

AUTOMATIC TRANSMISSION

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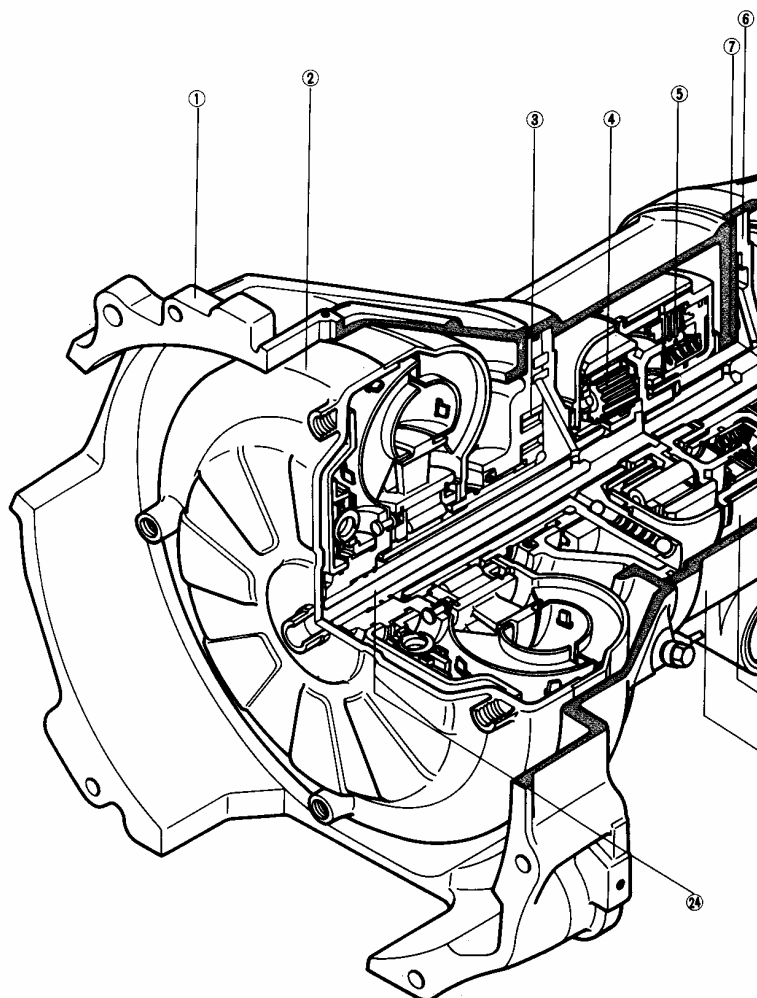
OUTLINE

OUTLINE OF CONSTRUCTION

- The construction of the L4N71B transmission is fundamentally that of the 3N71B transmission, with the new addition of the overdrive system (hereafter OD system) and the lock-up system (hereafter LU system).
- The combination of the OD (4th) system and the LU system has made possible excellent characteristics of silence and low fuel consumption.
- The LU system is a system in which there is a direct connection within the torque converter in order to eliminate noise and losses resulting from slippage of the torque converter fluid, while continuing to apply engine power without change to the transmission.

OPERATION OUTLINE

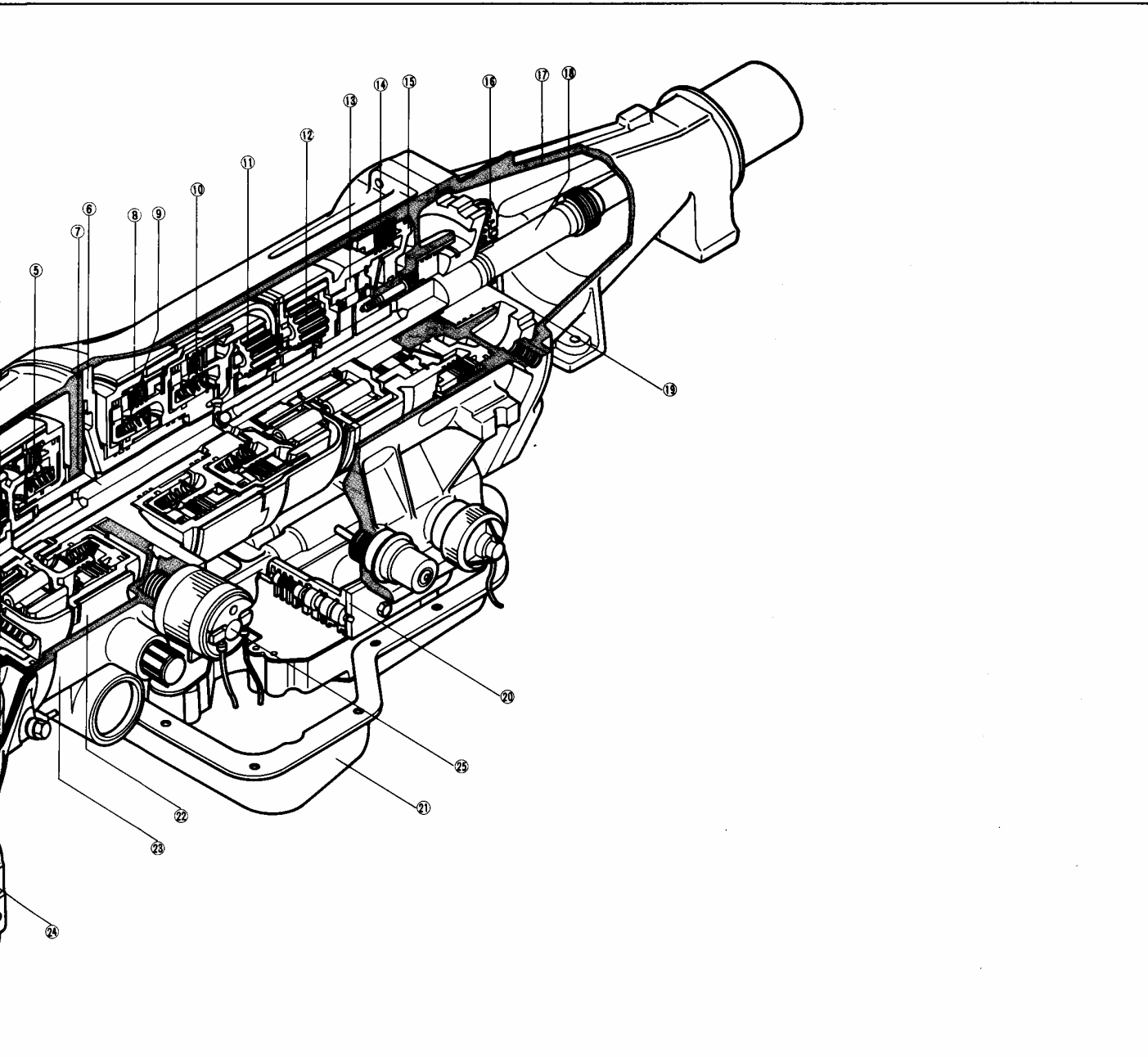
- Operation in the P, R, N, D₁, D₂, D₃, 2, 1₁, and 1₂ ranges is the same as in the 3N71B transmission.
- The OD system operates under the following combination of conditions. When it is operating, the OD ON indication in the indicator panel is displayed.
 - (1) OD control switch is ON
 - (2) Shift to the D range
 - (3) Accelerator opening 6/8 or less (except: 7/8 or less at 100 km/h or higher)
 - (4) In the OD zone shown on page 7B-8
- The LU system operates under the following combination of conditions.
 - (1) In the OD range
 - (2) Vehicle speed is 70 km/h or higher
 Thus, it is possible for the LU system not to operate even though the OD system is operating.



1. Torque converter housing
2. Torque converter
3. Oil pump
4. OD planetary gear
5. Direct clutch
6. Drum support
7. Intermediate shaft
8. 2nd brake band
9. Front clutch
10. Rear clutch
11. Front planetary gear
12. Rear planetary gear

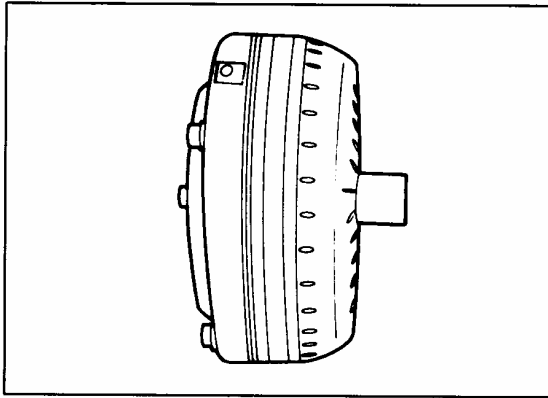
13. One-way clutch
14. Low-reverse brake
15. Transmission case
16. Governor
17. Extension housing
18. Output shaft
19. Oil distributor
20. Control valve assembly
21. Oil pan
22. OD brake band
23. OD case
24. Input shaft

25. OD cancel solenoid



SPECIFICATIONS

Model		L4N71B	3N71B
Transmission gear ratio	1st	2.458	2.458
	2nd	1.458	1.458
	3rd	1.000	1.000
	OD (4th)	0.685	—
	Rev.	2.181	2.181
Torque converter stall torque ratio		1.950	1.900
Number of plates	Direct clutch	2	—
	Front clutch	3	3
	Rear clutch	4	4
	Low rev. brake	4	4
Servo diameter (Piston outer dia./ retainer inner dia.)	OD band servo	60/40 mm (2.36/1.57 in.)	—
	2nd band servo	60/36 mm (2.36/1.42 in.)	60/40 mm (2.36/1.57 in.)
Oil	Type	A.T.F. type F (M2C33—F)	A.T.F. type F (M2C33—F)
	Amount	7.5 liters (7.9 U.S. quarts, 6.6 Imp. quarts)	6.2 liters (6.6 U.S. quarts, 5.5 Imp. quarts)



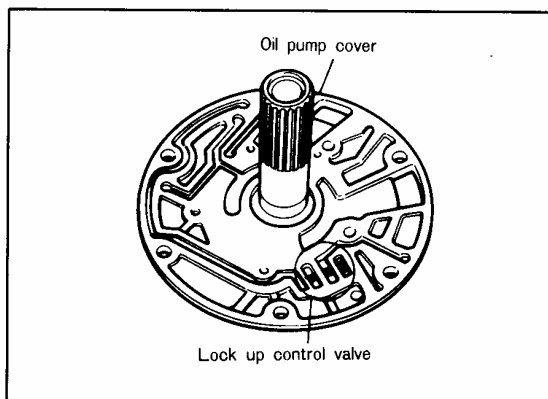
MAIN COMPONENT CHANGES

The main component changes in the L4N71B transmission, compared to the 3N71B transmission, are as follows.

Torque converter

The lock-up (LU) system has been added within the torque converter.

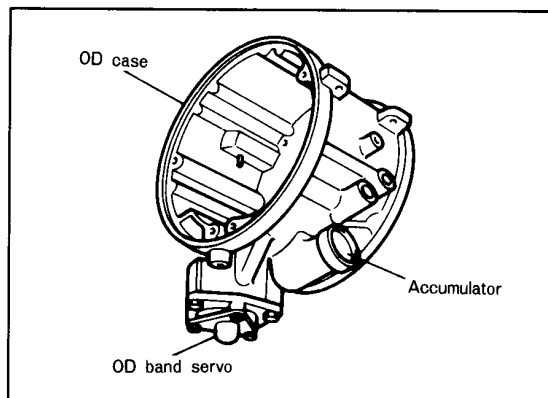
For more information regarding the lock-up system, refer to page 7B-23.



Oil pump

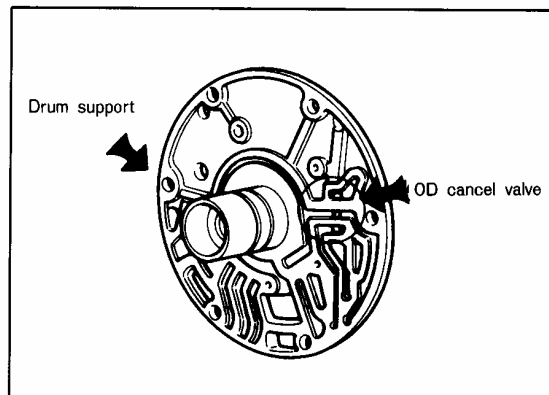
The configuration of the oil pump cover side as well as the internal hydraulic circuitry has been partially modified, and a lock-up control valve has been newly added.

Refer to page 7B-25 for information regarding the operation of the lock-up control valve.



