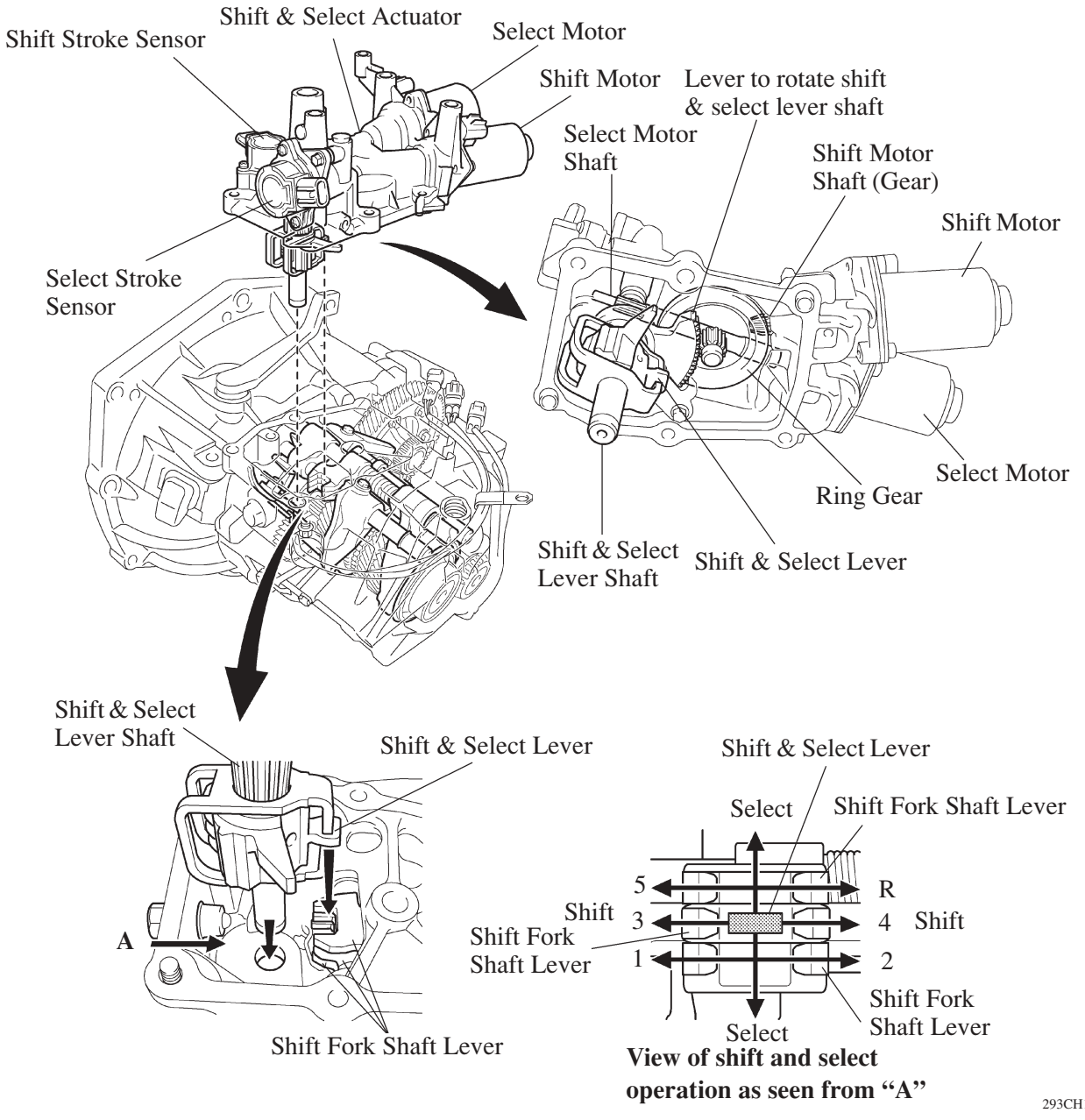
■CONSTRUCTION AND OPERATION

1. Shift & Select Actuator

General

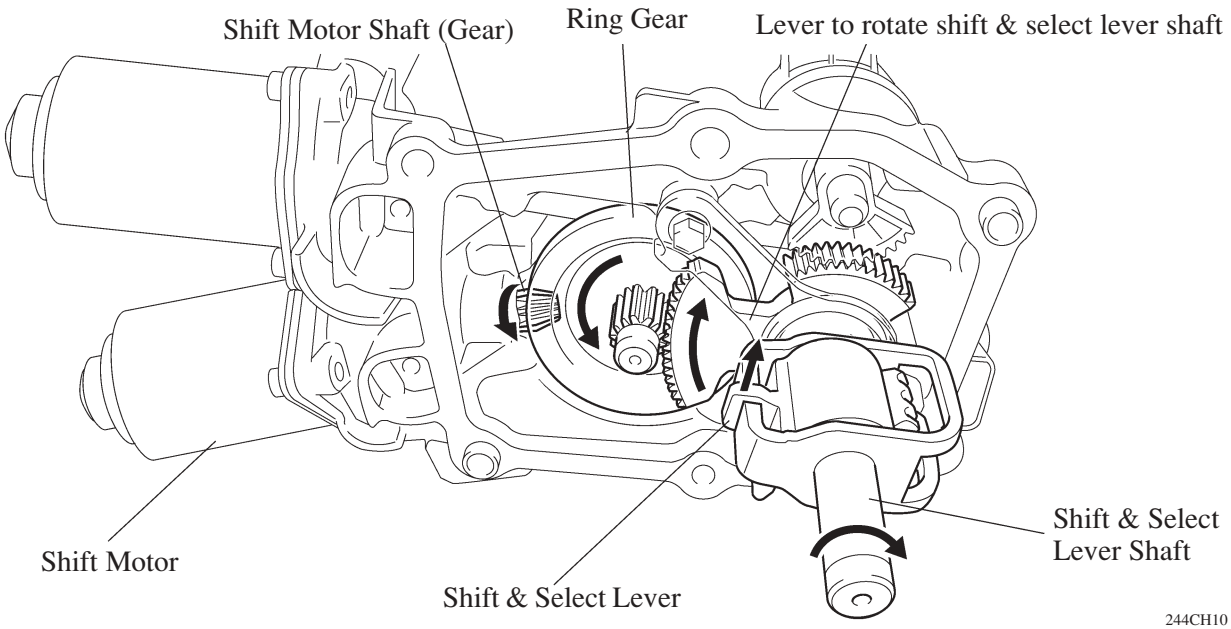
- The shift & select actuator consists of a shift motor, select motor, shift stroke sensor, select stroke sensor, and shift & select mechanism (shift & select lever, shift & select lever shaft, shift motor shaft, select motor shaft, ring gear, and a lever to rotate the shift & select lever shaft). This actuator cannot be disassembled.
- The rotation of the shift motor is transmitted to the reduction gears and the shift & select lever shaft and causes the shift & select lever to rotate.
- The rotation of the select motor is transmitted to the rack & pinion gear and the shift & select lever shaft and causes the shift & select lever to slide.
- The movement of the shift & select lever is transmitted to the shift fork shaft via the shift fork shaft lever. As a result, the gear position changes.



