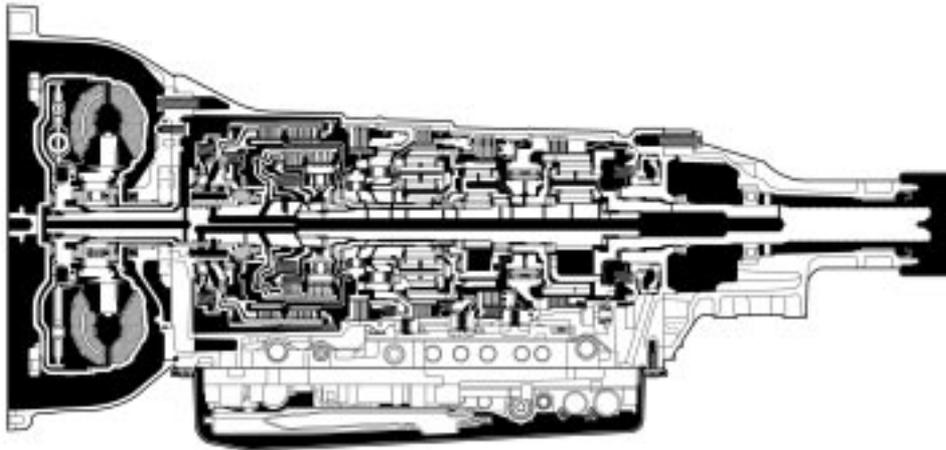


A960E AUTOMATIC TRANSMISSION

■ GENERAL

The A960E 6-speed automatic transmission [6 Super ECT (Electronic Controlled Transmission)] is used on the 4GR-FSE engine models (2WD).

- The fuel economy and driving performance have been improved by the 6-speed automatic transmission.
- The multi-mode automatic transmission with the shift paddle switch is used. For details, see page CH-45.



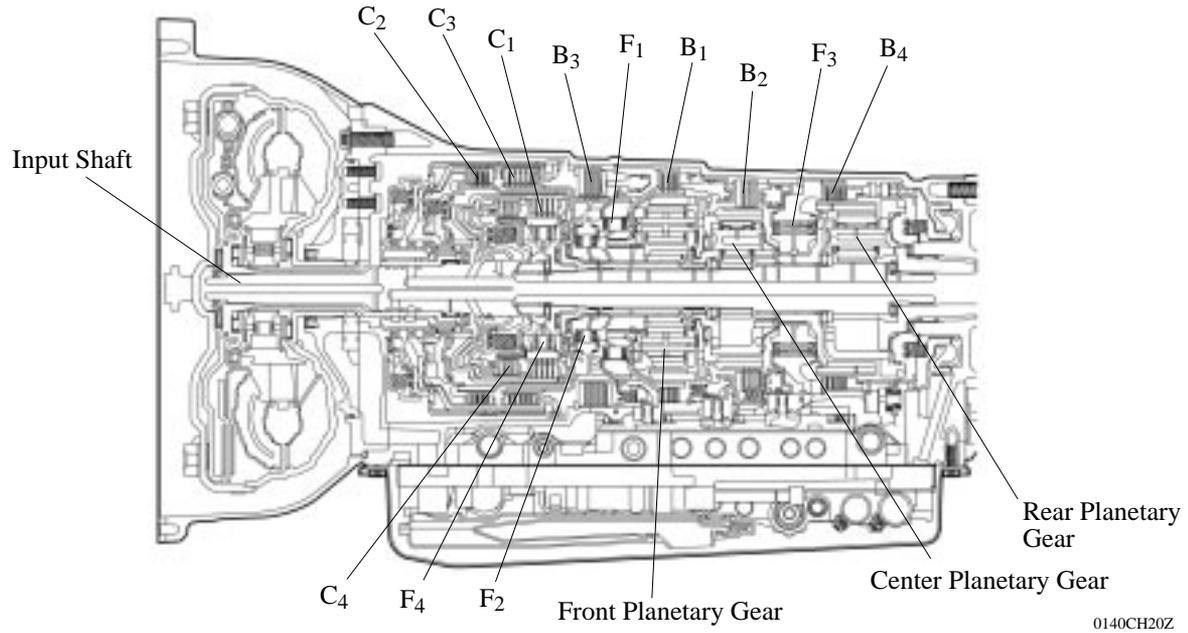
A960E Automatic Transmission

0140CH19Z

► Specification ◀

Transmission Type		A960E
Engine Type		4GR-FSE
Gear Ratio	1st	3.538
	2nd	2.060
	3rd	1.404
	4th	1.000
	5th	0.713
	6th	0.582
	Reverse	3.168
Fluid Capacity	Liters (US qts, Imp. qts)	7.2 (7.6, 6.3)
Fluid Type		TOYOTA Genuine ATF WS
Weight (Reference)*	kg (lb)	74.7 (164.7)

*: Weight shows the figure with the fluid fully filled.

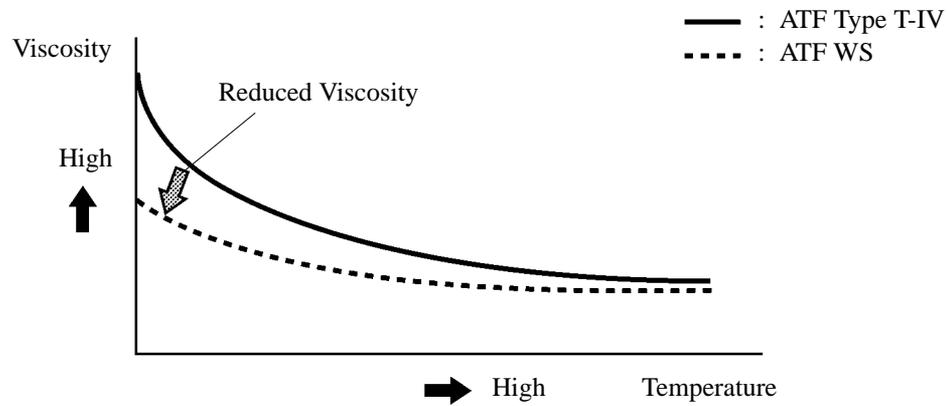


► Specification ◀

Item			A960E
C ₁	No.1 Clutch	The No. of Discs	4
C ₂	No.2 Clutch		5
C ₃	No.3 Clutch		4
C ₄	No.4 Clutch		4
B ₁	No.1 Brake		3
B ₂	No.2 Brake		4
B ₃	No.3 Brake		3
B ₄	No.4 Brake		5
F ₁	No.1 One-Way Clutch	The No. of Sprags	21
F ₂	No.2 One-Way Clutch		22
F ₃	No.3 One-Way Clutch		22
F ₄	No.4 One-Way Clutch		25
Front Planetary Gear	The No. of Sun Gear Teeth		33
	The No. of Pinion Gear Teeth	Inner	19
		Outer	18
The No. of Ring Gear Teeth		75	
Center Planetary Gear	The No. of Sun Gear Teeth		26
	The No. of Pinion Gear Teeth		20
	The No. of Ring Gear Teeth		66
Rear Planetary Gear	The No. of Sun Gear Teeth		26
	The No. of Pinion Gear Teeth		20
	The No. of Ring Gear Teeth		66

■ ATF WS

- The ATF WS is used to reduce the resistance of the ATF and improve fuel economy by reducing its viscosity in the practical operating temperature range. At higher-fluid temperatures, the viscosity is the same as that of ATF Type T-IV, to ensure the durability of the automatic transmission.
- There is no interchangeability between the ATF WS and other types of ATF (ATF Type T-IV, D-II.)



259LSK03

Service Tip

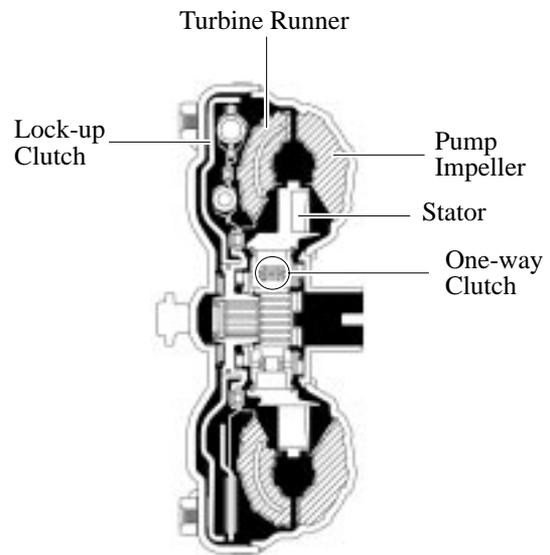
If a vehicle with a transmission that requires ATF WS is replenished with another type of ATF, the transmission might not engage at extremely low temperatures. However, the transmission might engage after it has been warmed up for a few minutes.

■ TORQUE CONVERTER

A compact, lightweight and high-capacity torque converter is used. The torque converter supports flex lock-up clutch control, thus improving fuel economy.

