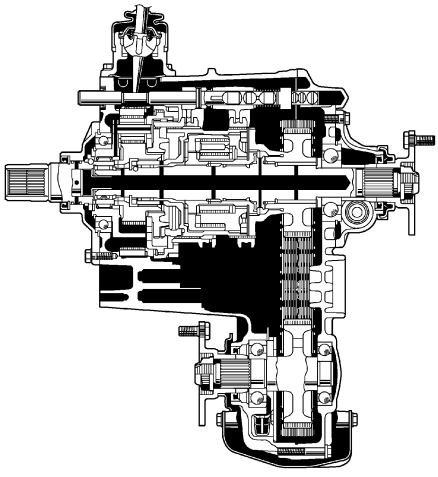
■VF4B AND VF4BM TRANSFERS

1. General

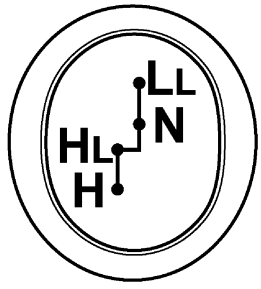
- The VF4B and VF4BM transfers have been newly developed. These transfers are a compact and lightweight full-time transfer.
- The center differential in these transfers uses a TORSEN LSD. As a result, this LSD ensures the proper stability during acceleration and high-speed driving.
- In these transfers, a planetary gear train is used in the reduction mechanism and a silent chain is used to reduce noise for the front drive. The basic construction and operation of the planetary gear train is the same as in the VF2A, VF3B, and VF3BM transfers on the previous Land Cruiser/Land Cruiser Prado. For details, see page CH-26.
- The major difference between the VF4B and VF4BM transfers is in the method for switching the center differential lock. On the VF4B transfer, the switching is performed manually by operating the transfer shift lever. On the VF4BM transfer, the switching is effected by the center differential lock ECU, which actuates the shift actuator motor in accordance with the operation of the center differential lock switch. For details, see page CH-37.

▶ VF4B Transfer ◀



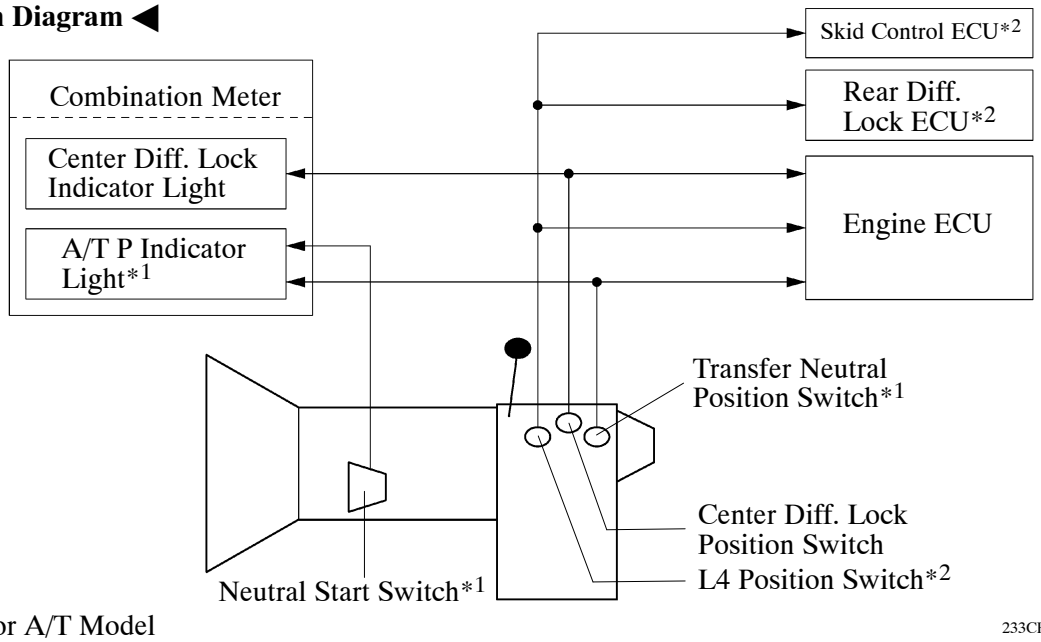
233CH23

▶ Shift Pattern ◀



233CH24

▶ System Diagram ◀



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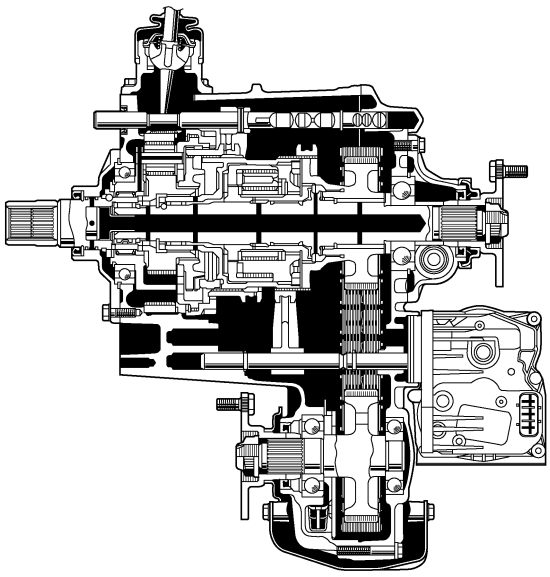
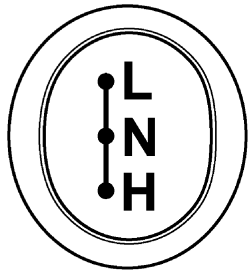
*1: Only for A/T Model
*2: for A/T, with Rear Diff. lock or with Brake Control (ABS with EBD)