OD case

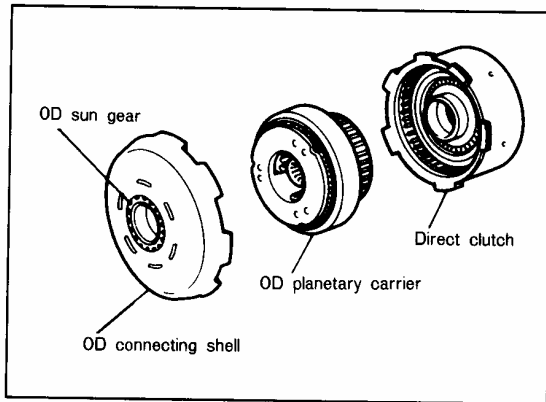
This case encloses the newly added planetary gear set, direct clutch, etc. for the OD mechanism, and is installed between the converter housing and the transmission case. Furthermore, the OD cancel solenoid, OD band servo, accumulator, etc. are installed on the perimeter of this casing.



Drum support

The drum support is installed between the OD case and the transmission case in order to support the front, rear and direct clutch drums.

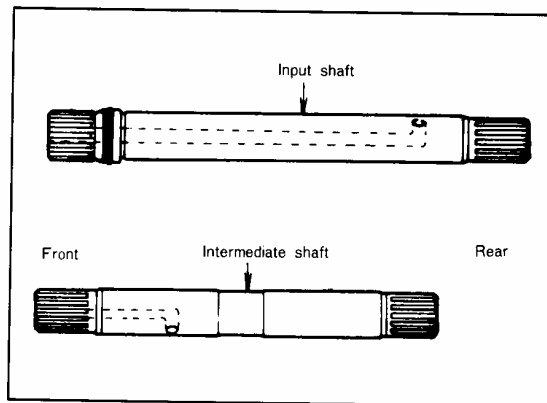
Furthermore, a hydraulic circuitry is located on the front side for the installation of the OD cancel valve.



OD geartrain

The OD geartrain is comprised of an OD planetary gear, direct clutch, OD sun gear, and OD connecting shell.

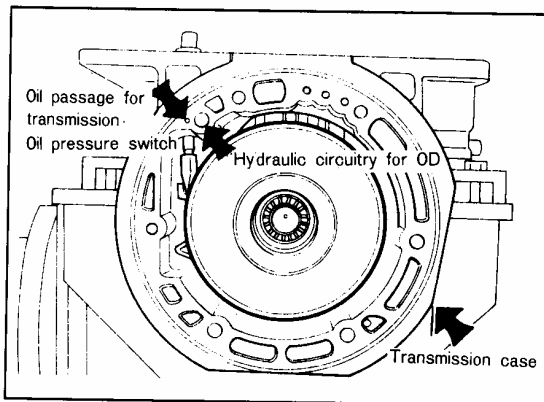
Refer to page 7B-10 for information regarding the operation of the OD geartrain.



Input shaft & intermediate shaft

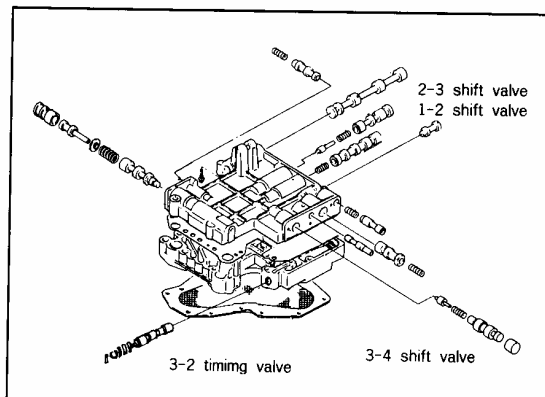
An oil passage for the lock-up circuit has been added to the input shaft.

The intermediate shaft has been newly added in order to couple the direct clutch hub and the rear clutch drum.



Transmission case

The Transmission Case has been modified with the addition of hydraulic circuitry for the OD and an oil passage for the OD indicator switch.



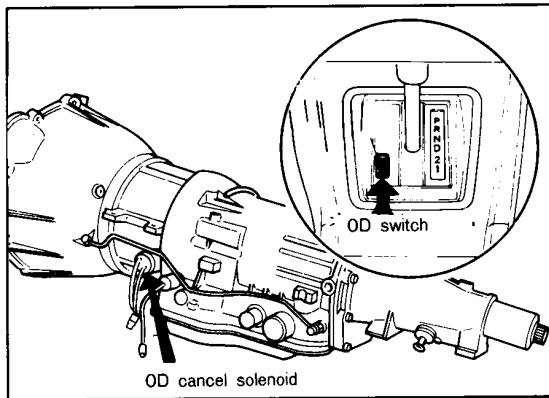
Control valve

The hydraulic circuitries for the upper and lower bodies as well as for the separation plate have been modified in accordance with the addition of the 3-4 shift valve.

Furthermore, the 1-2 shift valve and the 2-3 shift valve positions have been reversed for the same reason.

In addition, a 3-2 timing valve has been added to the control valve (lower).

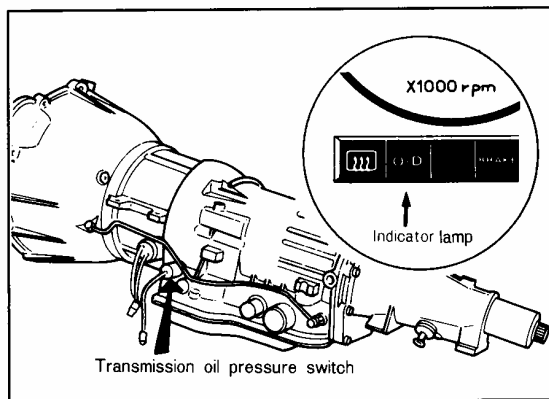
For more information regarding the operation of the 3-4 shift valve and the operation of the 3-2 timing valve, refer to pages 7B-12 and 7B-21 respectively.



OD control switch & OD cancel solenoid

This mechanism is provided to activate and deactivate the OD. The OD control switch is installed on the rear of the transmission selector lever, and the OD cancel solenoid is located on the left of the OD casing.

For information regarding the operation of the OD cancel solenoid and the OD control switch, refer to pages 7B-9 and 16.

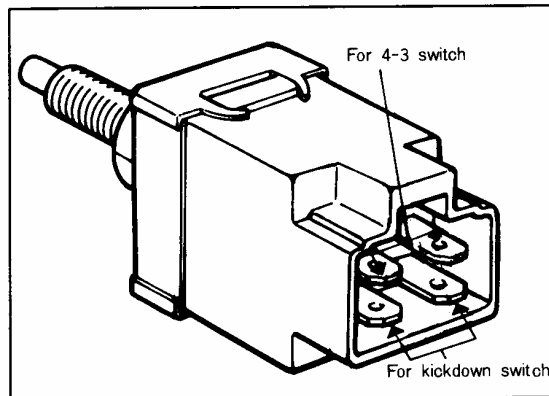


Transmission oil pressure switch & lamp

This mechanism is provided to indicate the OD activation to the driver.

The switch is located on the left side of the transmission casing and is actuated with the deactivation of the OD band servo's open side pressure.

The OD indicator lamps are installed within the combination meter for illumination during OD operation.



4-3 switch and kickdown switch

The 4-3 switch and kickdown switch are, as shown in the figure at the left, unified, and are located at the upper part of the accelerator pedal.

The 4-3 switch senses an accelerator opening of 6/8 or more, and the kickdown switch senses an accelerator opening of 7/8 or more.

The 4-3 Switch is provided to shift the gears from OD to 3rd gear.

The Kickdown Switch is provided to rapidly shift the gears down from 3rd to 2nd, and from 2nd to 1st gear.

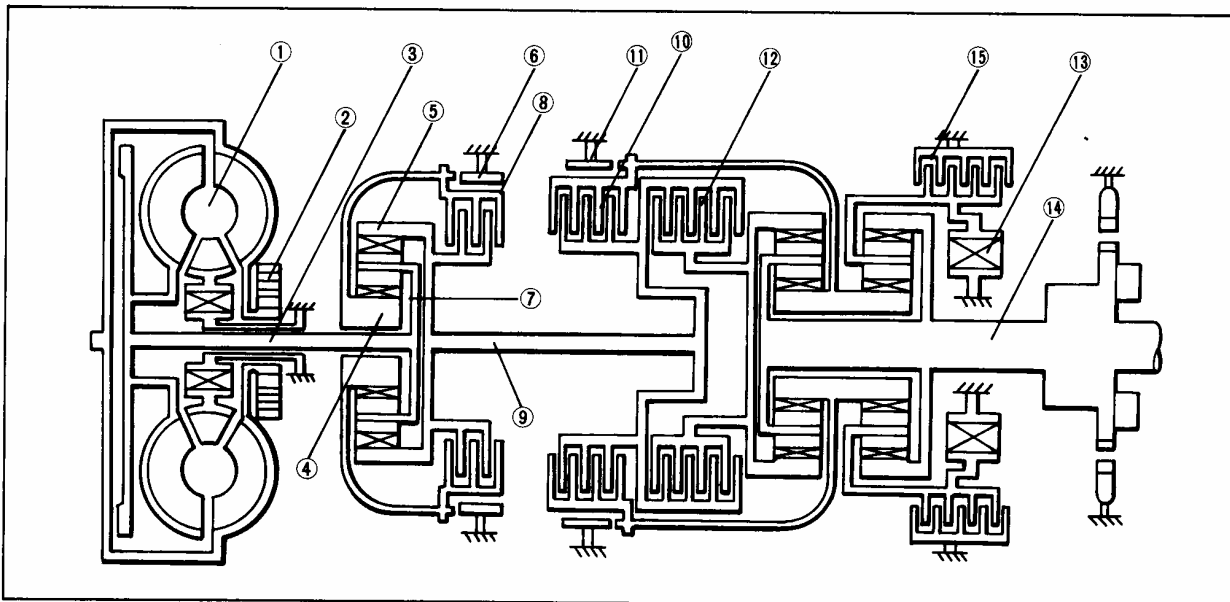
OPERATION TABLE

The individual transmission components operate as indicated in the table below for the respective gear positions.

Selector Position	Direct Clutch	OD Band Servo		Front Clutch	Rear Clutch	2nd Band Servo		Low & Reverse Brake	One-way Clutch
		Operation	Release			Operation	Release		
P	○	⊙	○					○	
R	○	⊙	○	●			○	○	
N	○	⊙	○						
D	1st Gear	○	⊙		○				○
	2nd Gear	○	⊙		○	○			
	3rd Gear	○	⊙	○	○	⊙	○		
	OD (4th Gear)		○	○	○	⊙	○		
2	○	⊙	○		○	○			
1	2nd Gear	○	⊙		○	○			
	1st Gear	○	⊙		○			○	

The ⊙ indications indicate operation although the band servos remain deactivated due to the large release pressure side area.