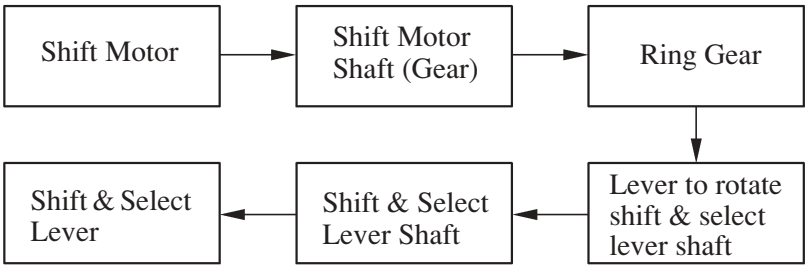
View of shift and select operation as seen from "A"

293CH19

▶ Shift Operation ◀

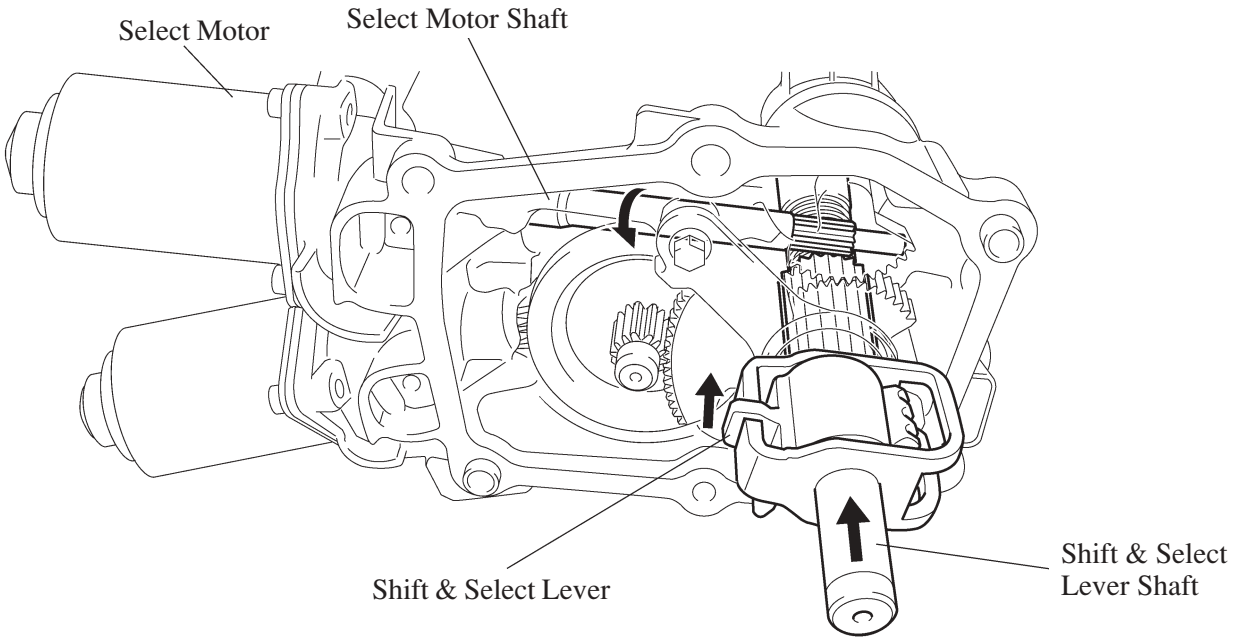


244CH10



244CH32

▶ Select Operation ◀



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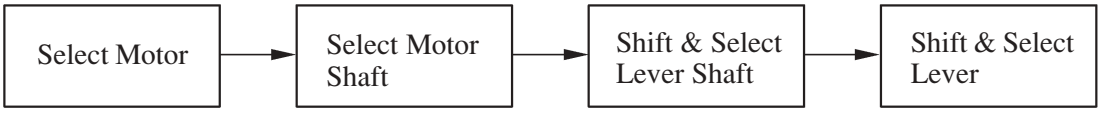
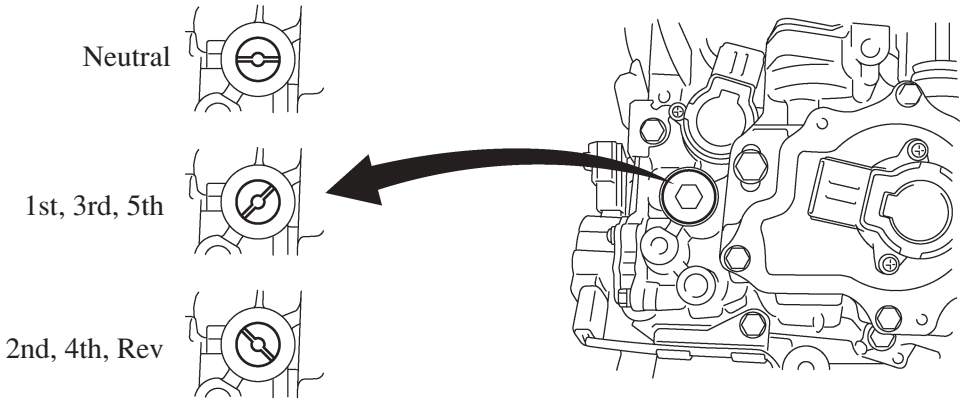


244CH33

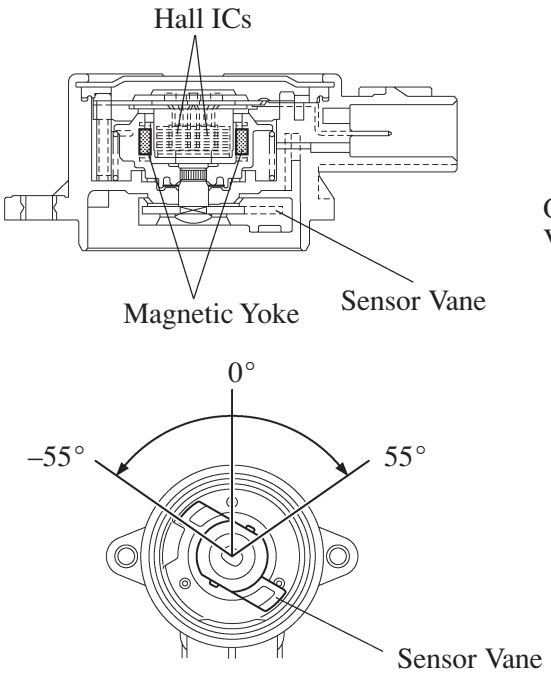
Service Tip

Make sure that the gear is in the neutral position before removing the shift & select actuator. If the gear cannot be shifted to the neutral position due to malfunctions in the actuator and/or transaxle gear, remove the plug from the shift & select actuator and confirm the slit is in the neutral position. If not, use a screwdriver to set it in the neutral position.