▶ VF4BM Transfer ◀



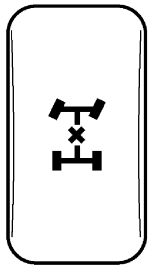
233CH26

▶ Shift Pattern ◀



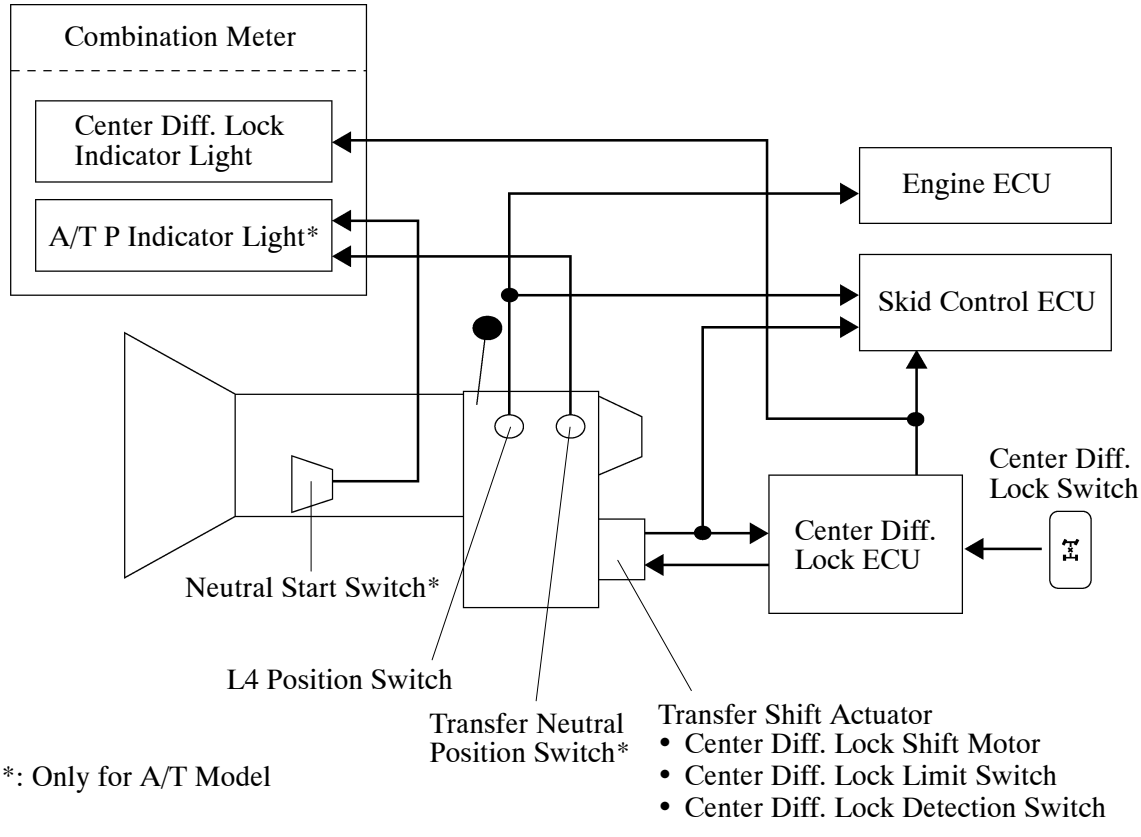
233CH27

▶ Center Diff. Lock Switch ◀



233CH28

▶ System Diagram ◀



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2. Specification

The following specification describes the changes of the specification from VF3B and VF3BM transfers on the previous Land Cruiser/ Land Cruiser Prado to VF4B and VF4BM transfers on the new Land Cruiser/ Land Cruiser Prado.

Model		New	Previous	New	Previous
Transfer Type		VF4B	VF3B	VF4BM	VF3BM
Drive Type		Full-Time	←	←	←
Engine Type		3RZ, 1KZ, 1KD	3RZ, 5VZ, 1KZ	1KZ*2, 1KD	1KD
Gear Ratio	H4	1.000	←	←	←
	L4	2.566	←	←	←
Reduction Gear Type		Single Pinion Planetary Gear	←	←	←
Center Differential Gear Type		TORSEN LSD	Double Pinion Planetary Gear	TORSEN LSD	Double Pinion Planetary Gear
Oil Capacity Liters (US qts, Imp.qts)		1.4 (1.5, 1.3)	1.2 (1.3, 1.1)	1.4 (1.5, 1.3)	1.2 (1.3, 1.1)
Oil Viscosity		SAE 75W-90	←	←	←
Oil Grade		API GL-5	API GL-3	API GL-5	API GL-3
Weight (Reference)*1 kg (lb)		39 (86.0)	43 (94.8)	39.6 (87.3)	43.2 (95.2)

