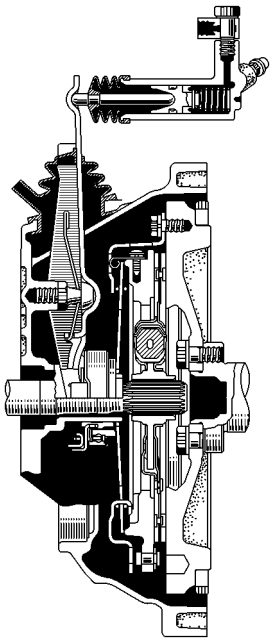
# CHASSIS

## CLUTCH

### ■DESCRIPTION

’06 Yaris has a clutch system with the following features.

- A dry type single plate clutch which is operated by hydraulic pressure is used.
- A clutch master cylinder made of plastic is used.
- The clutch start system is used to help ensure safety.
- A clutch pedal made of plastic is used.



171CH01

**▶ Specification ◀**

| | | | |
|---|---|---|---|
| Clutch | Type | | Dry Type Single Plate Clutch Diaphragm Spring |
| | Operation | | Hydraulic |
| Clutch Cover | Type | | DST*1 |
| | Size | mm (in.) | 212 (8.35) |
| | Installed Load | N | 4400 |
| Clutch Disc | Facing Size*2 | mm (in.) | 212 x 140 x 3.5 (8.35 x 5.51 x 0.14) |
| | Facing Area | $cm^2$ ($in.^2$) | 199 (30.8) |
| Master Cylinder | Type | | Plunger |
| | Cylinder Diameter | mm (in.) | 15.87 (0.62) |
| Release Cylinder | Type | | Non-Adjustable |
| | Cylinder Diameter | mm (in.) | 20.64 (0.81) |
| Clutch Start System | | | Standard |

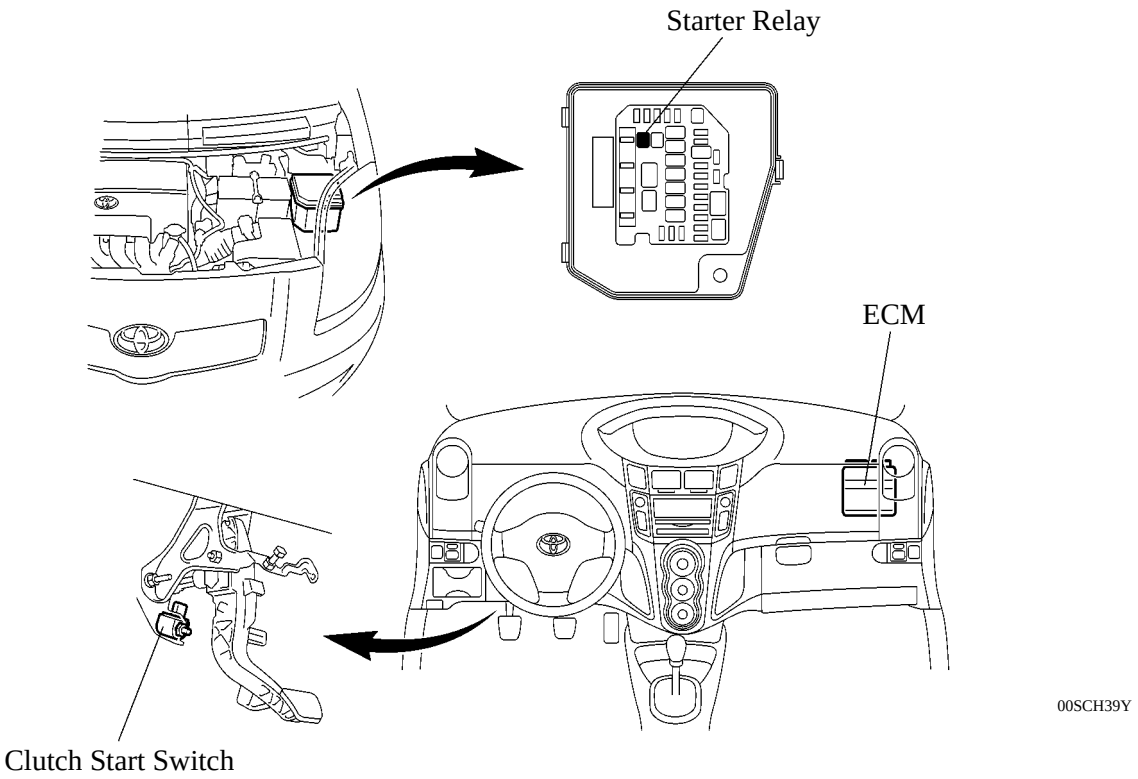
*1: DST (Diaphragm Spring Turnover)
*2: Outer Diameter x Inner Diameter x Thickness

## ■CLUTCH START SYSTEM

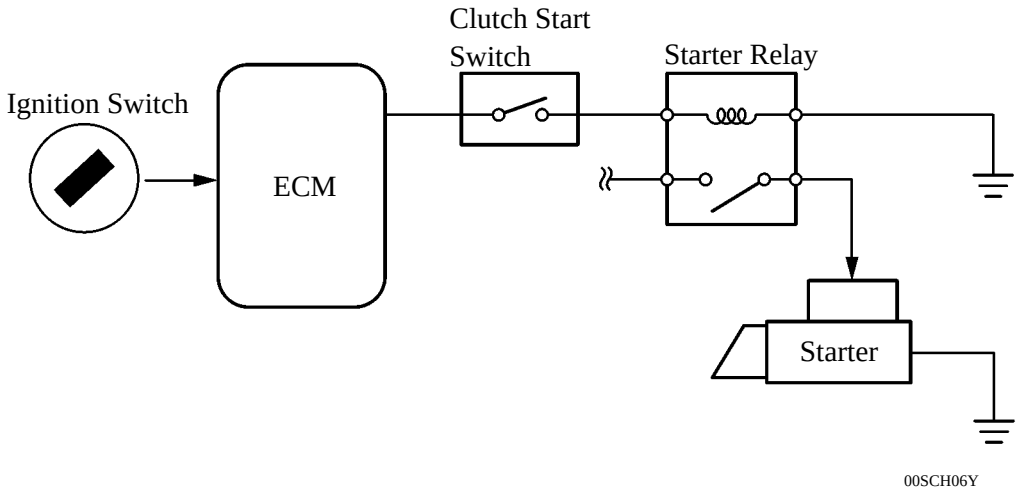
### 1. General

This system prevents the starter from cranking unless the clutch pedal is depressed. When the engine is started with the shift lever in a position other than N, and it helps ensure safety by preventing the vehicle from moving unintentionally.

### 2. Layout of Main Components



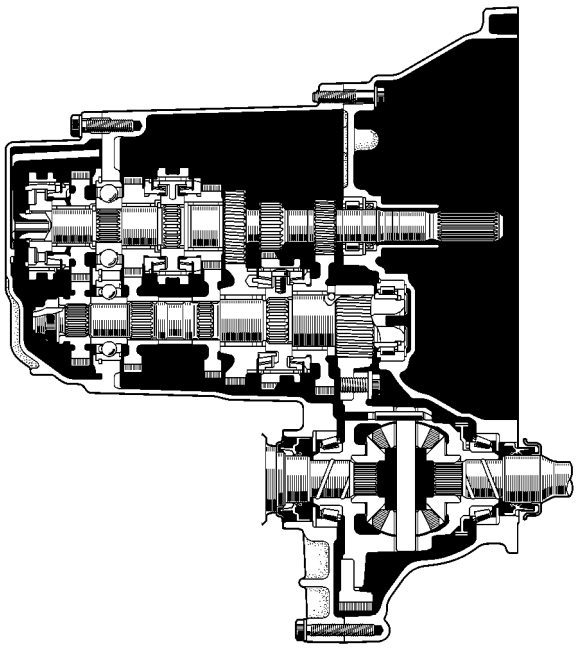

### 3. System Diagram



# C50 MANUAL TRANSAXLE

## ■DESCRIPTION

- The C50 manual transaxle is used. The gear ratio has been optimized to ensure proper balance with the 1NZ-FE engine.
- A double-cone type synchromesh mechanism is used for the 2nd gear to reduce the shift effort.
- An excellent shift feel has been achieved through the adoption of the mass damper on the shift and select shaft, and sliding ball bearing.
- A shift guide mechanism is used.
- A select cable with a length adjustment mechanism is used.



00SCH12Y

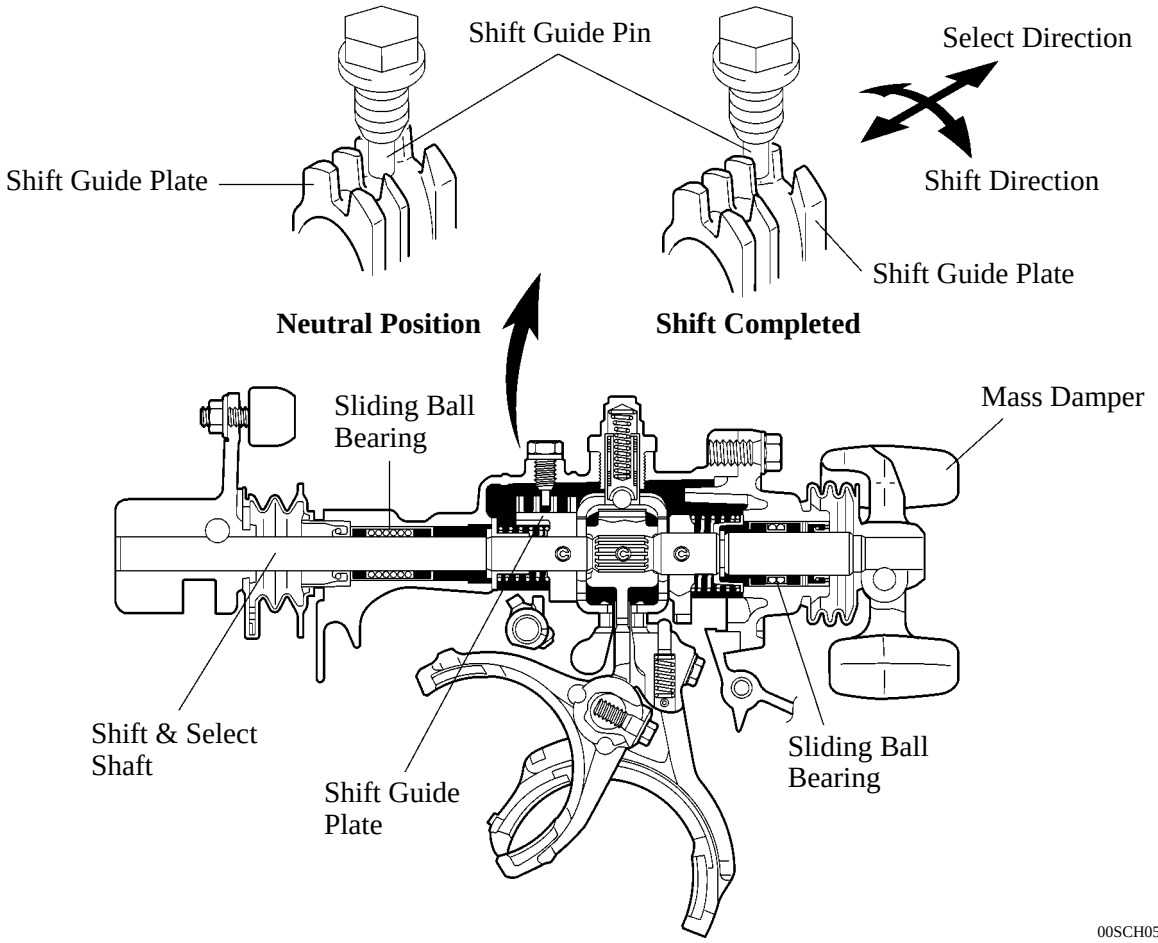
**▶ Specification ◀**

| Model | | ’06 Yaris | ’05 Yaris |
|---|---|---|---|
| Transaxle Type | | C50 | C150 |
| Engine | | 1NZ-FE | ← |
| Gear Ratio | 1st | 3.545 | ← |
| | 2nd | 1.904 | ← |
| | 3rd | 1.310 | ← |
| | 4th | 0.969 | ← |
| | 5th | 0.815 | ← |
| | Reverse | 3.250 | ← |
| Differential Gear Ratio | | 3.722 | 3.526 |
| Oil Capacity | Liter (US qts, Imp.qts) | 1.9 (2.0, 1.7) | ← |
| Oil Viscosity | | SAE 75W-90 | ← |
| Oil Grade | | API GL-4 or GL-5 | API GL-4 or GL-5 |
| Weight (Reference)* | kg (Ib) | 39.2 (86.2) | 34.7 (76.3) |

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

## ■SHIFT AND SELECT MECHANISM

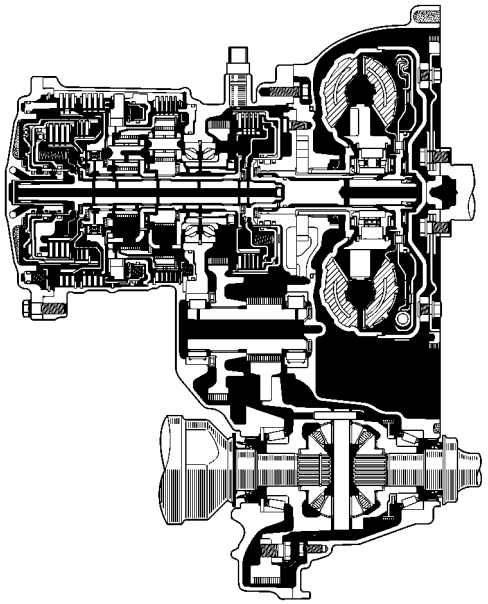
- An excellent shift feel has been achieved through the adoption of the mass damper on the shift and select shaft, and sliding ball bearing.
- A shift guide plate is provided on the shift and select shaft. The movement distance of the shift and select shaft in the select direction after the shifting is completed is regulated by the shift guide plate and shift guide pin. This clarifies the position of the shift knob and enables accurate shift operations.