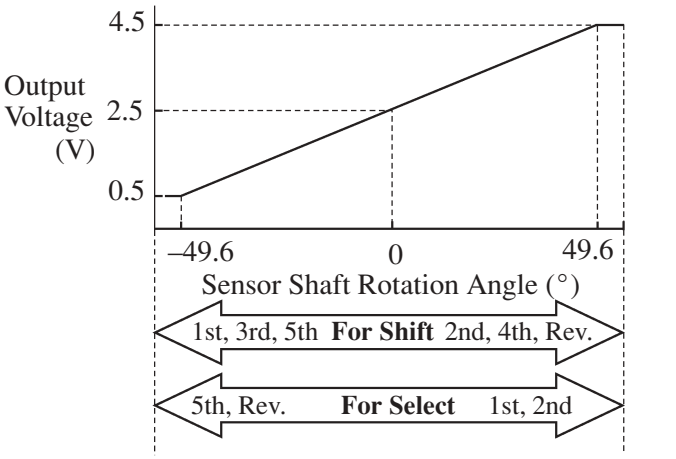


Shift and Select Stroke Sensors

- The shift and select stroke sensors consist of 2 Hall ICs and a magnetic yoke that rotates in unison with the shift & select lever shaft movement. The shift and select stroke sensors convert the changes in the magnetic flux that are caused by the rotation of the shift motor and the selector motor (hence, the rotation of the magnetic yoke) into electric signals, and output them to the M-MT ECU. The M-MT ECU determines the extent of the shift stroke and the select stroke from these electric signals in order to determine the present gear position.
- The main and sub circuits in the shift stroke sensor and the select stroke sensor exhibit the same output characteristics.

