1973

DATSUN

1200

SERVICE MANUAL

NISSAN MOTOR CO., LTD.

SERVICE MANUAL

DATSUN 1200
MODEL B110 SERIES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION AT

AUTOMATIC TRANSMISSION

AT

DESCRIPTION

The model 3N71B automatic transmission is a fully automatic unit consisting primarily of 3-element hydraulic torque converter and two planetary gear sets. Two multiple-disc clutches, a multiple-disc brake, a band brake and a one way sprag clutch provide the friction elements required to obtain the desired function of the two planetary gear sets.

The two planetary gear sets give three forward ratios and one reverse. Changing of the gear ratios is fully automatic in relation to vehicle speed and engine torque input. Vehicle speed and engine manifold vacuum signals are constantly fed to the transmission to provide the proper gear ratio for maximum efficiency and performance at all throttle openings.

The Model 3N71B has six selector positions: P, R, N, D, 2, 1.

"P" – Park position positively locks the out put shaft to the transmission case by means of a locking pawl to prevent the vehicle from rolling either direction.
This position should be selected whenever the driver leaves the vehicle.
The engine may be started in Park position.

"R" – Reverse range enables the vehicle to be operated in a reverse direction.

"N" – Neutral position enables the engine to be started and run without driving the vehicle.

"D" – Drive range is used for all normal driving conditions.
Drive range has three gear ratios, from the starting ratio to direct drive.

"2" – "2" range provides performance for driving on slippery surfaces. "2" range can also be used for engine braking.
"2" range can be selected at any vehicle speed, and prevents the transmission from shifting out of second gear.

"1" – "1" range can be selected at any vehicle speed and the transmission will shift to second gear and remain in second until vehicle speed is reduced to approximately 40 to 50 km/h (25 to 31 MPH).

"1" range position prevents the transmission from shifting out of low gear. This is particularly beneficial for maintaining maximum engine braking, when continuous low gear operation is desirable.

The torque converter assembly is of welded construction and can not be disassemble for service.

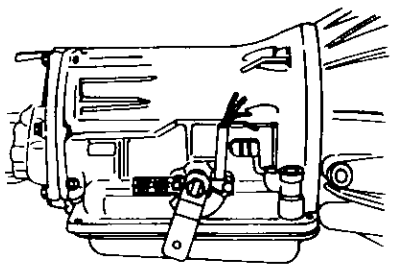
Fluid recommendation

Use automatic transmission fluid having "DEXRON" identifications only in the 3N71B automatic transmission.

Identification number

Stamped position:

The plate attached to the right hand side of transmission case as shown in Figure AT-1.



AT057

Fig. AT-1 Identification number

Identification of number arrangements:

See below.

Model code

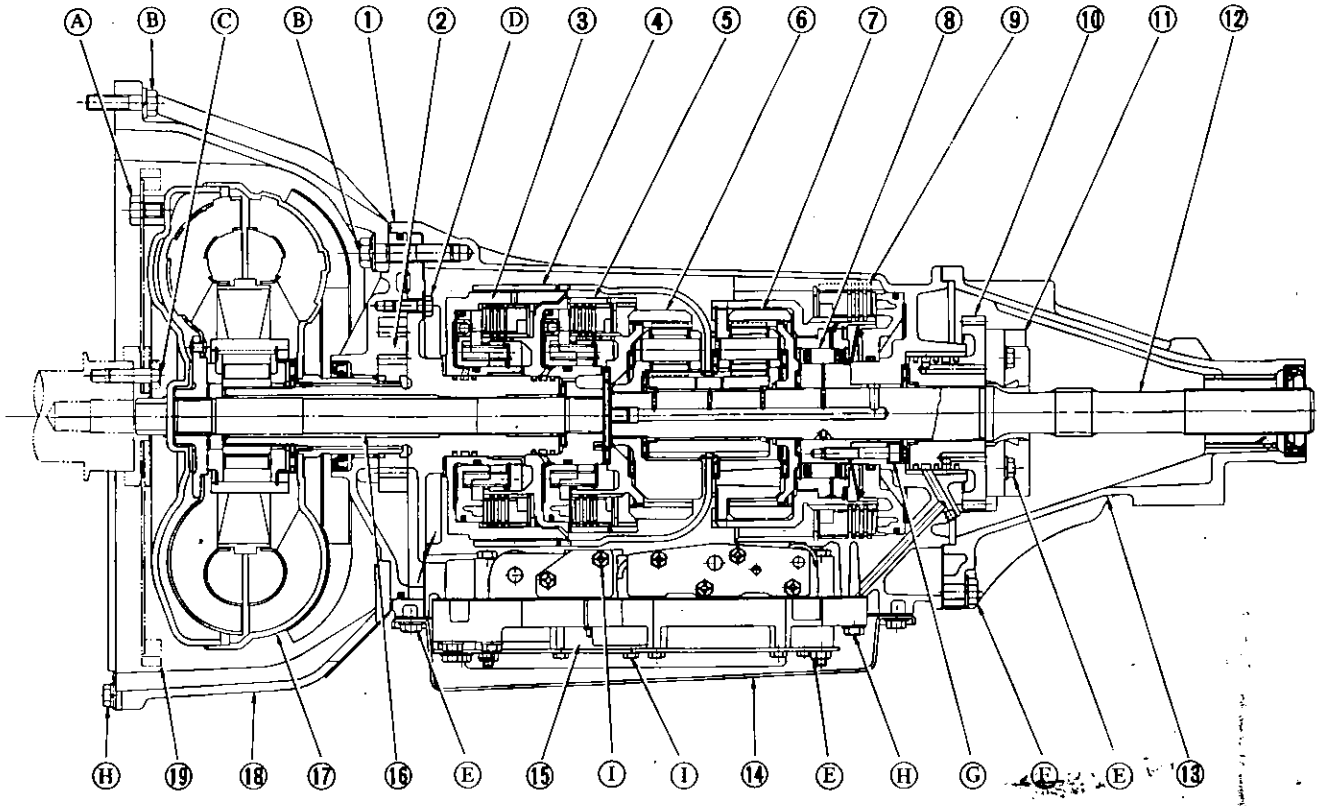
JAPAN AUTOMATIC TRANSMISSION CO., LTD.	
MODEL	X0100
NO.	2412345

Unit number

Number designation

2 4 1 2 3 4 5

- 5 – Serial production number for the month
- 4 – Month of production (X: Oct., Y: Nov., Z: Dec.)
- 2 – Last figure denoting the year (A.D.)