# U340E AUTOMATIC TRANSAXLE

## ■DESCRIPTION

’06 Yaris 1NZ-FE engine model with automatic transaxle uses the U340E automatic transaxle.
This automatic transaxle is a compact and high-capacity 4-speed Super ECT (Electronic Controlled Transaxle).

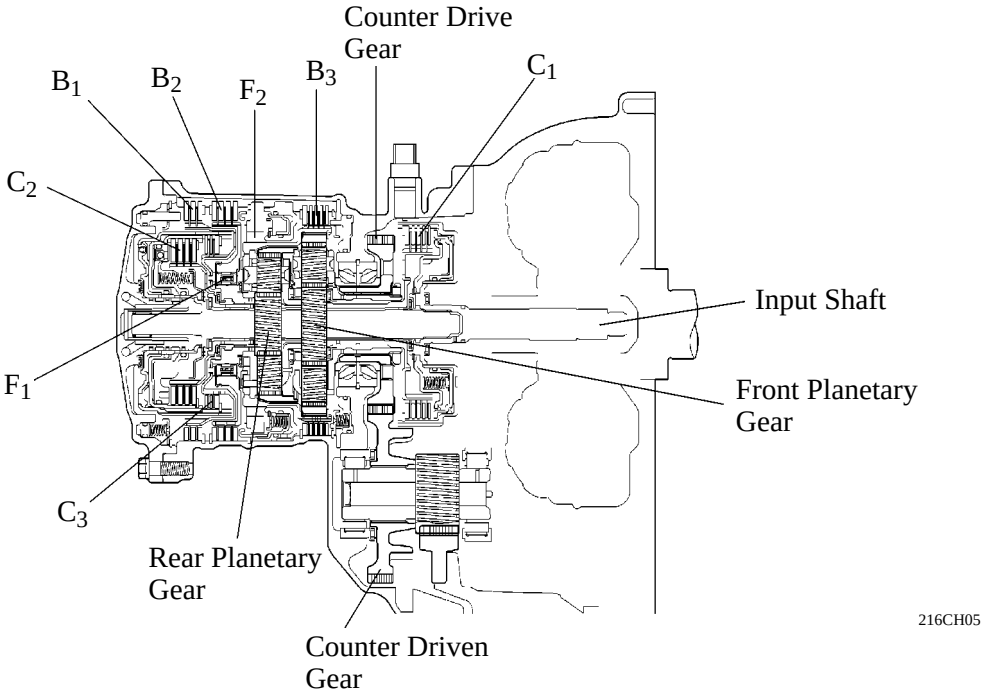


171CH03

**▶ Specification ◀**

| | | |
|---|---|---|
| Transaxle Type | | U340E |
| Engine Type | | 1NZ-FE |
| Gear Ratio | 1st | 2.847 |
| | 2nd | 1.552 |
| | 3rd | 1.000 |
| | 4th | 0.700 |
| | Reverse | 2.343 |
| Differential Gear Ratio*1 | | 4.237 |
| Fluid Capacity*2 Liters (US qts, Imp.qts) | | 6.4 (6.78, 5.63) |
| Fluid Type | | Toyota Genuine ATF WS |
| Weight (Reference)*3 kg (lb) | | 68.5 (150.7) |

*1: Counter Gear Ratio Included.
*2: Differential Included.
*3: Weight shows the figure with the fluid fully filled.

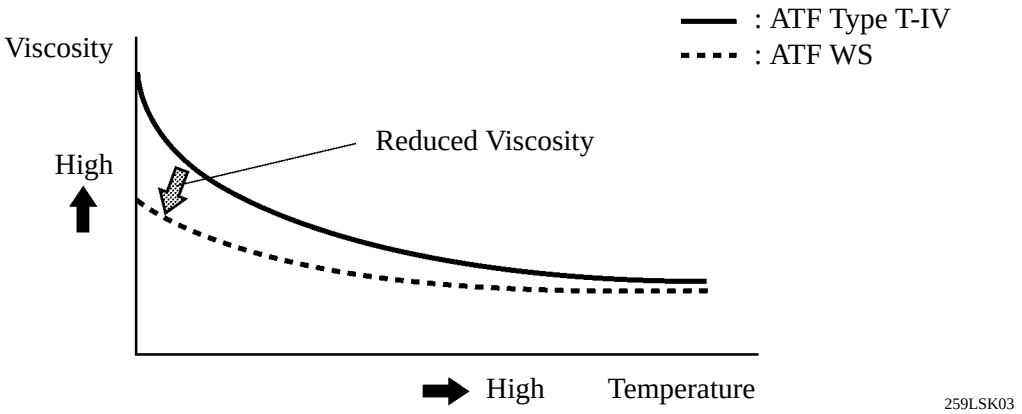



**▶ Specification ◀**

| | | | |
|---|---|---|---|
| $C_1$ | Forward Clutch | The No. of Discs | 4 |
| $C_2$ | Direct Clutch | | 3 |
| $C_3$ | Reverse Clutch | | 2 |
| $B_1$ | OD & 2nd Brake | | 2 |
| $B_2$ | 2nd Brake | | 3 |
| $B_3$ | 1st & Reverse Brake | | 4 |
| $F_1$ | No. 1 One-Way Clutch | The No. of Sprags | 16 |
| $F_2$ | No. 2 One-Way Clutch | The No. of Rollers | 15 |
| Front Planetary Gear | | The No. of Sun Gear Teeth | 46 |
| | | The No. of Pinion Gear Teeth | 21 |
| | | The No. of Ring Gear Teeth | 85 |
| Rear Planetary Gear | | The No. of Sun Gear Teeth | 32 |
| | | The No. of Pinion Gear Teeth | 21 |
| | | The No. of Ring Gear Teeth | 75 |
| Counter Gear | | The No. of Drive Gear Teeth | 52 |
| | | The No. of Driven Gear Teeth | 53 |

## ■ATF (AUTOMATIC TRANSMISSION FLUID) WS

- The ATF WS is used to reduce the resistance of the ATF and ensure fuel economy by reducing its viscosity in the practical operation range. At the high-temperature end, its viscosity is the same as that of the ATF Type T-IV, which ensures the durability of the automatic transaxle.
- There is no interchangeability between the ATF WS and other types of ATFs (ATF Type T-IV, D-II).




**Service Tip**

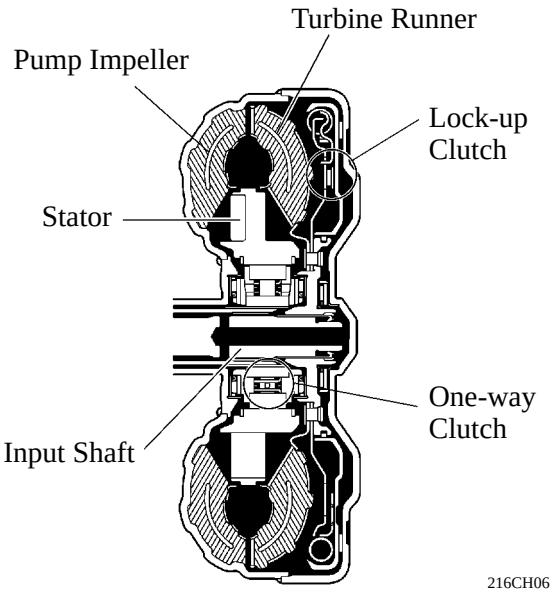
- The color of the ATF level gauge used in the ATF WS has been changed to black. (Orange was used in the ATF Type T-IV on the previous model.)
- If a vehicle with a transaxle filled with ATF WS is replenished with another type of ATF, the vehicle might not start off at extremely low temperatures.

## ■TORQUE CONVERTER

- This torque converter has optimally designed fluid passages and impeller configuration resulting in substantially enhanced transmission efficiency to ensure good starting, acceleration and fuel economy.
- Furthermore, a hydraulically operated lock-up mechanism which cuts power transmission losses due to slippage at medium and high speeds is used.

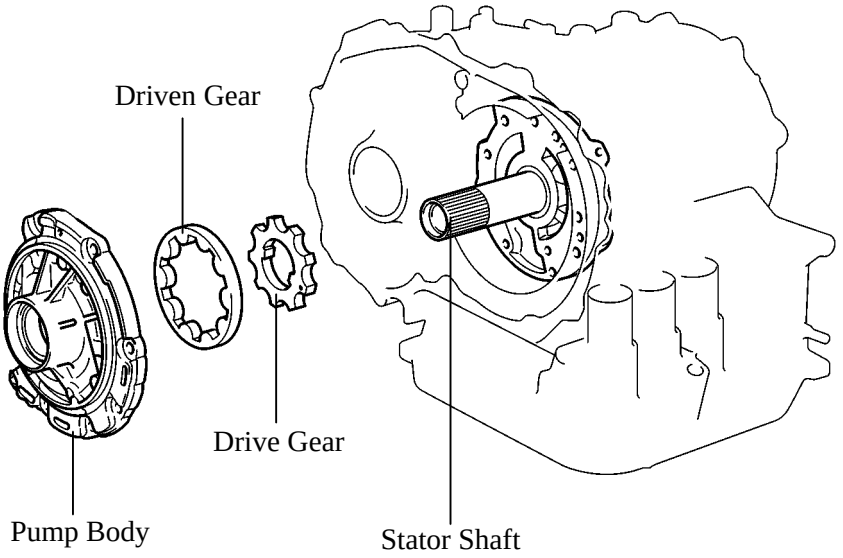
**▶ Specification ◀**

| | |
|---|---|
| Torque Converter Type | 3-Element, 1-Step, 2-Phase (With Lock-up Mechanism) |
| Stall Torque Ratio | 2.0 |



## ■OIL PUMP

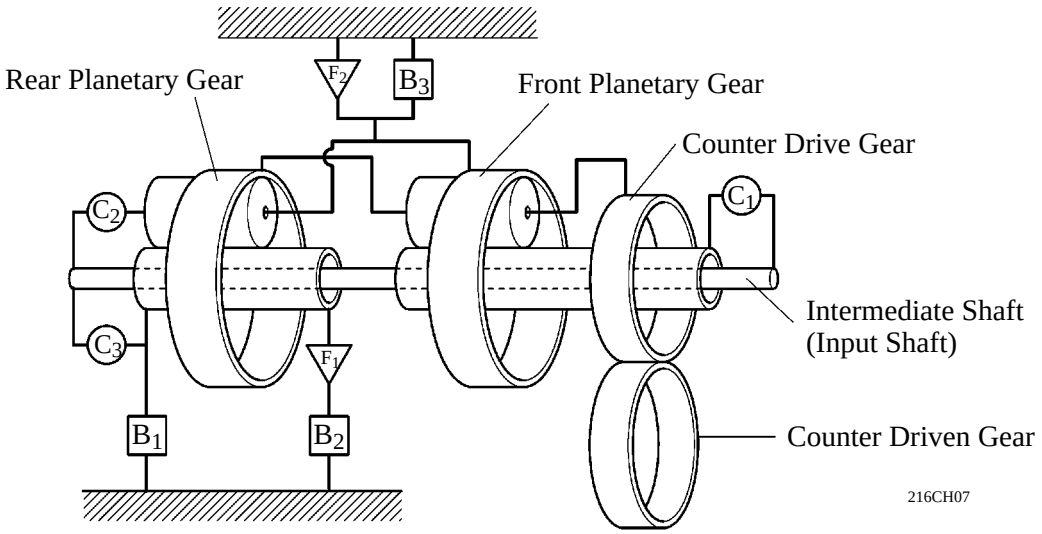
The oil pump is combined with torque converter, lubricates the planetary gear units and supplies operating pressure to the hydraulic control.



## ■PLANETARY GEAR UNIT

### 1. Construction

- A CR-CR type planetary gear is used in the planetary gear unit, which is located on the input shaft. This planetary gear is a type of the planetary gear unit that joins the front and rear planetary carriers to the front and rear ring gears. As a result, the unit has been made significantly simple and compact.
- A centrifugal fluid pressure canceling mechanism is used in the $C_1$ clutch, which is applied when shifting from the 3rd to 4th.