POWER TRANSMISSION MECHANISM DIAGRAM



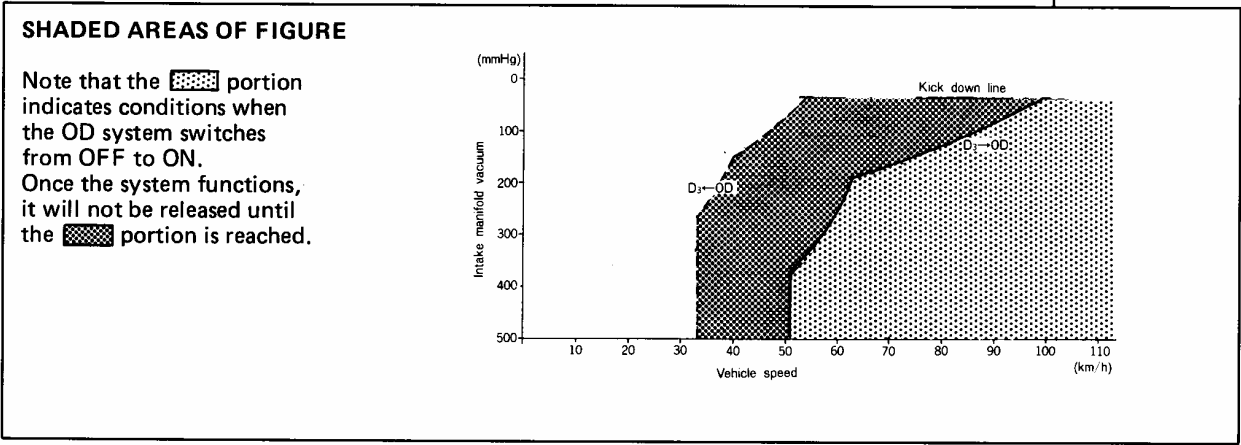
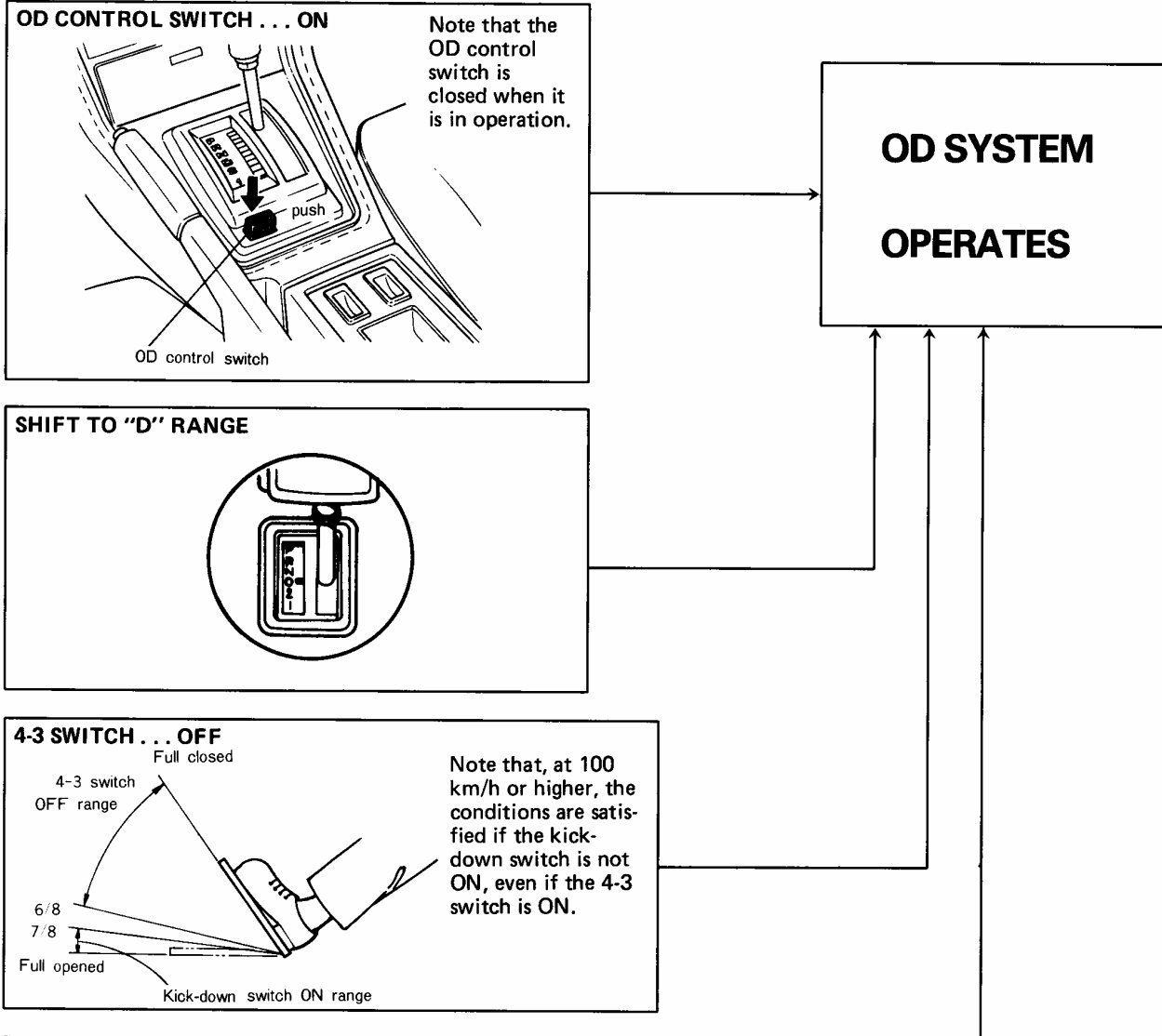
- | | | |
|---------------------|--------------------------------|-------------------------|
| 1. Torque converter | 6. OD brake band | 11. 2nd brake band |
| 2. Oil pump | 7. OD planetary pinion carrier | 12. Rear clutch |
| 3. Input shaft | 8. Direct clutch | 13. One-way clutch |
| 4. OD sun gear | 9. Intermediate shaft | 14. Output shaft |
| 5. OD clutch hub | 10. Front clutch | 15. Low & reverse brake |

OVERDRIVE (OD) SYSTEM

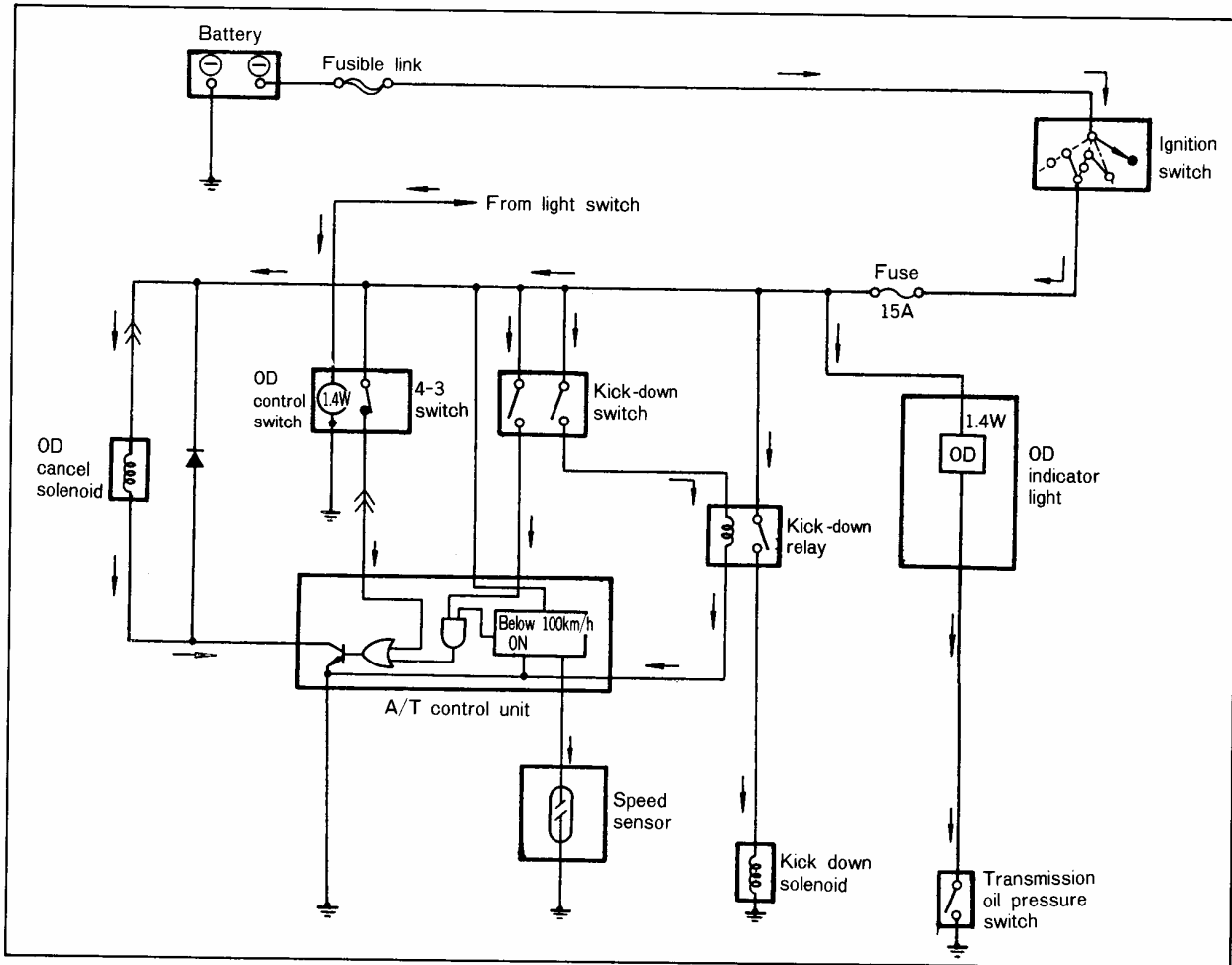
1. OPERATION CONDITIONS

The overdrive system operates when all of the following conditions exist.

Condition



2. OD SYSTEM ELECTRIC CIRCUIT



The A/T control unit controls the operation of the OD cancel solenoid.

OD Cancel Solenoid Operation Conditions

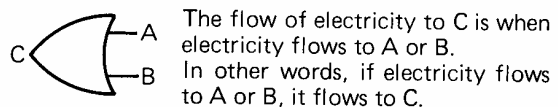
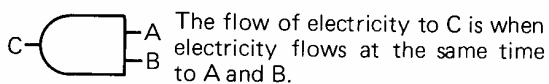
If electricity is flowing to the OD cancel solenoid, the OD is cancelled. Under what conditions, then, does electricity flow to the OD control switch? Those conditions are explained below.

- Condition 1:
When the OD control switch is closed (OD control switch OFF).
At this time, electricity flows to the OD cancel solenoid under any condition, and the OD hydraulic path is cancelled, so there is no shift to the OD range.
Even if the OD control switch is open, electricity may flow to it. This is condition 2.
- Condition 2:
When, while the vehicle is travelling at 100 km/h or less, the 4-3 switch is ON.
At an accelerator pedal opening of 6/8 or more, the 4-3 switch becomes ON.

Note

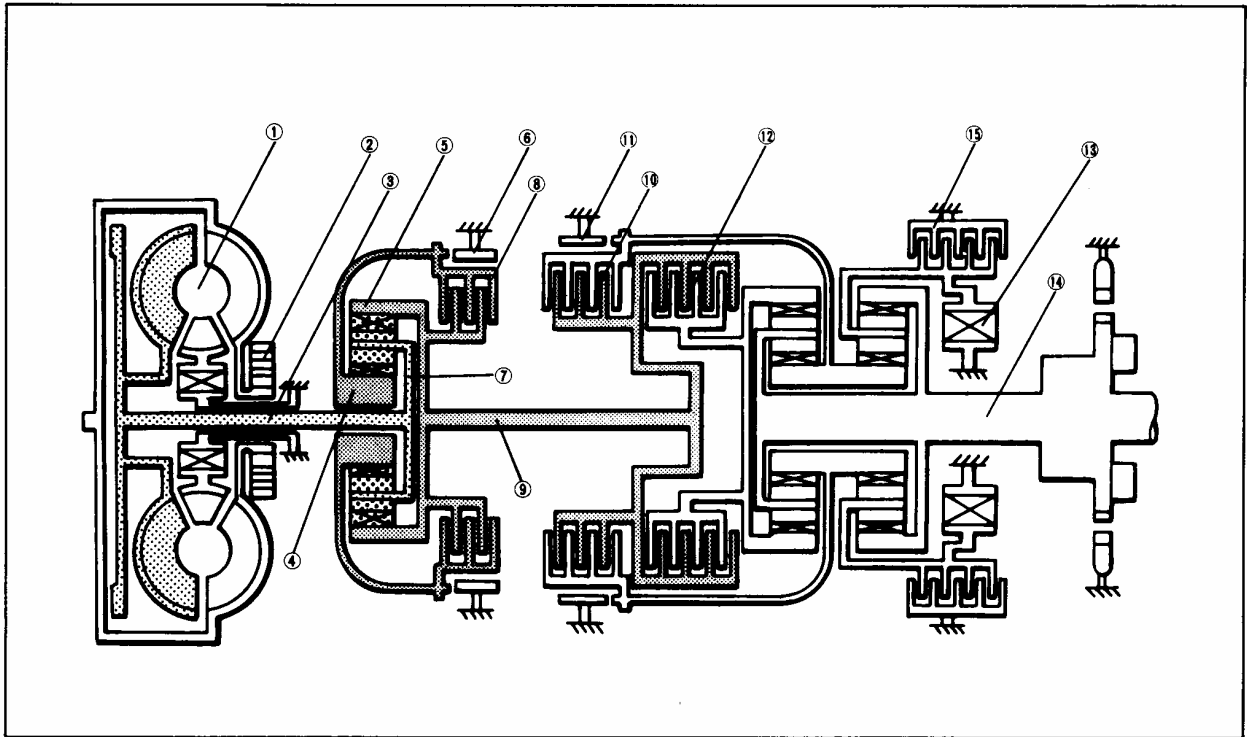
Explanation of  and  symbols used in the above wiring diagram of the control unit.