1	Transmission case	11	Governor
2	Oil pump	12	Output shaft
3	Front clutch	13	Rear extension
4	Band brake	14	Oil pan
5	Rear clutch	15	Control valve
6	Front planetary gear	16	Input shaft
7	Rear planetary gear	17	Torque converter
8	One way clutch	18	Converter housing
9	Low & Reverse brake	19	Drive plate
10	Oil distributor		

Tightening torque (T) of bolts and nuts kg-m (ft-lb)

Ⓐ T	=	0.8 to 1.0	(5.8 to 7.2)
Ⓑ T	=	4 to 5	(29 to 36)
Ⓒ T	=	6.5 to 7.5	(47 to 54)
Ⓓ T	=	0.6 to 0.8	(4.3 to 5.8)
Ⓔ T	=	0.5 to 0.7	(3.6 to 5.1)
Ⓕ T	=	2.0 to 2.5	(14 to 18)
Ⓖ T	=	1.3 to 1.8	(9.4 to 13)
Ⓗ T	=	0.55 to 0.75	(4.0 to 5.4)
Ⓘ T	=	0.25 to 0.35	(1.9 to 2.5)

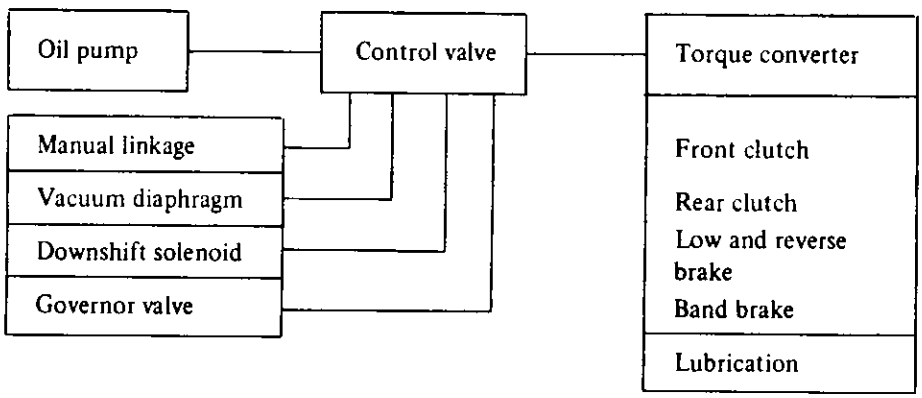
Fig. AT-2 Cross-sectional view of 3N71B automatic transmission

HYDRAULIC CONTROL SYSTEM

CONTENTS

FUNCTIONS OF HYDRAULIC CONTROL UNIT AND VALVES

The hydraulic control system contains a oil pump for packing up oil from the oil pan through the oil strainer. A shift control is provided by two centrifugally operated hydraulic governors on the output shaft, vacuum control diaphragm and downshift solenoid. These parts work in conjunction with valves in the valve body assembly located in the base of the transmission. The valves regulate oil pressure and direct it to appropriate transmission components.



Oil pump

The oil pump is the source of control medium (in other words, oil) for the control system.

The oil pump is of an internal, involute gear type. The drive sleeve is a part of the torque converter pump impeller and serves to drive the pump inner gear with the drive sleeve directly coupled with the engine operation.

The oil flows through the following route:

Oil pan – Oil strainer (bottom of the control valve) – Control valve lower body suction port – Transmission case suction port – Pump housing suction port – Pump gear space – Pump housing delivery port – Transmission case delivery port – Lower body delivery port – Control valve line pressure circuit.

Manual linkage

The hand lever motion (The hand lever is located in the driver's compartment.) mechanically transmitted from the remote control linkage is further transmitted to the inner manual lever in the transmission case from the range selector lever in the right center portion of the transmission case through the manual shaft. The inner manual lever is thereby turned.

A pin installed on the bottom of the inner manual lever slides the manual valve spool of the control valve, and thus, the spool is appropriately positioned opposing to each select position.

The parking rod pin is held in the groove on the top of the inner manual plate. The parking rod pin operates the rod at "P" range, and operates the mechanical lock system.

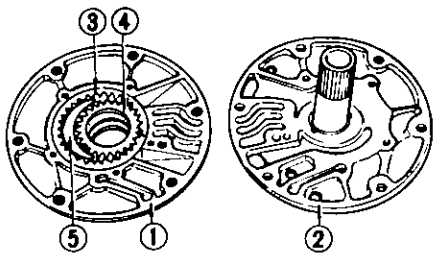
Moreover, the above described manual shaft is equipped with an inhibitor switch. A rotor inside the inhibitor switch rotates in response to each range. When the range is selected at "P" or "N," the rotor closes the starter magnet circuit so that the engine can be started. When the range is selected at "R," the rotor closes the back-up lamp circuit, and the back-up lamp lights.

Vacuum diaphragm

The vacuum diaphragm is installed on the left center portion of the transmission case. The internal construction of the vacuum diaphragm is as follows. A rubber diaphragm forms a partition in the center. The engine intake manifold negative pressure led through vacuum tube and spring force are applied to the front surface of the rubber diaphragm, and atmospheric pressure is applied to the back surface. A difference between pressure applied to the front and back surfaces becomes a vacuum reaction, and thus, the throttle valve of the control valve inside the transmission case is operated.

When accelerator pedal is fully depressed and the carburetor is fully opened but the engine speed is not sufficiently increased, the manifold negative pressure lowers (becomes similar to the atmospheric pressure) and the vacuum reaction increases since the flow velocity of mixture inside the intake manifold is slow. Contrarily, when the engine speed increases and the flow velocity of the mixture increases or when the carburetor is closed, the manifold negative pressure increases (becomes similar to vacuum) and the vacuum reaction reduces.

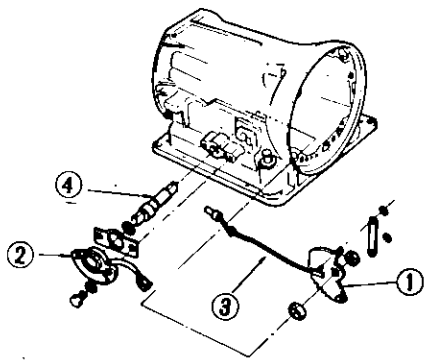
Thus, a signal to generate hydraulic pressure completely suited to the engine loading at the control valve is transmitted from the vacuum diaphragm, and most suitable speed change timing and line pressure are obtained so that the most proper torque capacity is obtained against the transmitting torque.



AT071

1 Housing
2 Cover
3 Outer gear
4 Inner gear
5 Crescent

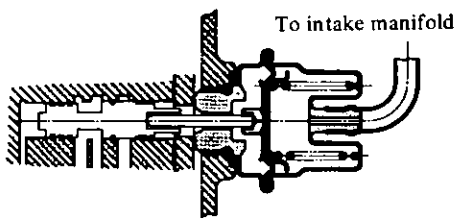
Fig. AT-3 Oil pump



AT087

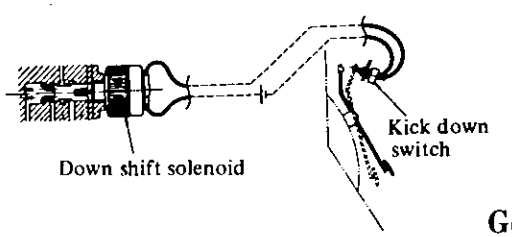
1 Manual plate
2 Inhibitor switch
3 Parking rod
4 Manual shaft

Fig. AT-4 Manual linkage



AT088

Fig. AT-5 Vacuum diaphragm



AT089

Fig. AT-6 Downshift solenoid

Downshift solenoid

The downshift solenoid is of a magnetic type installed on the left rear portion of the transmission case. When a driver requires accelerating power and depresses the accelerator pedal down to the stopper, a kick-down switch located in the middle of the accelerator link is depressed by a push rod, the kick-down switch closes, current flows to the solenoid, the solenoid push rod is depressed, the downshift valve of the control valve inside the transmission case is depressed, and the speed is changed forcedly from "3rd" to "2nd" within a certain vehicle speed limit.

Note: As the kick-down switch closes when the accelerator pedal is depressed from 7/8 to 15/16 of the whole stroke, the accelerator pedal should be correctly adjusted and fixed so as to afford complete stroke.
The arrangement of the switch differs according the models of vehicle.