### 2. Function of Component

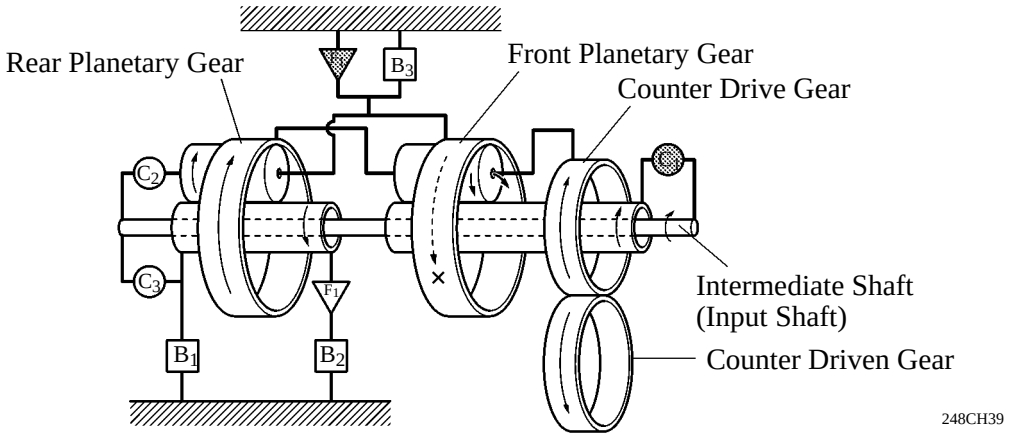
| Component | | Function |
|---|---|---|
| $C_1$ | Forward Clutch | Connects input shaft and front planetary sun gear. |
| $C_2$ | Direct Clutch | Connects intermediate shaft and rear planetary carrier. |
| $C_3$ | Reverse Clutch | Connects intermediate shaft and rear planetary sun gear. |
| $B_1$ | OD & 2nd Brake | Lock the rear planetary sun gear. |
| $B_2$ | 2nd Brake | Prevent rear planetary sun gear from turning counterclockwise. |
| $B_3$ | 1st & Reverse Brake | Lock the front planetary ring gear and rear planetary carrier. |
| $F_1$ | No. 1 One-Way Clutch | Prevents rear planetary sun gear from turning counterclockwise. |
| $F_2$ | No. 2 One-Way Clutch | Prevents front planetary ring gear and rear planetary carrier 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 input and output speed. |

## 3. Transaxle Power Flow

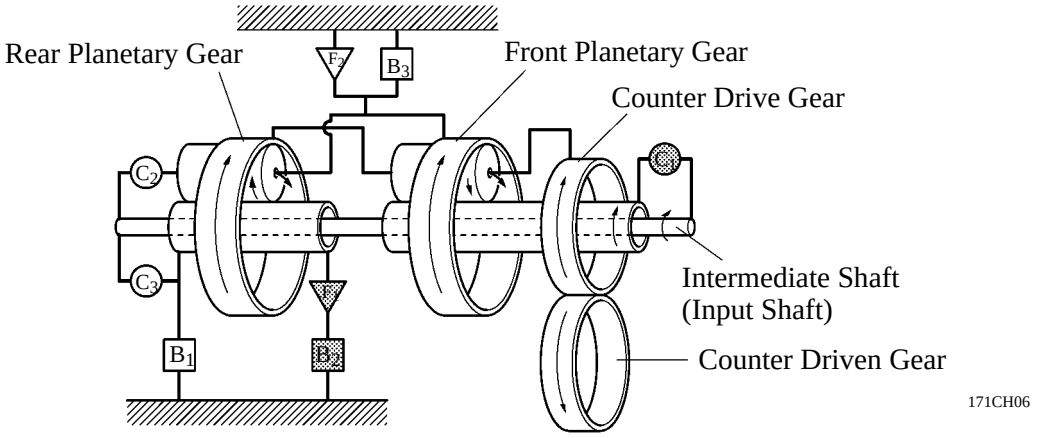
| Shift Lever Position | Gear | Solenoid Valve | | Clutch | | | Brake | | | One-Way Clutch | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | $C_1$ | $C_2$ | $C_3$ | $B_1$ | $B_2$ | $B_3$ | $F_1$ | $F_2$ |
| P | Park | ON | ON | | | | | | | | |
| R | Reverse | ON | ON | | | ○ | | | ○ | | |
| N | Neutral | ON | ON | | | | | | | | |
| D | 1st | ON | ON | ○ | | | | | | | ○ |
| | 2nd | ON | OFF | ○ | | | | ○ | | ○ | |
| | 3rd | OFF | OFF | ○ | ○ | | | ○ | | | |
| | 4th | OFF | ON | | ○ | | ○ | ○ | | | |
| 3 | 1st | ON | ON | ○ | | | | | | | ○ |
| | 2nd | ON | OFF | ○ | | | | ○ | | ○ | |
| | 3rd | OFF | OFF | ○ | ○ | | | ○ | | | |
| 2 | 1st | ON | ON | ○ | | | | | | | ○ |
| | 2nd | ON | OFF | ○ | | | ○ | ○ | | ○ | |
| L | 1st | ON | ON | ○ | | | | | ○ | | ○ |