*1: Weight shows the figure with the oil fully filled.
*2: Except General Countries

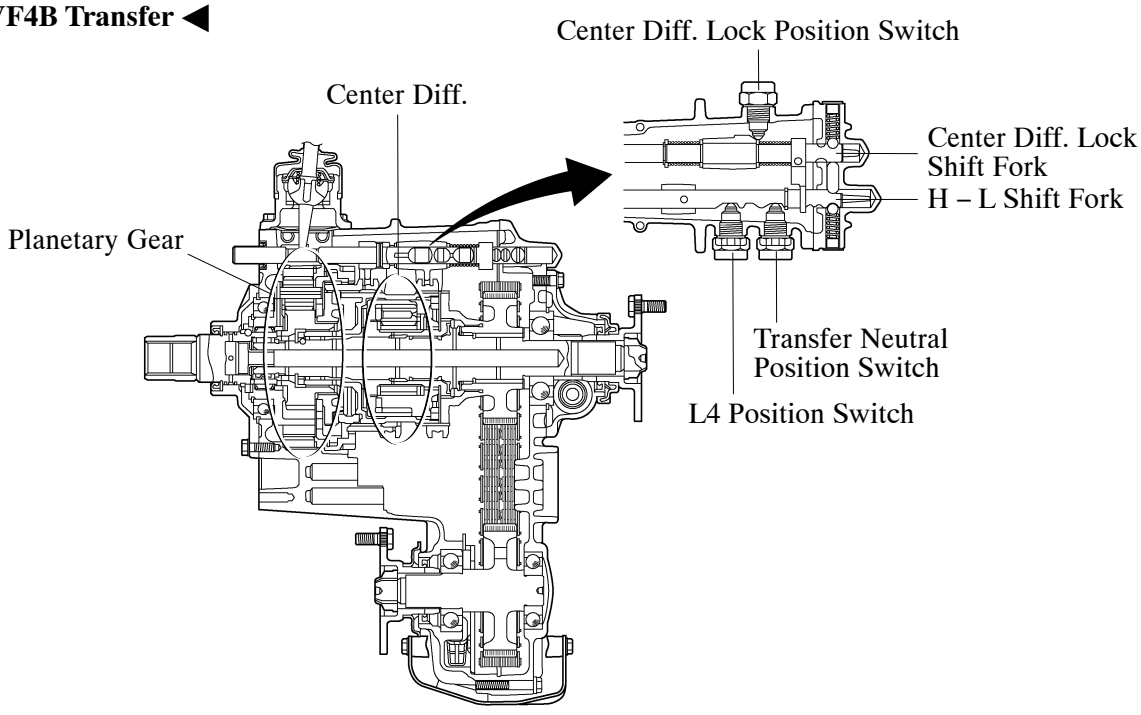
3. Construction

General

The construction of the transfer is shown below.

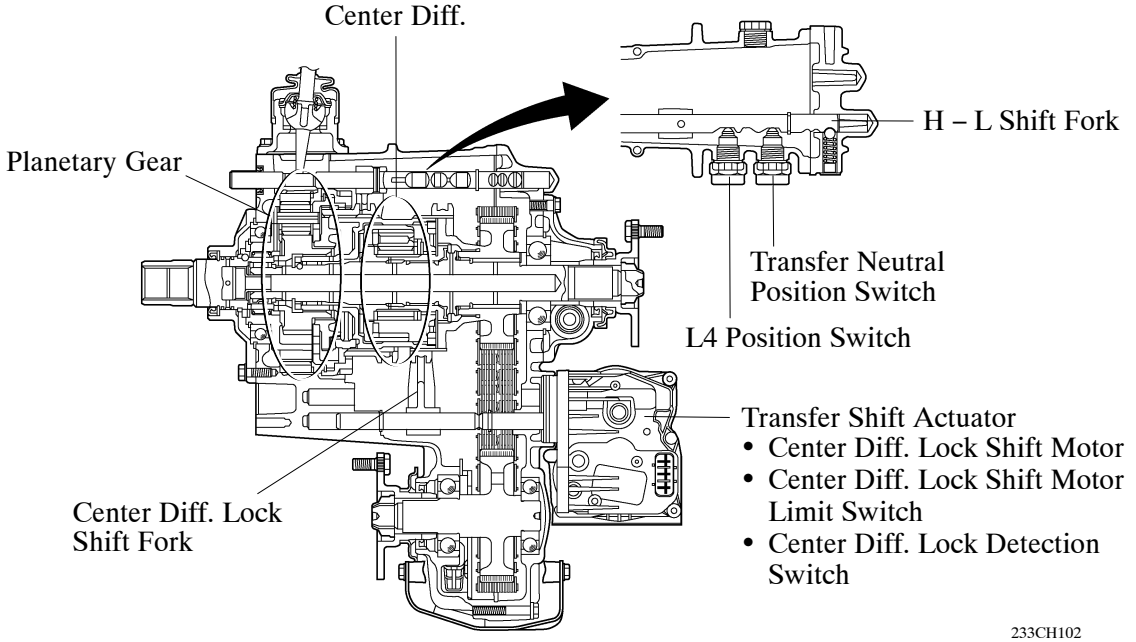
- The construction of the planetary gears is the same as the VF2A, VF3B, or VF3BM transfers on the previous Land Cruiser/ Land Cruiser Prado.
- The center differential uses a TORSEN LSD.
- On the VF4BM transfer, the transfer shift actuator, which contains center diff. lock shift motor and center differential lock position switch, cannot be disassembled.