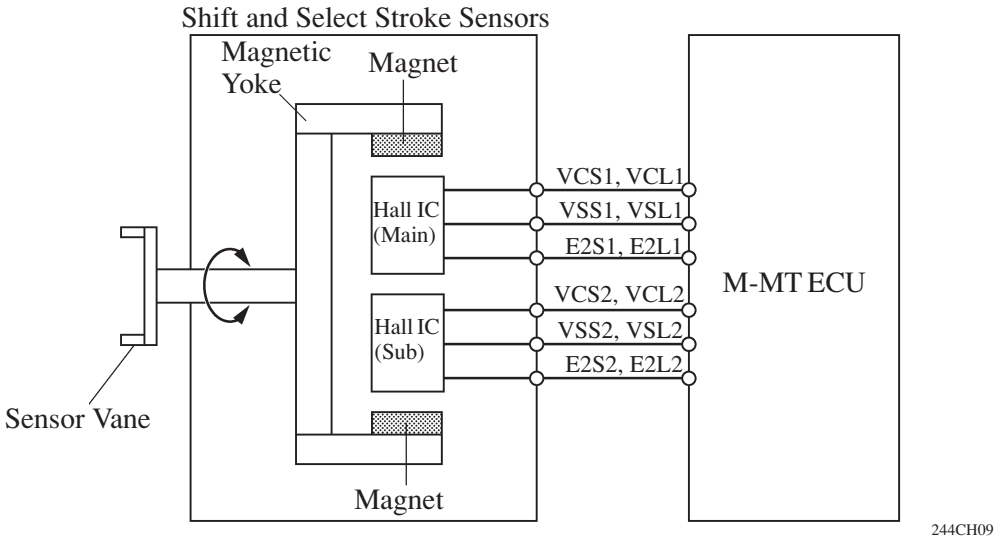


244CH07



293CH20

▶ System Diagram ◀

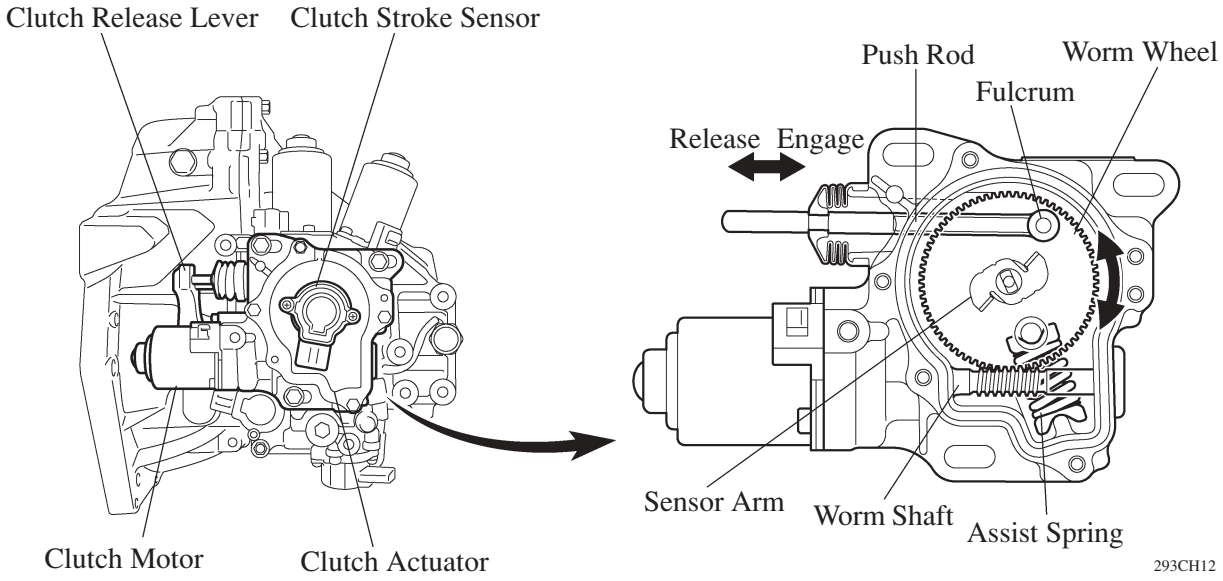


244CH09

2. Clutch Actuator

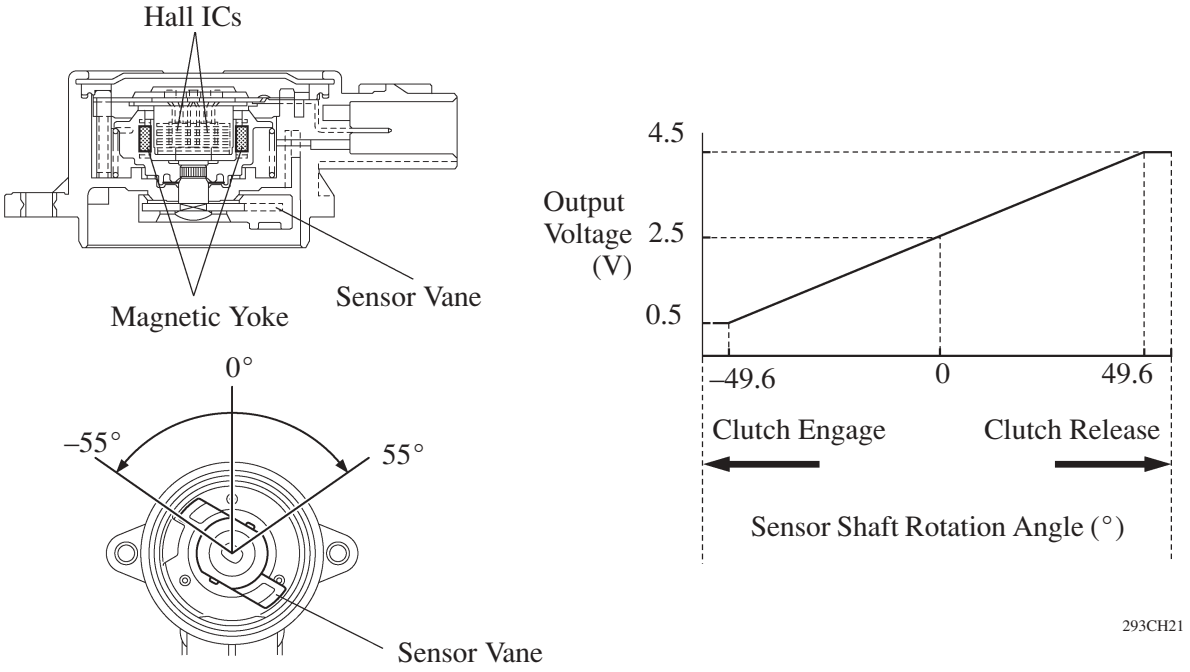
General

- The clutch actuator consists of clutch motor, clutch stroke sensor, worm shaft, worm wheel, push rod and assist spring. This actuator cannot be disassembled.
- The rotation of the clutch motor travels to the reduction gears of the worm shaft and the worm wheel, thus causing the worm wheel to rotate. This movement causes the push rod to move via a fulcrum provided on the worm wheel, actuating the clutch release lever.
- The worm wheel is provided with an assist spring, which provides a force to assist the movement of the push rod when the clutch is being operated. This reduces the load on the clutch motor at the time the clutch is being released.