○: Operation

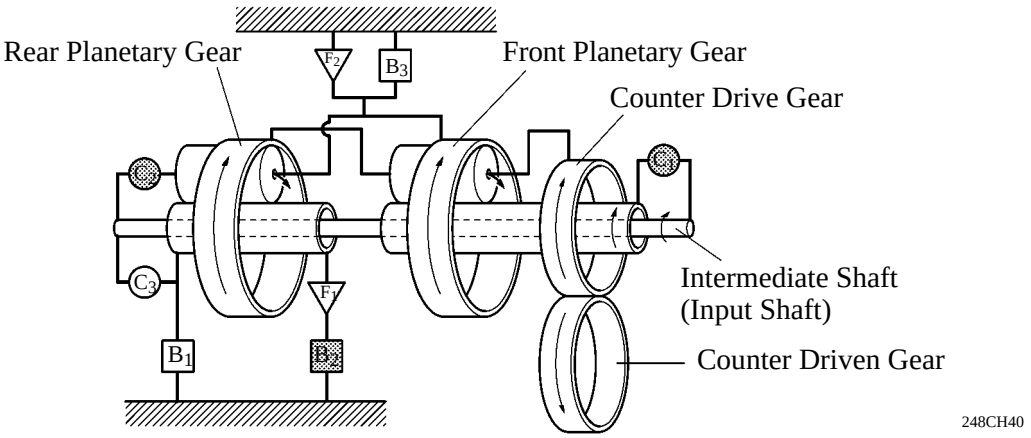
**1st Gear (D, 3 or 2 Position)**



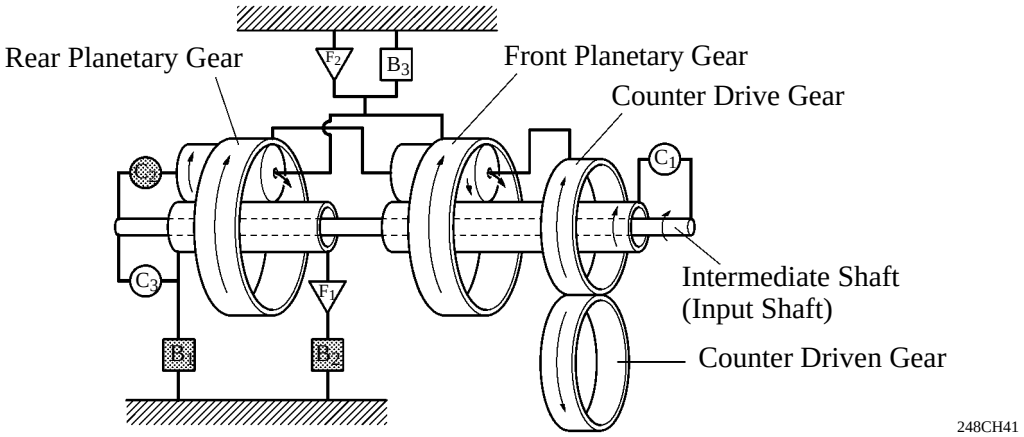
**2nd Gear (D or 3 Position)**



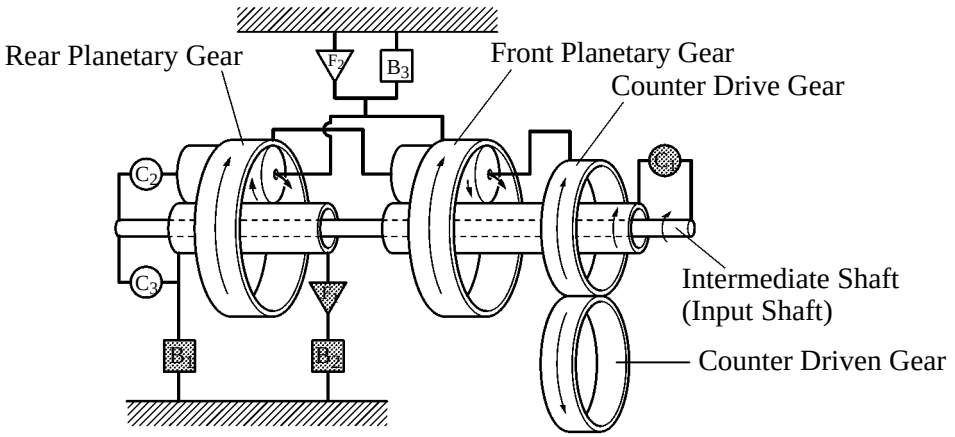

**3rd Gear (D or 3 Position)**




**4th Gear (D Position)**

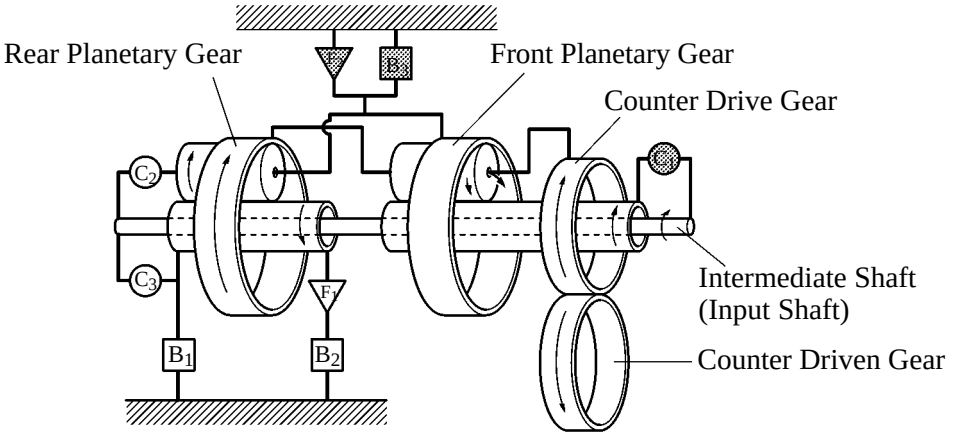


**2nd Gear (2 Position)**



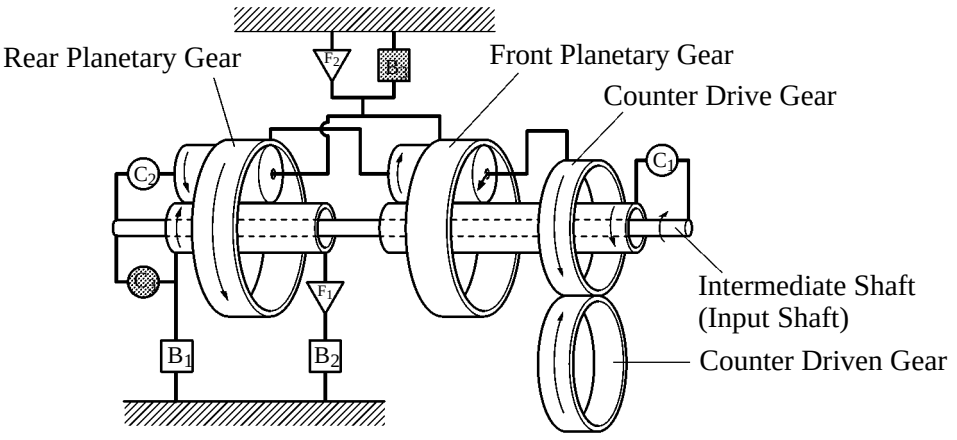

171CH09

**1st Gear (L Position)**




248CH42

**Reverse Gear (R Position)**



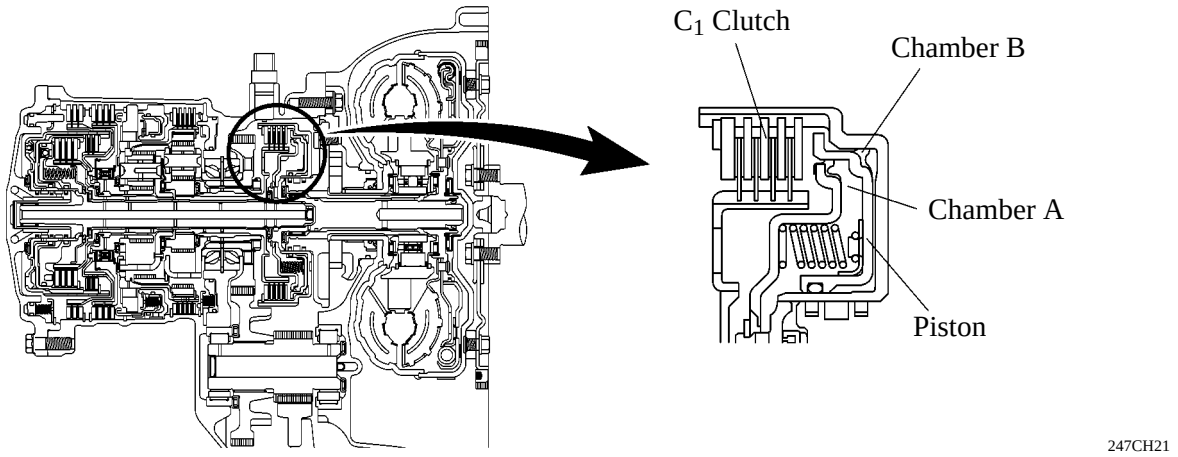

248CH43

## 4. Centrifugal Fluid Pressure Canceling Mechanism

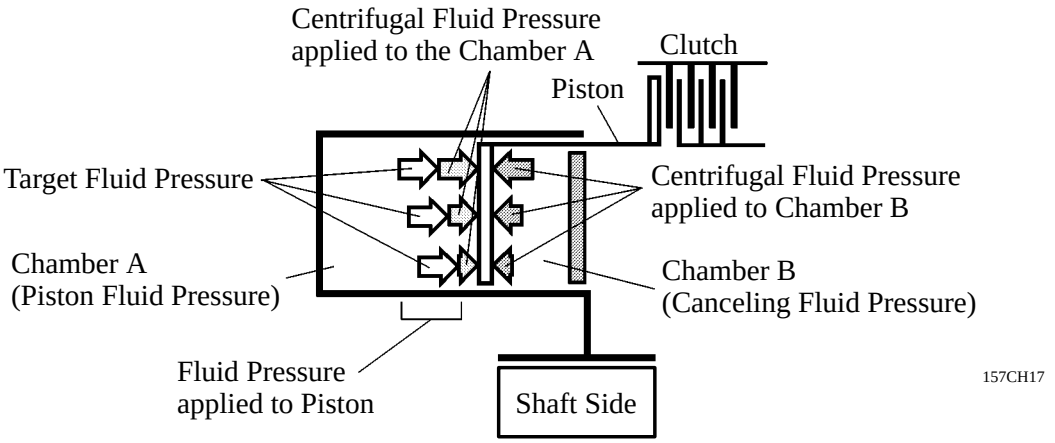
There are two reasons for improving the conventional clutch mechanism:

- To prevent the generation of pressure by the centrifugal force that applied to the fluid in piston fluid pressure chamber (hereafter referred to as “chamber A”) when the clutch is released, a check ball is provided to discharge the fluid. Therefore, before the clutch can be subsequently applied, it took time for the fluid to fill the chamber A.
- During shifting, in addition to the original clutch pressure that is controlled by the valve body, the pressure that acts on the fluid in the chamber A also exerts influence, which is dependent upon revolution fluctuations.

To address these two needs for improvement, a canceling fluid pressure chamber (hereafter referred to as “chamber B”) has been provided opposite chamber A.



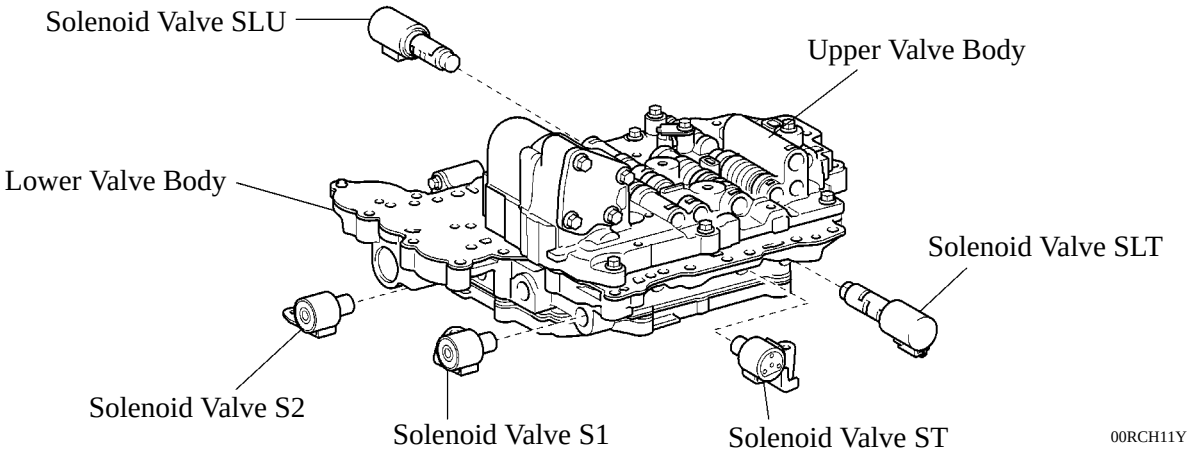

By utilizing the lubrication fluid such as that of the shaft, the same amount of centrifugal force is applied, thus canceling the centrifugal force that is applied to the piston itself. Accordingly, it is not necessary to discharge the fluid through the use of a check ball, and a highly responsive and smooth shifting characteristic has been achieved.



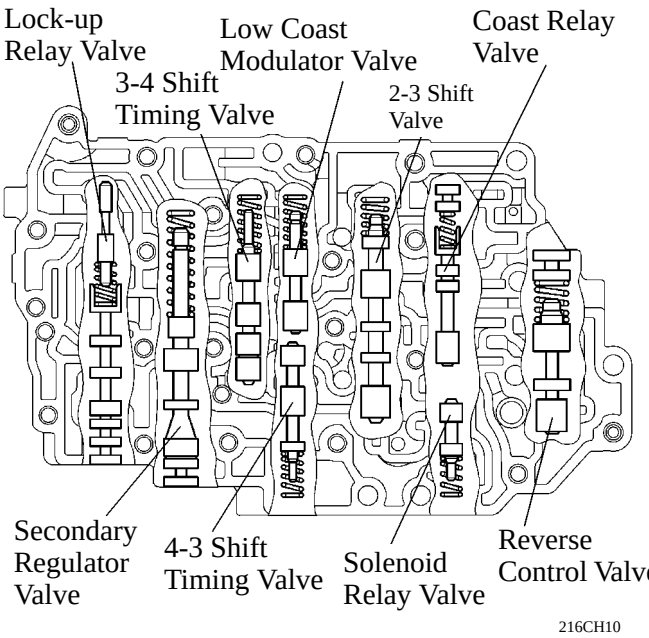

| | | | | |
|---|---|---|---|---|
| Fluid pressure applied to piston | - | Centrifugal fluid pressure applied to chamber B | = | Target fluid pressure (Original clutch pressure) |

## ■VALVE BODY UNIT

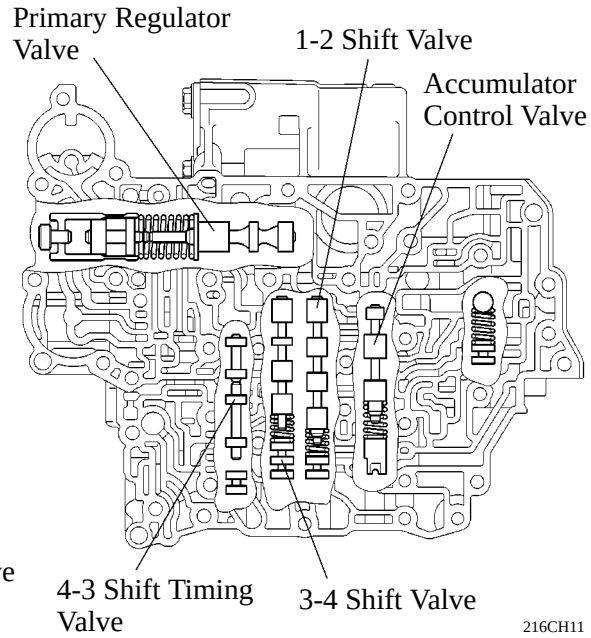
The valve body consists of the upper and lower valve bodies and 5 solenoid valves.
The 5 solenoid valves are installed in the lower valve body for serviceability.




**▶ Upper Valve Body ◀**




**▶ Lower Valve Body ◀**




**▶ Function of Solenoid Valve ◀**

| Solenoid Valve | Action | Function |
|---|---|---|
| S1 | For 2-3 shift valve control | Shifts gears by switching the 2-3 shift valve and controlling the $C_2$ clutch. |
| S2 | For 1-2 and 3-4 shift valve control | Shifts gears by switching the 1-2 and 3-4 shift valves and controlling 2 clutches ($C_1$ and $C_2$) and 2 brakes ($B_1$ and $B_2$). |
| ST | For clutch to clutch pressure control | Switches 3-4 and 4-3 shift valves. |
| SLU | For clutch engagement pressure control | Controls the lock-up clutch. |
| SLT | For line pressure control | Controls the line pressure, secondary pressure, and accumulator back pressure. |

## ■ELECTRONIC CONTROL SYSTEM

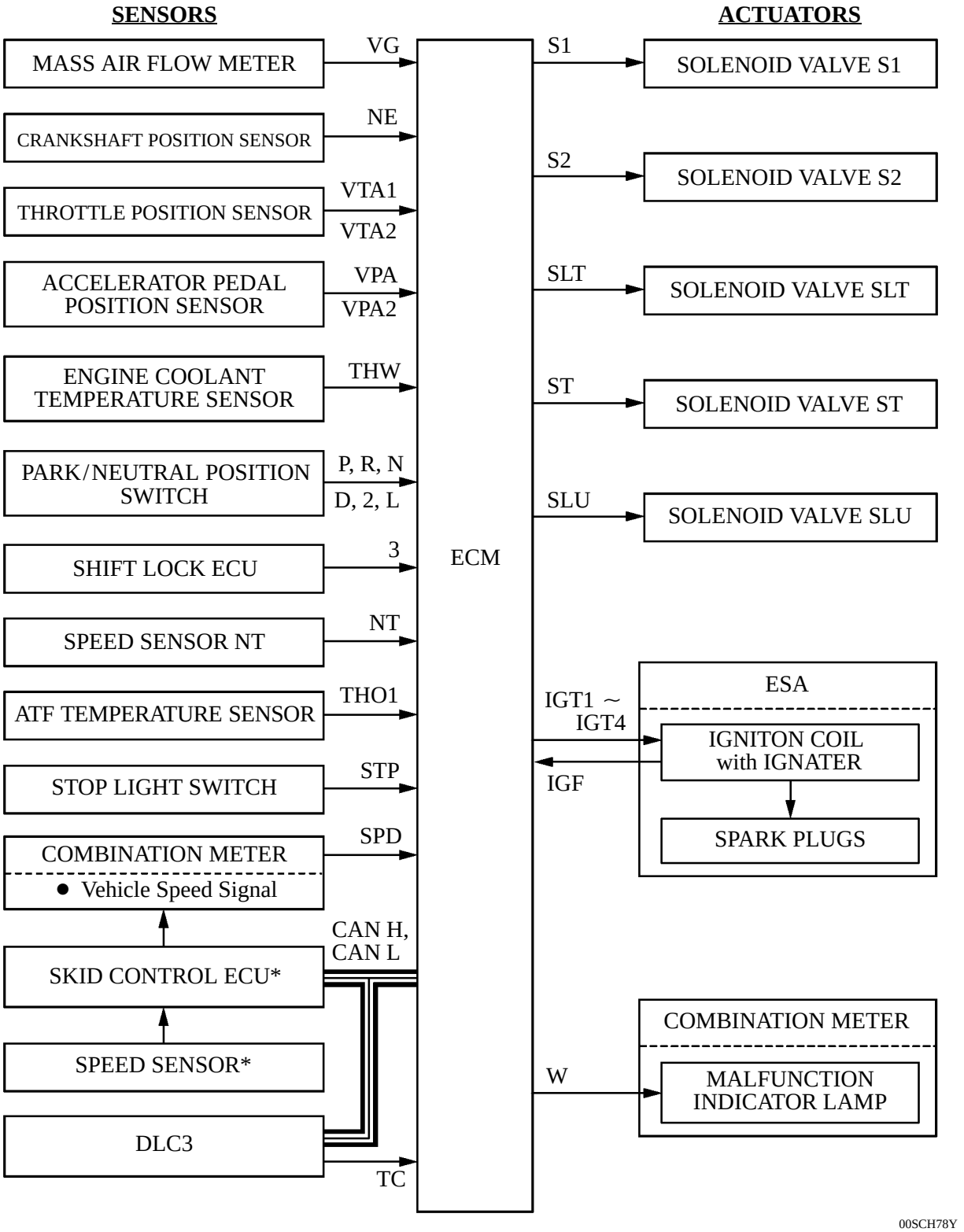
### 1. General

The electronic control system of the U340E automatic transaxle consists of the controls listed below.