Example



3. POWER FLOW OF OD GEAR TRAIN

(1) 1st to 3rd, and reverse condition (except OD)



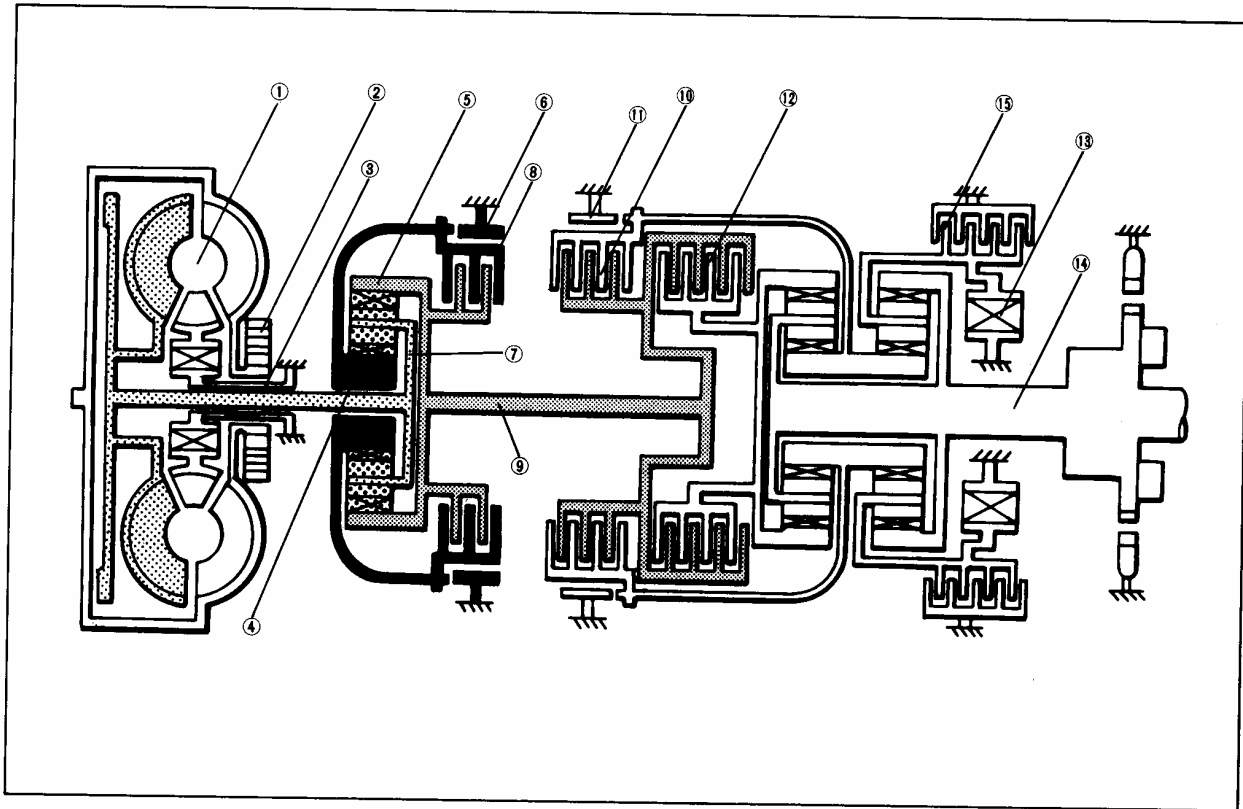
- | | | |
|---------------------|--------------------------------|-------------------------|
| 1. Torque converter | 6. OD brake band | 11. 2nd brake band |
| 2. Oil pump | 7. OD planetary pinion carrier | 12. Rear clutch |
| 3. Input shaft | 8. Direct clutch | 13. One-way clutch |
| 4. OD sun gear | 9. Intermediate shaft | 14. Output shaft |
| 5. OD clutch hub | 10. Front clutch | 15. Low & reverse brake |

FIXED DIRECT CLUTCH (OD brake band is released.)

As a result of the operation of the direct clutch, the intermediate shaft, internal gear, direct clutch, connecting shell and sun gear become united.

Engine power is input, via the input shaft and OD carrier, to the pinion gear, but, because the internal gear and sun gear (meshed with the pinion gear) become united, the pinion does not rotate, it revolves. As a result, the power from the input shaft is transmitted without change to the intermediate shaft; power transmission after that point is in the same way as for the 3N71B type.

(2) OD conditions

**FIXED OD BRAKE BAND (Direct clutch is released.)**

Because the OD brake band operates and the direct clutch does not operate, the connecting shell and sun gear remain fixed to the OD case and do not move.

As a result, the input via the OD carrier is transferred, the pinion gear rotates as it revolves around the sun gear, and power is transferred to the internal gear. The result is that the speed of the intermediate shaft increases.

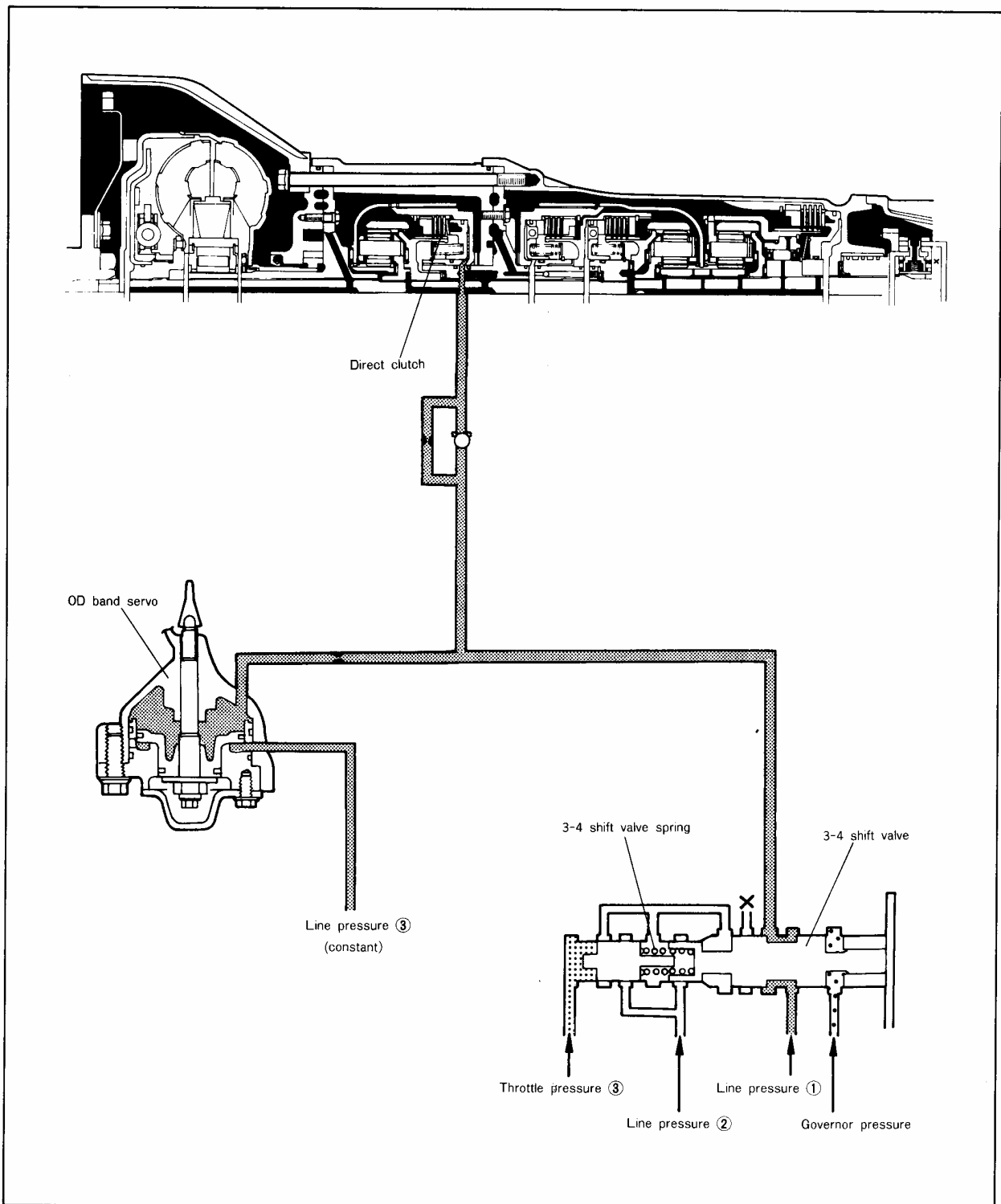
Power transfer after the intermediate shaft is the same as for the D_3 range.

OPERATION OF VALVES AND HYDRAULIC PRESSURE

(1) 3-4 shift valve (4 = OD)

The 3-4 shift valve is located on the control body (upper), and function to shift between 3rd and 4th gears.

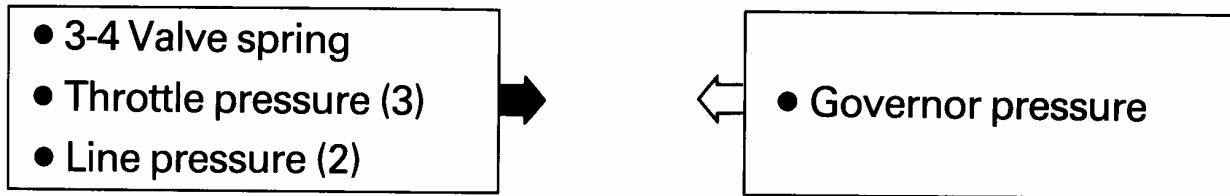
3rd condition



The 3-4 shift valve, as shown in the figure, moves to the right, the oil passage of line-pressure (1) expands, and hydraulic pressure is applied to the direct clutch and OD band servo open side.

Pushing valve to right

Pushing valve to left

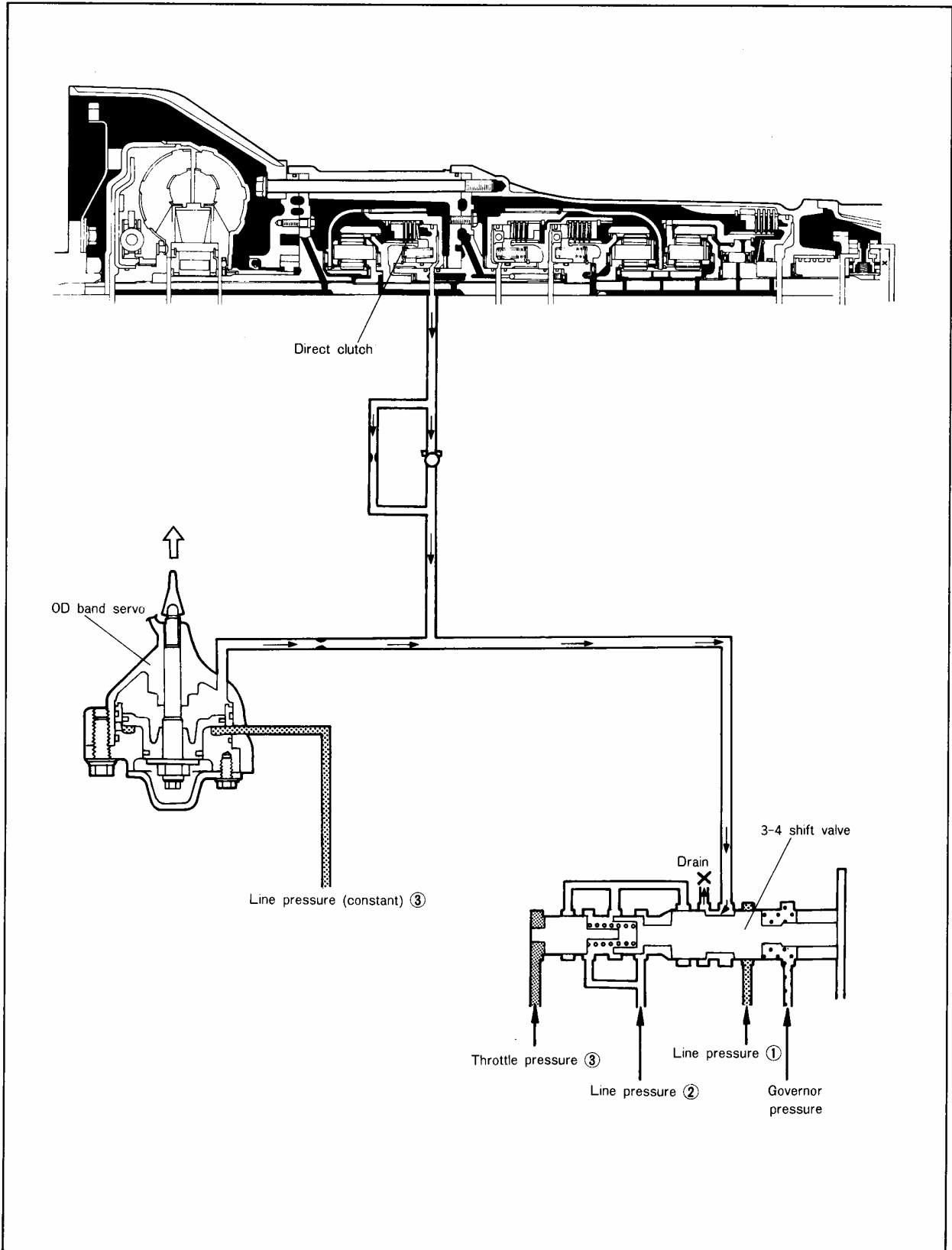


Notes

- a) The 3-4 valve spring usually pushes the 3-4 valve to the right, in other words in the direction in which there will be no OD.
- b) Throttle pressure (3)
 - "Throttle pressure" is pressure proportional to engine load. In other words, on an up-grade, where engine load is great, throttle pressure also becomes great.
 - As a consequence of throttle pressure becoming higher, the force which pushes the 3-4 valve toward the right also becomes higher, and the speed change is sent to the OD.
- c) Line pressure (2)
 - When the downshift (kickdown) solenoid functions, line pressure (2) is sent from the downshift (kickdown) solenoid valve.
 - When this line pressure (2) is applied, there can absolutely be no pushing toward the left.
- d) Governor pressure
 - Governor pressure is pressure which is proportional to vehicle speed.