Governor valve

The primary and secondary governor valves are installed separately on the back of the oil distributor on the

transmission output shaft. They operate in the same speed as that of the output shaft. (In other words, they operate at a speed in proportion to the vehicle speed.) To those valves, the line pressure is applied as the input from the control valve through the transmission case, rear flange and oil distributor. The governor pressure [in proportion to the output shaft speed (vehicle speed)] is led to the shift valve of the control valve through inverse route as the output, and thus, the speed change and the line pressure are controlled.

Operation of secondary governor valve

The secondary valve is a control valve which receives line pressure (1) and controls the governor pressure.

When the manual valve is selected at "D," "2," or "1" range, line pressure is applied to the ring shape area of this valve from circuit (1), and this valve is depressed toward the center side. Movement of this valve to a certain position closes the circuit from (1) to (15) simultaneously while making a space from the (15) to the center drain port, and pressure in the circuit (15) is lowered.

When the vehicle is stopped and the centrifugal force of this valve is zero, the valve is balanced. In this, a governor pressure which is balanced with the spring force occurs on the (15).

When the vehicle is started and the centrifugal force increases, this valve slightly moves to the outside, and when the space from (1) to (15) increases, space from the (15) to the drain port reduces simultaneously. As the result, governor pressure of the (15) increases, and the governor pressure is balanced with the sum of centrifugal force and the spring force. The governor pressure thus changes in response to the vehicle speed change (centrifugal force).

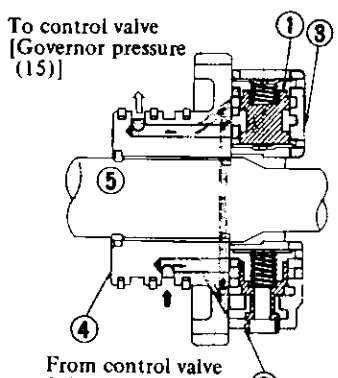
Operation of primary governor valve

The valve is an ON-OFF valve which closes the governor pressure (15) regulated by the secondary governor valve when the vehicle speed reaches the minimum speed, and when the vehicle speed exceeds a certain level open the governor and forwards the governor pressure (15) to the control valve.

When the vehicle is stopped, the governor pressure is zero. However, when the vehicle is running slowly, this valve is depressed to the center side and the groove to the (15) is closed since the governor pressure applied to the ring shape area is higher than the centrifugal force of this valve. When the governor speed exceeds certain revolution, the governor pressure in the circuit (15) also increases. However, as the centrifugal force increases and exceeds the governor pressure, this valve moves toward the outside, and the governor pressure is transmitted to the circuit (15).

Two different valves are employed in the governor so that it will independently control the speed at high speed and at low speed. That is, within the low speed range, the governor pressure is not generated owing to the primary valve; whereas at the high speed range above the break point, a governor pressure regulated by the secondary valve is introduced.

* The break point is the point at which the function of one of the governors is transferred to the other when the speed changes from the low-speed range to the high-speed range.



1 Primary governor
2 Secondary governor
3 Governor valve body
4 Oil distributor
5 Output shaft

Fig. AT-7 Cross-sectional view of governor

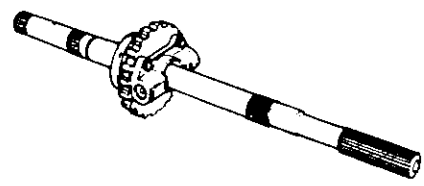
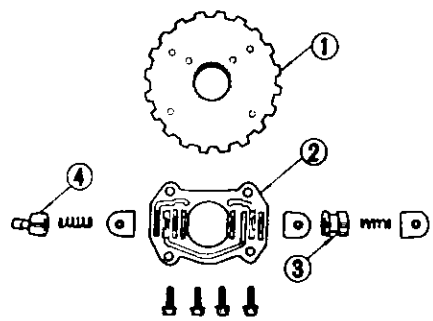


Fig. AT-8 Output shaft with oil distributor and governor



1 Oil distributor
2 Governor valve body
3 Primary governor valve
4 Secondary governor valve

Fig. AT-9 Exploded view of governor

This quality product has been packaged
by hand. If you have any difficulty please
mention my number in your correspondence.
Thank you. 2655

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50 WEST STREET ROAD
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Shifters	12 months
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2. Carefully print on the carton the name and address of Hurst as above. Don't forget your return address.

3. Put a letter showing service desired in an envelope addressed to Hurst as above. In your letter please be sure to give full information; such as date and place of purchase, your full name and address, and the service or repairs desired.

4. PASTE ENVELOPE TO PACKAGE.

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STREET ADDRESS PROFESSION
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CAR YEAR CAR MAKE CAR MODEL
2 3 4 (SPEED) TRANSMISSION MANUAL AUTOMATIC 4 6 8 (CYLINDER) CUBIC INCHES

PRODUCT PURCHASED
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- ☐ SUPER SHIFTER
- ☐ RAM 4
- ☐ MASTERSHIFT
- ☐ HURST INDY SHIFTER
- ☐ AUTO STICK
- ☐ MINI-CAR SHIFTER
- ☐ SUPER AIR SHOCKS
- ☐ ALUMINUM FLYWHEEL
- ☐ STEEL FLYWHEEL
- ☐ PRESSURE PLATE
- ☐ RING & PINION GEARS
- ☐ CLUTCH DISC
- ☐ OTHER

Where was product purchased?

- ☐ SPEED SHOP
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- ☐ AUTO PARTS STORE
- ☐ OTHER

How did you learn about Hurst products?

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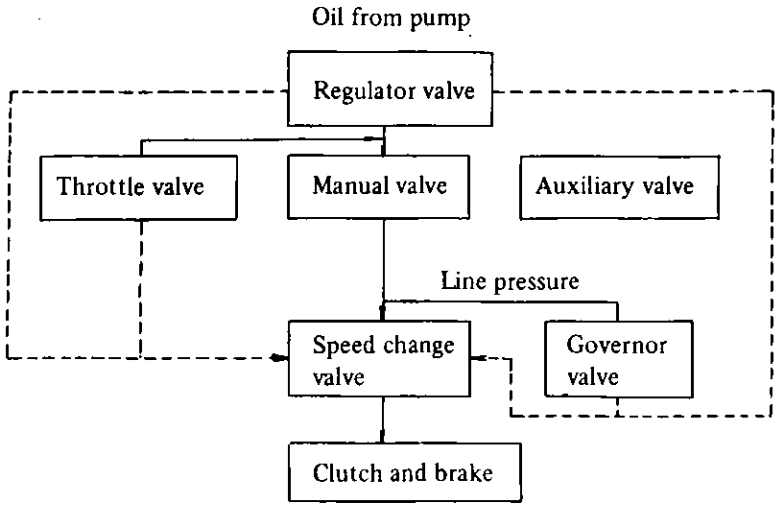
Do you have any suggestions to help us improve out products?

Are there any new products you would like to see Hurst manufacture?

Control valve assembly



Flow chart of control valve system

The control valve assembly receives oil from the pump and the individual signals from the vacuum diaphragm, and transmits the individual line pressures to the transmission friction element, torque converter circuit, and lubricating system circuit as the outputs. To be more specifically, the oil from the oil pump is regulated by the regulator valve and line pressures build up. The line pressures are fed out from the control valve assembly as they are through various direction changeover valves (including ON-OFF valve) and regulator valves, newly reformed to a throttle system oil pressure and operates other valves, or finally, the line pressure are transmitted to the required clutch or brake servo piston unit in response to the individual running conditions after receiving signals from the previously described vacuum diaphragm, downshift solenoid, governor valve, and/or manual linkage.