| System | Function |
|---|---|
| Clutch Pressure Control (See page CH-20) | ● Controls the pressure that is applied directly to $B_1$ brake and $C_1$ clutch by actuating the solenoid valves (ST, SLT) in accordance with the ECM signals.<br>● The solenoid valve SLT minutely controls the clutch pressure in accordance with the engine output and driving conditions. |
| Line Pressure Control (See page CH-21) | Actuates the solenoid valve SLT to control the line pressure in accordance with information from the ECM and the operating conditions of the transaxle. |
| Shift Control in Uphill/Downhill Traveling (See page CH-22) | Controls to restrict the 4th upshift or to provide appropriate engine braking by using the ECM to determine whether the vehicle is traveling on uphill or downhill. |
| Shift Timing Control | The ECM sends current to the solenoid valve S1 and/or S2 based on signals from each sensor and shifts the gear. |
| Flex Lock-up Clutch Control (See page CH-23) | Controls the solenoid valve SLU, provides an intermediate mode between the ON/OFF operation of the lock-up clutch, and increases the operating range of the lock-up clutch to ensure fuel economy. |
| Lock-up Timing Control | The ECM sends current to the solenoid valve SLU based on the signals from each sensor and engages or disengages the lock-up clutch. |
| Engine Torque Control | Temporarily retards the engine ignition timing to restrict the output torque, thus ensuring the shift feel during up or down shifting. |
| “N” to “D” Squat Control | When the shift lever is shifted from the “N” to “D” position, the gear is temporarily shifted to the 3rd and then to the 1st to reduce vehicle squat. |
| Diagnosis (See page CH-24) | When the ECM detects a malfunction, the ECM makes a diagnosis and memorizes the failed section. |
| Fail-Safe (See page CH-24) | Even if a malfunction is detected in the sensors or solenoids, the ECM effects fail-safe control to prevent the vehicle’s drivability from being affected significantly. |

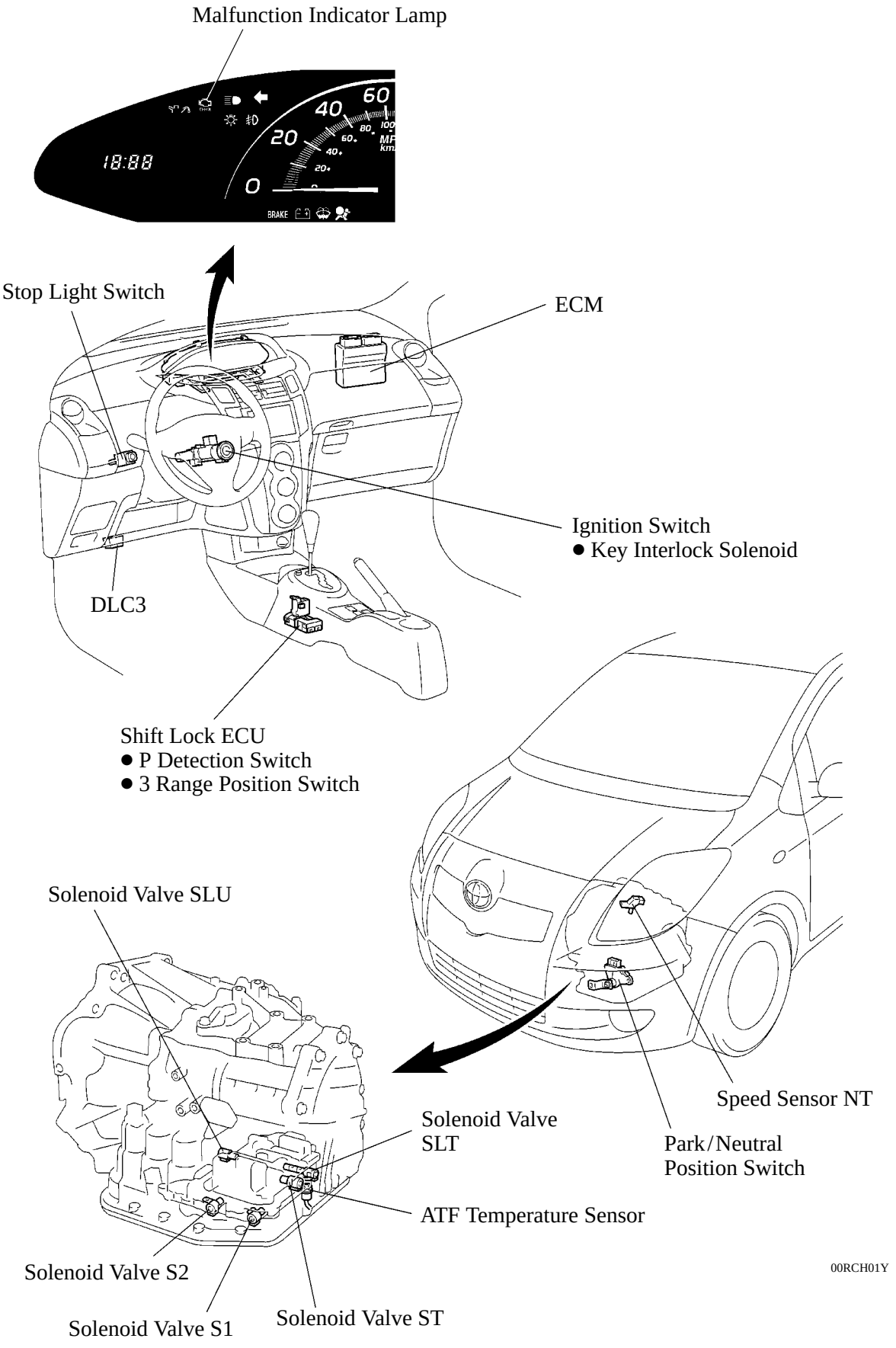
## 2. Construction

The configuration of the electronic control system in the U340E automatic transaxle is as show in the following chart.




*: Models with ABS System

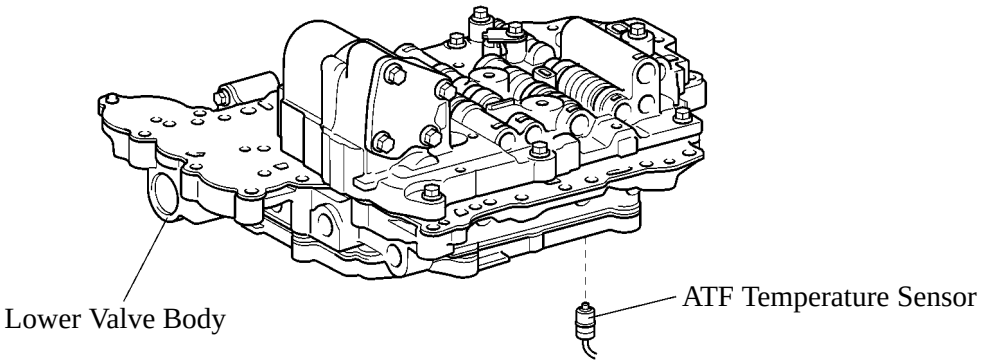
### 3. Layout of Main Components



## 4. Construction and Operation of Main Components

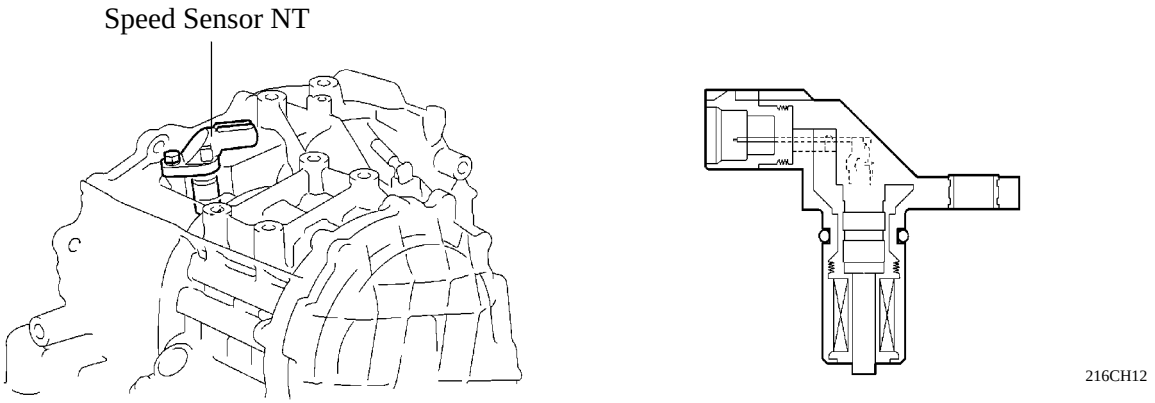
### ATF Temperature Sensor

- The ATF temperature sensor is installed in the lower valve body for direct detection of the fluid temperature.
- The ATF temperature sensor is used for correction of clutch and brake pressures to keep smooth shift quality every time.




### Speed Sensor NT

The speed sensor NT detects the input speed of the transaxle. The forward clutch ($C_1$) drum is used as the timing rotor for this sensor.
Thus, the ECM can detect shift timing of the gears and appropriately control the engine torque and hydraulic pressure in response to the various conditions.

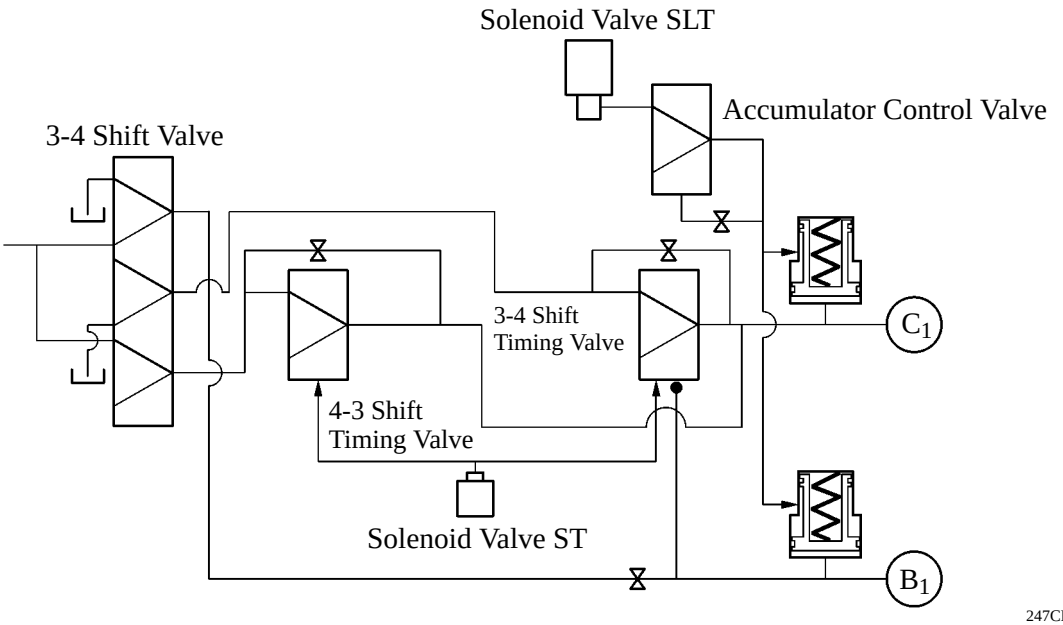



**Speed Sensor NT**

## 5. Clutch Pressure Control

### Clutch to Clutch Pressure Control

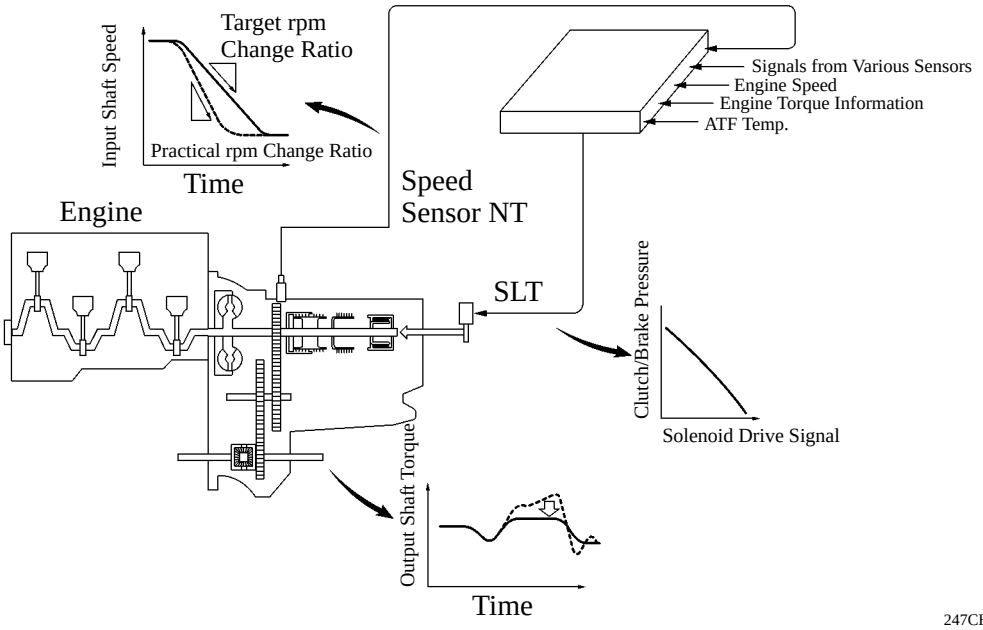
This control is used for shifting from the 3rd to 4th gear, and from the 4th to 3rd gear. It actuates solenoid valves ST and SLT in accordance with the signals from the ECM, and guides this output pressure directly to 4-3 shift timing valve and 3-4 shift timing valve in order to regulate the line pressure that acts on the $B_1$ brake and $C_1$ clutch.
As a result, compact $B_1$ and $C_1$ accumulators without a back pressure chamber have been realized.




