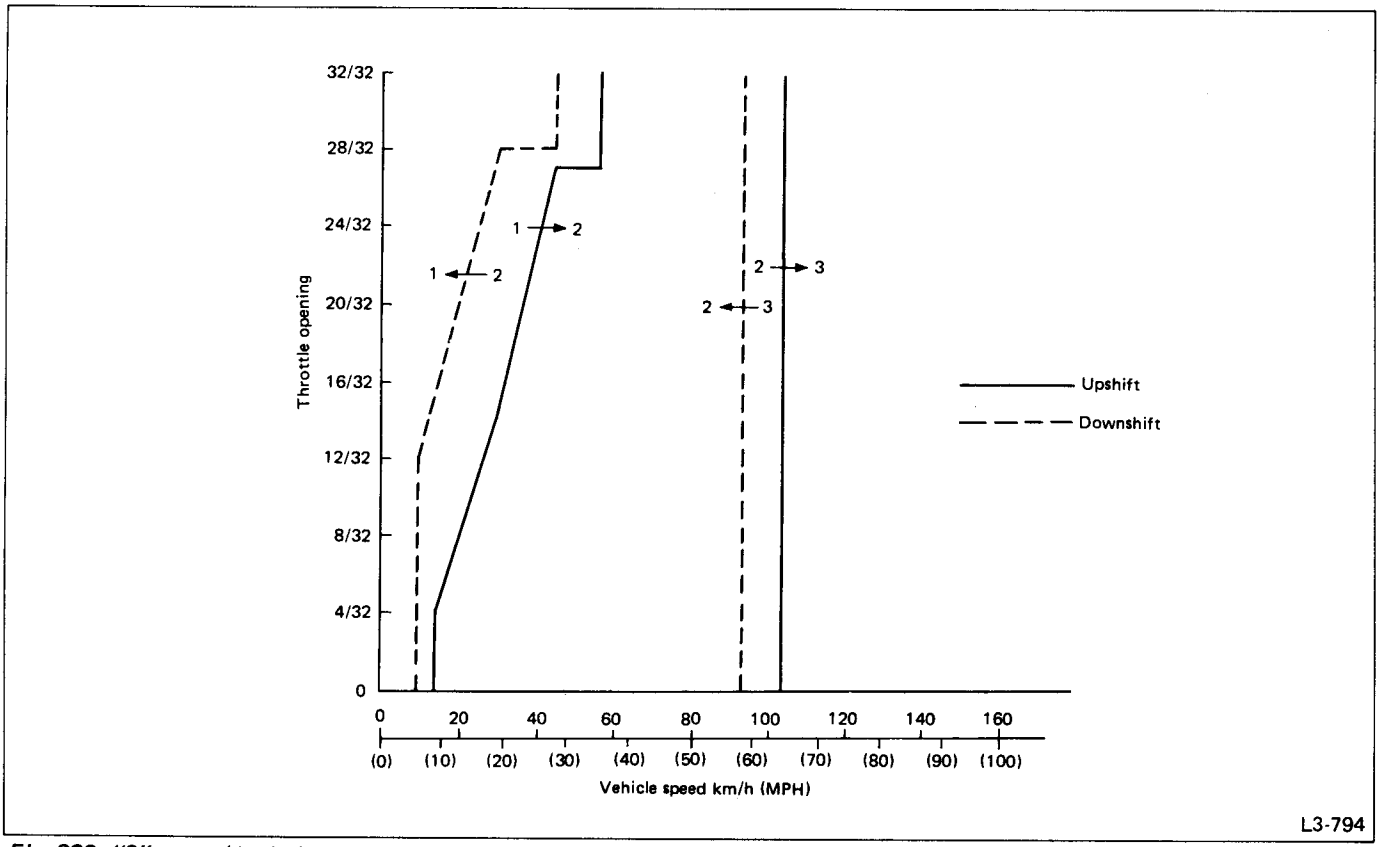


Fig. 328 "2" range (1st hold switch OFF)