The control valve assembly consists of the following valves:

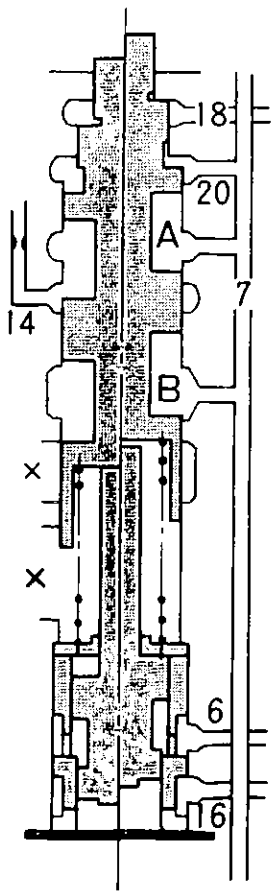
1. Pressure regulator valve
2. Manual valve
3. 1st-2nd shift valve
4. 2nd-3rd shift valve
5. Pressure modifier valve
6. Vacuum throttle valve
7. Throttle back-up valve
8. Solenoid downshift valve
9. Second lock valve
10. 2nd-3rd timing valve

Pressure regulator valve (PRV)

The pressure regulator valve receives valve spring force, force from plug created by the throttle pressure (16) and line pressure (7), and force of the throttle pressure (18). With the mutual operations of those forces, the PRV regulates the line pressure (7) to the most suitable pressures at the individual driving conditions.

The oil from the oil pump is applied to the ring-shaped area through orifice (20). As the result, the PRV is depressed downward, and moves from port (7) up to such extent that the space to the subsequent drain port (marked with "x" in Figure AT-10) opens slightly. Thus, the line pressure (7) is balanced with the spring force, and the PRV is thereby balanced. In this, the space from the port (7) to the subsequent converter oil pressure (14) circuit has also been opened. As the result, the converter is filled with the pressurized oil in the circuit (14), and the oil is further used for the lubrication of the rear unit. Moreover, a part of the oil is branched and used for the lubrication of front unit for the front and rear clutches.

When the accelerator pedal is depressed, the throttle pressure (16) increases as described in the preceding paragraph, oil pressure is applied to the plug through orifice (21), and the pressure is added to the spring force. As the result, the PRV is contrarily depressed upward, space to the drain port is reduced, and the line pressure (7) increases.



AT095

Fig. AT-10 Pressure regulator valve

When the range is selected at "R" (Reverse), the line pressure (6) is applied to the plug in the manner identical to the throttle pressure (16) and is added to the spring force. Consequently, the line pressure (7) further increases.

When the vehicle speed increases and the governor pressure rises, the throttle pressure (18) is applied to the port on the top of the PRV, and pressure is applied contrarily against the spring force. As the result, the line pressure (7) lowers. Moreover, at the individual conditions, the line pressure (7) is equal to the line pressure (6) and the throttle pressure (16) is equal to (18).

Manual valve (MNV)

The manual lever turning motion is converted to reciprocating motion of the manual valve through a pin, and the MNV is properly positioned so that the line pressure (7) is distributed to the individual line pressure circuits at each "P," "R," "N," "D," "2" or "1" range as shown below.

"P" range:
(7) – (4) – SDV and TBV
(5) – FSV (12) – TBV and Low & reverse brake

"R" range:
(7) – (4) – Same as above
(5) – Same as above
(6) – PRV and SSV – (F.C.) and band release

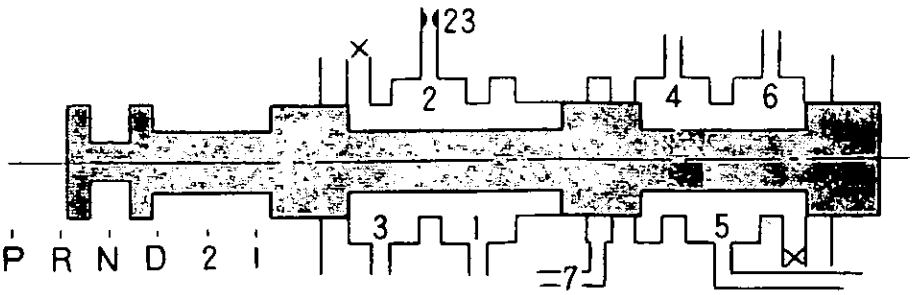
"N" range: (7) – None

"D" range:
(7) – (1) – Governor valve, FSV, and rear clutch
(2) – SLV
(3) – SLV and SSV

"2" range:
(7) – (1) – Same as above
(2) – SLV – (9) Band applied
(4) – SDV and TBV

"1" range:
(7) – (1) – Same as above
(4) – Same as above
(5) – FSV

Moreover, (1), (2), (3), (4), (5), and (6) are always drained at a position where the line pressure is not distributed from (7).



AT096

Fig. AT-11 Manual valve

1st-2nd shift valve (FSV)

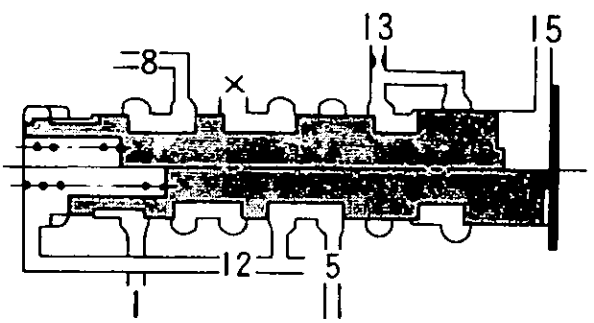
The FSV is a transfer valve which shifts speed from low to second. When the vehicle is stopped, the FSV is depressed to the right side by the force of a spring located in the left side, and thus, the FSV is in the "Low" position.

When the vehicle speed increases, the governor pressure (15) is applied to the right side of the FSV, and the FSV is depressed toward the left. Contrarily, the line pressure (1) and throttle pressure (19) depress the FSV toward the right together with the spring force, and thus, oppose to the governor pressure (15).

When the vehicle speed exceeds a certain level, the governor pressure (15) exceeds the sum of the throttle pressure and the spring force, and the FSV is depressed toward the left.

When the FSV is depressed and reaches a certain position, the line pressure (1) and the throttle pressure (19) are closed, only the spring depresses the FSV toward the right, and the FSV is depressed to the end for a moment. As the result, the line pressure (1) is forwarded to (8), the band servo is engaged through the SLV, and thus, the speed is shifted to "2nd." With the accelerator pedal depressed, the FSV is remained in the "Low" position unless the governor pressure (15) increases to a high level corresponding to the line pressure (1) and the throttle pressure (19) since the line pressure (1) and the throttle pressure (19) increase when the accelerator pedal is depressed.

Contrarily, when the vehicle speed lowers, the governor pressure (15) reduces. However, the speed is not shifted to "Low" unless the governor pressure (15) becomes zero since the force to depress the FSV toward the right is remained only on the spring.