► Specification ◀

Type	3-Element, 1-Step, 2-Phase
Stall Torque Ratio	1.95

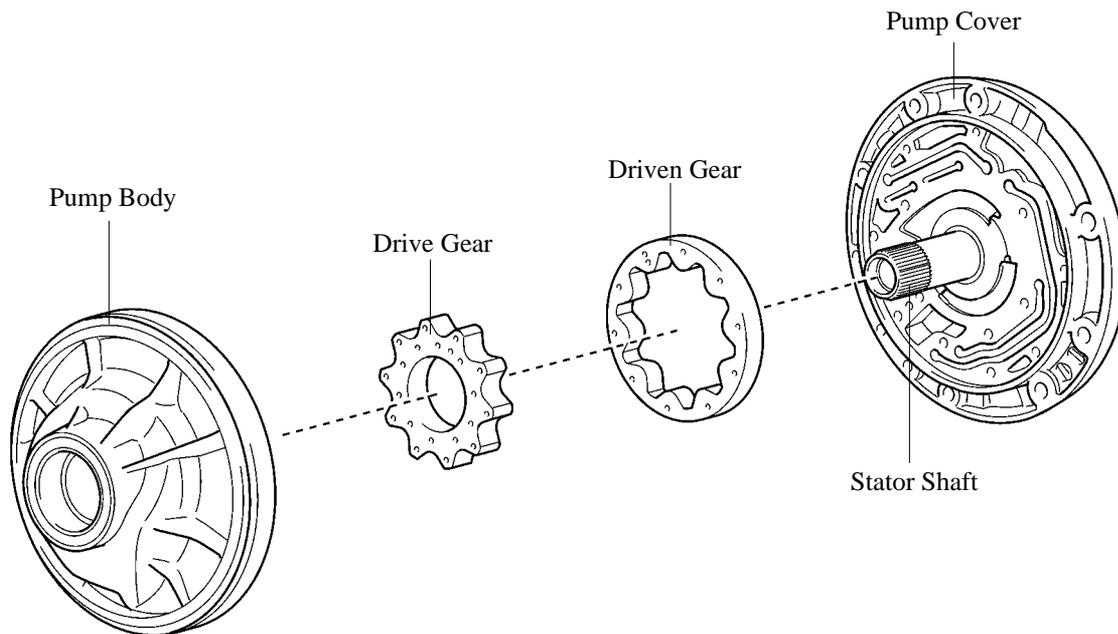


0140CH27Z

■ OIL PUMP

The oil pump is operated by the torque converter. It lubricates the planetary gear units and supplies operating fluid pressure for hydraulic control.

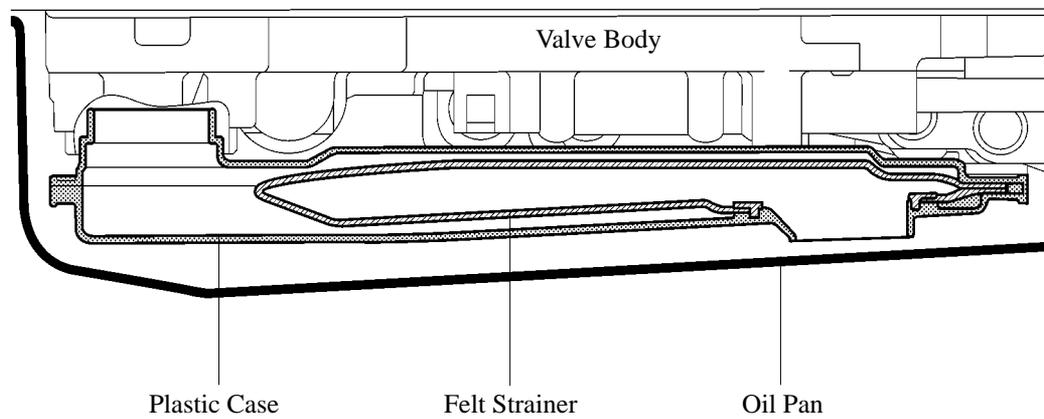
The material of the pump cover is aluminum to reduce weight.



232CH89

■ OIL STRAINER

A felt type oil strainer (in a plastic case) is used because it weighs less, offers excellent debris capturing ability, and is more reliable. This oil strainer is maintenance-free.

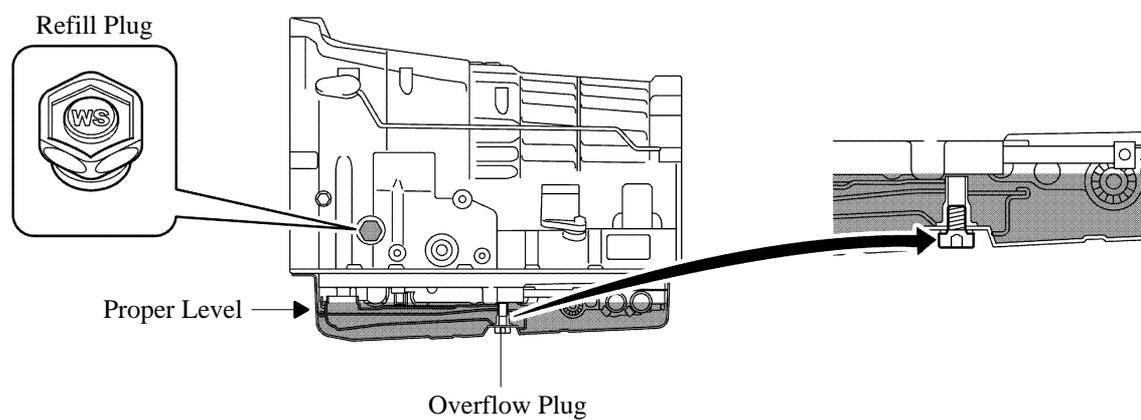


0140CH138Y

■ ATF FILLING PROCEDURES

The ATF filling procedure is changed in order to improve the accuracy of the ATF level when the transmission is being repaired or replaced. As a result, the oil filler tube and the oil level gauge used for a conventional automatic transmission are discontinued, eliminating the need to inspect the fluid level as a part of routine maintenance.

- This filling procedure uses a refill plug, overflow plug, ATF temperature sensor, and shift indicator light "D".



0140CH21Z

Service Tip

ATF Filling procedure using SST (09843-18040)

When a large amount of ATF needs to be filled (i. e. after removal and installation of oil pan or torque converter), perform the procedure from step 1.

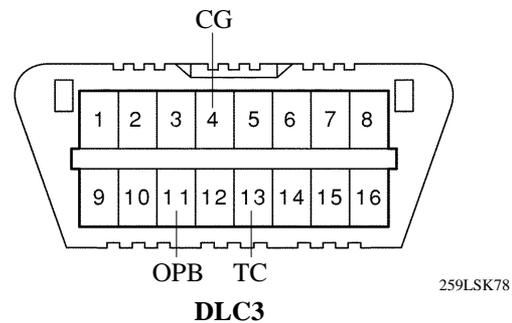
When a small amount of ATF is required (i. e. removal and installation of oil cooler tube, repair of a minor oil leak), perform the procedure from step 7.

- 1) Raise the vehicle while keeping it level.
- 2) Remove the refill plug and overflow plug.
- 3) Fill the transmission with WS type ATF from the refill plug hole until it overflows from the overflow plug hole.
 - The fluid used to fill the transmission should be ATF WS.
- 4) Install the overflow plug.
- 5) Add the specified amount of ATF (specified amount is determined by the procedure that was performed) and install the refill plug.

Example:

Procedure	Liters (US qts, Imp.qts)
Removal and installation of transmission oil pan (including oil drainage)	1.0 (1.06, 0.88)
Removal and installation of transmission valve body	2.2 (2.33, 1.94)
Replacement of torque converter	3.7 (3.91, 3.26)

- 6) Lower the vehicle.
- 7) Use the SST (09843-18040) to short the TC, OPB, and CG terminals of the DLC3 connector:
- 8) Start the engine and allow it to idle.
 - A/C switch must be turned off.
- 9) Move the shift lever from the P position to the S mode position and slowly select each gear S1 - S6. Then move the shift lever back to the P position.



- 10) Move the shift lever to the D position, and quickly move then back and forth between N and D (at least once every 1.5 seconds) for at least six seconds. This will activate the oil temperature detection mode.

Standard: The shift position indicator light “D” will remain illuminated for 2 seconds and then go off.

- 11) Return the shift lever to the P position and disconnect the TC terminal.
 - Do not disconnect the SST from terminals OPB and CG of DLC3 until the procedure is finished.
- 12) Idle the engine to raise the transmission fluid temperature.
- 13) Immediately after the shift position indicator light “D” light turns on, lift the vehicle up.
 - The shift position indicator light “D” will indicate the ATF temperature according to the following table. (Insert table here)

ATF Temp.	Less than Optimized Temp.	Optimized Temp.	More than Optimized Temp.
Shift Position Indicator Light “D”	Turn OFF	Turn ON	Blinking

(Continued)

- 14) Remove the overflow plug and adjust oil quantity.
 - If the ATF overflows, go to step 17, and if the ATF does not overflow, go to step 15.
- 15) Remove the refill plug.
- 16) Add ATF to the refill plug hole until it flows out from the overflow plug hole.
- 17) When the ATF flow slows to a trickle, install the overflow plug and a new gasket.
- 18) Install the refill plug (if the refill plug was removed).
- 19) Lower the vehicle down.
- 20) Turn the ignition switch OFF to stop the engine.