247CH25

### Clutch Pressure Optimal Control

The ECM monitors the signals from various types of sensors such as the speed sensor NT, allowing solenoid valve SLT to minutely control the clutch pressure in accordance with engine output and driving conditions. As a result, smooth shift characteristics have been realized.

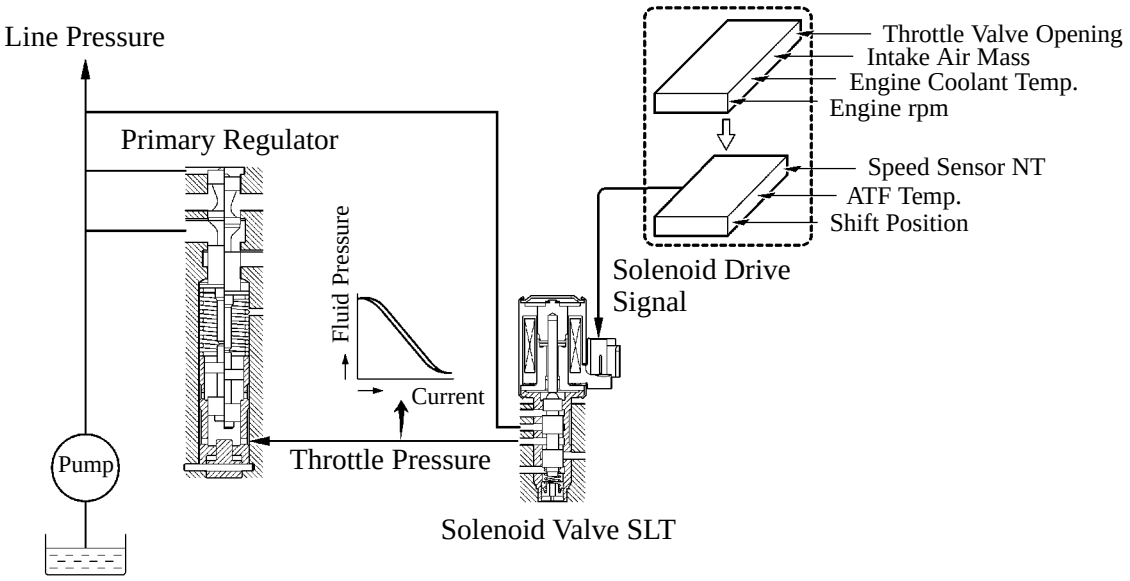



247CH26

## 6. Line Pressure Control

Through the use of the solenoid valve SLT, the line pressure is optimally controlled in accordance with the engine torque information, as well as with the internal operating conditions of the torque converter and the transaxle.

Accordingly, the line pressure can be controlled minutely in accordance with the engine output, traveling condition, and the ATF temperature, thus realizing smooth shift characteristics and optimizing the workload in the oil pump.



## 7. Shift Control in Uphill/Downhill Traveling

### General

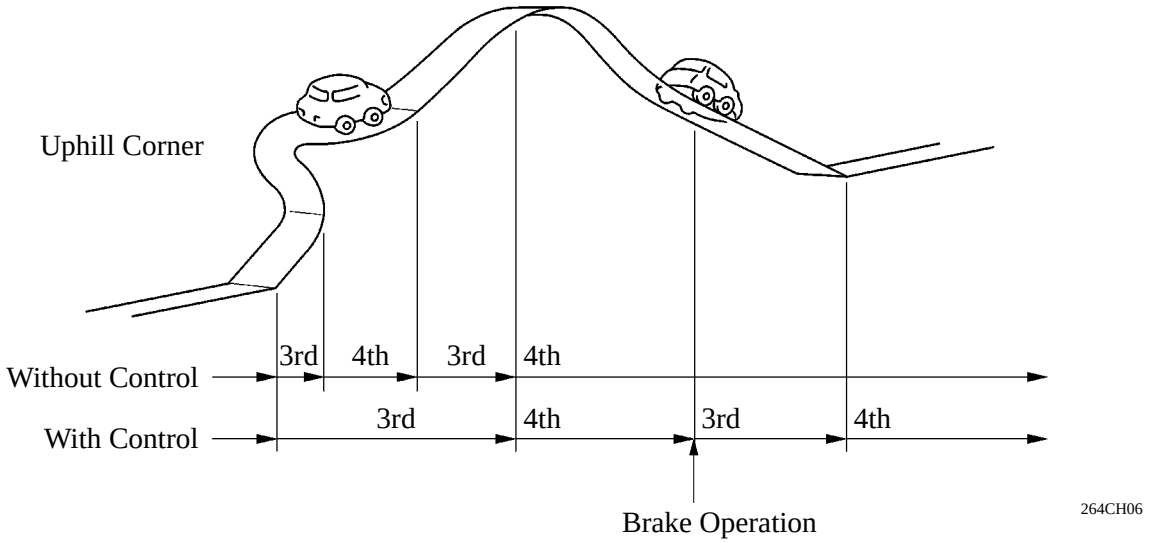
This control helps minimize the gear shifting when the driver operates the accelerator pedal while driving on a winding uphill or downhill road in order to ensure a smooth drive.

### Shift Control in Uphill Traveling

When the ECM detects uphill travel, it prohibits upshifting to the 4th after downshifting to the 3rd.

### Shift Control in Downhill Traveling

If a signal indicating that the driver has operated the brake pedal is input while the ECM detects downhill travel, it downshifts from the 4th to 3rd.

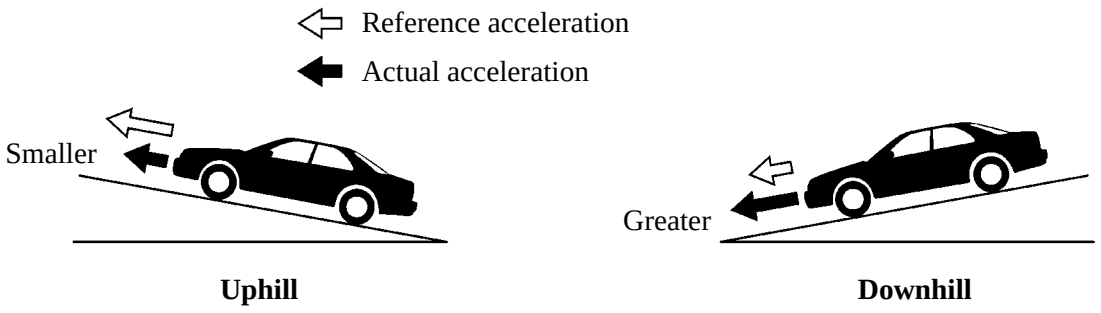



#### 1) Uphill/Downhill Judgment

The actual acceleration calculated from the speed sensor signal is compared with the reference acceleration (based on level road travel) stored in the ECM to determine uphill or downhill travel.

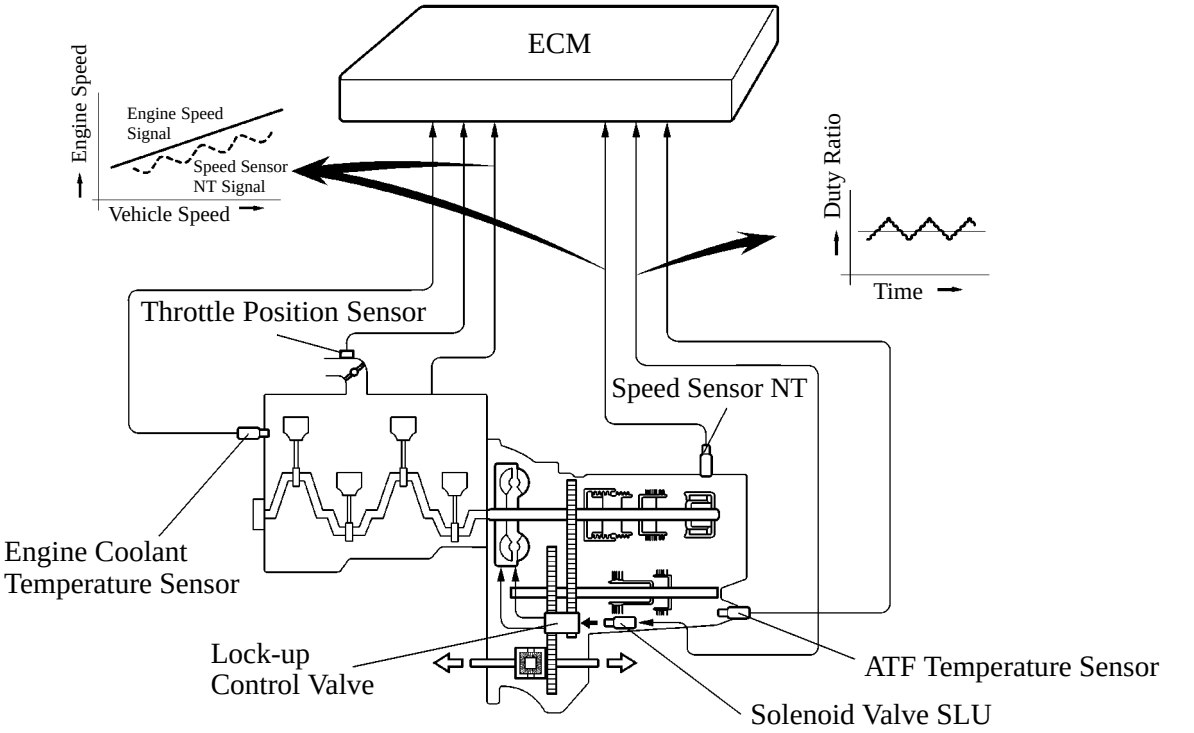
Actual Acceleration < Reference Acceleration

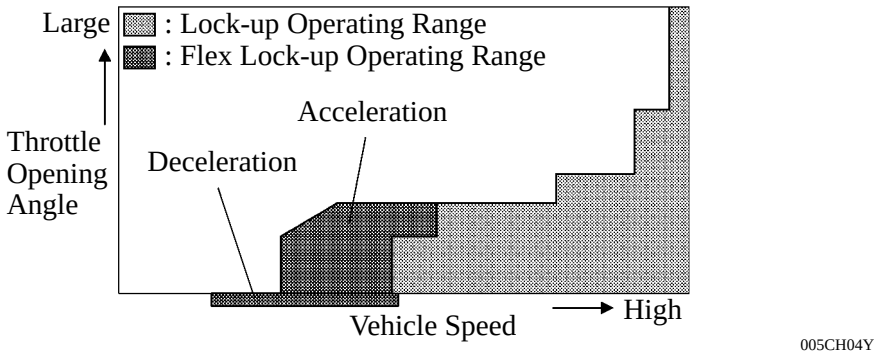
Actual Acceleration > Reference Acceleration



## 8. Flex Lock-up Clutch Control

In addition to the conventional lock-up timing control, flex lock-up clutch control is used.
This flex lock-up clutch control regulates the solenoid valve SLU as an intermediate mode between the ON/OFF operation of the lock-up clutch.
The flex lock-up clutch control operates during acceleration, in the 3rd and 4th gears in the D range, and during deceleration, in the 3rd and 4th gears in the D range, and in the 3rd gear in the 3 range.




**Flex Lock-up Operating Range**

**▶ Flex Lock-up Operation Gears in D and 3 Range ◀**

| Range | Gear | Acceleration Flex Lock-up | Deceleration Flex Lock-up |
|---|---|---|---|
| D | 1st | x | x |
| | 2nd | x | x |
| | 3rd | ○ | ○ |
| | 4th | ○ | ○ |
| 3 | 1st | x | x |
| | 2nd | x | x |
| | 3rd | x | ○ |

## 9. Diagnosis

- When the ECM detects a malfunction, the ECM makes a diagnosis and memorizes the failed section. Furthermore, the MIL (Malfunction Indicator Lamp) in the combination meter illuminates or blinks to inform the driver.
- At the same time, the DTCs (Diagnosis Trouble Codes) are stored in the memory. The DTCs can be read by connecting the hand-held tester. For details, see the '06 Yaris Repair Manual (Pub. No. RM00R0U).

## 10. Fail-Safe

This function minimizes the loss of operability when any abnormality occurs in each sensor or solenoid.