AT097

Fig. AT-12 "1st-2nd" shift valve

"Low" in the range "1" is led to the low and reverse clutch from the line pressure (5) through the line pressure (12), and at the same time, the same is led to the left end spring unit. Consequently, although the governor pressure increases, the valve is still depressed toward the right, and the SFV is fixed in the "Low" position. When kicked down at the "2nd" speed, the SDV operates, and the line pressure (13) depresses the FSV toward the right. Although the governor pressure (15) is considerably high, the valve is depressed completely toward the right, and the FSV is returned to the "Low" position. (This operation is called "Kick-down shift")

2nd-3rd shift valve (SSV)

The SSV is a transfer valve which shifts speed from "2nd" to "3rd." When the vehicle is stopped, the SSV is depressed toward the right by the spring, and is in the "2nd" position. It is provided, however, that the FSV decides the shifting either to "Low" or "2nd."

When the vehicle is running, the governor pressure (15) is applied to the right end surface, and the SSV is depressed toward the left. Contrarily, the spring force, line pressure (3), and throttle pressure (19) depress the SSV toward the right.

When the vehicle speed exceeds a certain level, the governor pressure exceeds the sum of the spring force, line pressure, and throttle pressure, the valve is depressed toward the left, and the line pressure (3) is closed. Consequently, the forces are rapidly unbalanced, the force to depress the SSV toward the right reduces, and thus, the SSV is depressed to the left end for a moment. With the SSV depressed toward the left end, the line pressure (3) is connected with the line pressure (10), the band servo is released, the front clutch is engaged, and speed is shifted to "3rd."

When the accelerator pedal is depressed, both the line pressure (3) and the throttle pressure (19) are high, and therefore, the SSV is retained in "2nd" unless the governor pressure (15) exceeds the line pressure (3) and the throttle pressure (19).

In the "3rd" position, force to depress the SSV toward the right is remained only on the throttle pressure (16), and the throttle pressure (16) is slightly lower than that toward the right which is applied while shifting from "2nd" to "3rd."

Consequently, the SSV is returned to the "2nd" position at a slightly low speed side. (Shifting from "3rd" to "2nd" occurs at a speed slightly lower than that for "2nd" to "3rd" shifting.)

When kicked down at the "3rd," line pressure (13) is led from the SDV, and the SSV is depressed toward the right. Although the governor pressure is considerably high, the valve is depressed completely toward the right, and thus, the SSV is returned to "2nd" position. (This operation is called "Kick-down shift.")

When the shift lever is shifted to "2" or "1" range at the "3rd" speed, the line pressure (3) is drained at the MNV. Consequently, the front clutch operating and band servo releasing oils are drained. As the result, the transmission is shifted to the "2nd" or "low" speed although the SSV is in the "3rd" position.

When the speed is shifted to the "3rd," a one-way orifice (24) on the top of the SSV relieves oil transmitting velocity from the line pressure (3) to the line pressure (10), and reduces a shock generated from the shifting. Contrarily, when shifted from "3rd" to "2" or "1" range and the speed is shifted to the "2nd," spring of the orifice (24) is depressed, the throttle becomes ineffective, the line pressure (10) is drained quickly, and thus, delay in the speed shifting is eliminated.

Throttle of the line pressure (6) relieves the oil transmitting velocity from the line pressure (6) to the line pressure (10) when the lever is shifted to the "R" range, and relieves drain velocity from the line pressure (10) to the line pressure (6) when shifting from "3rd" to "2nd" at the "D" range. Thus, the throttle of the line pressure (6) reduces a shock generated from the shifting.

A plug in the SSV left end readjusts the throttle pressure (16) which varies depending on the engine throttle condition, to a throttle pressure (19) suited to the speed change control. Moreover, the plug is a valve which applies line pressure (13), in lieu of the throttle pressure, to the SSV and the FSV when kick-down is performed.

When the throttle pressure (16) is applied to the left side of this plug, and the plug is depressed toward the right, a slight space is made from the throttle pressure (16) to (19). A throttle pressure (19) which is lower by the pressure loss equivalent to this space is generated, the pressure loss is added to the spring force, and thus, the plug is depressed back from the right to the left. When this pressure (19) increases excessively, the plug is further depressed toward the left, space from the throttle pressure (19) to the drain circuit (13) increases, and the throttle pressure (19) lowers. Thus, the plug is balanced, and the throttle pressure (19) is reduced in a certain value

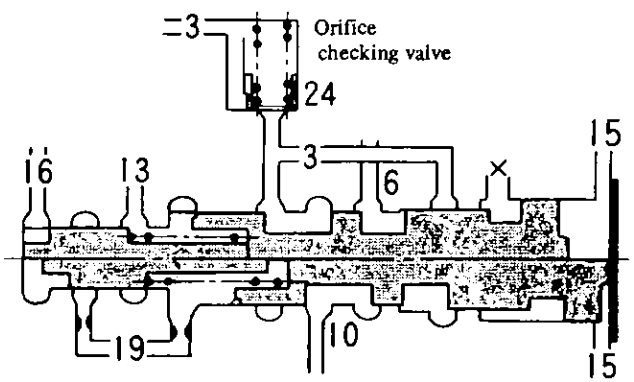


Fig. AT-13 "2nd-3rd" shift valve

against the throttle pressure (16).

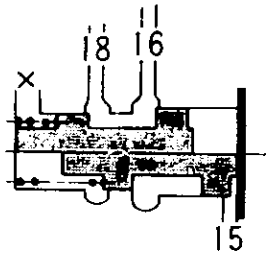
When performing the kick-down, the SDV moves, a high line pressure is led to the circuit (19) from the line pressure circuit (13) (which had been drained), the plug is depressed toward the left, and the circuit (19) becomes equal to the line pressure (13). Thus, the kick-down is performed.

Pressure modifier valve (PMV)

In comparison with the operating pressure required in starting the vehicle, power transmitting capacity of the clutch (in other words, required operating pressure) may be lower when the vehicle is once started. When the line pressure is retained in a high level up to a high vehicle speed, a shock generated from the shifting increases, and the oil pump loss also increases. In order to prevent the above described defective occurrences, with the operation of the governor pressure (15), the throttle pressure must be changed over to reduce the line pressure. The PMV is used for this purpose.

When the governor pressure (15) which is applied to the right side of the PMV is low, the valve is depressed toward the right by the throttle pressure (16) (applied to the area difference of the value) and the spring force, and the circuit from the circuit (16) to the circuit (18) is closed. However, when the vehicle speed increases and the governor pressure (15) exceeds a certain level, the governor pressure toward the left which is applied to the right side exceeds the spring force and the throttle pressure (16) toward the right, the valve is depressed toward the left, and the throttle pressure is led from the circuit (16) to the circuit (18). This throttle pressure (18) is applied to the top of the PRV, and pressure of the line pressure source (7) is reduced. Contrarily, when the vehicle speed lowers and the governor pressure (15) lowers, the force toward the right exceeds the governor pressure, the valve is depressed back toward the right, the throttle pressure (18) is drained to the spring unit.

This valve is switched when the throttle pressure and the governor pressure are high or when the throttle pressure is low and the governor pressure is low.



AT099

Fig. AT-14 Pressure modifier valve

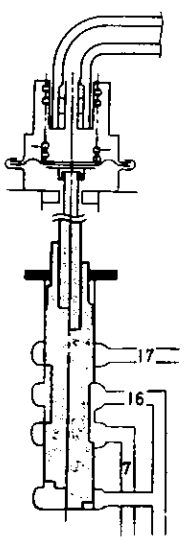
Vacuum throttle valve (VTV)

The vacuum throttle valve is a regulator valve which uses the line pressure (7) for the pressure source and regulates the throttle pressure (16) which is proportioned to the force of the vacuum diaphragm. [The vacuum diaphragm varies depending on the engine throttle condition (negative pressure in the intake line)].