▶ VF4B Transfer ◀



233CH30

▶ VF4BM Transfer ◀



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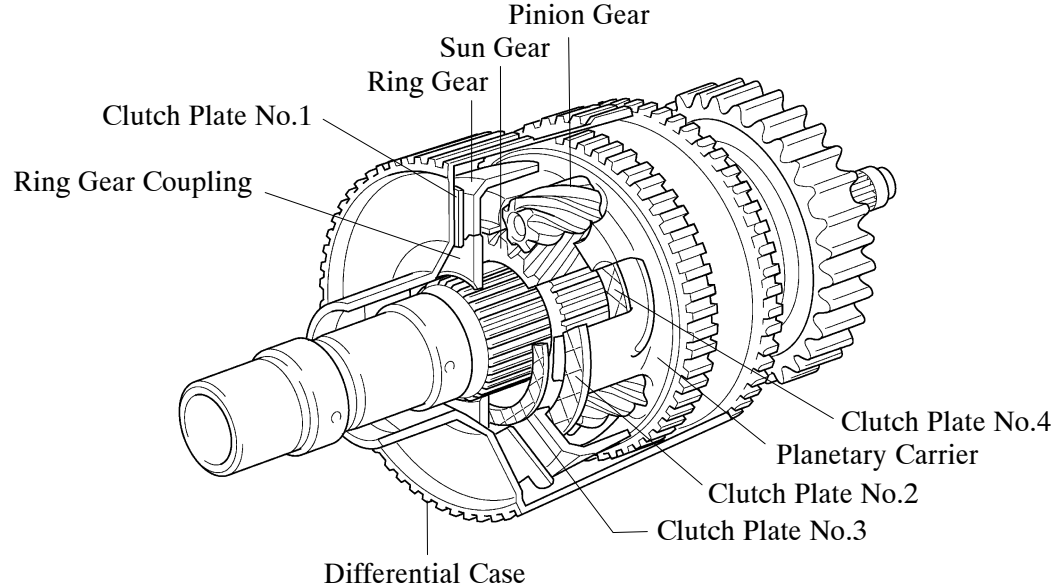
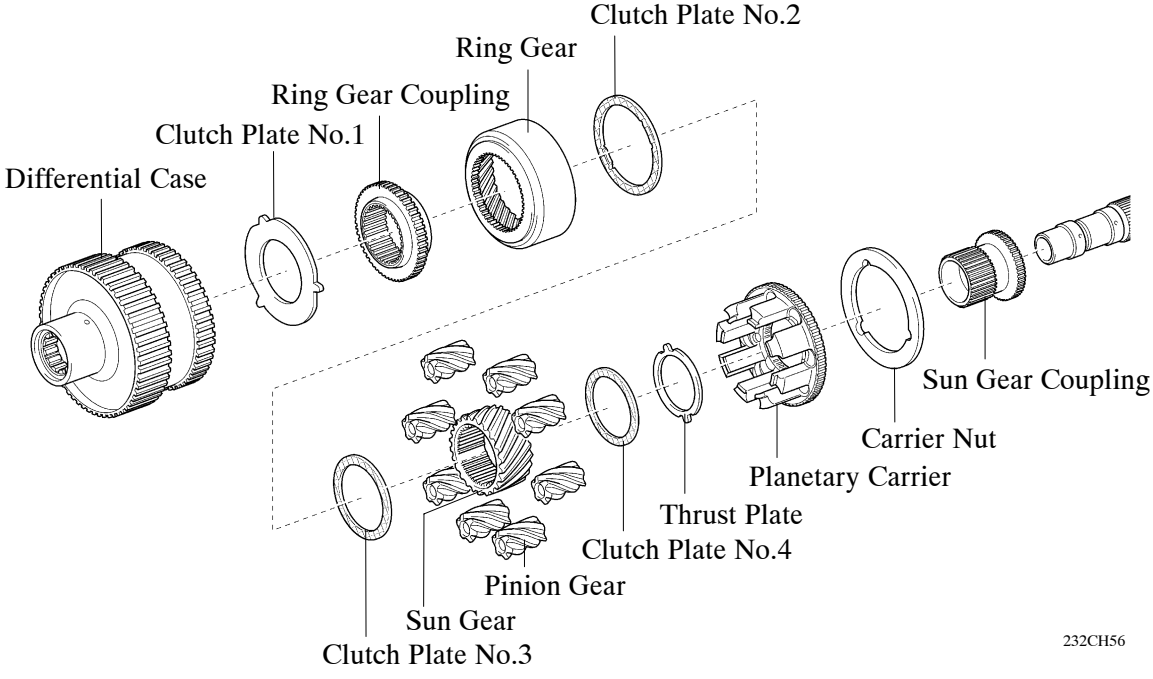
Center Differential (TORSEN LSD)

1) General

- The center differential uses a TORSEN LSD (Limited Slip Differential).
- The TORSEN LSD is a torque-sensing LSD. It generates a limited-differential torque in proportion to the drive torque, and instantly changes the front and rear torque distribution.
- The torque distribution during straightline driving is 40/60 (front/rear), which is helpful for an appropriate steering response during the initial stage of a turn. During the acceleration stage of a turn, the torque distribution increases the rear wheels.
- This center differential consists of a differential case, coupling, ring gear, 8 pinion gears, sun gear, and planetary carrier.