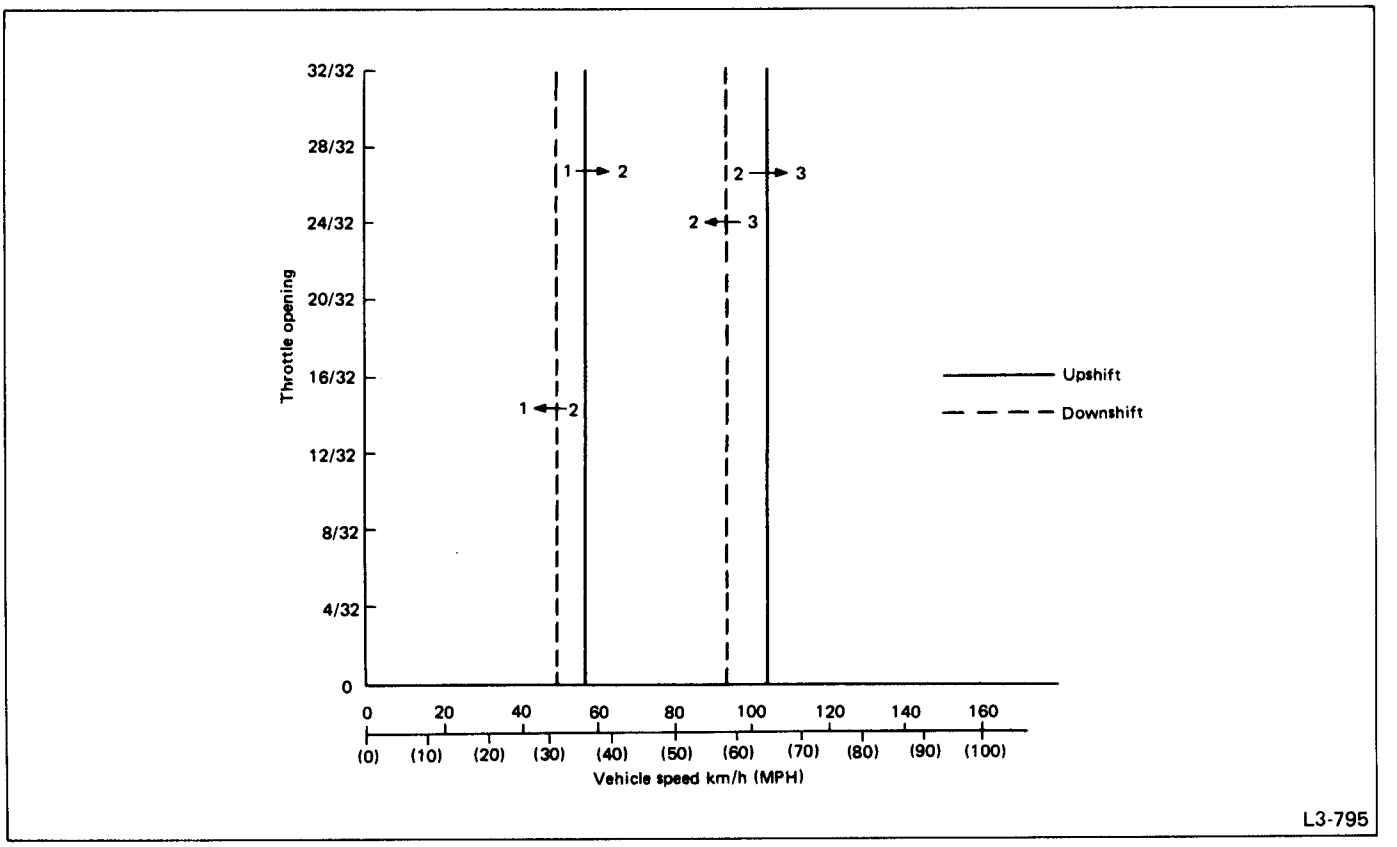


Fig. 329 "2" range (1st hold switch ON)