When the line pressure (7) is applied to the bottom through the valve hole and the valve is depressed upward, space from the line pressure (7) to the throttle pressure (16) is closed, and the space from the throttle pressure (16) to the drain circuit (17) is about to open. In this, the throttle pressure (16) becomes lower than the line pressure (7) by the pressure equivalent to the pressure loss of the space, and the force to depress through the rod of the vacuum diaphragm is balanced with the throttle pressure (16) applied upward to the bottom.

When the engine torque is high, the negative pressure in the intake line rises (similar to the atmospheric pressure), and the force of the rod to depress the valve increases. As the result, the valve is depressed downward, the space from the throttle pressure (16) to the drain (17) reduces, and the space from the line pressure (7) to the throttle pressure (16) increases.

Consequently, the throttle pressure (16) increases, and the valve is balanced. Contrarily, when the engine torque lowers and the negative pressure in the intake line lowers (similar to vacuum), force of the rod to depress the valve lowers, and the throttle pressure (16) also lowers. When a pressure regulated by the throttle back-up valve (described in the subsequent paragraph) is led to the circuit (17), a high pressure is applied through the space from the circuit (17) to the throttle pressure (16). Consequently, the VTV is unbalanced, the throttle pressure (16) becomes equal to the back-up pressure (17), and the valve is locked upward.



AT100

Fig. AT-15 Vacuum throttle valve

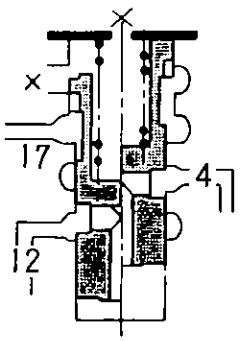
Throttle back-up valve (TBV)

Usually, this valve is depressed downward by the spring force, and the circuit (17) is drained upward.

As soon as the lever is shfted either to "2" or "1" range, line pressure is led from the circuit (4), the line pressure is applied to the area difference of the valve, the valve is depressed upward, the space from the circuit

(4) to the circuit (17) is timely closed, and with the space from the circuit (17) to the upper drain being about to open, the back-up pressure (17) which is lower than the line pressure (4) by the pressure loss due to the space from the circuit (4) to the circuit (17) is balanced with the spring force.

Further, when speed is shifted from "2nd" to "Low" at the range "1," line pressure is led from the circuit (12), and the line pressure is applied upward to the bottom of the valve through the valve hole. Consequently, the valve is depressed upward, and locked. As the result, the space from the line pressure (4) to the back-up pressure (17) is closed completely, and the back-up pressure (17) is drained upward.



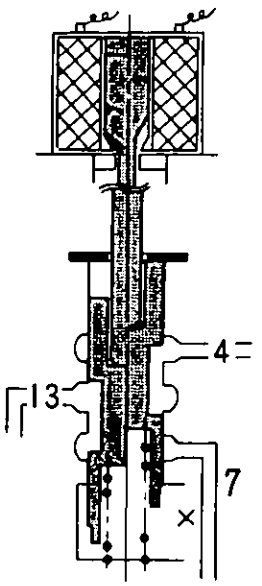
AT101

Fig. AT-16 Throttle back-up valve

Solenoid downshift valve (SDV)

This valve is a transfer valve which leads the line pressure (7) to (13) and transmits the same to the FSV and SSV when a kick-down signal is received from the downshift solenoid. Usually, the solenoid push rod and valve are locked upward by the spring in the lower end, and circuit from the line pressure (4) to the line pressure (13) is opened.

When kick-down is performed, the push rod operates, the valve is depressed downward, and the circuit from the line pressure (7) to the line pressure (13) opens. The line pressure (13) opposes the governor pressure (15) at the SSV and FSV, and thus, performs the downshift operation.



AT102

Fig. AT-17 Solenoid downshift valve

Second lock valve (SLV)

This valve is a transfer valve which assists the shift valve in order to decide the fixed "2nd" speed at the "2" range.

In the "D" range, the sum of the spring force and line pressure (3) applied upward exceeds the line pressure (2) which is applied to the valve area difference as the downward force. As the result, the valve is locked upward, and the circuit from the line pressure (8) to the line pressure (9) is opened.

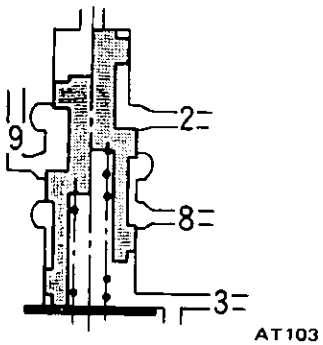
Consequently, the FSV becomes the "2nd" speed condition, and line pressure is led to the band servo engaging circuit (9) only when the line pressure (1) is released to the line pressure (8).

In the "2" range, the upward force is retained only on the spring, and the downward line pressure (2) exceeds the upward force.

As the result, the valve is locked downward, the line pressure (2) is released to (9) regardless of the operating condition of the FSV, and the band servo is engaged.

2nd-3rd timing valve (TMV)