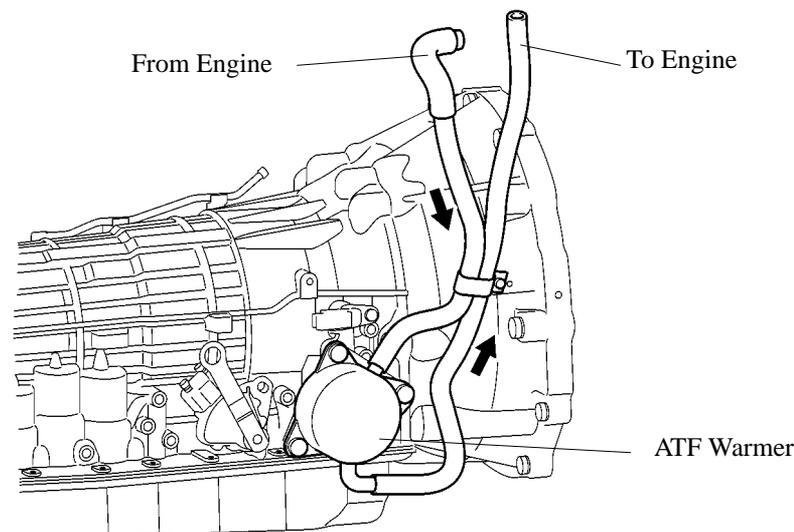
For details about ATF Filling procedures, see the 2006 LEXUS IS350/250 Repair Manual (Pub. No. RM0140U).

■ ATF WARMER

General

An ATF warmer is used for the purpose of warming up the ATF quickly and to keep the ATF temperature higher (within limits). As a result, fuel economy has been improved.

► Layout of Component ◀



281CH13

Operation

1) During warm-up

The engine coolant flows directly from the engine to the ATF warmer in order to warm up the ATF quickly even before the engine thermostat opens. Consequently, the friction losses of the automatic transmission are quickly reduced, thus improving fuel economy.

2) After warm-up

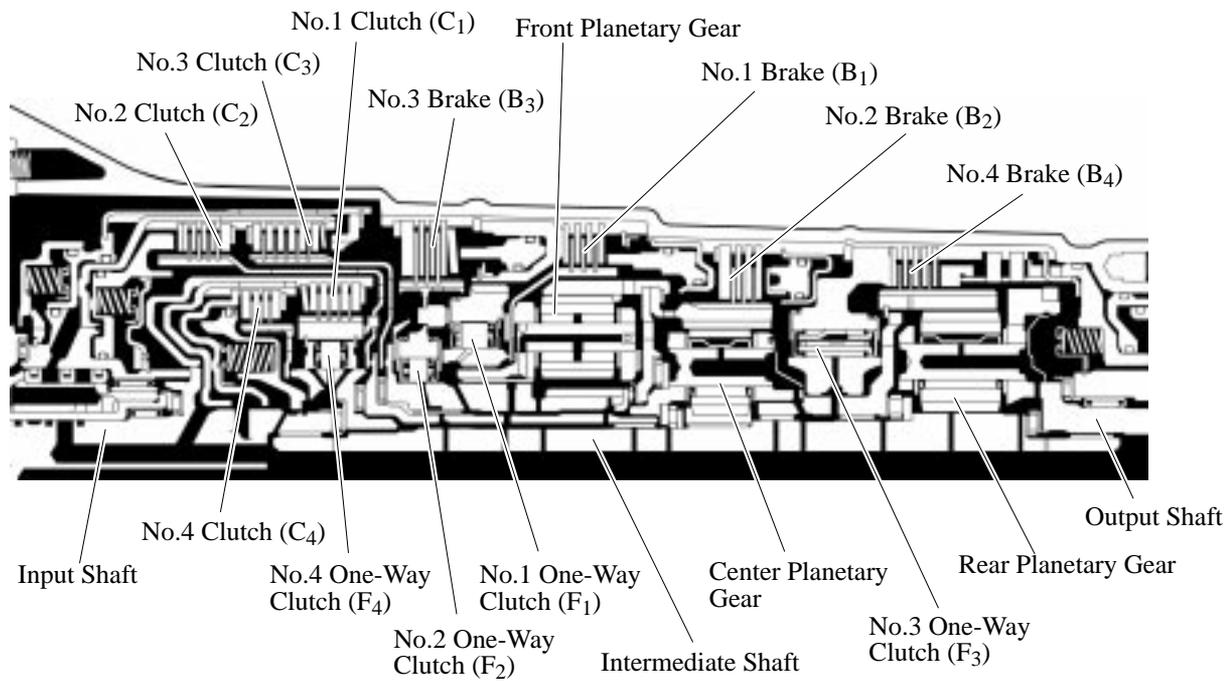
The engine coolant that flows through the ATF warmer will help to limit the ATF temperature increase.

■ PLANETARY GEAR UNIT

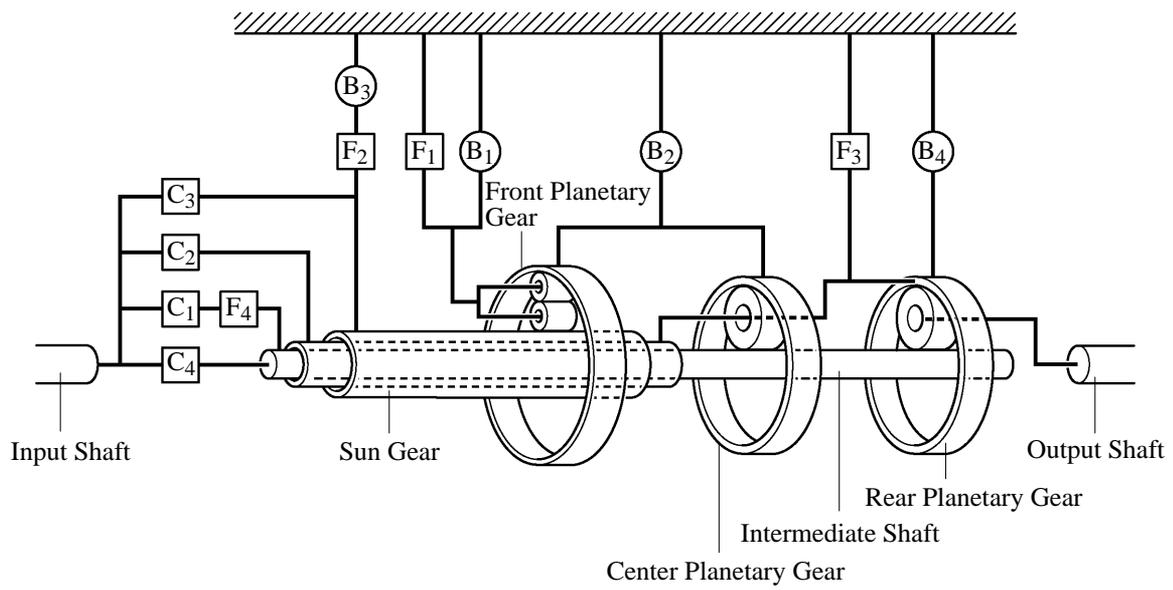
1. Construction

The planetary gear unit consists of three planetary gear units, four clutches, four brakes, and four one-way clutches.

- A centrifugal fluid pressure canceling mechanism is used in the C₁, C₂, C₃, and C₄ clutches that are applied when shifting 2nd → 3rd, 3rd → 4th, 4th → 5th, and 5th → 6th. For details, refer to page CH-66.