2700 cc

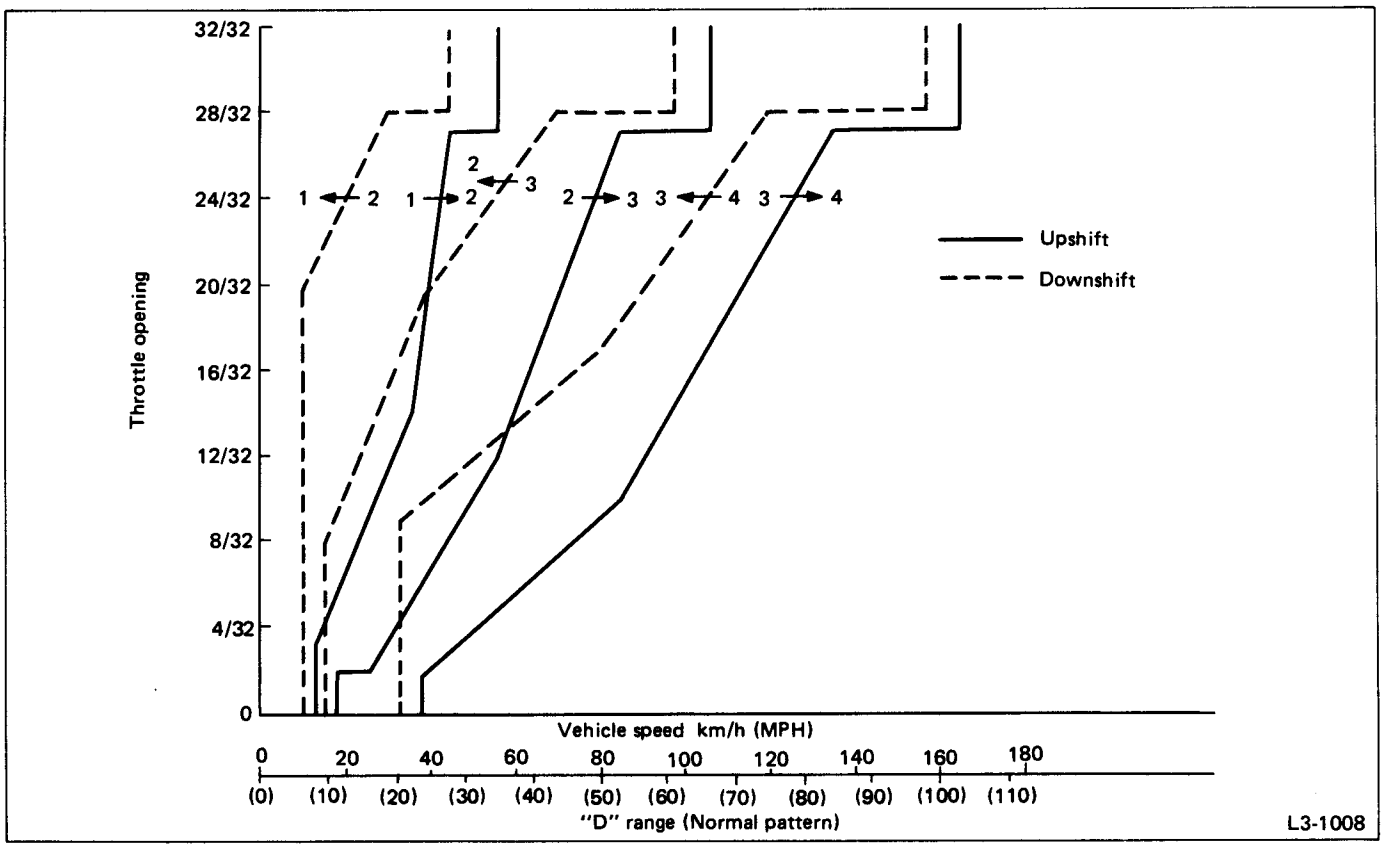


Fig. 330 "D" range (Normal pattern)