Clutch Stroke Sensor

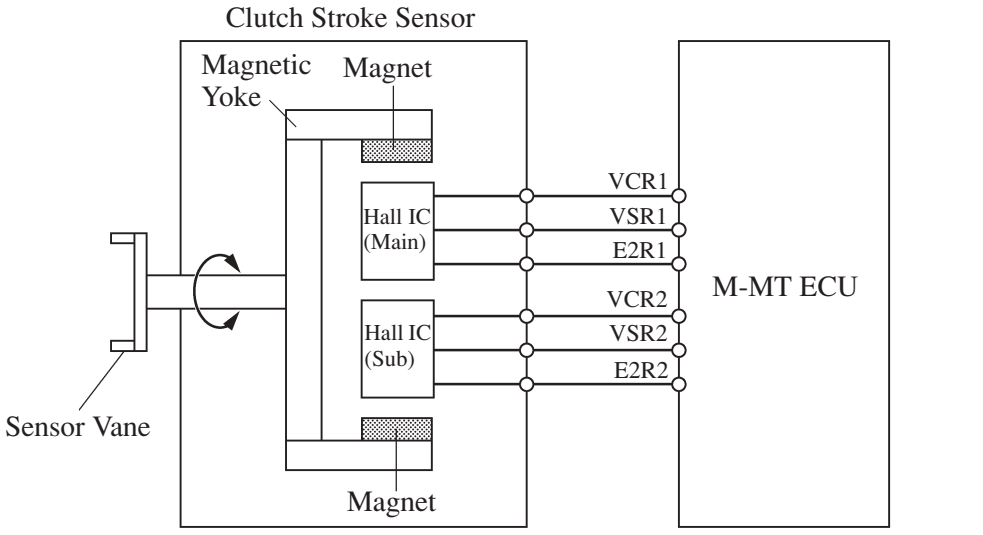
- Same as the shift and select stroke sensors, the clutch stroke sensor consists primarily of 2 Hall ICs (main and sub), and a magnetic yoke that rotates in unison with the rotation of the worm wheel.
- The 2 Hall ICs convert the changes in the magnetic flux that are caused by the rotation of the clutch motor (hence, the rotation of the magnetic yoke) into electric signals, and output them to the M-MT ECU. The M-MT ECU determines the extent of the clutch stroke from these electric signals.
- The main and sub circuits in the clutch stroke sensor exhibit the same output characteristics.
- The basic construction and operation of the shift and select stroke sensors are the same as for the clutch stroke sensor.



293CH21

244CH07

▶ System Diagram ◀

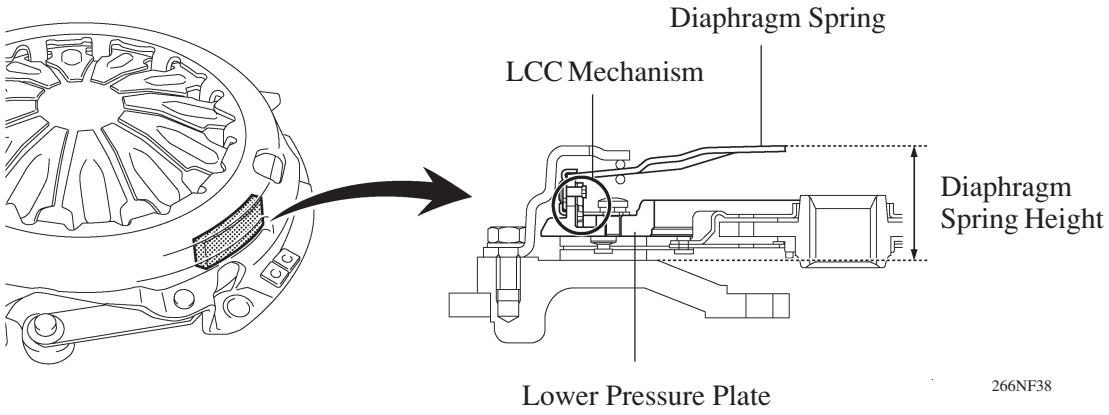


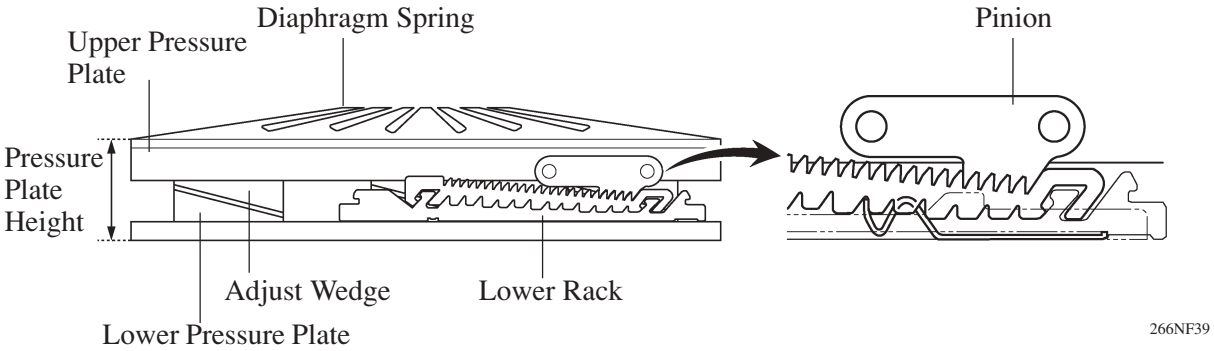
244CH09

3. LCC (Load Controlled Clutch cover) Mechanism

General

- To minimize the increase in the clutch operating load that results from the change in the pressure plate height with the wear of the clutch disc facing, the LCC (Load Controlled Clutch cover) mechanism mechanically adjusts the pressure plate height to a predetermined position.
- The LCC mechanism is provided in the clutch cover and consists of a pinion, which is located on the upper pressure plate, and a lower rack, upper rack, adjustment wedge, and spring, which are located on the lower pressure plate.
- Upon determining an increase in the clutch operating load through the load (clutch motor amperage) that is applied to the clutch motor, the M-MT ECU operates the clutch actuator in order to move the diaphragm spring to the operating range of the LCC mechanism. This enables the LCC mechanism to operate and mechanically adjust the pressure plate height to a predetermined position.