**▶ Fail-Safe Control List ◀**

| Malfunction Part | Function |
|---|---|
| Vehicle Speed Signal | During a vehicle speed signal malfunction, the 4th upshift is prohibited. |
| Speed Sensor NT | During a speed sensor NT signal malfunction, the 4th upshift is prohibited. |
| ATF Temperature Sensor | During a ATF temperature sensor malfunction, the 4th upshift is prohibited. |
| Solenoid Valve SLT or SLU | During a solenoid valves SLT or SLU malfunction, the 4th upshift is prohibited. |
| Engine Coolant Temperature Sensor, Knock Sensor, or Throttle Position Sensor | During a water temperature sensor, knock sensor, or throttle position sensor malfunction, the 4th upshift is prohibited. |
| Solenoid Valve S1 or S2 | During a malfunction in the solenoid valve S1 or S2, the current to the faulty solenoid valve is cut off and control is effected by operating the normal solenoid valves.<br>Shift control is effected as described in the table below, depending on the failed solenoid valve. |

| When all solenoid valves are normal | | | When solenoid valve S1 is abnormal | | | When solenoid valve S2 is abnormal | | | When solenoid valves S1 and S2 are abnormal | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Solenoid valve | | Gear | Solenoid valve | | Gear | Solenoid valve | | Gear | Solenoid valve | | Gear |
| S1 | S2 | | S1 | S2 | | S1 | S2 | | S1 | S2 | |
| ON | ON | 1st | x | ON ↓ OFF | 3rd | ON | x | 2nd | x | x | 3rd |
| ON | OFF | 2nd | x | OFF | 3rd | ON | x | 2nd | x | x | 3rd |
| OFF | OFF | 3rd | x | OFF | 3rd | OFF | x | 3rd | x | x | 3rd |
| OFF | ON | 4th | x | ON | 4th | OFF | x | 3rd | x | x | 3rd |

## ■SHIFT CONTROL MECHANISM

### 1. General

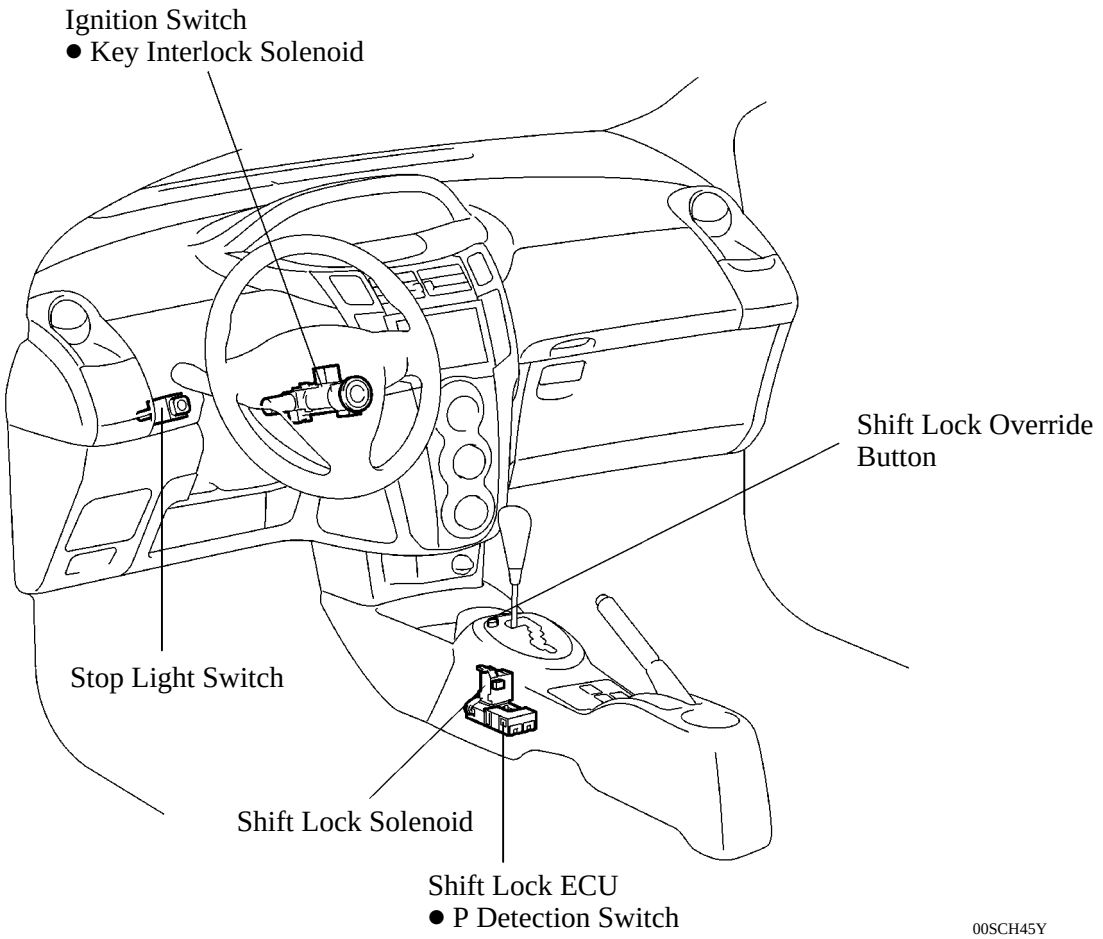
- A gate type shift lever that uses a shift control cable is used. For the gate type, the shift lever button and the overdrive switch of the straight type shift lever have been discontinued. Similar functions are achieved through a single-shift operation (fore-aft and side-to-side).
- A shift lock system that consisting of the key interlock device and shift lock mechanism is used.

### 2. Shift Lock System

#### General

- The key interlock device prevents the key from being pulled out after the ignition switch is turned OFF, unless the shift lever is moved to the P position. Thus, the driver is urged to park the vehicle in the P position.
- The shift lock mechanism prevents the shift lever from being shifted to a position other than the P position, unless the ignition switch is ON and the brake pedal is depressed. It prevents the vehicle from starting off suddenly.

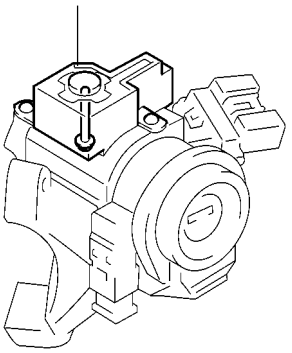
#### Layout of Main Components



### Key Interlock Solenoid

The activation of the key interlock solenoid that is mounted on the upper column bracket moves the lock pin to restrict the movement of the key cylinder. Therefore, if the shift lever is shifted to any position other than “P”, the ignition key cannot be moved from the “ACC” to the “LOCK” position.

Key Interlock Solenoid

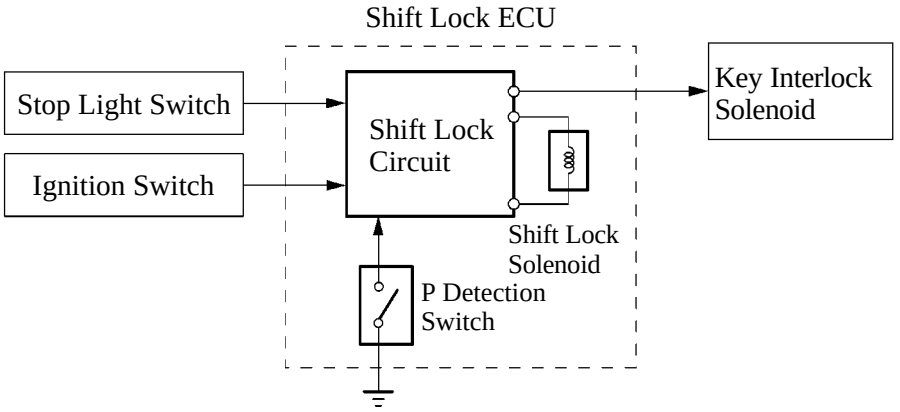


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### System Operation

- The shift lock ECU uses the P detection switch to detect the shift lever position, and receives input signals from the stop light switch and ignition switch. Upon receiving these signals, the shift lock ECU turns ON the key interlock solenoid and the shift lock solenoid in order to release the key interlock and shift lock.
- A shift lock override button, which manually overrides the shift lock mechanism, is used.

**▶ System Diagram ◀**



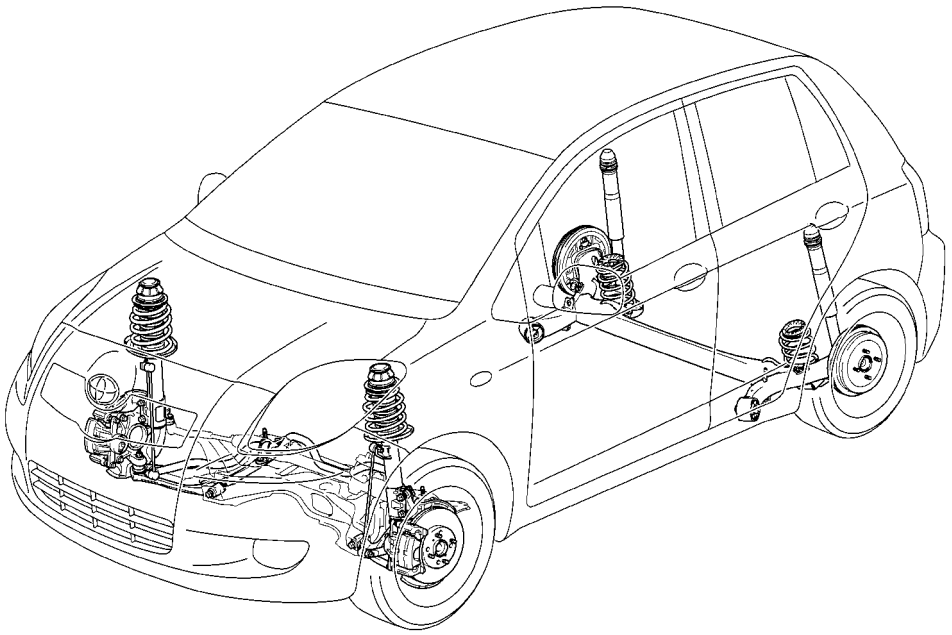

232CH94

# SUSPENSION AND AXLE

## ■SUSPENSION

### 1. General

- The MacPherson strut type is used for the front suspension and the torsion-beam type is used for the rear suspension.
- The characteristics and allocation of the components have been optimized to ensure excellent drivability, stability, and riding comfort.



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**▶ Specification ◀**

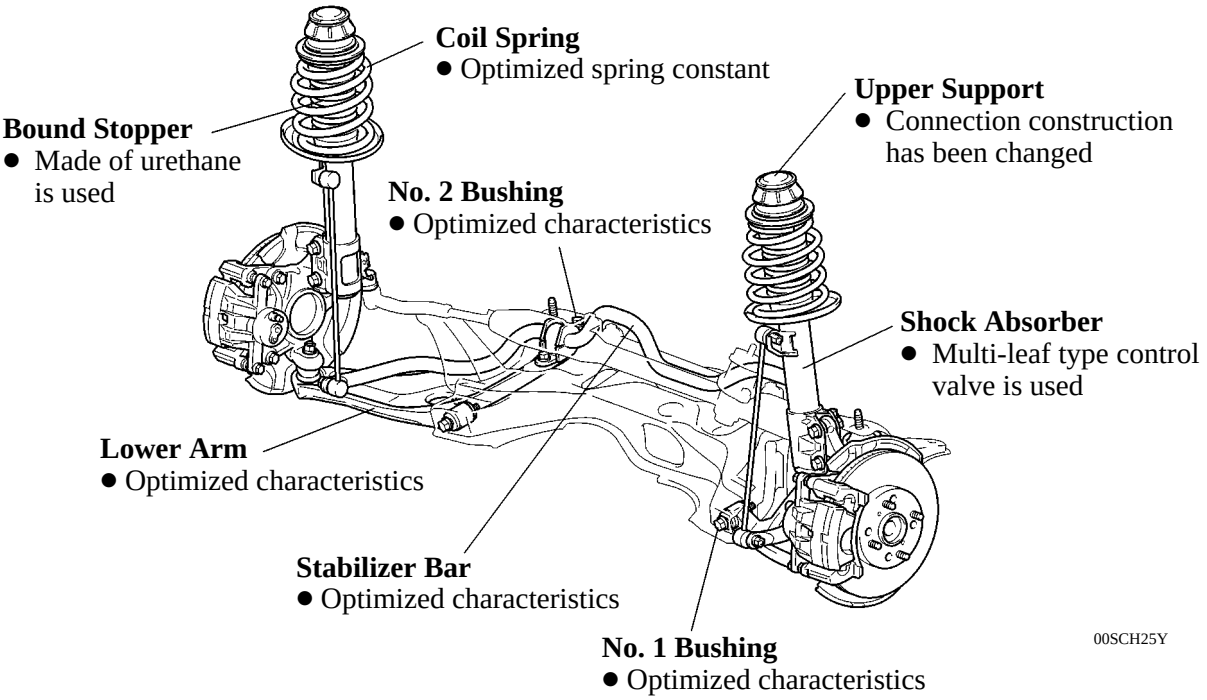
| Tire Size | | | 175/65 R 14 | 185/60 R 15 |
|---|---|---|---|---|
| Front Wheel Alignment* | Tread | mm (in.) | 1480 (58.3) | 1470 (57.9) |
| | Caster | degrees | 4° 46’ | ← |
| | Camber | degrees | - 0° 10’ | ← |
| | Toe-in | mm (in.) | 1.4 (0.055) | ← |
| | King Pin Inclination | degrees | 11° 16’ | ← |
| Rear Wheel Alignment* | Tread | mm (in.) | 1470 (57.9) | 1460 (57.4) |
| | Camber | degrees | - 0° 57 | ← |
| | Toe-in | mm (in.) | 2.8 (0.110) | 2.9 (0.114) |

*: Unloaded Vehicle Condition

## 2. Front Suspension

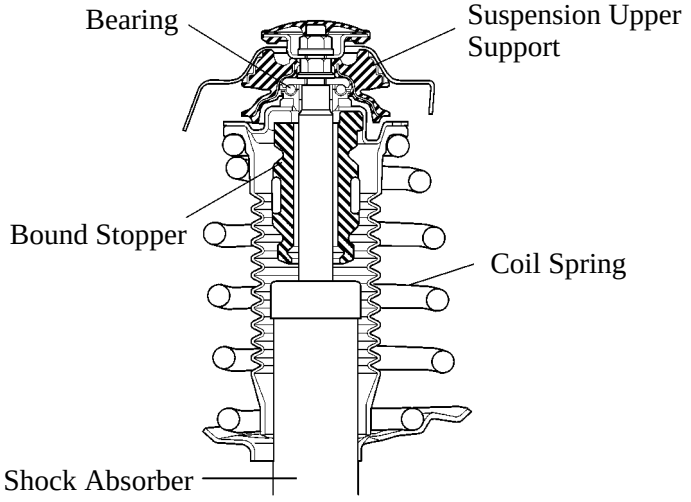
### General

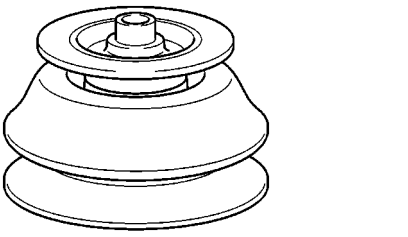
Through the optimal allocation of components, the front suspension realizes excellent riding comfort and controllability.