0140CH22Z



259LSK08

2. Function of Component

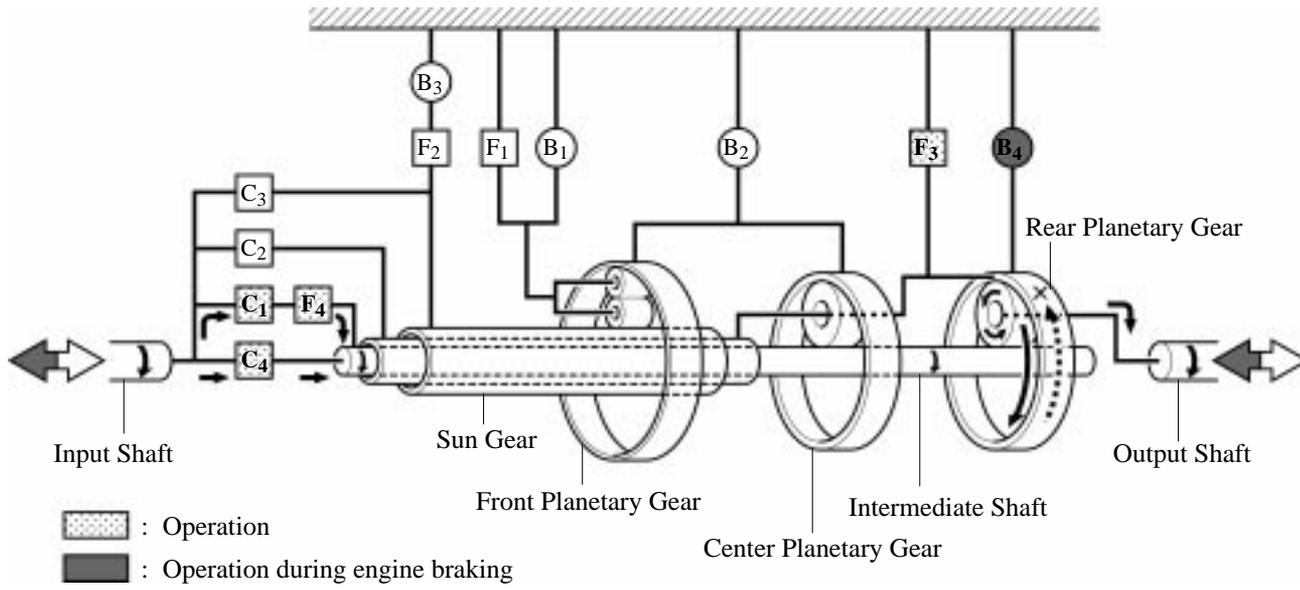
Component		Function
C ₁	No.1 Clutch	Connects the input shaft, F ₄ and intermediate shaft.
C ₂	No.2 Clutch	Connects the input shaft and center planetary carrier.
C ₃	No.3 Clutch	Connects the input shaft and sun gear.
C ₄	No.4 Clutch	Connects the input shaft and intermediate shaft.
B ₁	No.1 Brake	Prevents the front planetary carrier from turning either clockwise or counterclockwise.
B ₂	No.2 Brake	Prevents the front and the center ring gear from turning either clockwise or counterclockwise.
B ₃	No.3 Brake	Prevents outer race of F ₂ from turning both clockwise and counterclockwise.
B ₄	No.4 Brake	Prevents center planetary carrier and the rear ring gear from turning either clockwise or counterclockwise.
F ₁	No.1 One-Way Clutch	Prevents the front planetary carrier from turning counterclockwise.
F ₂	No.2 One-Way Clutch	When B ₃ is operating, the one way clutch prevents the front sun gear from turning counterclockwise.
F ₃	No.3 One-Way Clutch	Prevents the center planetary carrier and the rear ring gear from turning counterclockwise.
F ₄	No.4 One-Way Clutch	Prevents the intermediate shaft from turning counterclockwise.
Planetary Gears		These gears change the route through which driving force is transmitted, in accordance with the operation of each clutch and brake, in order to increase or reduce the output shaft speed.

3. Transmission Power Flow

Shift Lever Position	Solenoid Valve								Clutch				Brake				One-way Clutch				
	S1	S2	S3	S4	SR	SL1	SL2	SLU	C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄	
P		ON	ON		ON		ON														
R*		ON	ON		ON		ON				○		○			○	○				
N		ON	ON		ON		ON														
D, S6	1st		ON	ON		ON		ON	○			○							○	○	
	2nd	ON	ON	ON		ON		ON	ON	○		○			○		○	○			○
	3rd	ON		ON		ON		ON	ON	○	○	○			●		○				○
	4th*	ON				ON		ON	ON	○	○	●	○		●						○
	5th*	ON			ON		ON		ON	●	○	○		○		●					
	6th*	ON	ON		ON		ON		ON	●	○			●	○	●					
S5	1st		ON	ON		ON		ON	○			○							○	○	
	2nd	ON	ON	ON		ON		ON	ON	○		○			○		○	○			○
	3rd	ON		ON		ON		ON	ON	○	○	○			●		○				○
	4th*	ON				ON		ON	ON	○	○	●	○		●						○
	5th*	ON			ON		ON		ON	●	○	○		○		●					
S4	1st		ON	ON		ON		ON	○			○							○	○	
	2nd	ON	ON	ON		ON		ON	ON	○		○			○		○	○			○
	3rd	ON		ON		ON		ON	ON	○	○	○			●		○				○
	4th*	ON				ON		ON	ON	○	○	●	○		●						○
S3	1st		ON	ON		ON		ON	○			○							○	○	
	2nd	ON	ON	ON		ON		ON	○			○			○		○	○			○
	3rd*	ON		ON		ON			○		○	○	(○)		●		○				○
S2	1st		ON	ON		ON		ON	○			○							○	○	
	2nd*	ON	ON	ON	ON	ON			○			○		(○)	○		○	○			○
S1	1st*		ON	ON		ON			○			○				(○)			○	○	

○: Operation ●: Operate but is not related to power transmission
 (○): Operation during engine braking *: with Engine Brake

1st Gear (D Position or S Mode)

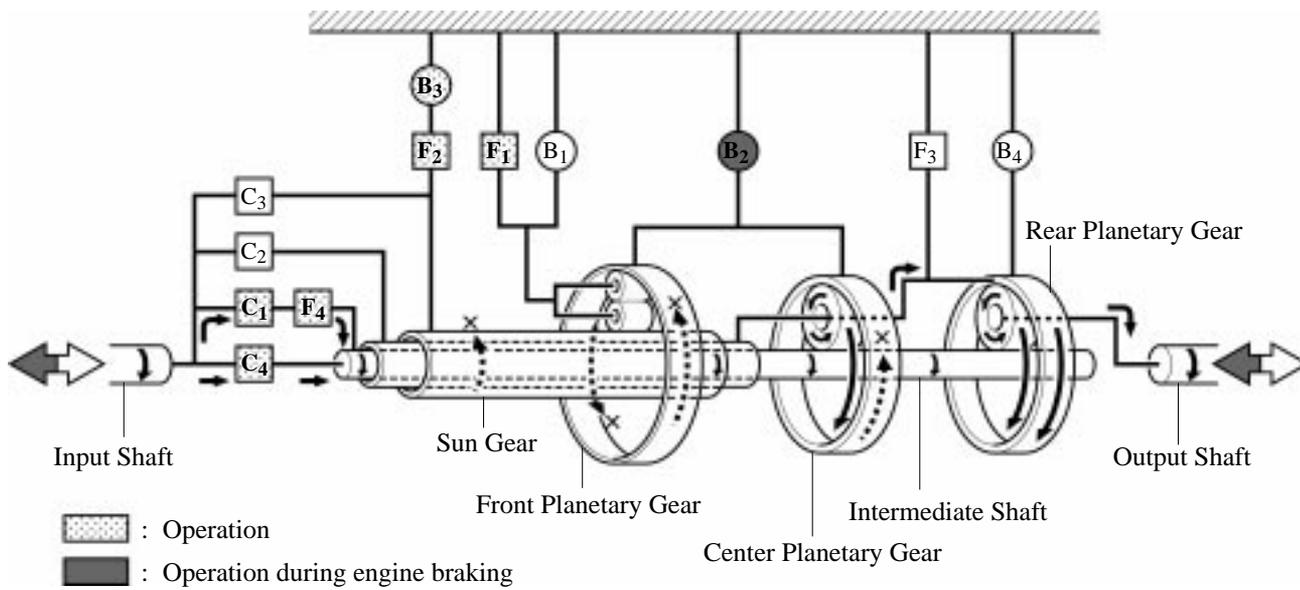


040SC03C

C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄
○			○				(○)			○	○

○: Operation (○): Operation during engine braking (only in the S mode [1st])

2nd Gear (D Position or S Mode)

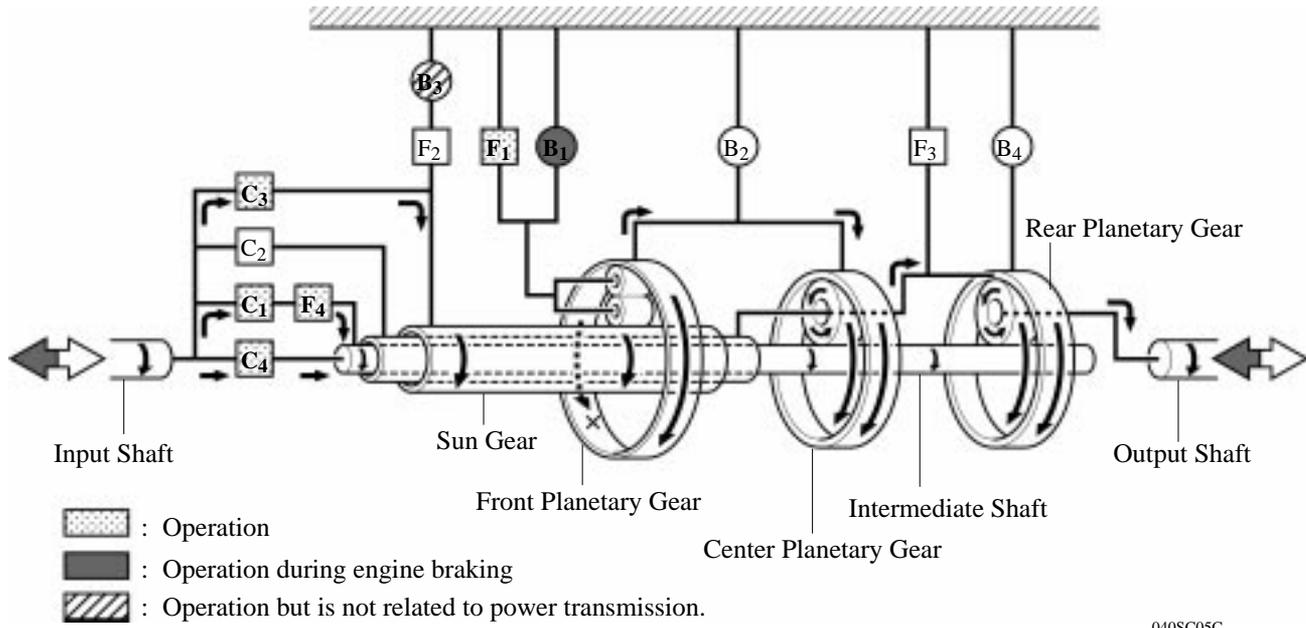


040SC04C

C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄
○			○		(○)	○		○	○		○

○: Operation (○): Operation during engine braking (only in the S mode [2nd])