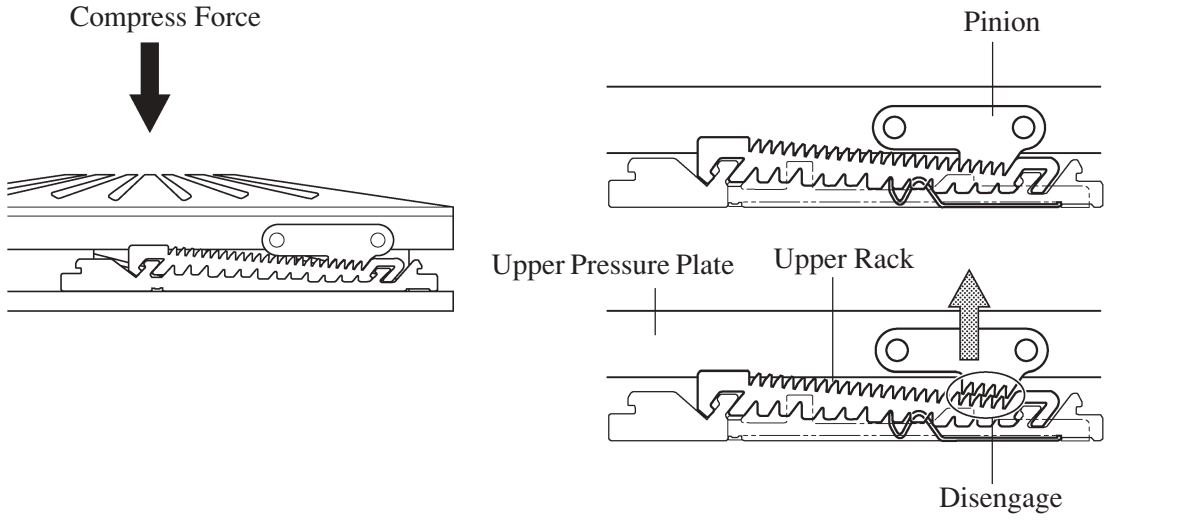




Operation

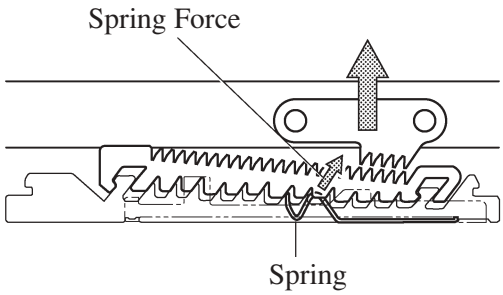
If the M-MT ECU determines that the clutch operating load is more than normal based on the clutch motor amperage, it activates the clutch actuator to operate the LCC mechanism after the ignition switch is turned OFF with the vehicle stopped. The M-MT ECU starts this operation prior to the parking control (see page CH-35) that is performed when the ignition switch is turned OFF.

- The diaphragm spring is compressed to the LCC operation range by the clutch actuator, allowing the upper pressure plate and the pinion to move upward more than normal. As result, the pinion and the upper rack become disengaged.



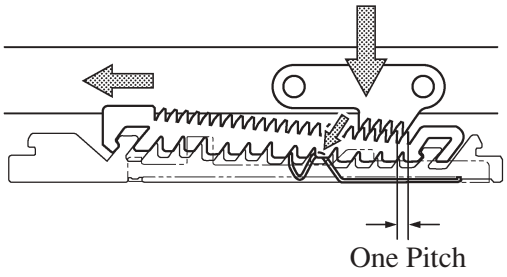
266NF40

- When the pinion and the upper rack are disengaged, the spring force causes the upper rack to move diagonally to the right along the teeth of the lower rack. As a result, the tooth position of the upper rack and the pinion shifts by 1 pitch, as compared to before the operation of the LCC mechanism.



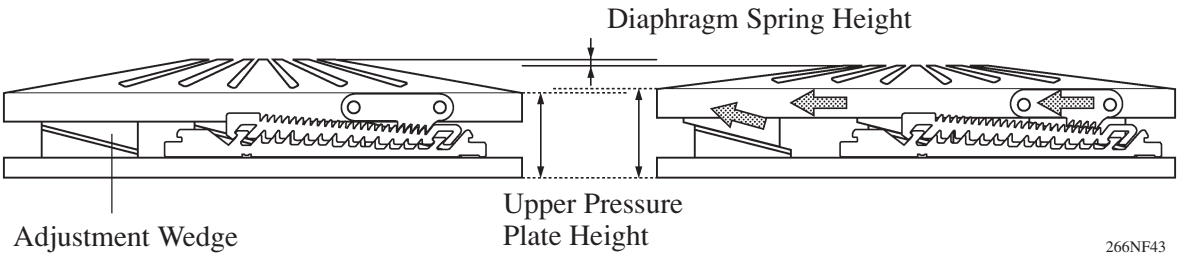
266NF41

- The M-MT ECU stops the clutch actuator based on signals from the clutch stroke sensor. Then the tooth position between the pinion and the upper rack is shifted 1 pitch, as compared to before the operation of the LCC mechanism. As a result, the pinion and the upper pressure plate move together to the left and engage with lower rack.