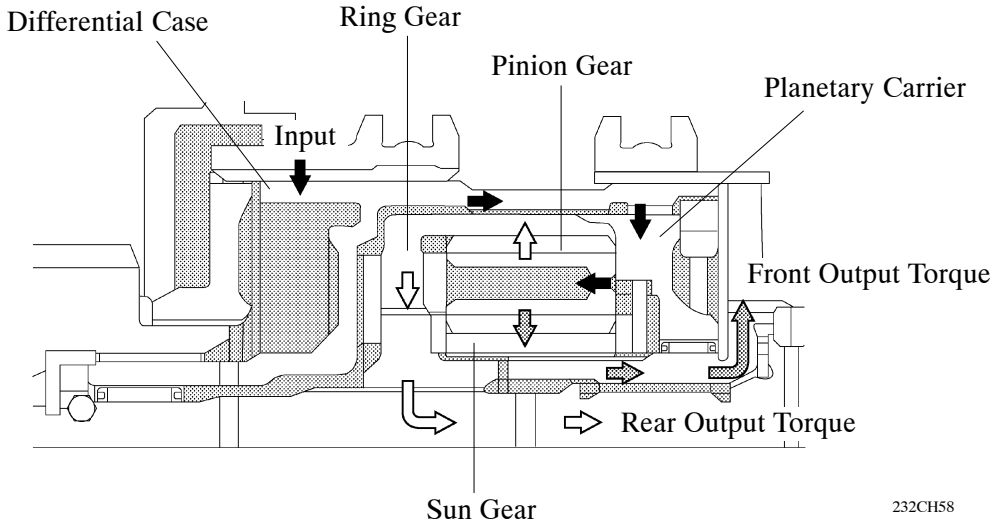


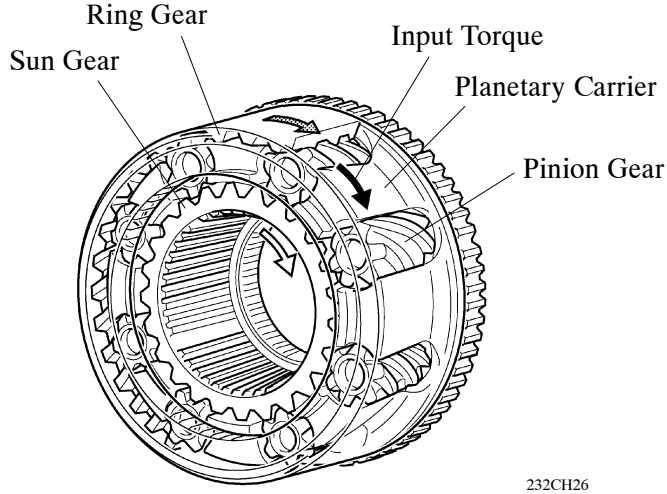
Service Tip

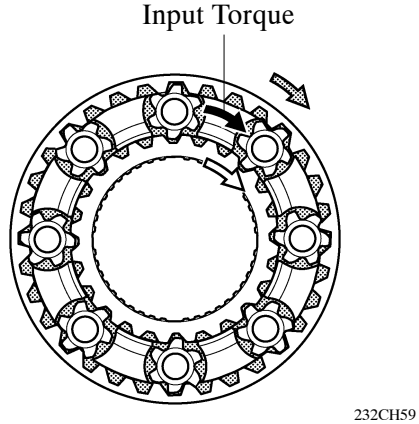
The TORSEN LSD cannot be disassembled, so it must be replaced as an assembly. For details, see the Land Cruiser/ Land Cruiser Prado Repair Manual (Pub. No. RM990E).

2) Normal Driving Operation

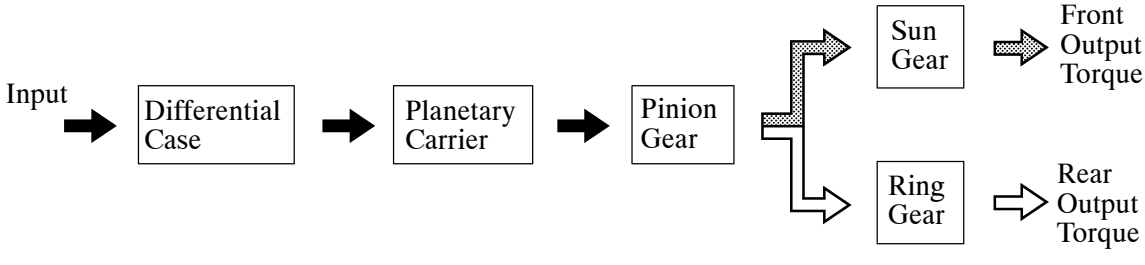
During normal driving (front wheel speed = rear wheel speed), the driving force that is input by the differential case is transmitted (Front: 40/ Rear: 60) as shown below, without involving the LSD function.