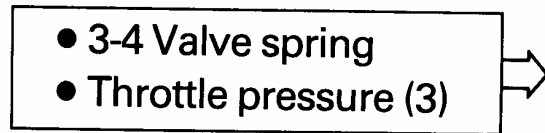
(1) 3-4 shift valve (cont.)

OD condition

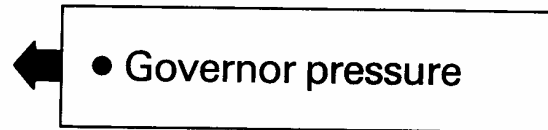


The 3-4 shift valve, as shown in the figure, moves to the left, and line pressure (1) is closed. As a result of this action, the hydraulic pressure of the OD servo release side and the direct clutch is drained. However, because line pressure is usually applied to the OD band servo operation side, the OD band servo moves to the operation side.

Pushing valve to right



Pushing valve to left



Note

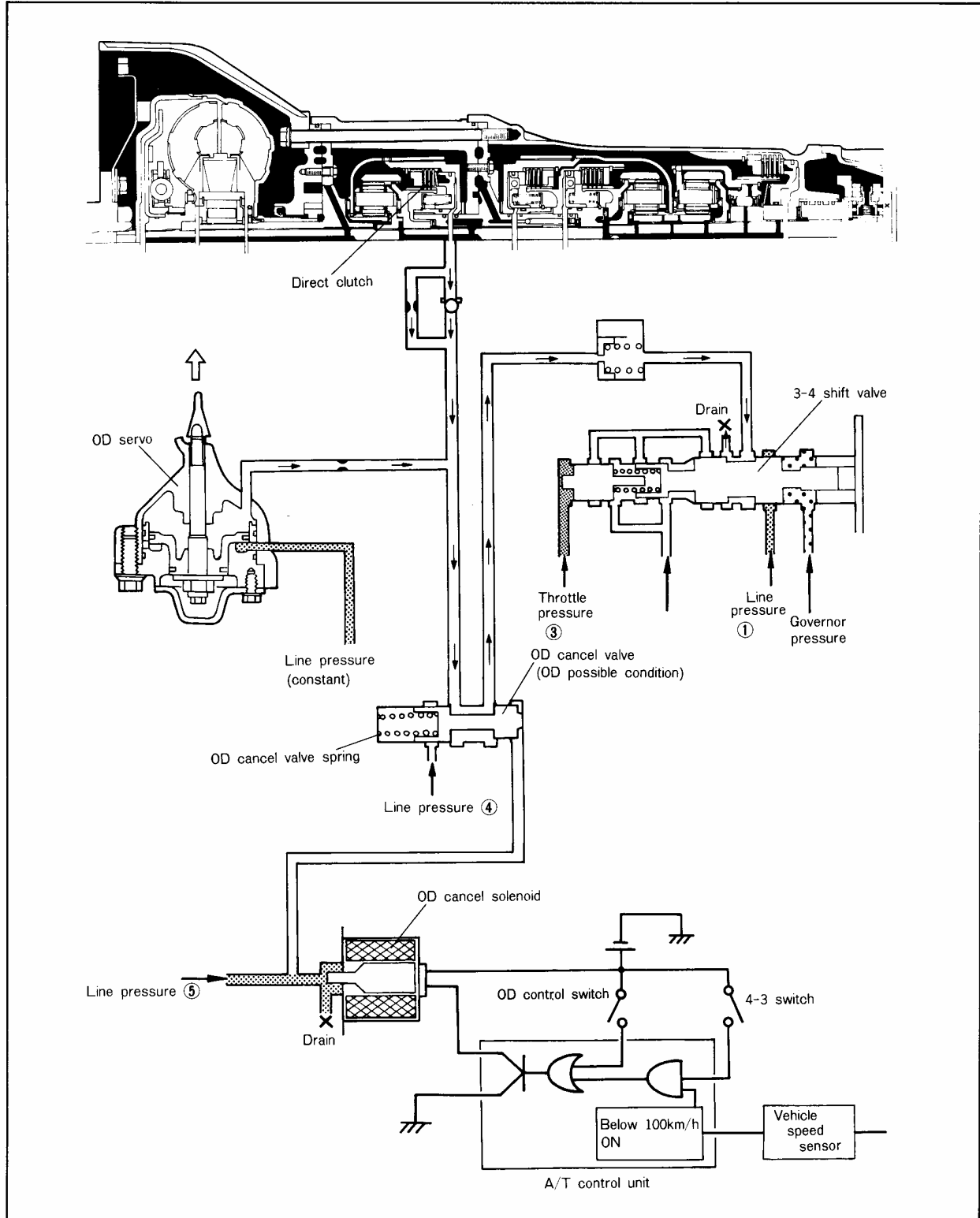
When the vehicle speed is increased from the condition described on the page 7B-12 (line pressure (2) not applied), the governor pressure also increases accordingly.

When this governor pressure overcomes the forces pushing the valve toward the right, that is the 3-4 spring and the throttle pressure (2), the 3-4 shift valve is pushed to the left.

(2) OD cancel valve

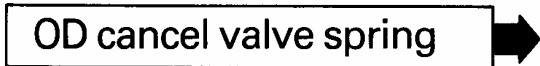
The OD cancel valve is contained within the drum support. It functions to force the release of the OD running condition, or to prevent shifting to OD. It operates according to signals from the OD cancel solenoid.

OD condition



Because the OD cancel valve is pushed toward the right and the line pressure (4) is shut off, if the 3-4 shift valve changes from the 3rd gear condition to the OD condition, the condition would be such that shifting to OD would be possible.

Pushing OD cancel valve to right



Pushing OD cancel valve to left



Note

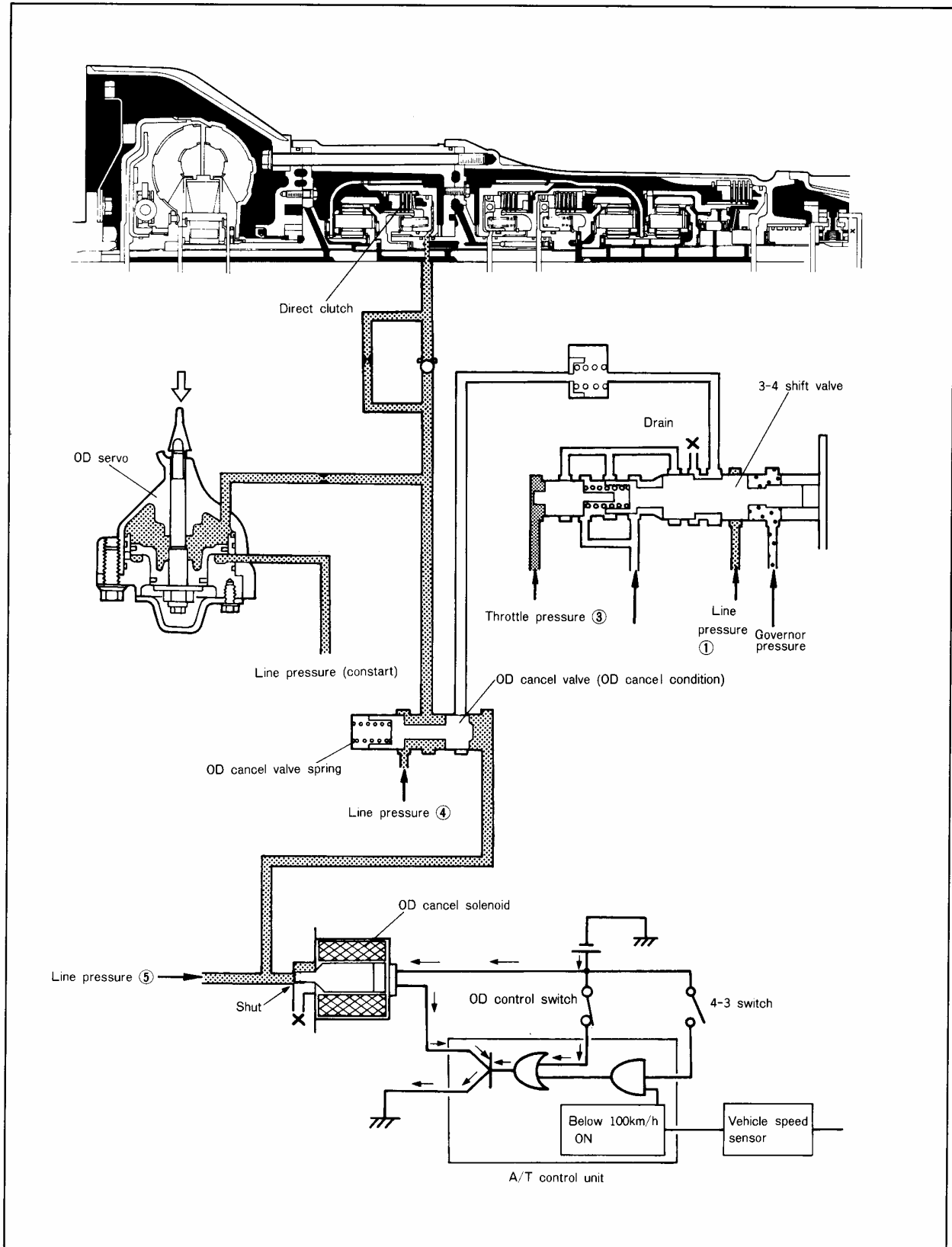
Because current does not flow to the OD cancel valve, the line pressure (5) is drained, and pressure is not applied to the right side of the OD cancel solenoid.

Question:

- What happens when, in the condition in the figure left, current flows to the OD cancel solenoid and the line pressure (5) is not drained?

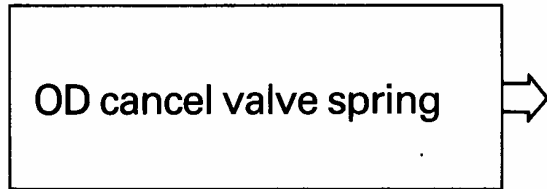
(2) OD cancel valve (cont.)

OD cancel condition

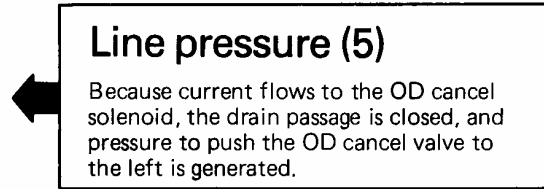


The OD cancel valve moves to the left, and the oil passage of line pressure (4) expands. As a result, hydraulic pressure is applied to the direct clutch and OD servo cancel side, and there is no shift to OD even if the 3-4 control valve becomes in the OD condition.

Pushing OD cancel valve to right



Pushing OD cancel valve to left

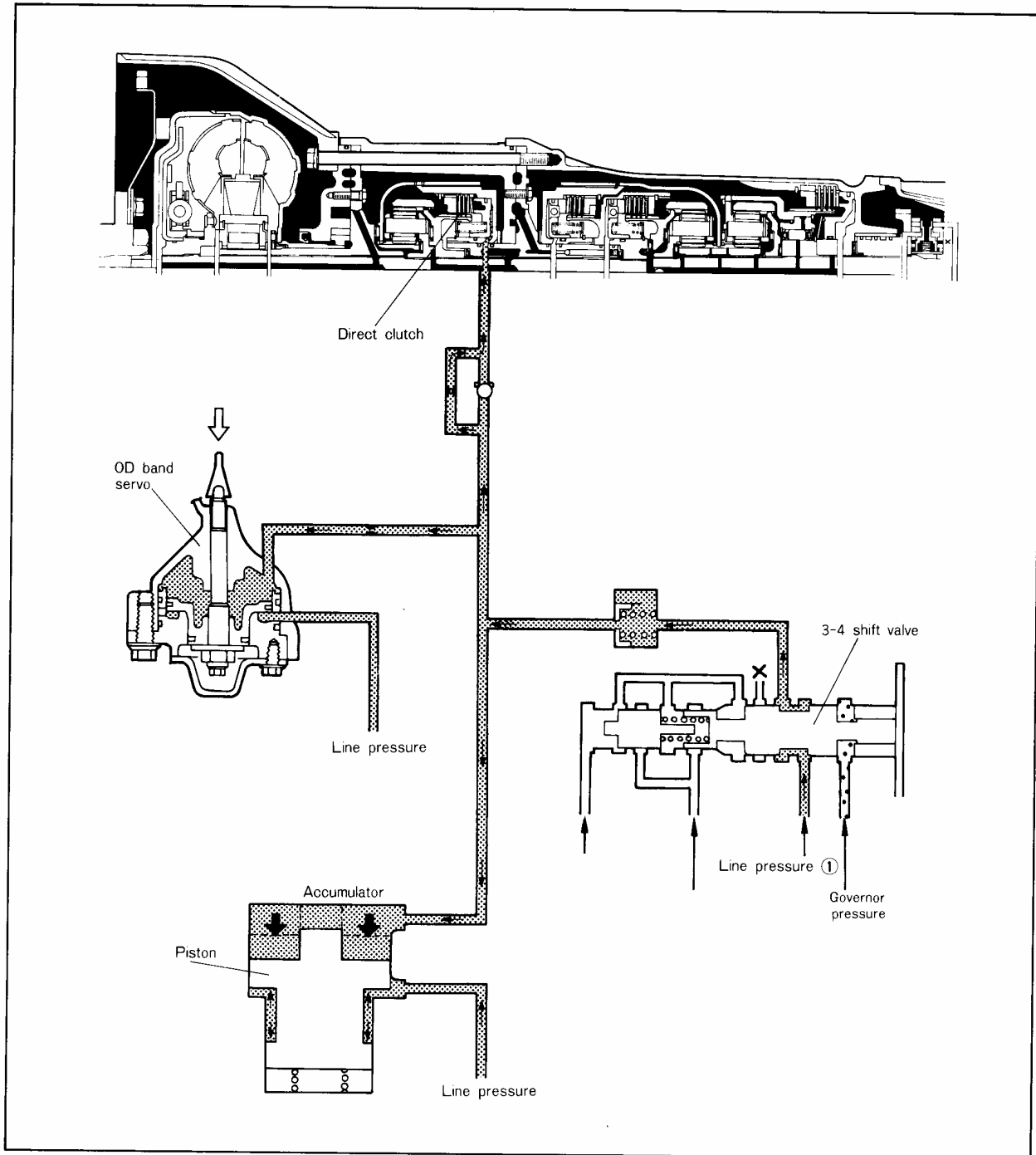


Question:

Give two conditions under which current flows to the OD cancel solenoid.