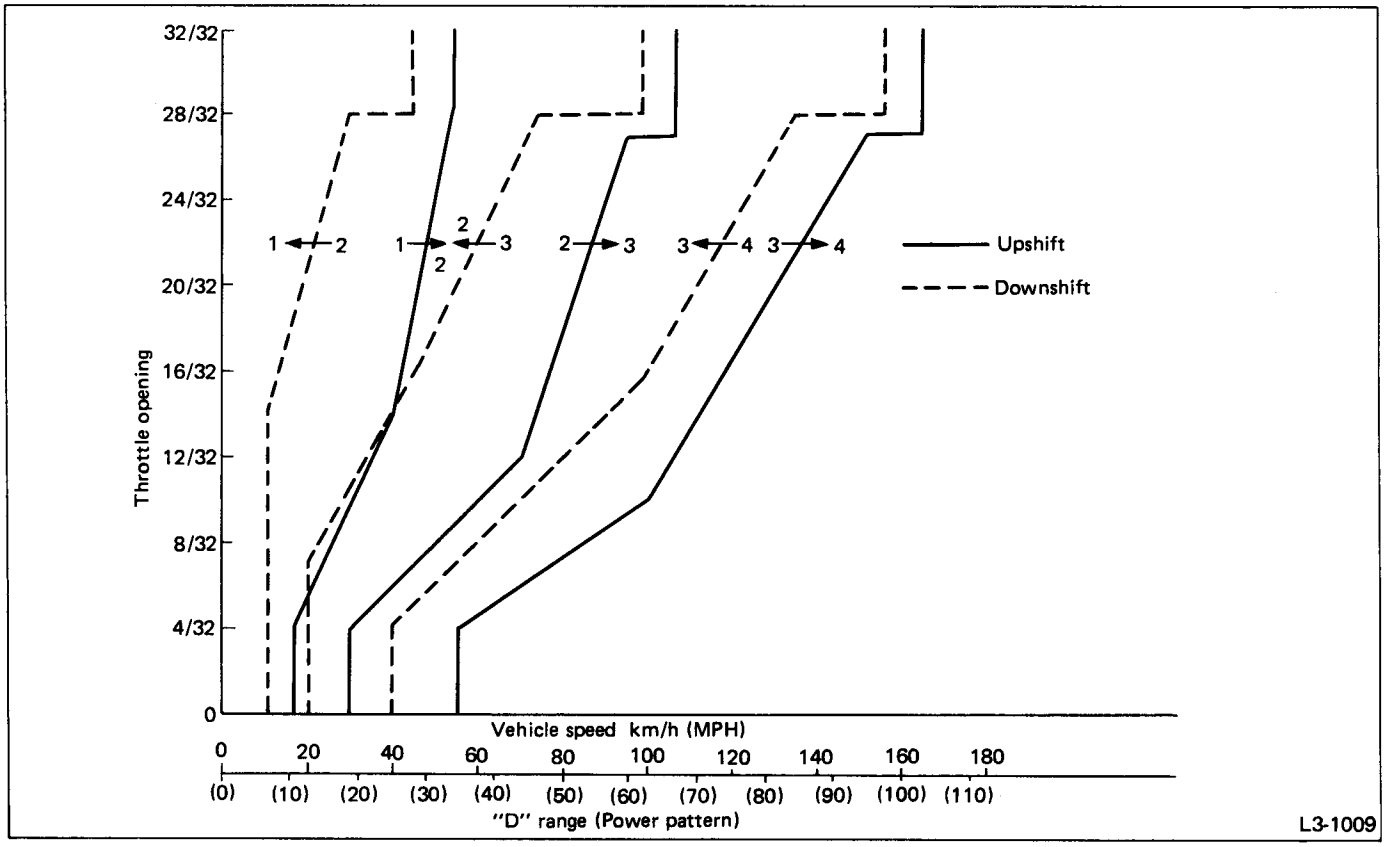


Fig. 331 "D" range (Power pattern)