This valve is a transfer valve which switches the by-pass circuit of the

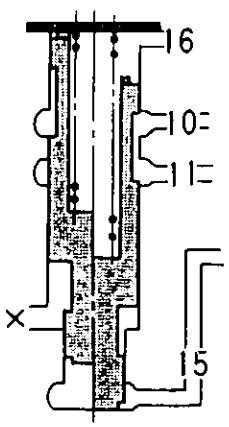


AT103

Fig. AT-18 Second lock valve

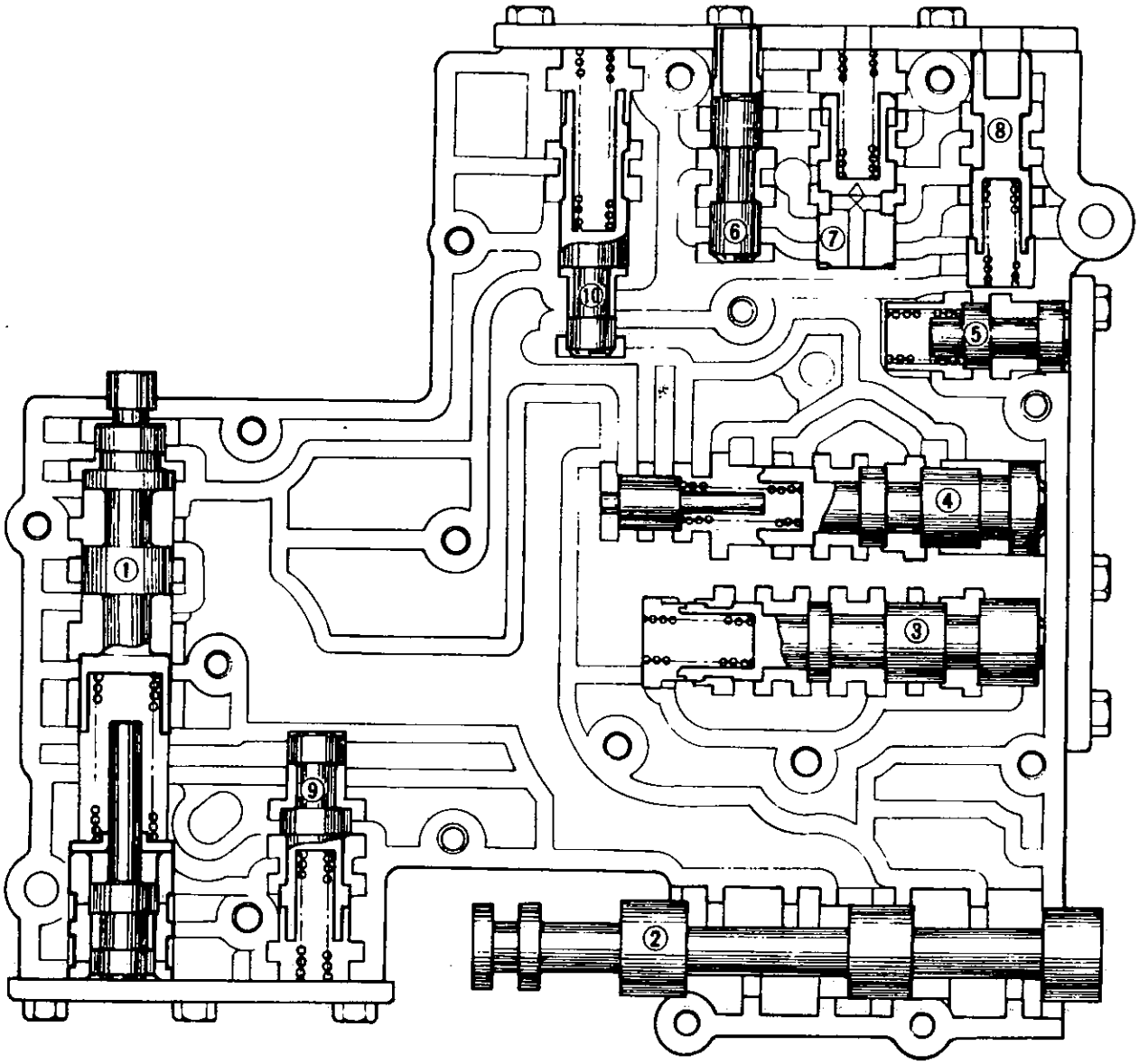
orifice (22) in the front clutch pressure circuit (11) in response to the vehicle speed and the throttle condition. A force created when the governor pressure (15) applies to the bottom of the TMV is used for the upward force, and a force created when the spring force and the throttle pressure apply to the top of the TMV is used for the downward force.

When the throttle pressure (16) is lower than the governor pressure (15), the upward force exceeds the downward force, the valve is locked upward, and passage from the circuit (10) ("2nd" from the "Top") to the circuit (11) is closed. Consequently, the line pressure (10) is led to the front clutch circuit (11) through the orifice (22), and thus, the oil pressure is transmitted slowly. However, under the normal shifting, the throttle pressure (16) has a pressure exceeding a certain level, and the downward force exceeds the upward force. As the result, the valve is locked downward, the passage from the circuit (10) to the circuit (11) is opened, and the orifice (22) is disregarded.



AT104

Fig. AT-19 "2nd-3rd" timing valve



AT094

1 Pressure regulating valve
2 Manual valve
3 1st-2nd shift valve
4 2nd-3rd shift valve
5 Pressure modifier valve
6 Vacuum throttle valve
7 Throttle back-up valve
8 Solenoid down shift valve
9 Second lock valve
10 2 - 3 timing valve

Fig. AT-20 Control valve

HYDRAULIC SYSTEM AND MECHANICAL OPERATION

The operating system of oil pressure in each range is described below:

The oil pressure in each circuit shown in the illustration is classified as follows according to the function. (The numerals show the circuit numbers.)

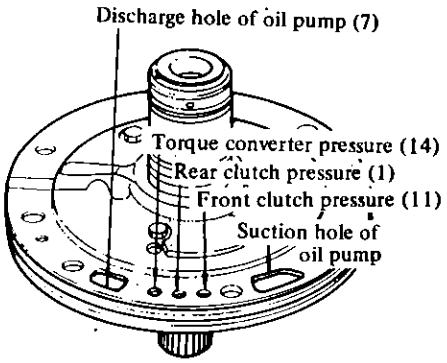
Pressure source of the line: 7

Operating line pressure for friction elements:
1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12.

Auxiliary line pressure: 13

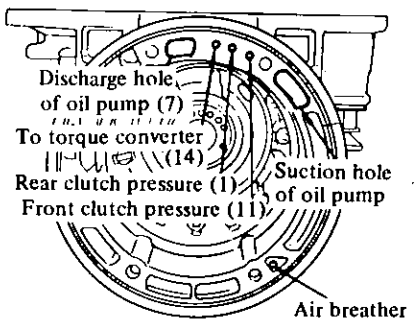
Pressure of throttle system:
16, 17, 18, 19.

Others: 14, 15



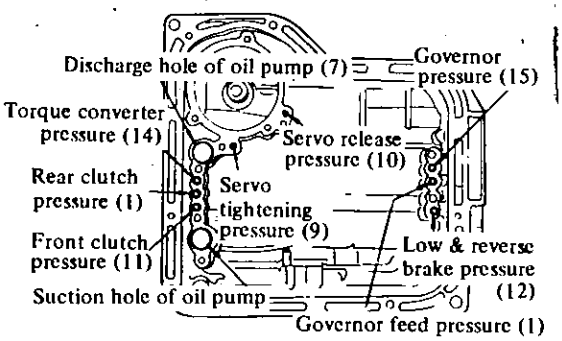
AT105

Fig. AT-21 Identification of oil channels in oil pump



AT106

Fig. AT-22 Identification of oil channels in case front face



AT107

Fig. AT-23 Identification of oil channels in case face

"P" range (Park)

The operation of clutches and band are functionally quite the same as in "Neutral."

In parking, however, as the parking pawl meshes in a gear which is splined to the output shaft, the output shaft is mechanically locked from rotating.

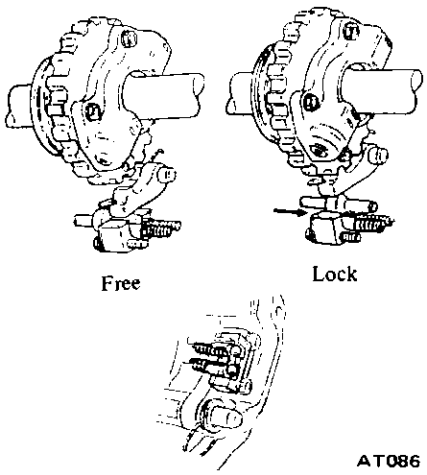


Fig. AT-24 Parking mechanism

The oil discharged from the oil pump is fed to each part in a similar manner to that of the "N" range. The oil having the line pressure (7) which has been introduced to the manual valve ② reaches the "1st-2nd" shift valve ③ through the line pressure circuit (5). As the "1st-2nd" shift valve is forced to the right-hand side by the spring the line pressure (5) and (12) actuates the low and reverse brake through the groove. Also, the parking pawl engages with the outer teeth of the oil distributor by the manual lever, mechanically locking the output shaft.