(3) Accumulator

The accumulator is located on the outside of the OD case. It weakens the hydraulic pressure applied to the direct clutch from the OD during downshift, and thus lessens the impact "shock" of downshift.



Downshift from OD

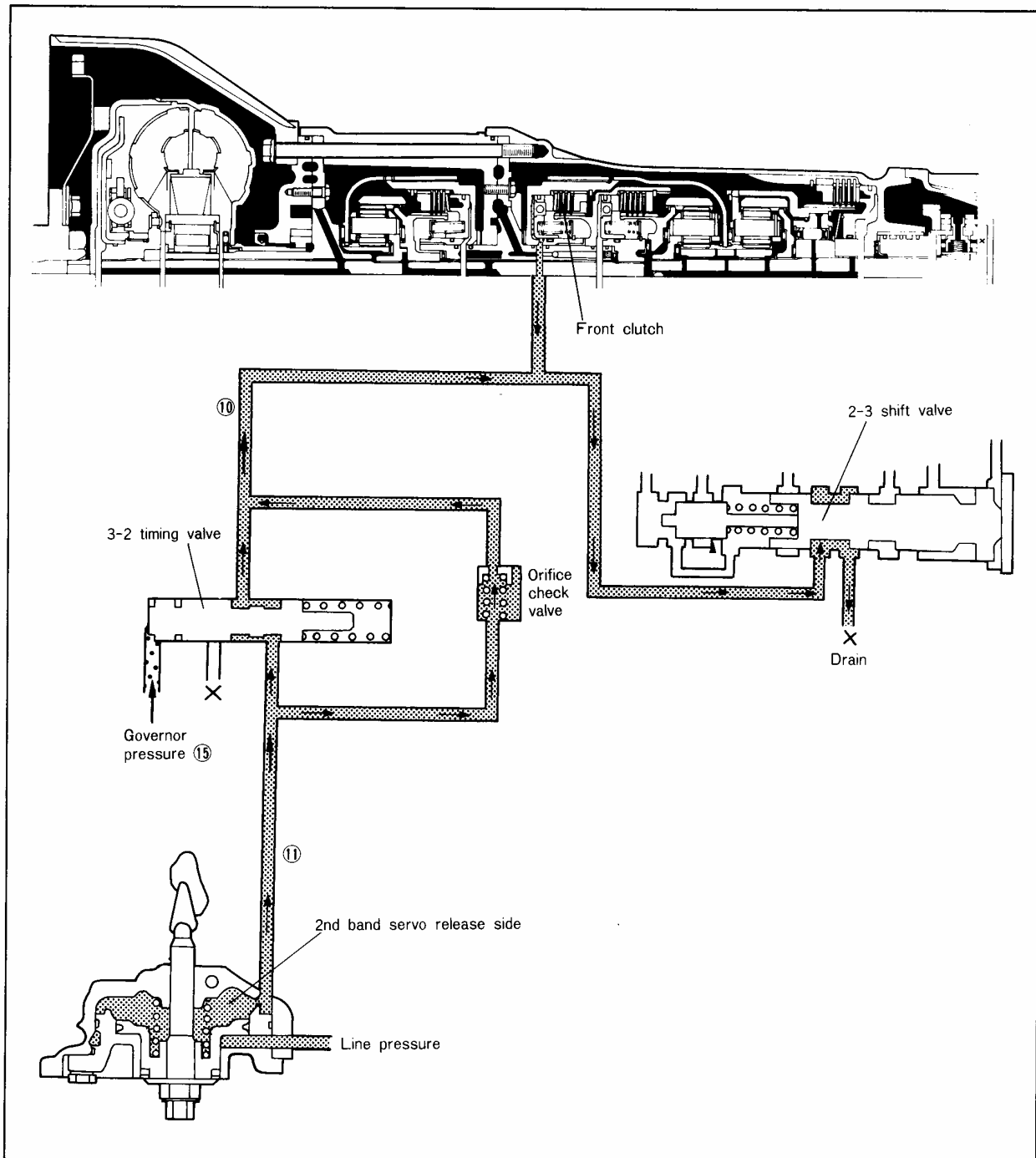
At the instant that the 3-4 shift valve moves to the right, the line pressure (1) tries to apply hydraulic pressure to the direct clutch and OD servo cancel side. At the same time, line pressure (1) is also applied to the upper part of the accumulator piston. When this happens, the piston moves downward, the line pressure (1) passage size becomes larger, and the hydraulic pressure there is temporarily weakened. When in that condition, the accumulator functions so that the direct clutch is connected slowly and smoothly, thus lessening the impact "shock" of speed reduction.

(4) 3-2 timing valve

The 3-2 timing valve functions, depending upon the vehicle speed, to change the closure of the 2nd band servo open side circuit, and thereby lessen the impact shock during 3-2 downshifts. This valve is located in the lower body of the control valve.

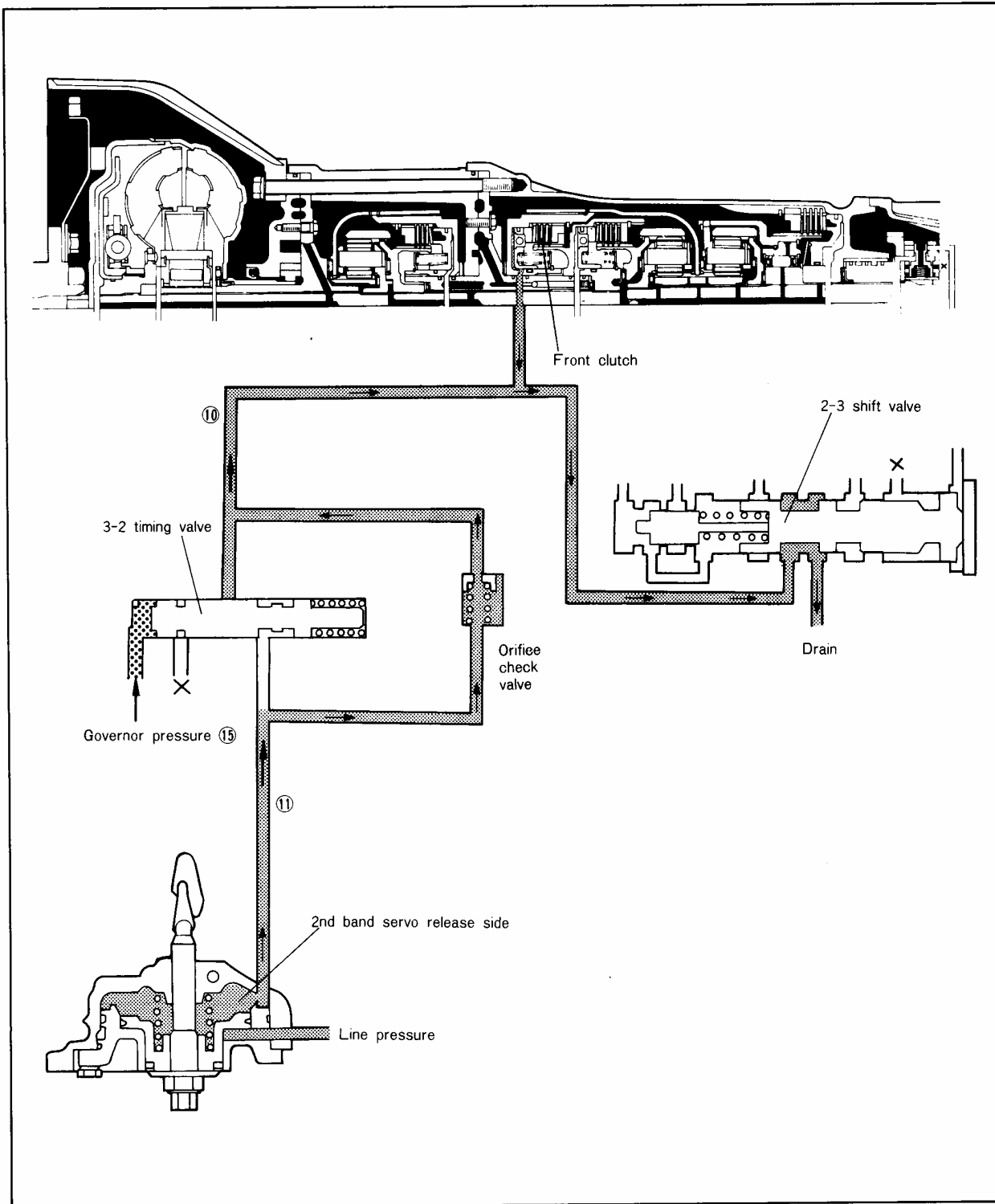
Operation

When the vehicle speed is low, that is when the governor pressure is low, the pressure to the right by governor pressure is low, and, for that reason, the valve is pushed toward the left by spring force. In this condition, when there is a shift from 3rd to 2nd, the line pressure (10) is drained, and the line pressure (11) applied to the 2nd band servo is drained after passing through the valve closure part and the orifice of the orifice check valve.



When the vehicle speed is high, that is when the governor pressure is high, the governor pressure pushing to the right overcomes the spring force, the valve is pushed to the right, and the line pressure passage ((10) ↔ (11)) is closed.

When, in this condition, there is a downshift from 3rd to 2nd, the line pressure (11) applied to the 2nd band servo passes through the orifice of the orifice check valve only, and is drained slowly. When this happens, the band servo slowly and smoothly moves the brake band to the open side. As a result, the downshift impact shock is lessened.



LOCK-UP (LU) SYSTEM



1. LOCK-UP MECHANISM

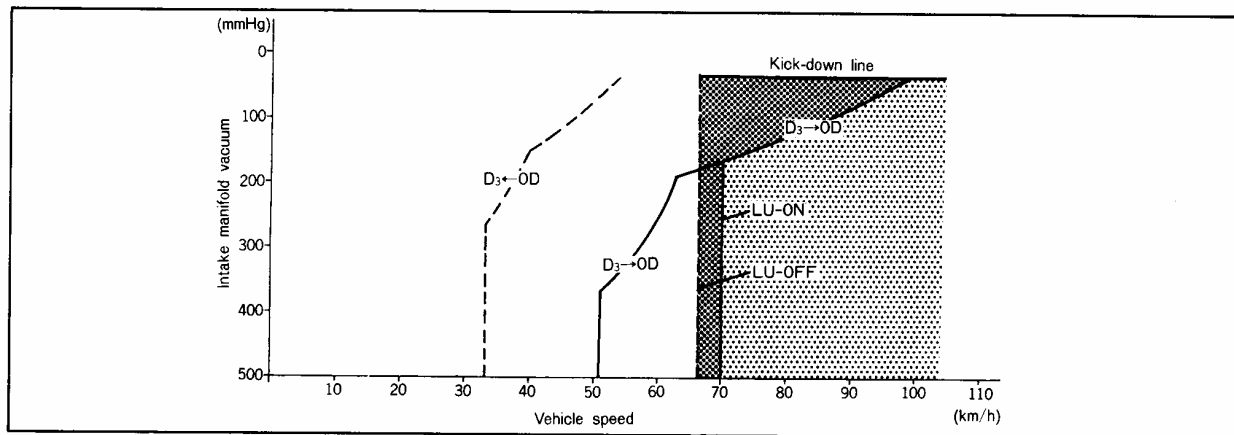
A rotation difference between the impeller and turbine revolutions was generated previously due to slippage in conventional torque converters because the power input from the engine was transmitted by the impeller via the ATF to the turbine. This Lock-Up Mechanism eliminates this rotation difference by directly linking the impeller and the turbine mechanically.