266NF42

- At this time, the upper pressure plate also moves via the adjustment wedge, causing the position of the upper pressure plate to become higher than before. Additionally, the diaphragm spring moves via the fulcrum, causing the position of the diaphragm spring to become lower than before.

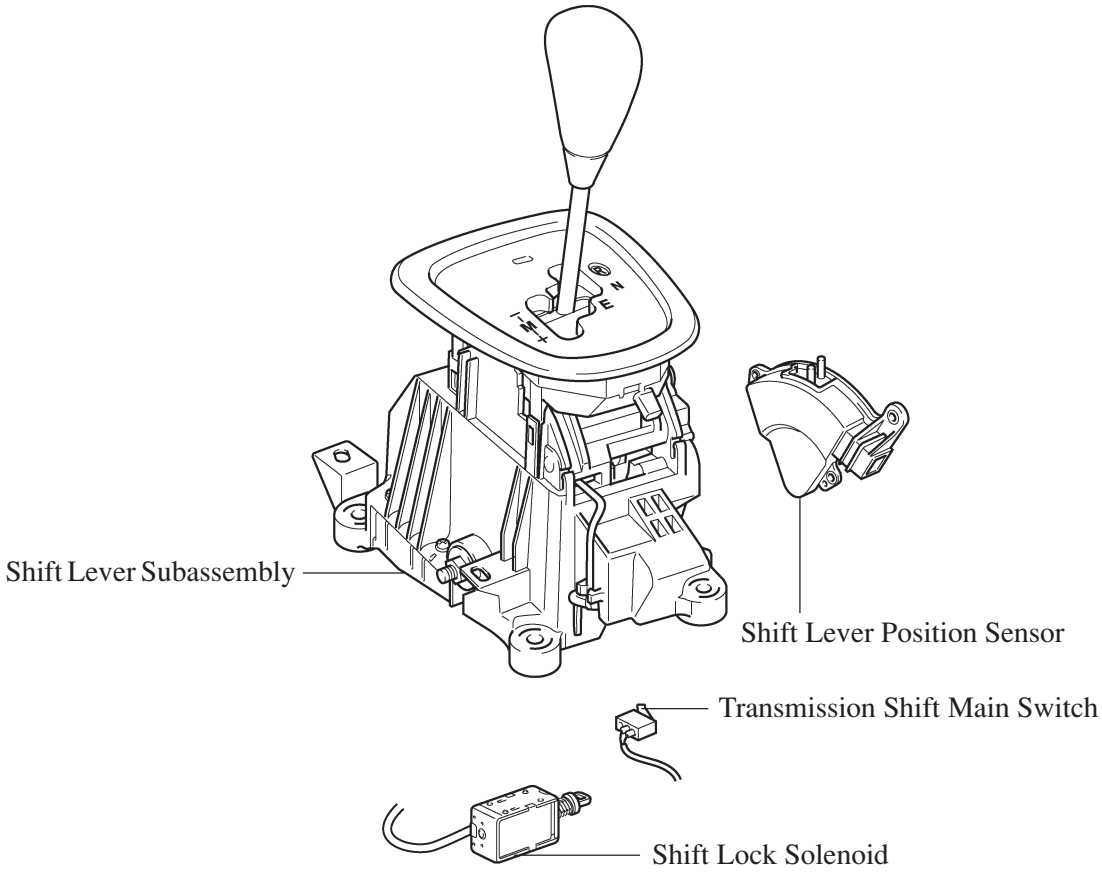


Diaphragm Spring Height: Height Before > Height After
Upper Pressure Plate Height: Height Before < Height After

4. Shift Lever Assembly

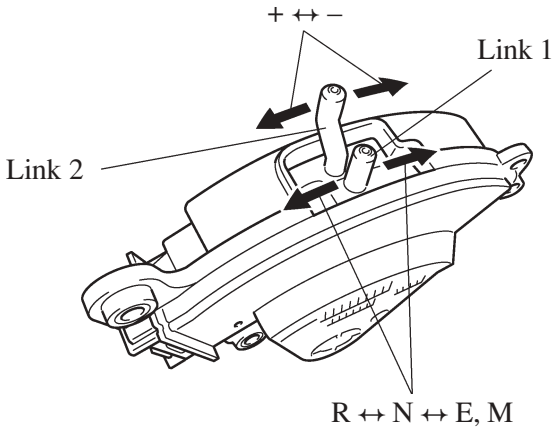
General

- The shift lever mainly consists of the shift position sensor, transmission shift main switch, shift lock solenoid and shift lever sub-assembly.
- The multi-mode manual transmission system uses a shift-by-wire system in which the M-MT ECU changes the gear position via actuators in accordance with the shift lever position that has been detected through the shift lever position sensor and the transmission shift main switch.
- An electrical shift lock mechanism that uses a shift lock solenoid to restrict the movement of the shift lever has been adopted.