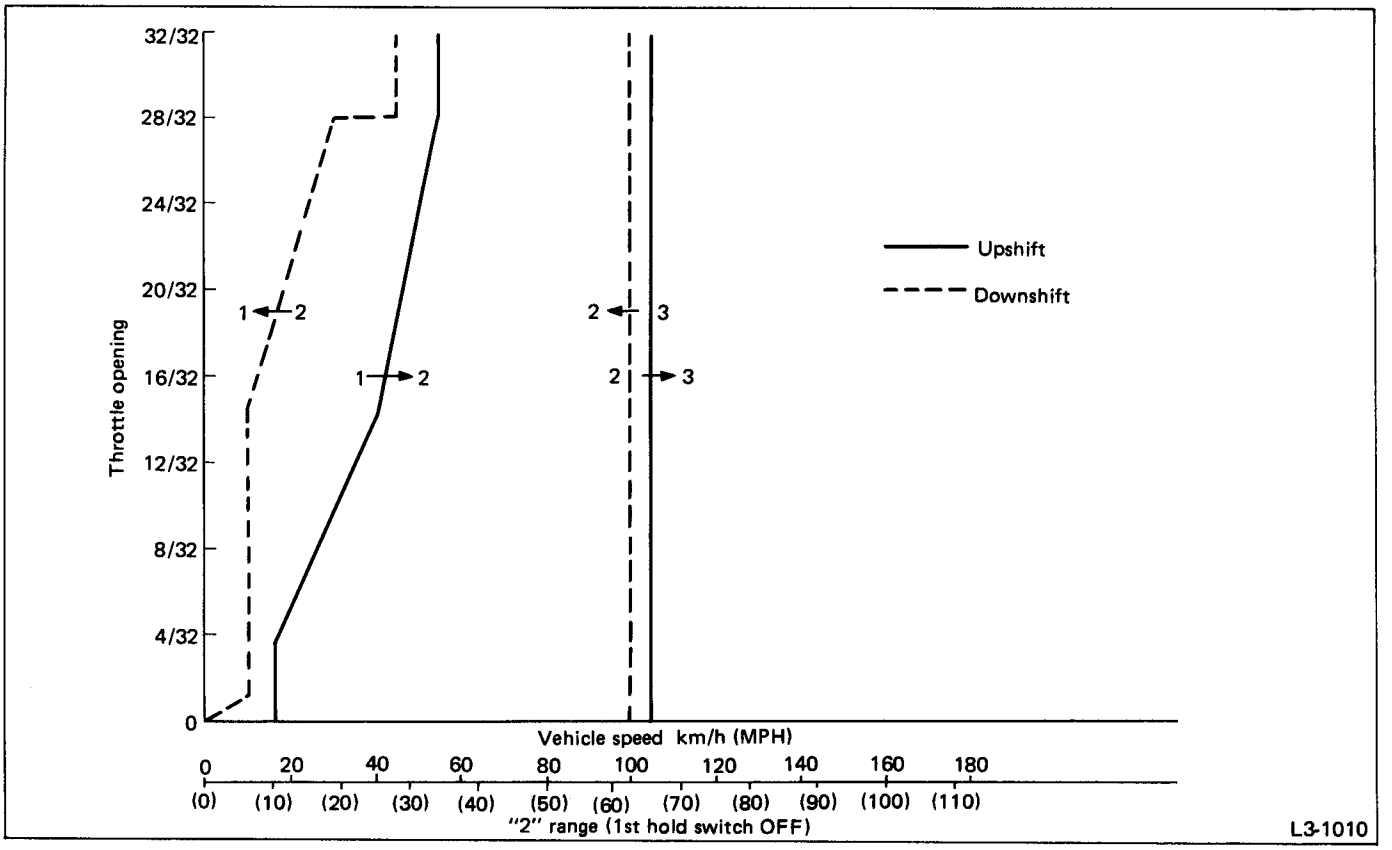


Fig. 332 "2" range (1st hold switch OFF)