2. OPERATION CONDITIONS

The lock-up system operates when the following conditions all exist.



- (1) OD in operation
- (2) Vehicle speed is 70 km/h or higher (when OFF → ON). Once the LU system has switched ON, it is not cancelled, as long as the OD is operating, until vehicle speed decreases to 62 km/h.

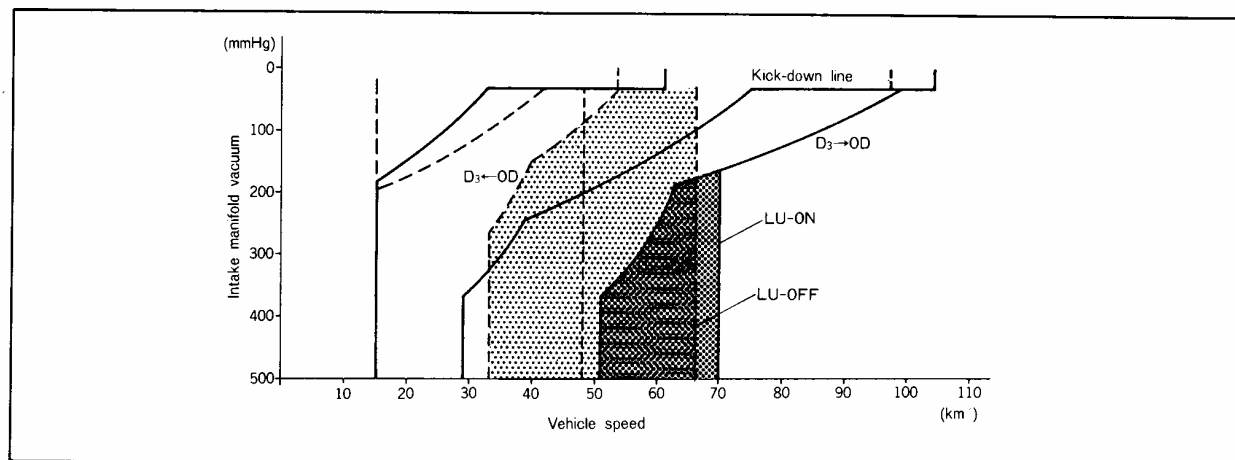
In other words, the  area in the graph represents the conditions when the LU system switches from OFF to ON, and the  area represents the conditions after it has once switched ON.



Notes

- a) Because there is a close relationship between the lock-up system and the OD system, care should be taken not to confuse their conditions of operation. It may be easier to think of them, therefore, as two completely separate and distinct systems.
- b) Depending upon the circumstances, the LU system may sometimes not operate even though the OD system is in the operation condition.

The  area in the graph represents when the lock-up system switches for OFF to ON, and the  area represents the condition, after the OD system has switched ON once, of the LU system being OFF, even though the OD system is ON.

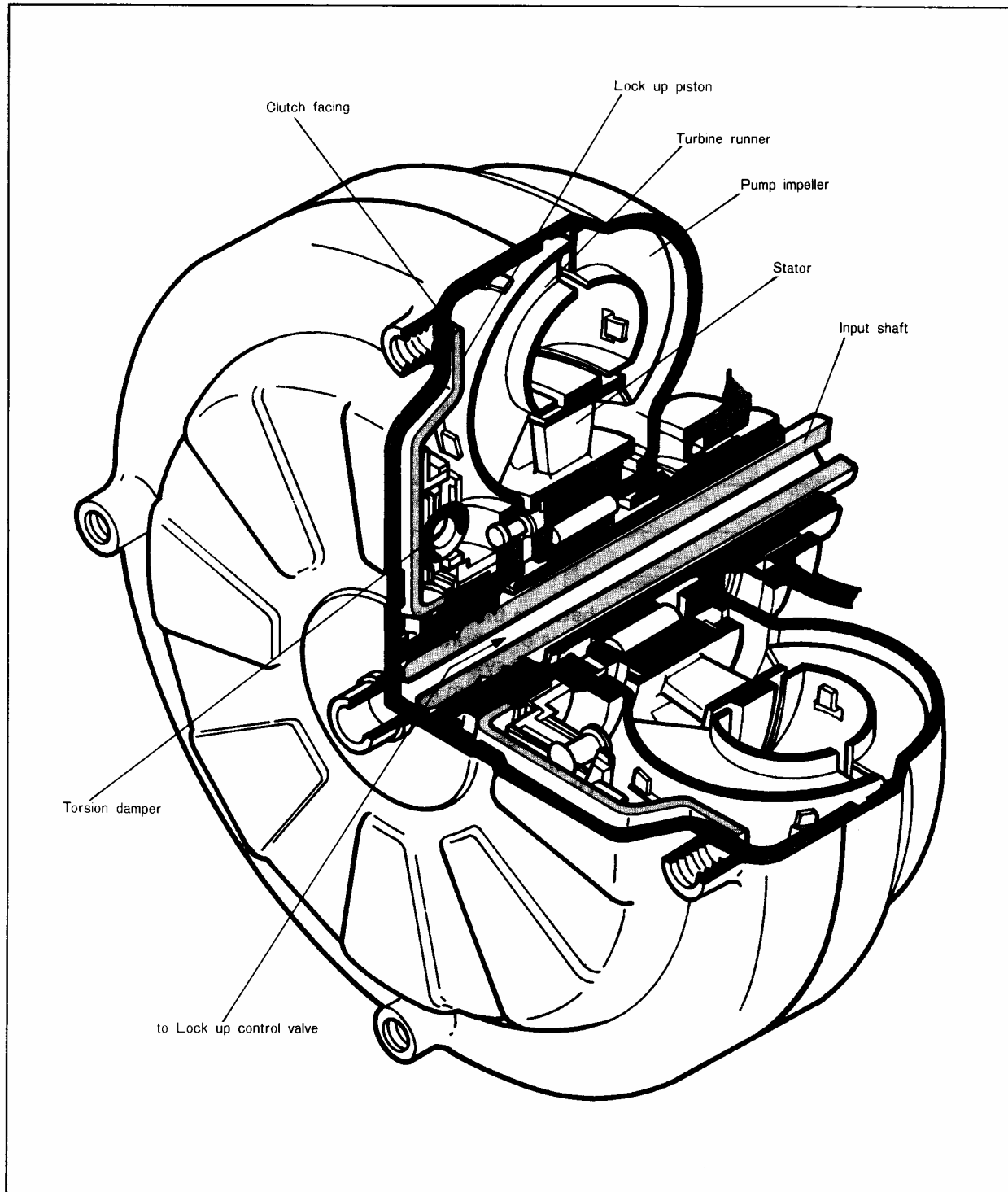


3. TORQUE CONVERTER

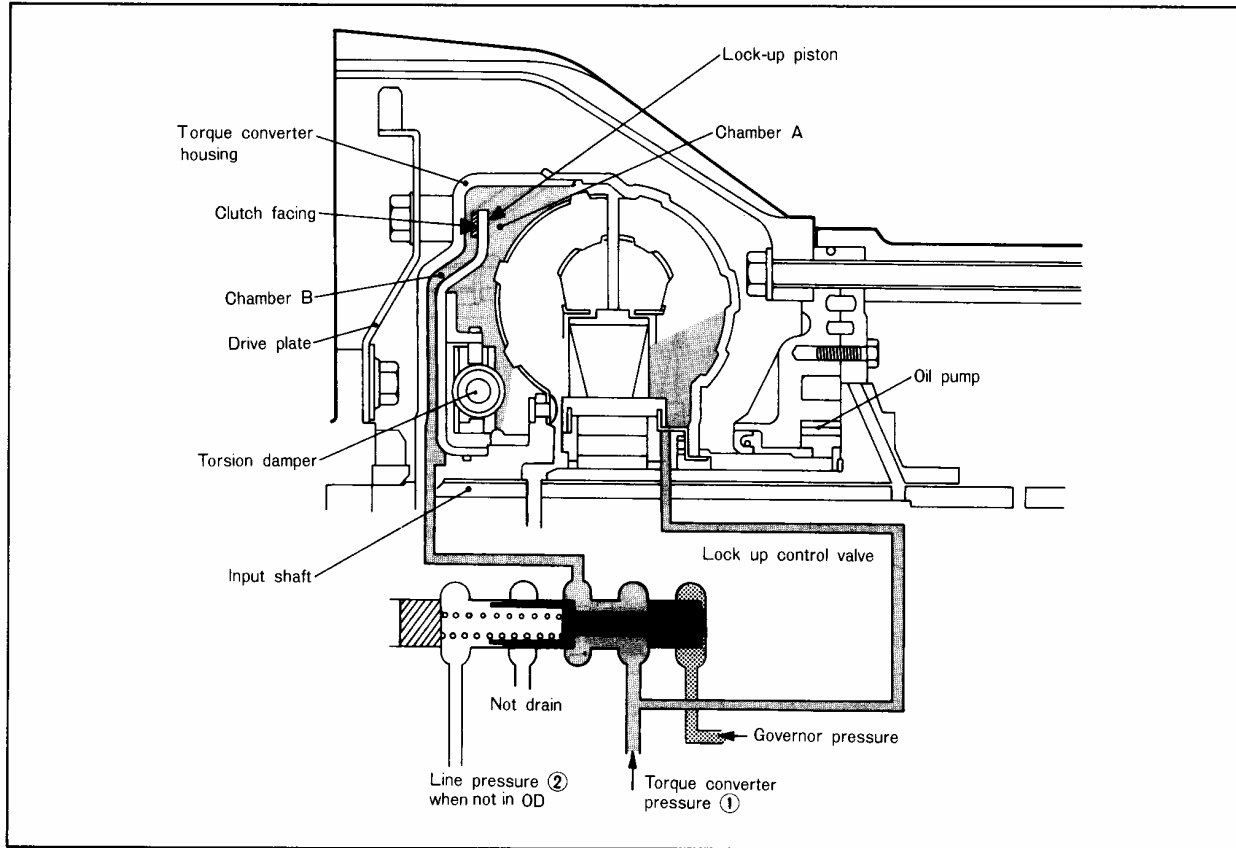
Within the torque converter of the L4N71B transmission, a lock-up piston, torsion damper, etc. have been added to the former converter.

When the lock-up operates, the clutch facing around the lock-up piston is pressed against the converter housing, and slippage caused by the fluid is entirely eliminated. In other words, the engine power is transmitted as is to the transmission.

There is a torsion damper located between the lock-up piston and the input shaft. This torsion damper functions in the same way as the torsion damper equipped on the clutch of the manual transmission.



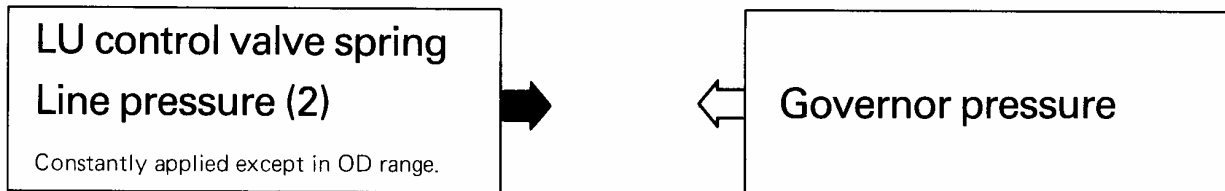
4. UNLOCK (RELEASE) CONDITIONS



Because the lock-up control valve is pressed to the right, causing the torque converter pressure (1) to be applied to both A and B chambers within the converter, the lock-up piston moves away from the torque converter housing. In other words, the engine power is transmitted in the conventional way via the fluid to the input shaft.