▶ Torque Transmission Path ◀



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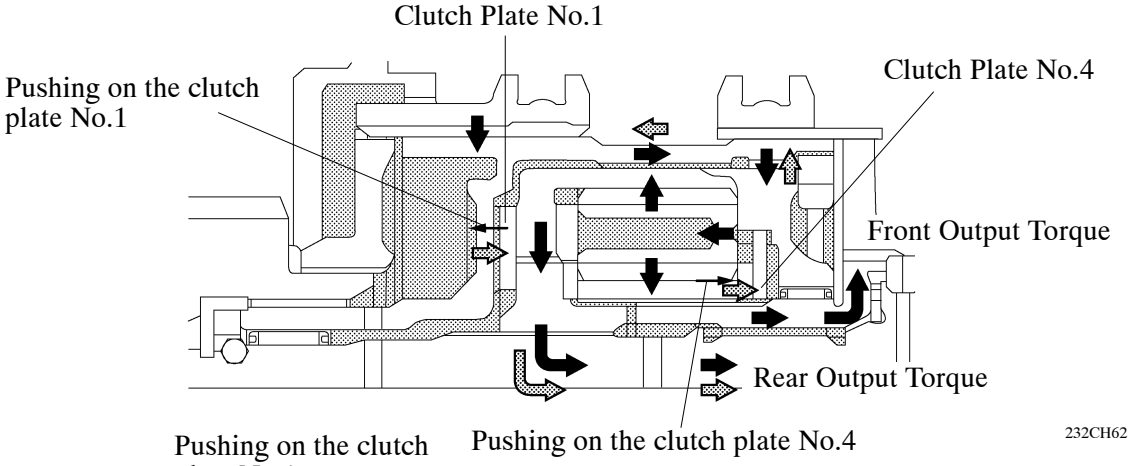
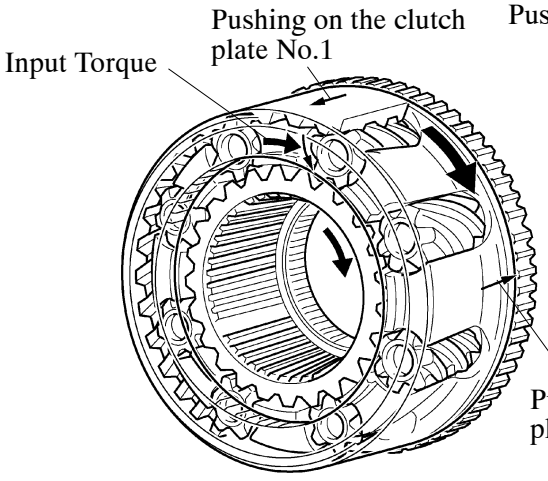
3) Front Wheel Skid Driving Operation

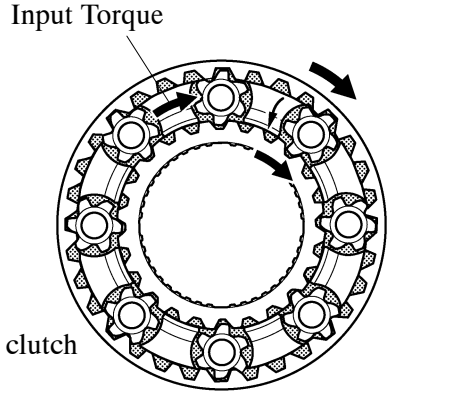
During front wheel skid driving (front wheel speed > rear wheel speed) when a rotational difference exists between the sun gear and the ring gear, the torque distribution of the driving force (torque) that is input by the differential case changes instantly before the torque is transmitted, as follows:

- The sun gear transmits torque to the planetary carrier while pushing on the clutch plate No.4. The planetary carrier transmits this torque to the ring gear from the differential case via the clutch plate No.1.
- The ring gear outputs torque while pushing on the clutch plate No.1.

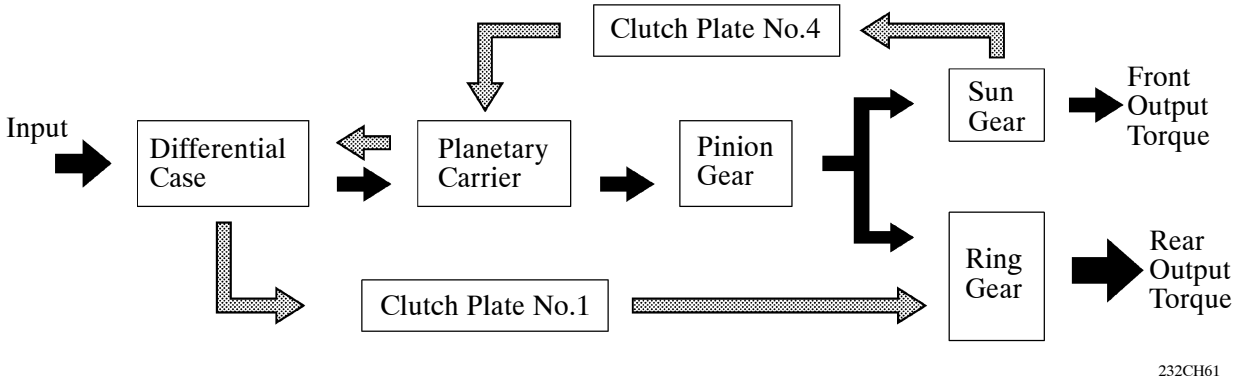
These LSD functions change the torque distribution.