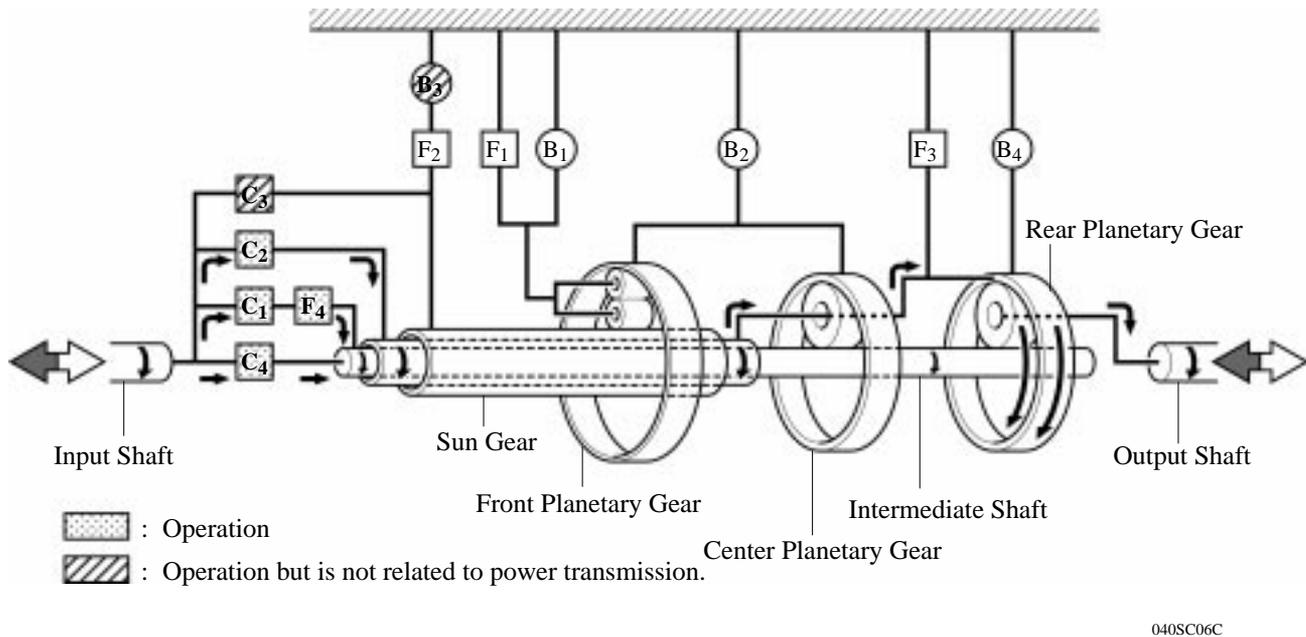
3rd Gear (D Position or S Mode)



C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄
○		○	○	(○)		Δ		○			○

○: Operation (○): Operation during engine braking (only in the S mode [3rd])
 Δ: Operation but is not related to power transmission

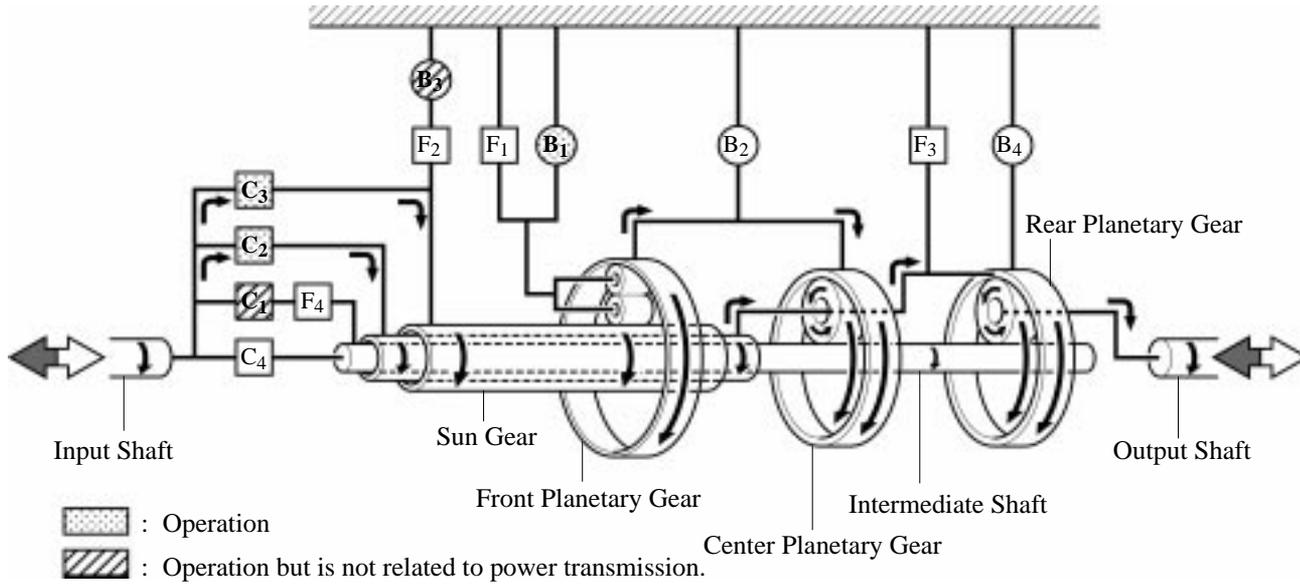
4th Gear (D Position or S Mode)



C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄
○	○	Δ	○			Δ					○

○: Operation Δ: Operation but is not related to power transmission

5th Gear (D Position or S Mode)

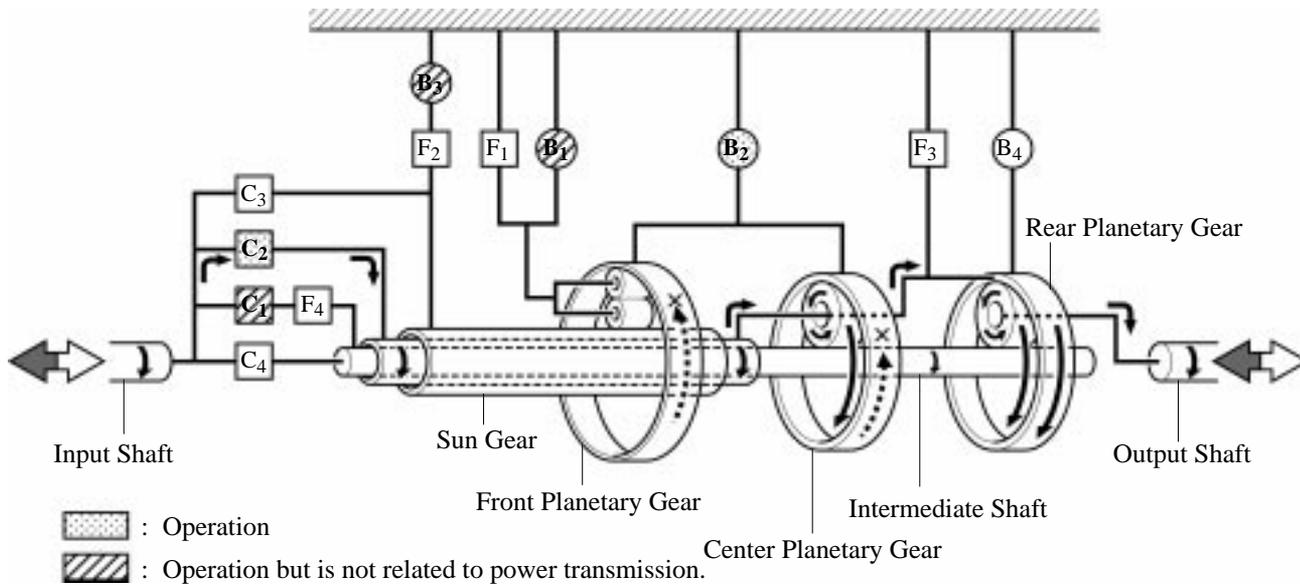


040SC07C

C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄
Δ	○	○		○		Δ					

○: Operation Δ: Operation but is not related to power transmission

6th Gear (D Position or S Mode)