Shift Position Sensor and Transmission Shift Main Switch

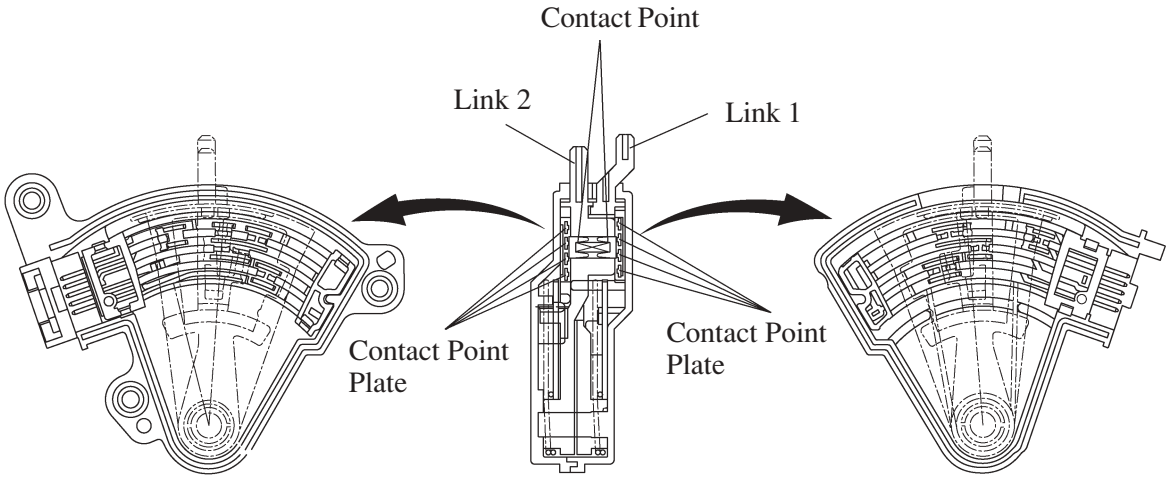
- The shift lever position sensor consists of a Link 1 circuit that detects the R, N, E, and M positions of the shift lever, and a Link 2 circuit that detects the "+" and "–" positions. The circuits are connected to the shift lever via the respective links. The contact switches (6-contact switches for Link 1, and 2-contact switches for Link 2) of the circuits turn ON and OFF in accordance with the fore-aft movement of the shift lever. The M-MT ECU determines the present shift lever position in accordance with the ON/OFF status of these contact switches.
- The transmission shift main switch detects the side-to-side movement of the shift lever. It turns OFF when the shift lever is in the R, N, or E position, and ON in the M, +, or – position.



Shift Lever Position Sensor

- The shift lever position sensor and the transmission shift main switch convert the shift lever position into electric signals and output them to the M-MT ECU. The M-MT ECU determines the present shift lever position from these signals and operates the actuators to change the gear position.

▶ Shift Lever Position Sensor Cross Section ◀



Contact Point for LSWR, LSSC, LSNC and LSW–

Contact Point for LSRC, LSWS, LSWN and LSW+

293CH07

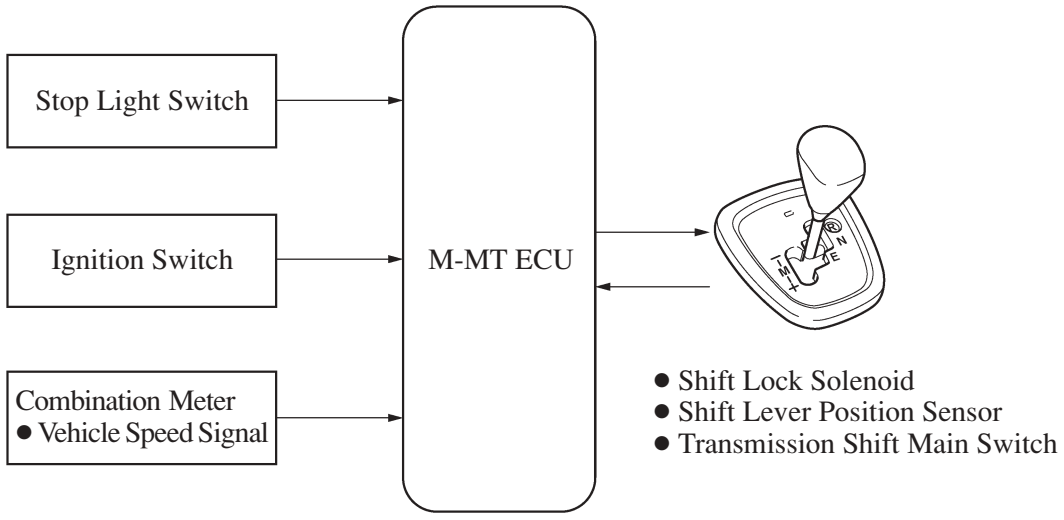
Contact Point		Shift Lever Position					
		R	N	E	M	–	+
Link 1	LSRC	OFF	ON	ON	ON	ON	ON
	LSWR	ON	OFF	OFF	OFF	OFF	OFF
	LSSC	ON	ON	OFF	OFF	OFF	OFF
	LSWS	OFF	OFF	ON	ON	ON	ON
	LSNC	ON	OFF	ON	ON	ON	ON
	LSWN	OFF	ON	OFF	OFF	OFF	OFF
Link 2	LSW–	OFF	OFF	OFF	OFF	ON	OFF
	LSW+	OFF	OFF	OFF	OFF	OFF	ON
Transmission Shift Main Switch		OFF	OFF	OFF	ON	ON	ON

Shift Lock Mechanism

- The shift lock mechanism activates under the conditions listed below.
  - – Activates when the ignition switch is turned from ON to OFF, and locks the shift lever in the position (R, N, E and M) in which the ignition switch has been turned OFF. Thus, it disables the operation of the shift lever with the ignition switch OFF (when the shift & select actuator is inactive). As a result, it prevents the shift position selected at the shift lever and the actual shift position in the transaxle from being mismatched, thus preventing the unintended operation of the shift lever.
  - – When the brake pedal is not depressed for a minimum of 2 seconds while the following three conditions are satisfied, the shift lock mechanism activates to lock the shift lever in the neutral position:
    - Shift lever is in the neutral position
    - The vehicle speed is approximately 9 km/h (6 mph) or less
    - Engine is running

    Thus, it prevents the unintended operation of the shift lever, which prevents the vehicle from moving suddenly.
- The shift lock mechanism becomes deactivated when the ignition switch is turned OFF to ON and the brake pedal is depressed, thus allowing the driver to operate the shift lever.
- A shift lock release button that can manually cancel the shift lock mechanism has been provided.

▶ System Diagram ◀



244CH30

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