▶ Torque Transmission Path ◀

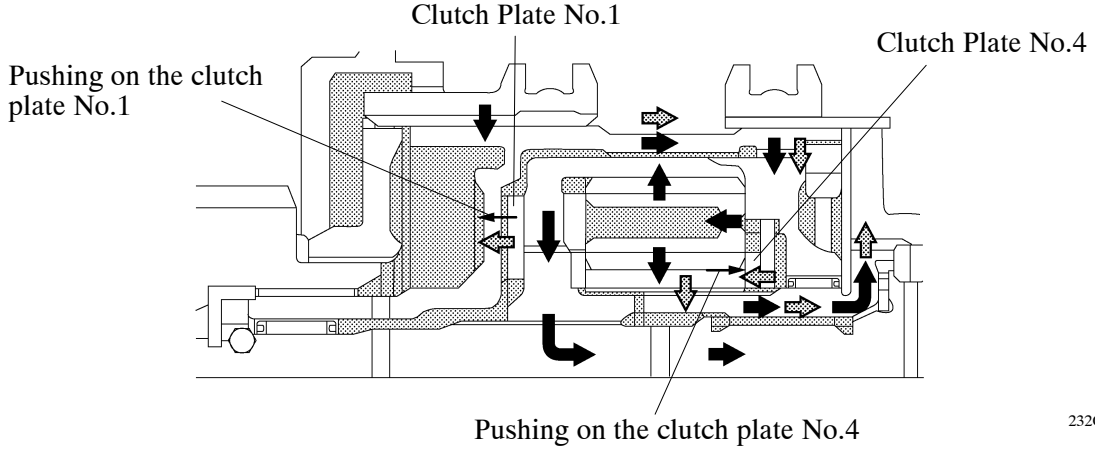


4) Rear Wheel Skid Driving Operation

During rear wheel skid driving (front wheel speed < rear wheel speed), when a rotational difference exists between the sun gear and the ring gear, the torque distribution of the driving force (torque) that is input by the differential case changes instantly before the torque is transmitted, as follows:

- The ring gear transmits torque to the differential case while pushing the clutch plate No.1. The differential case transmits this torque from the planetary carrier to the sun gear via the clutch plate No.4.
- The sun gear outputs torque while pushing on the clutch plate No.4.

These LSD functions change the torque distribution.



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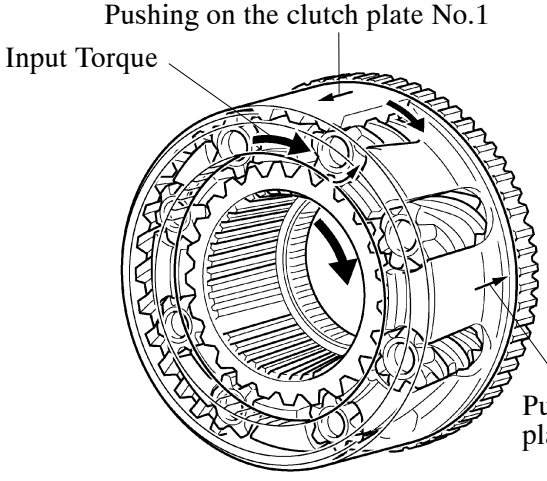
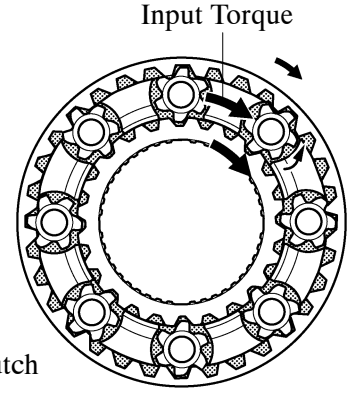
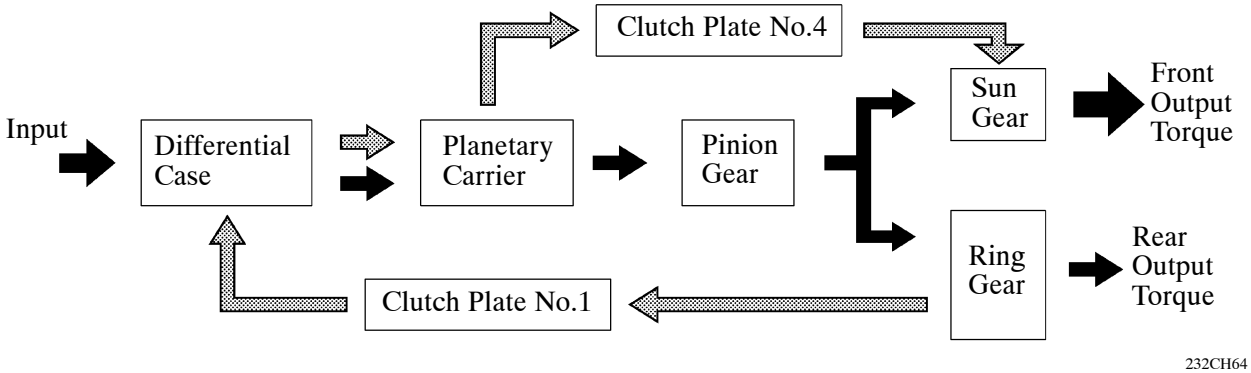