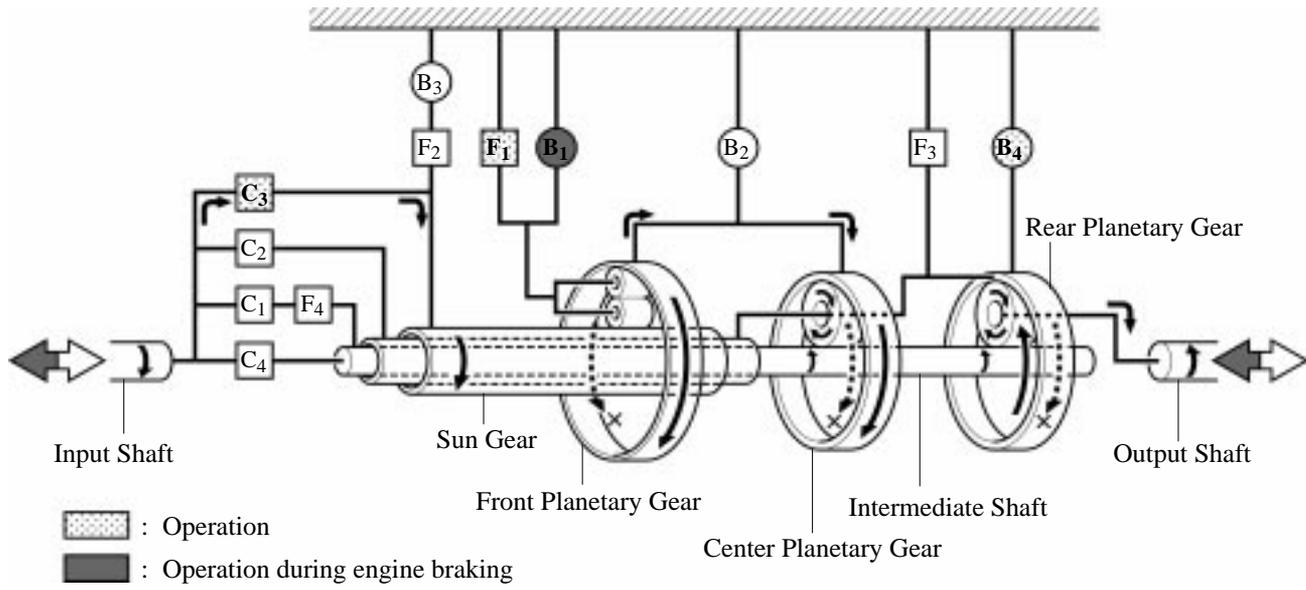


040SC08C

C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄
Δ	○			Δ	○	Δ					

○: Operation Δ: Operation but is not related to power transmission

Reverse (R Position)



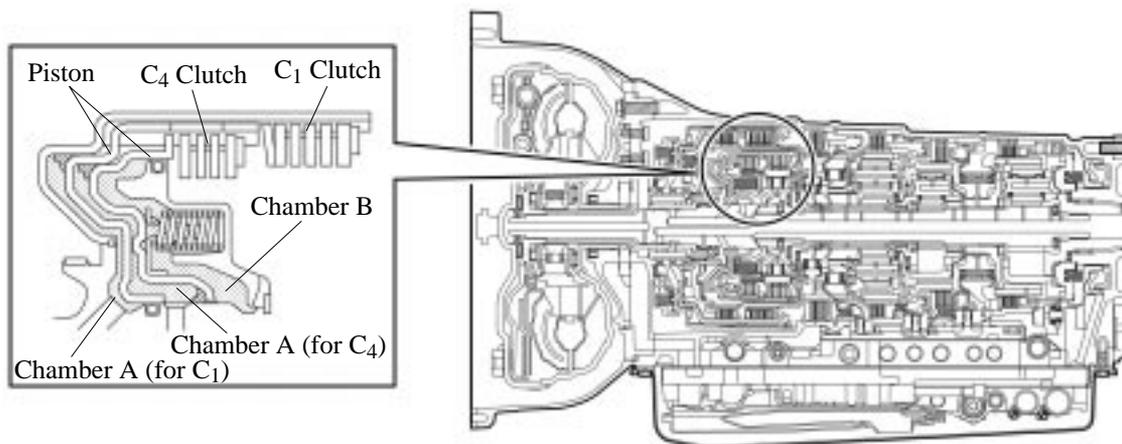
C ₁	C ₂	C ₃	C ₄	B ₁	B ₂	B ₃	B ₄	F ₁	F ₂	F ₃	F ₄
		○		(○)			○	○			

○: Operation (○): Operation during engine braking

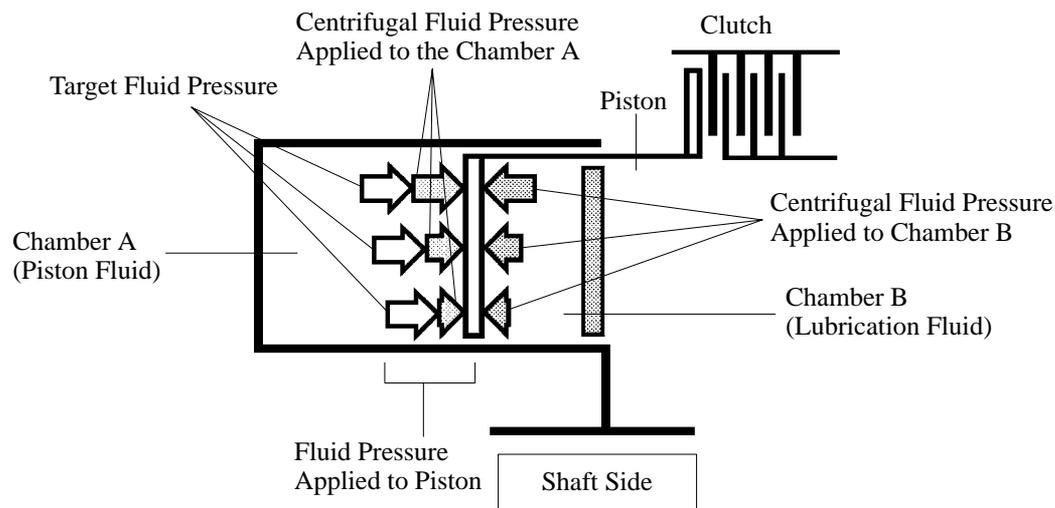
4. Centrifugal Fluid Pressure Canceling Mechanism

For the following reason, the centrifugal fluid pressure canceling mechanism is used on C₁, C₂, C₃, and C₄ clutch.

- Clutch shifting operation is affected not only by the valve body controlling fluid pressure but also by centrifugal fluid pressure that is present due to fluid in the clutch piston oil pressure chamber. The centrifugal fluid pressure canceling mechanism has chamber B to reduce this affect applied to the chamber A. As a result, smooth shifting with excellent response has been achieved.