Pushing LU control valve to right

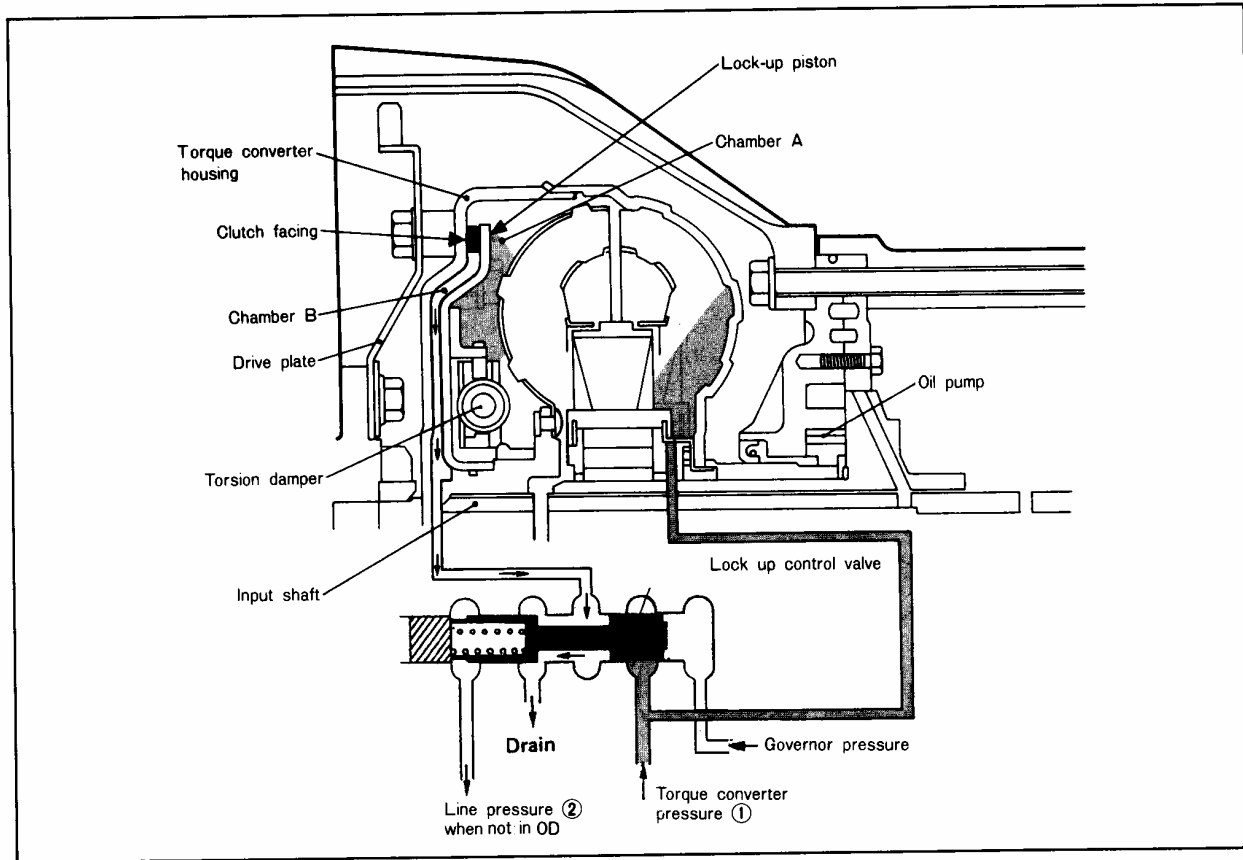
Pushing LU control valve to left



Notes

- a) Line pressure (2) is always applied to the LU control valve left side except in the OD range, but, because the force of line pressure (2) pushing the LU control valve to the right at that time is absolutely sure to be greater than the force of governor pressure pushing to the left, the LU control valve is always at the right. In other words, there will absolutely be no LU condition outside of the OD range.
- b) Even if line pressure (2) is not applied, the valve is pushed to the right when the force of the LU control valve spring is greater than governor pressure.
- c) Governor pressure is pressure which is proportional to vehicle speed. Thus, if the speed increases the pressure also becomes higher.
- d) The LU control valve is located within the oil pump body.

5. LOCK-UP CONDITIONS



At the instant that the LU control valve is pushed to the left, the drain passage expands and the fluid in chamber B is drained. When this happens, torque converter pressure (1) applied to chamber A pushed the lock-up piston against the torque converter housing. When this occurs, engine power is input to the input shaft via the drive plate, clutch facing, lock-up piston and torsion damper (but not through the fluid).

Pushing LU control valve to right

Pushing LU control valve to left



Notes

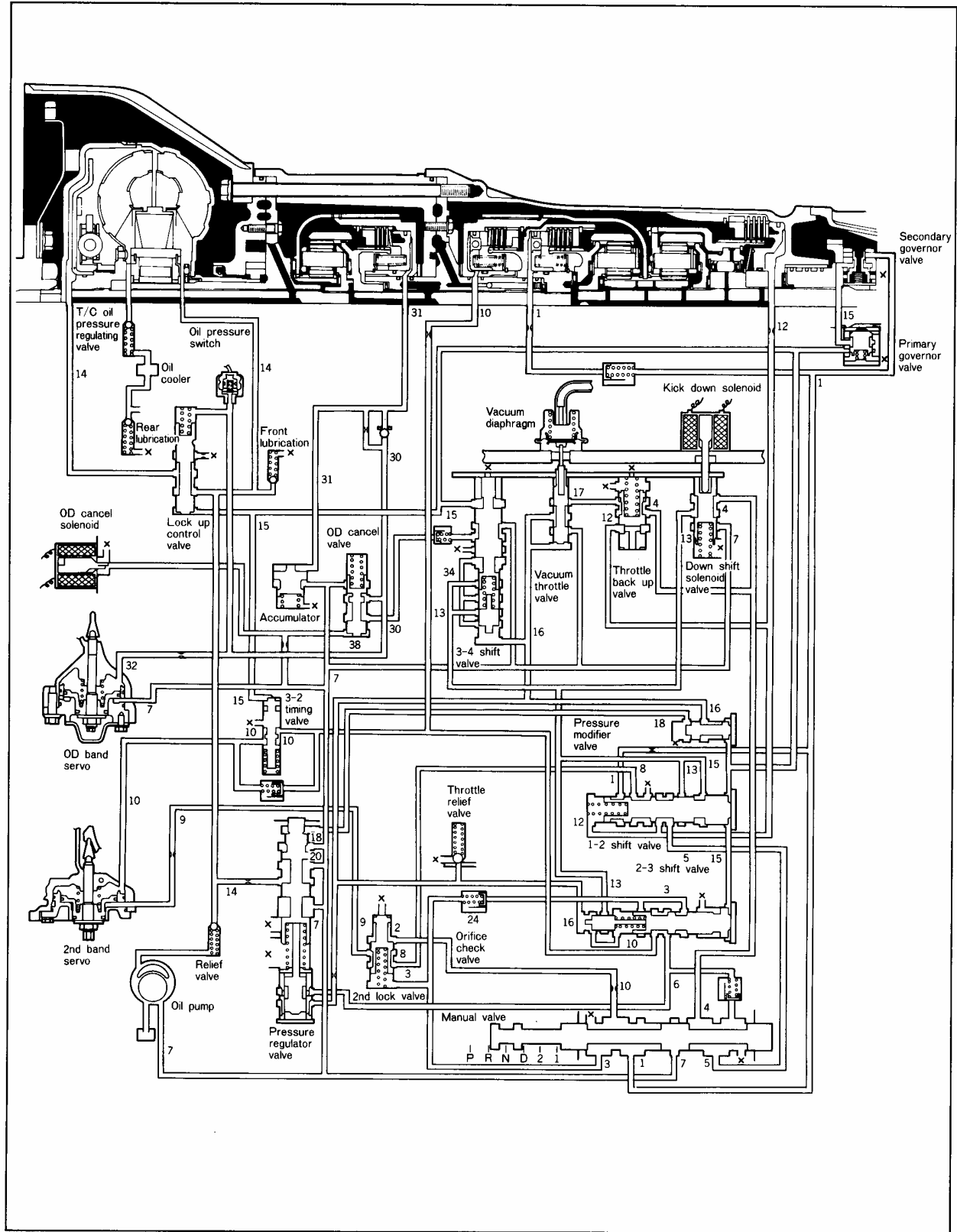
- a) When line pressure (2) is not applied, the LU control valve is pushed to the right by the force of the LU control valve spring only. If the governor pressure overcomes this force, the LU control valve moves to the right, thus activating the LU condition.
- b) The governor pressure overcomes the LU control valve spring force when the vehicle speed is 70 km/h or higher.

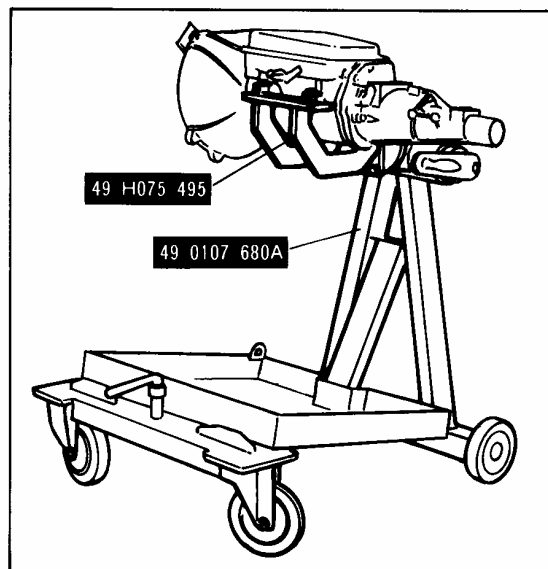
OD & LOCK-UP MECHANISM TROUBLESHOOTING

Trouble	Possible Cause
Does not shift to OD	<ul style="list-style-type: none">● OD control switch malfunction● OD cancel solenoid malfunction● Insufficient governor pressure● Stuck OD cancel valve● Stuck 3-4 shift valve
Does not lock up.	<ul style="list-style-type: none">● Insufficient governor pressure● Stuck lock-up valve● Exfoliated lock-up clutch facing
Does not shift down to 3 from OD.	<ul style="list-style-type: none">● OD cancel solenoid malfunction● Improper adjustment of malfunction of 4-3 switch● Stuck 3-4 shift valve
Does not kickdown to 3 and 2 from OD.	<ul style="list-style-type: none">● Improper adjustment of malfunction of kickdown switch
Slips when shifting to OD from 3.	<ul style="list-style-type: none">● Improper OD band servo adjustment
Excessive OD to 3 and 2 downshift shock	<ul style="list-style-type: none">● Stuck accumulator

HYDRAULIC CIRCUIT DIAGRAMS

NEUTRAL RANGE





SPECIAL TOOLS

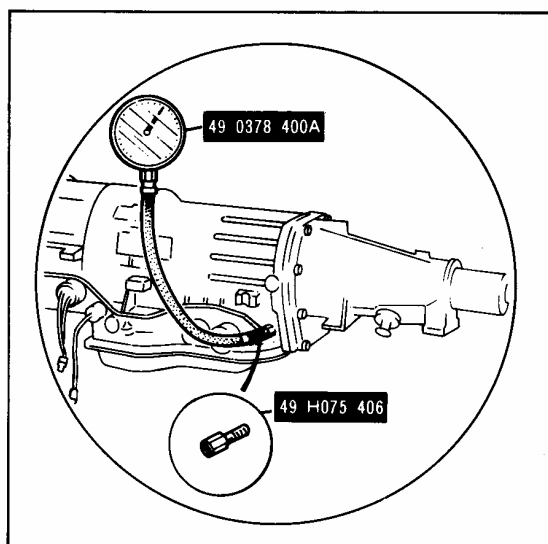
The service special tools used for the L4N71B automatic transmission are basically the same as those used for the 3N71B automatic transmission, but there are two new additions and one change.

New additions

1. Transmission hanger (49 H075 495)

This has been newly added in order to make overhauling of the L4N71B automatic transmission faster and more efficient.

As shown in the figure, it is used by installing it to the **engine stand** (49 0107 680A).

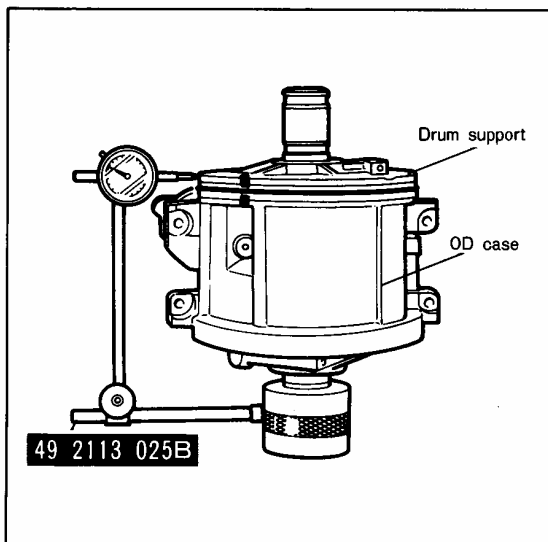


2. Oil pressure gauge adapter (49 H075 406)

This is used when the governor pressure is measured.

The governor pressure of the L4N71B automatic transmission is led from the rear part of the transmission, through the governor pressure pipe, to the front part.

To rest the governor pressure, attach this **oil pressure gauge** (49 H075 406) to the rear of the governor pressure pipe and use the oil passage for the oil-pressure gauge.



Changed item

1. Oil pump assembling gauge (49 2113 025B)

When the L4N71B automatic transmission is assembled, the oil pump and drum support must be centered.

Because the length of the rod of the **oil pump assembling gauge** (49 2113 025B) used until now is too short for drum support centering, the rod length has now been extended 70 mm (2.8 in).