232CH65



232CH68

▶ Torque Transmission Path ◀

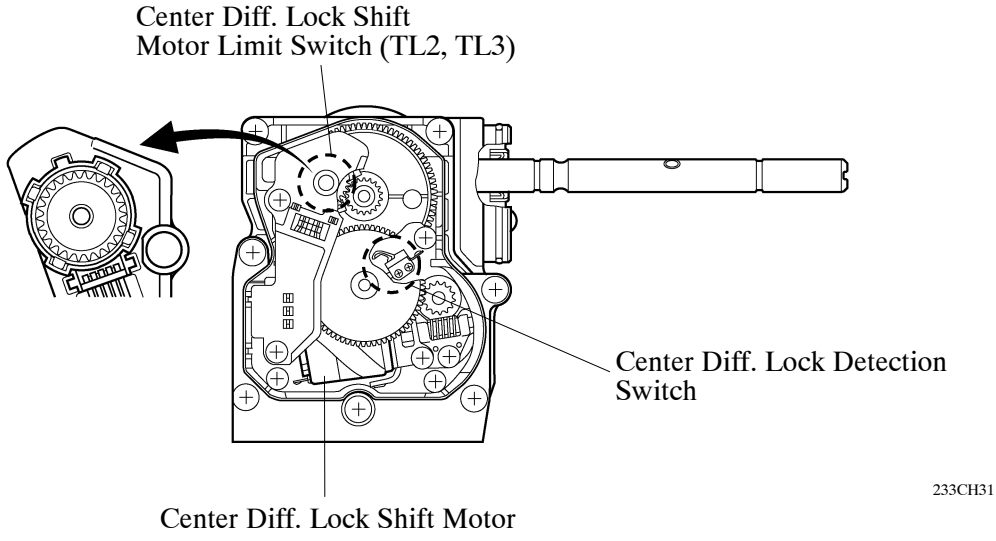


232CH64

4. Transfer Shift Actuator (only for VF4BM Transfer)

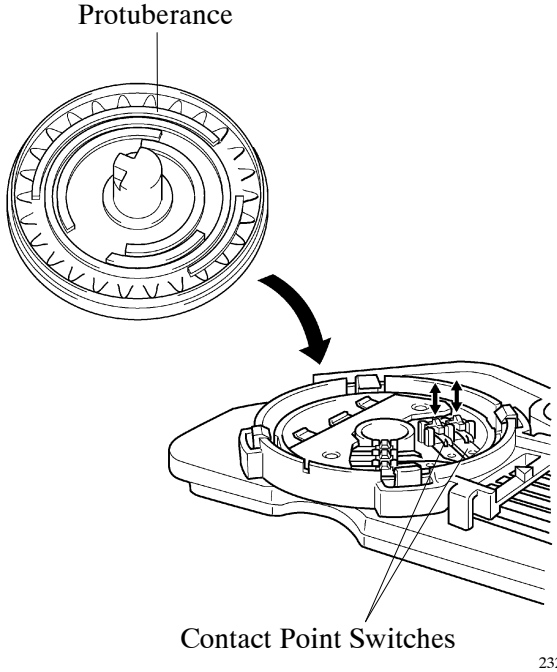
- The transfer shift actuator, which contains center diff. lock shift motor, center differential lock shift motor limit switch, and center diff. lock detection switch, cannot be disassembled.
- The limit switch has 2 contact points switch. 2 contact point switches contacted by protuberance and the combinations of 2 contact point switches have detected shift motor position (Center Diff Lock Condition).

▶ Cross Section of Transfer Shift Actuator ◀

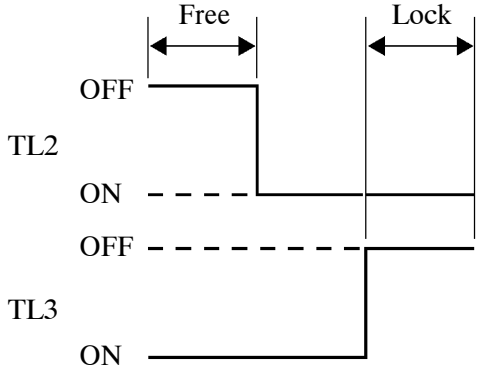


233CH31

▶ Limit Switch ◀



232CH152



Combinations of 2 Contact Point Switches

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