0140CH23Z



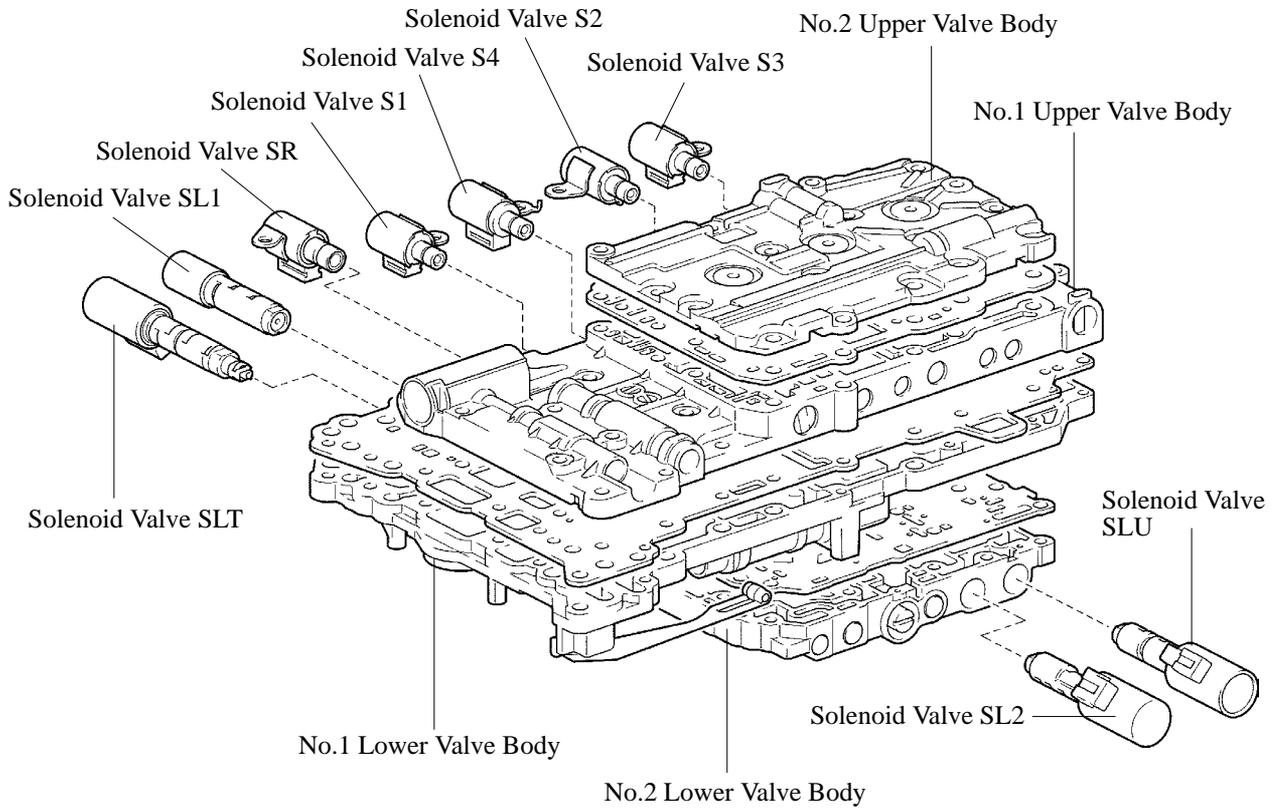
157CH17

Fluid pressure applied to piston	—	Centrifugal fluid pressure applied to chamber B	=	Target fluid pressure (original clutch pressure)
----------------------------------	---	---	---	--

■ VALVE BODY UNIT

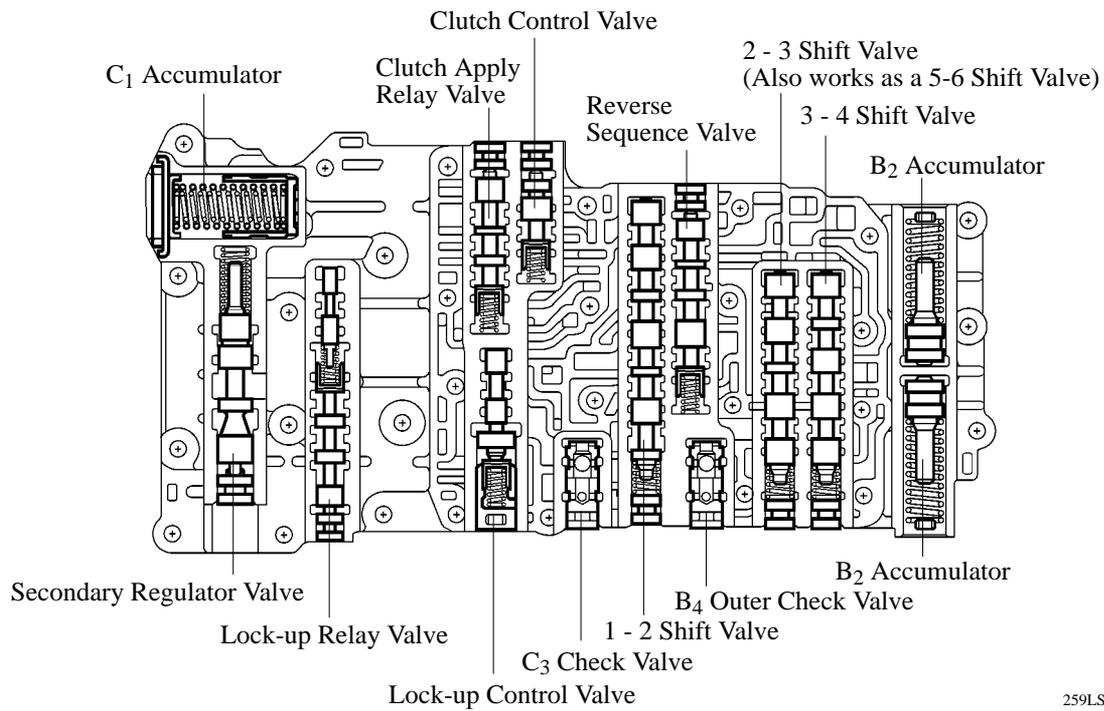
1. General

The valve body consists of the upper (No.1 and No.2) and lower (No.1 and No.2) valve bodies and 9 solenoid valves.