Range			Gear ratio	Clutch		Low & reverse brake	Band servo		One way clutch	Parking pawl
				Front	Rear		Operation	Release		
Park						on				on
Reverse			2.182	on		on		on		
Neutral										
Drive	D1	Low	2.458		on				on	
	D2	Second	1.458		on		on			
	D3	Top	1.000	on	on		(on)	on		
2		Second	1.458		on		on			
1	1_2	Second	1.458		on		on			
	1_1	Low	2.458		on	on				

"P" range (Park)

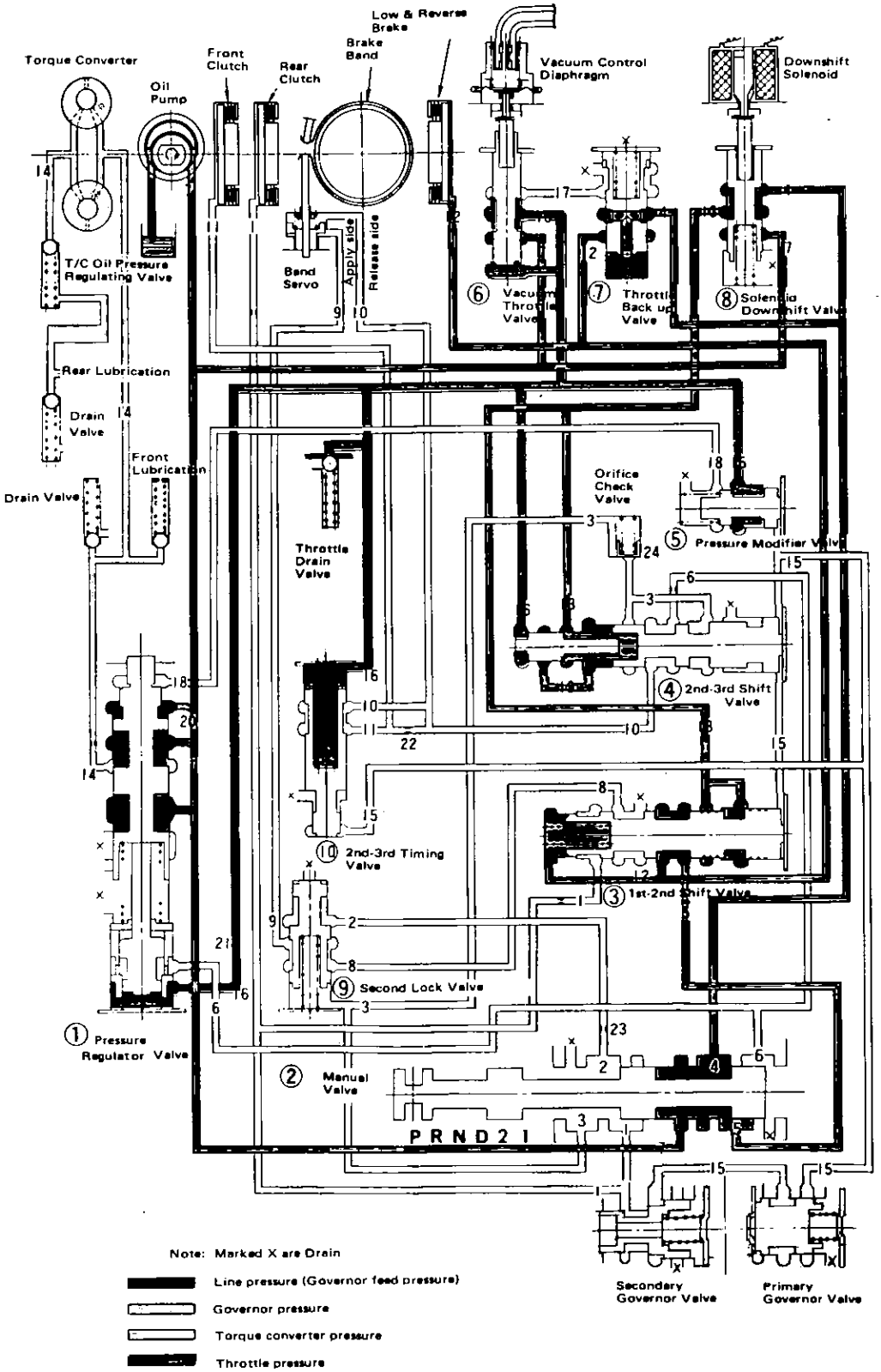


Fig. AT-25 Oil pressure circuit diagram — "P" range (Park)

"R" range (Reverse)

In "R" range, the front clutch and low and reverse brake are applied. The power flow is through the input shaft, front clutch, connecting shell and to the sun gear. Clockwise rotation of the sun gear causes counterclockwise rotation of the rear planetary gears. With the connecting drum held stationary by the low and reverse brake, the rear planetary gears rotate the rear internal gear and drive flange counterclockwise. The rear drive flange splined to the output shaft rotates the output shaft counterclockwise at a reduced speed with an increase in torque for reverse gear.

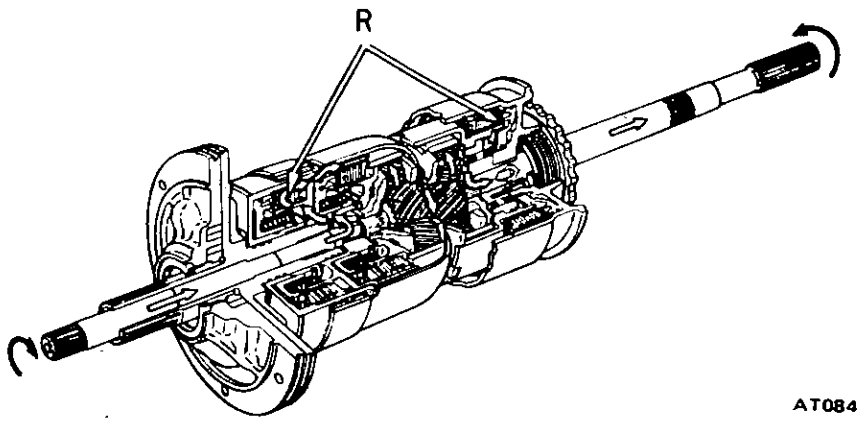


Fig. AT-26 Power transmission during "R" range

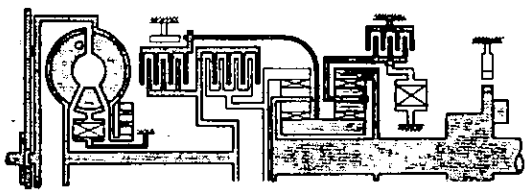


Fig. AT-27 Operation of each mechanism duirng "R" range

When the manual valve ② is positioned at "R" range, the oil having the line pressure (7) is directed to the line pressure circuits (5) and (6), The pressure in the circuit ⑤ actuates the low and reverse brake after being introduced into the line pressure circuit (12) through the "1st-2nd" shift valve ③. The pressure in the circuit operates the release side of band servo and the front clutch after being led to the line pressure circuit (10) through the "2nd-3rd" shift valve ④. The throttle pressure (16) and the line pressure (6) which vary with the degree of the depression of accelerator pedal both act on the pressure regulator valve ① and press its valve ①, increasing the line pressure (7). In "R" range, the governor pressure is absent, making all such valves inoperative as the "1st-2nd" shift valve ③, "2nd-3rd" shift valve ④, and pressure modifier valve ⑥.

Range			Gear ratio	Clutch		Low & reverse brake	Band servo		One way clutch	Parking pawl
				Front	Rear		Operation	Release		
Park						on				on
Reverse			2.182	on		on		on		
Neutral										
Drive	D1	Low	2.458		on				on	
	D2	Second	1.458		on		on			
	D3	Top	1.000	on	on		(on)	on		
2		Second	1.458		on		on			
1	1_2	Second	1.458		on		on			
	1_1	Low	2.458		on	on				