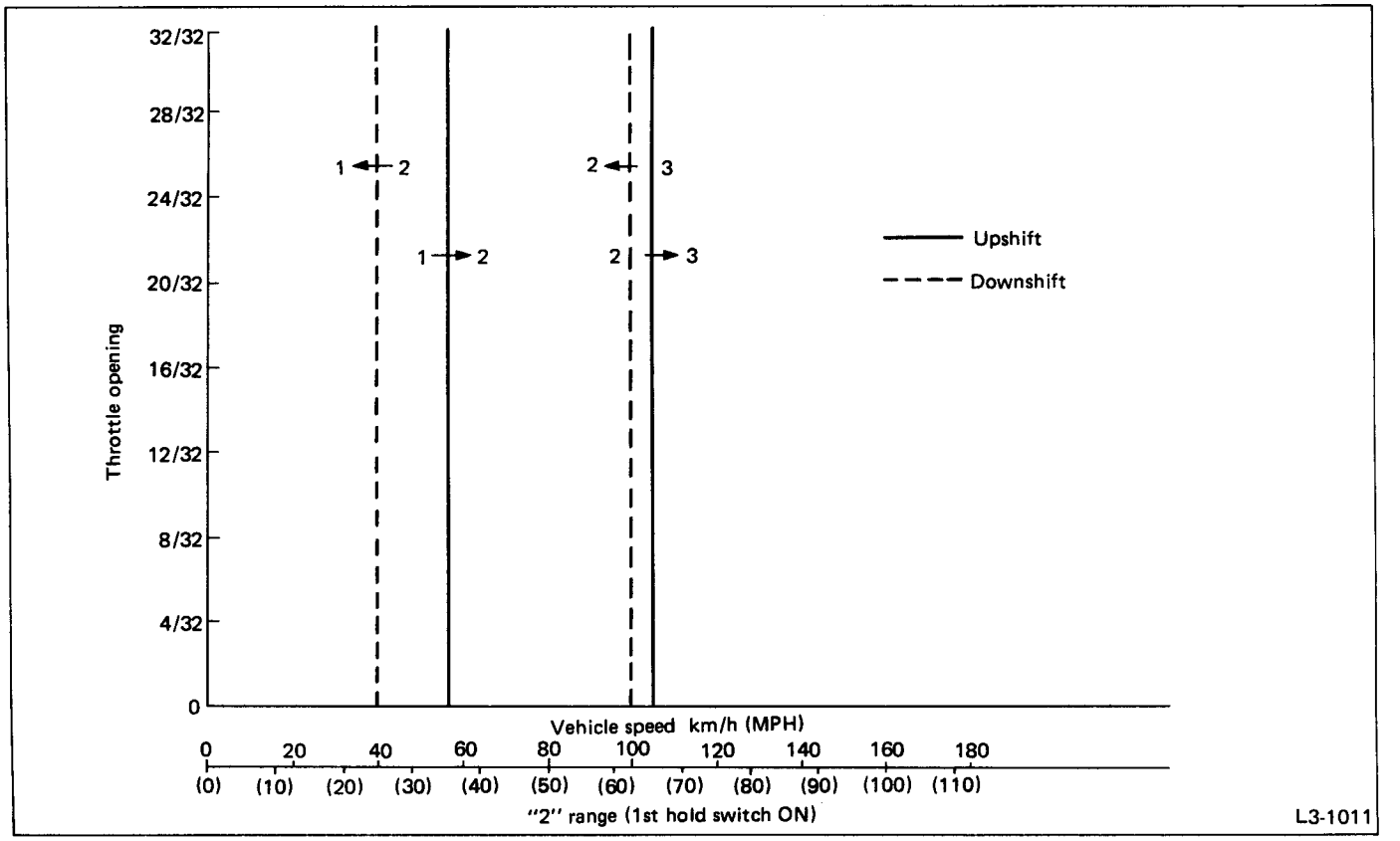


Fig. 333 "2" range (1st hold switch ON)