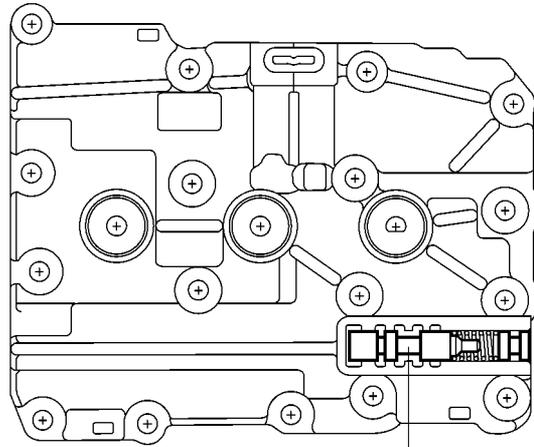
259LSK76

► No.1 Upper Valve Body ◀



259LSK74

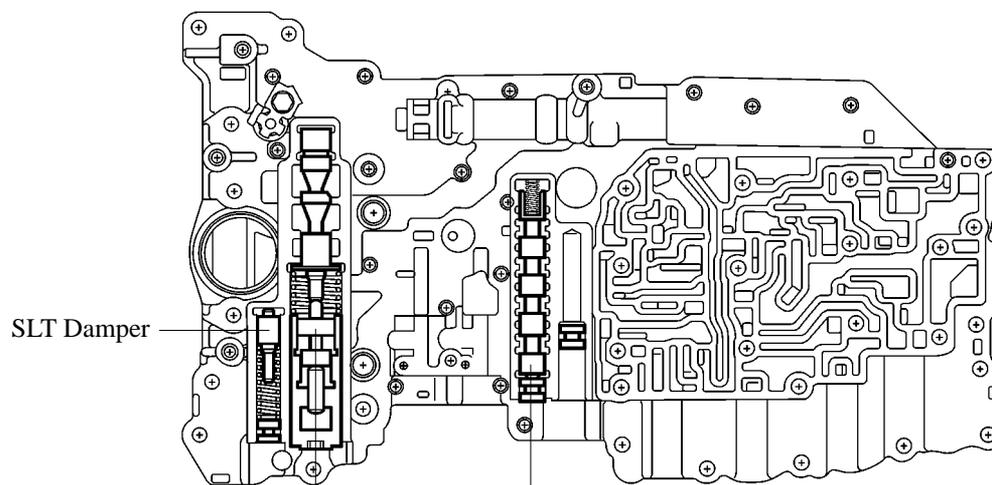
► No.2 Upper Valve Body ◀



C₃ Apply Relay Valve

259LSK72

► No.1 Lower Valve Body ◀



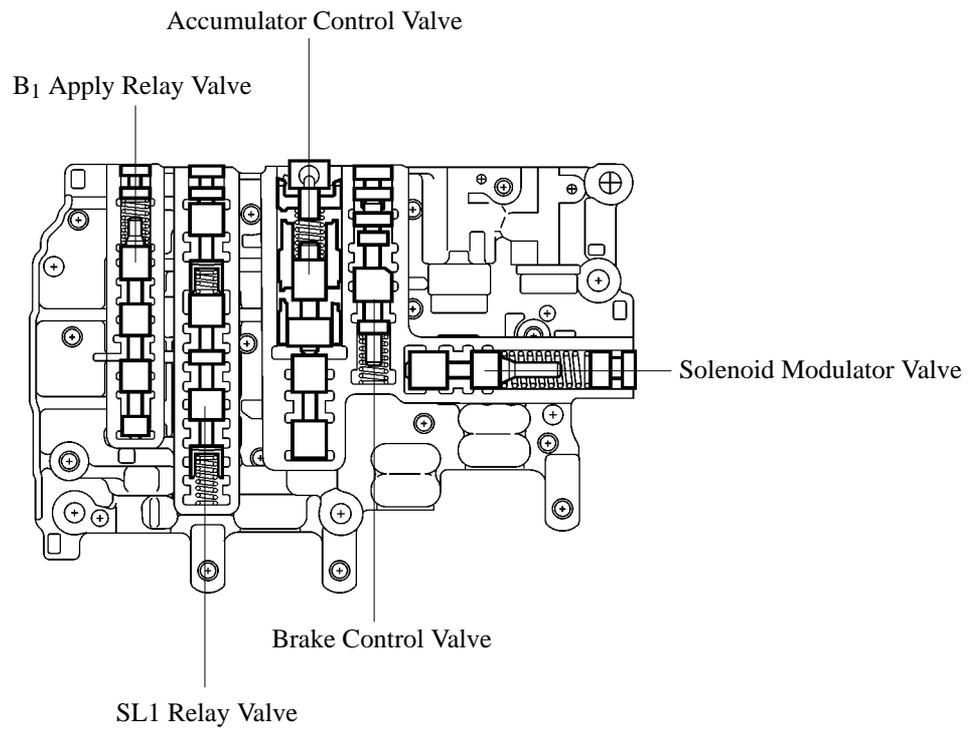
SLT Damper

4 - 5 Shift Valve

Primary Regulator Valve

259LSK73

► No.2 Lower Valve Body ◀



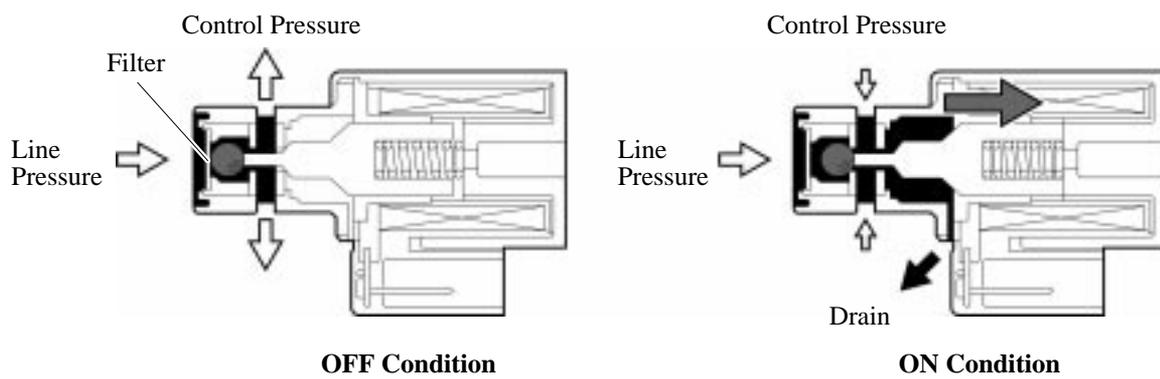
2. Solenoid Valve

Solenoid Valve S1, S2, S3, S4 and SR

1) General

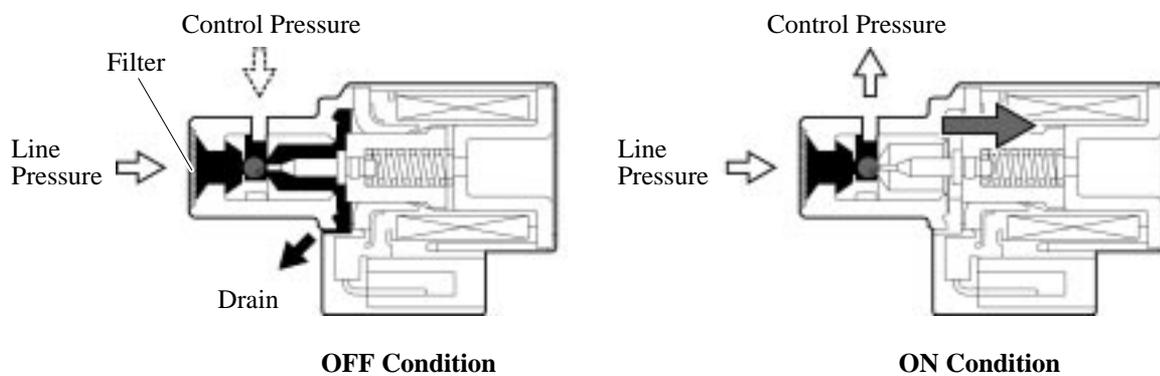
These solenoid valves are 3-way solenoid valves. A filter is provided at the tip of the solenoid valve to further improve operational reliability.

► Solenoid Valve S1, S2, S3 and SR ◀



040SC10C

► Solenoid Valve S4 ◀



040SC11C

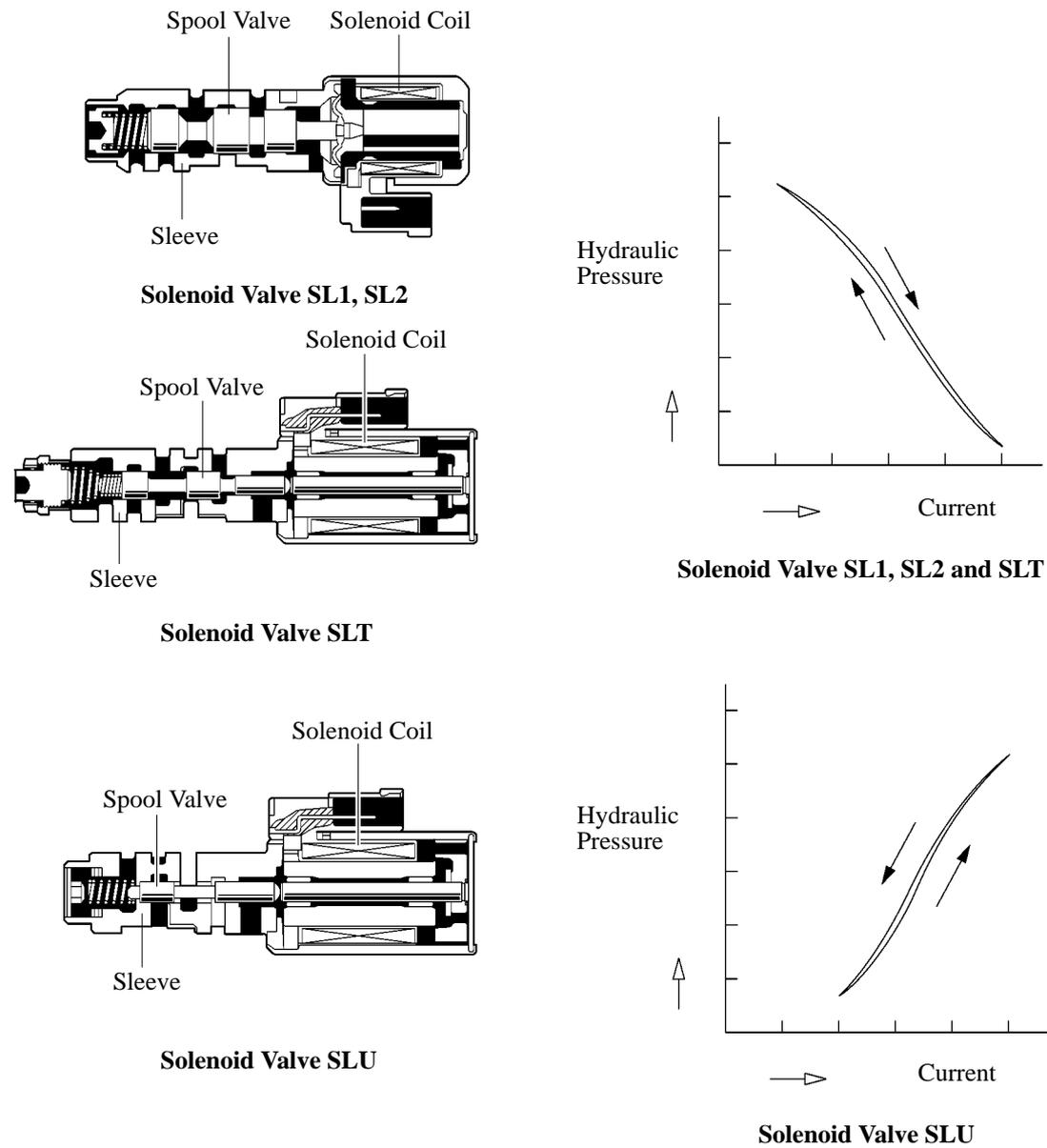
2) Function of Solenoid Valve S1, S2, S3, S4 and SR

Solenoid Valve	Type	Function
S1	3-way	<ul style="list-style-type: none"> • Switches the 1-2 shift valve. • Switches the SL1 relay valve.
S2	3-way	<ul style="list-style-type: none"> • Switches the 2 - 3 shift valve. • Switches the 5 - 6 shift valve.
S3	3-way	Switches the 3 - 4 shift valve.
S4	3-way	<ul style="list-style-type: none"> • Switches the 4 - 5 shift valve. • Switches the SL1 relay valve. • Switches the reverse sequence valve.
SR	3-way	<ul style="list-style-type: none"> • Switches the clutch apply relay valve. • Switches the B₁ relay valve.

Solenoid Valve SL1, SL2, SLT and SLU

1) General

In order to provide a hydraulic pressure that is in proportion to current that flows to the solenoid coil, the solenoid valve SL1, SL2, SLT, and SLU linearly controls the line pressure and clutch and brake engagement pressure based on the signals received from the Engine CPU.



259LSK16

2) Function of Solenoid Valve SL1, SL2, SLT and SLU

Solenoid Valve	Function
SL1	<ul style="list-style-type: none"> • Clutch pressure control • Accumulator back pressure control
SL2	Brake pressure control
SLT	<ul style="list-style-type: none"> • Line pressure control • Accumulator back pressure control
SLU	<ul style="list-style-type: none"> • Lock-up clutch pressure control