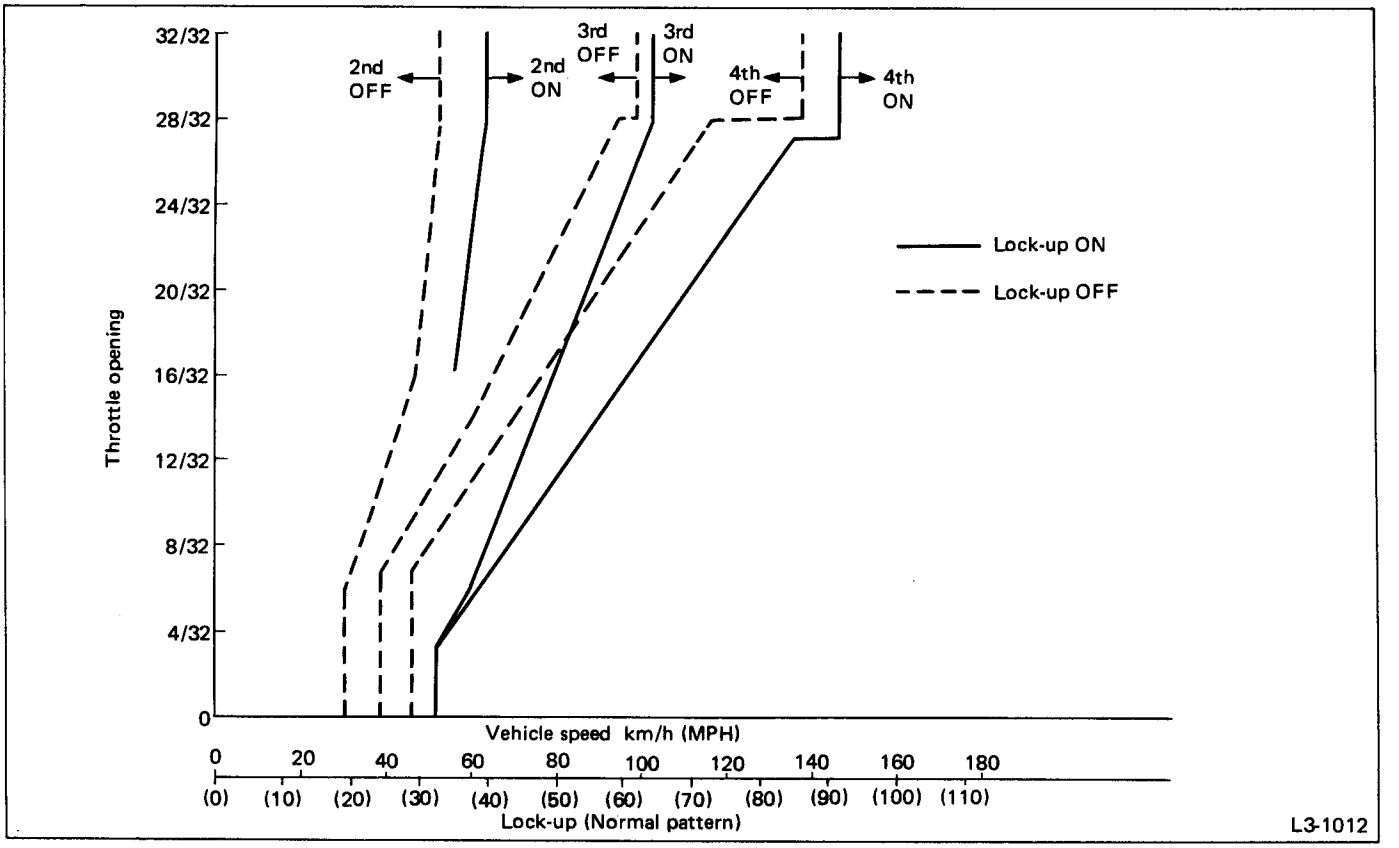


Fig. 334 Lock-up (Normal pattern)

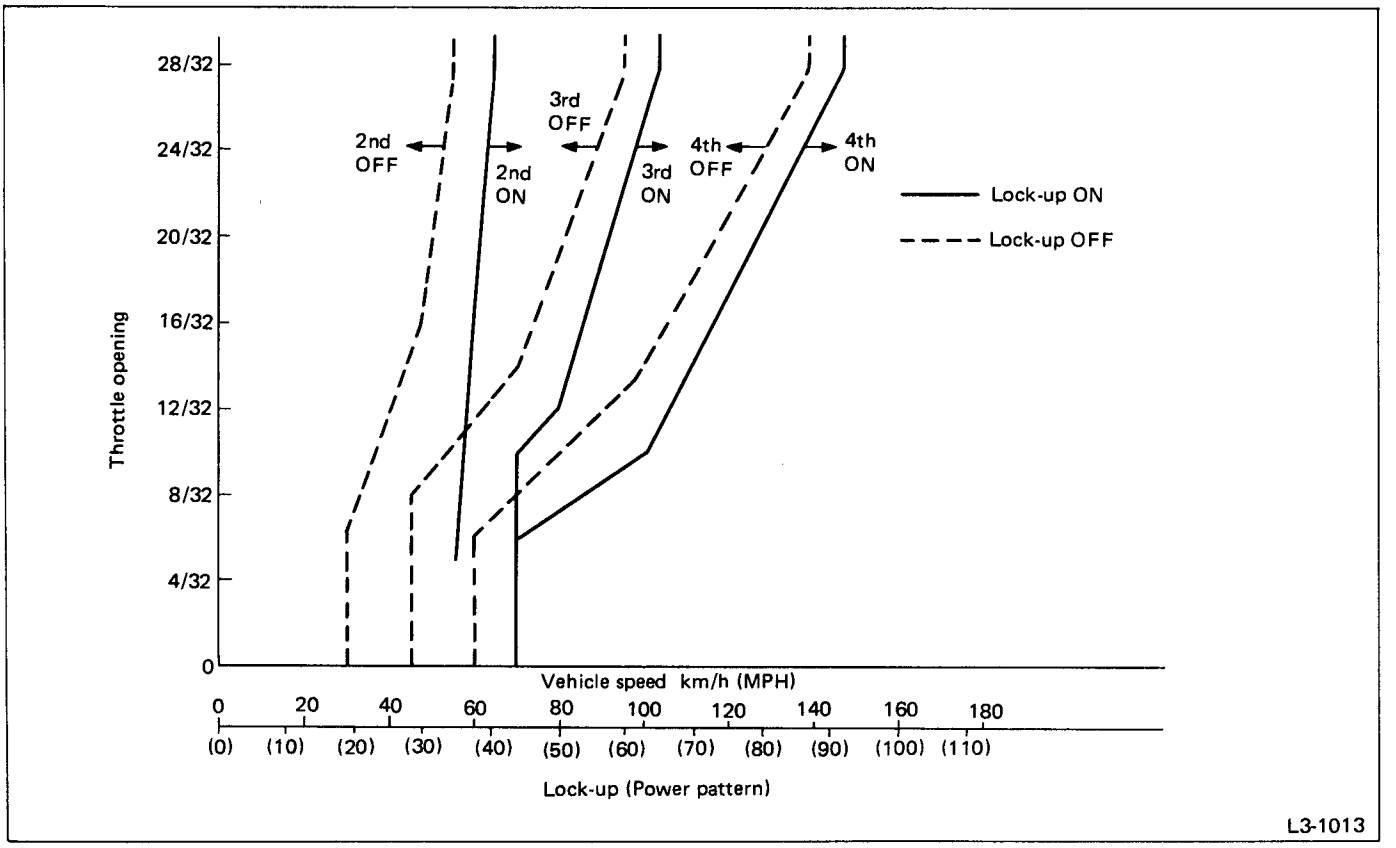


Fig. 335 Lock-up (Power pattern)

Check for the 4WD function

If "tight-corner braking" occurs when the steering wheel is fully turned at low speed:

1) Determine the applicable trouble code and check the corresponding duty solenoid C (transfer) for improper operation.

2) If the solenoid is operating properly, check transfer clutch pressure.

3) If oil pressure is normal but "tight-corner braking" occurs:

Check the transfer control valve for sticking, and the transfer clutch facing for wear.

(Refer to Disassembly and Inspection of the Transmission.)