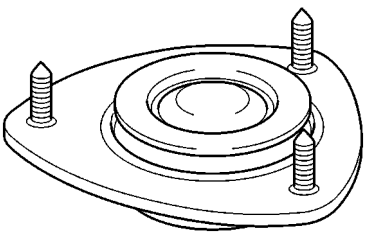

### Suspension Upper Support and Coil Spring

- The suspension upper support has been changed from the construction that the support is connected with the body in three points on the previous models to that it is connected in one point. As a result, a compact and lightweight construction is realized.
- The center axis of the coil spring is slanted toward the outside of the vehicle compared to the center axis of the shock absorber. This reduces the lateral force bearing on the shock absorber piston rod and piston, and prevents increased sliding resistance while helping to maintain riding comfort.




**New**



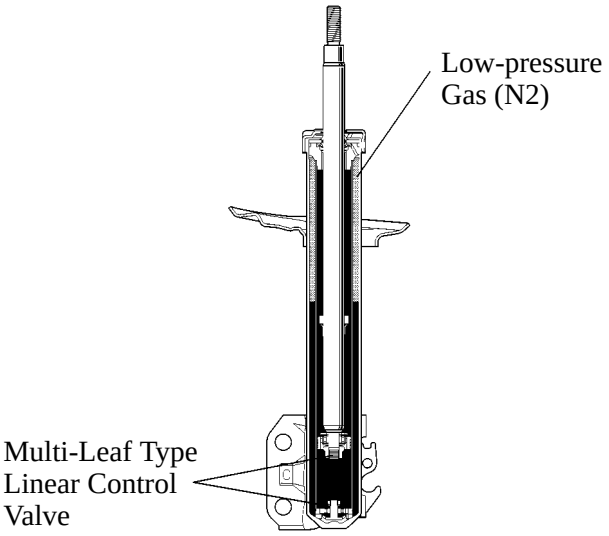

**Previous**

## Shock Absorber

### 1) General

The two functions listed below are used for the shock absorber to realize both driving stability and riding comfort.

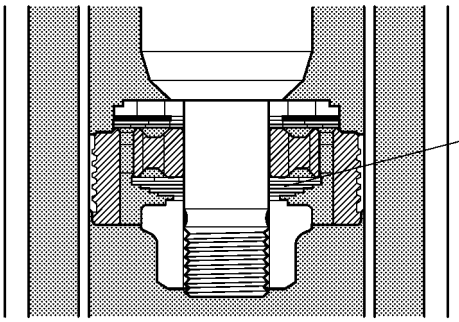
- A low-pressure (N2) gas sealed type construction is used to suppress cavitation.
- A multi-leaf type linear control valve is used to attain linear damping force characteristics.



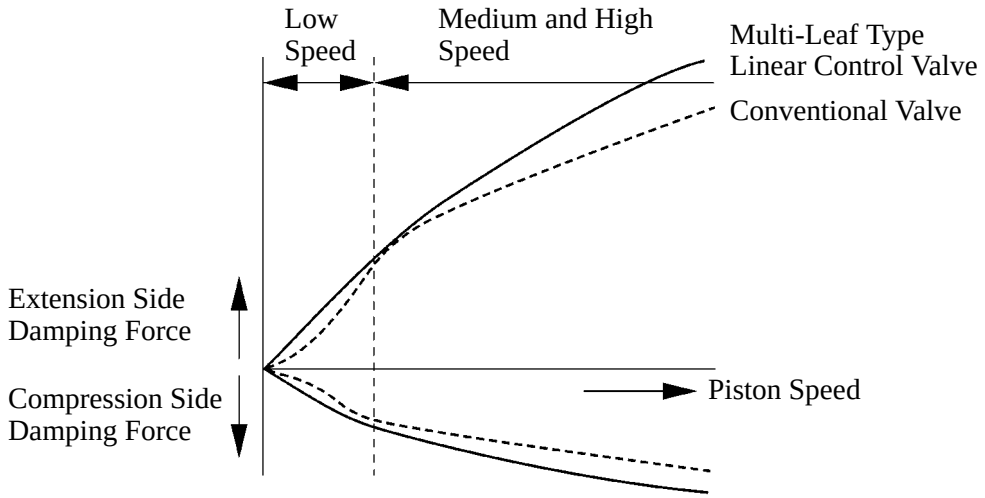

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### 2) Construction of Multi-Leaf Type Linear Control Valve

The multi-leaf type linear control valve has a structure of several layered leaf valves with different diameter. With the adoption of the multi-leaf type linear control valve, the changes in the damping force are made constant at low piston speeds, thus realizing the excellent riding comfort and controllability.




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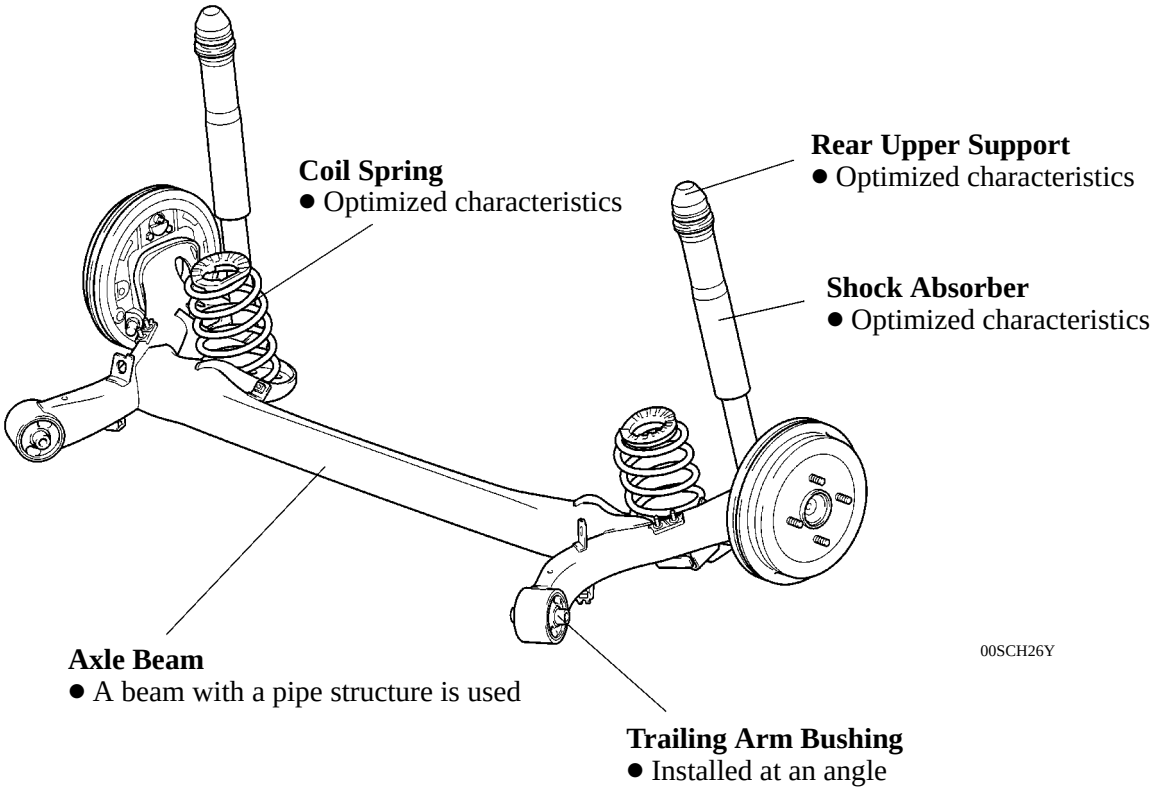

199CH110

**Damping Force Characteristics**

## 3. Rear Suspension

### General

- A compact, lightweight and stiffness torsion-beam type suspension is used to achieve a soft ride and excellent driving stability.
- A beam with a pipe structure combined with a stabilizer function is used for the axle beam.
- The trailing arm bushing is installed at an angle.




**Service Tip**

Be sure to use the jack-up points that are provided on the body when raising the vehicle on the jack. Never place the jack under the torsion beam, spring seat, trailing arm, or bushing of the rear suspension.

### Toe and Camber Change

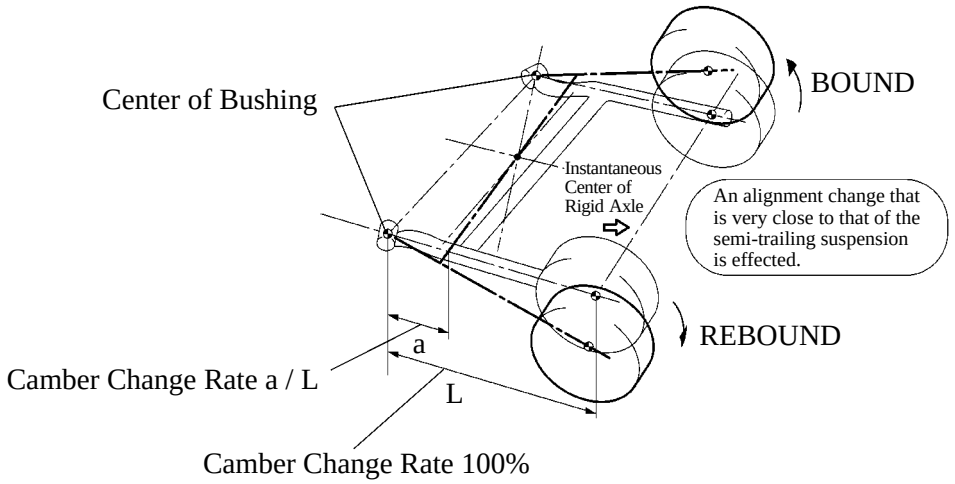
In a torsion-beam type suspension, the camber angle and the toe change differ between the bouncing case and the tramping case, offering both straight-line stability and excellent cornering stability.

#### 1) Bouncing Case

Similar to the full-trailing arm type suspension, the axis that joins the center of the right and left trailing arm bushings is the center of the movement.

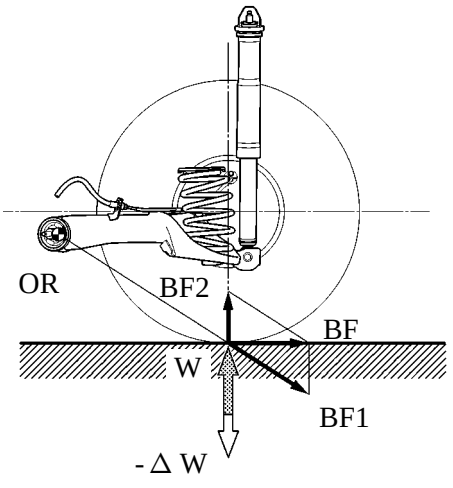
#### 2) Tramping Case

During tramping case, or if a difference in suspension travel is created between the right and left wheels, the torsion beam twists with its shearing center as the center of its rotation.
Also, camber changes in relation to the suspension travel are determined by the ratio of the distance between the No.1 trailing arm bushing, the axle center and the shearing center ('a' in the figure below) and distance between the No.1 trailing arm bushing and the axle beam ('L' in the figure below).
Consequently, through the optimal allocation of the axle beam, the changes in the camber angle in relation to the suspension travel have been optimized, thus ensuring excellent cornering performance.



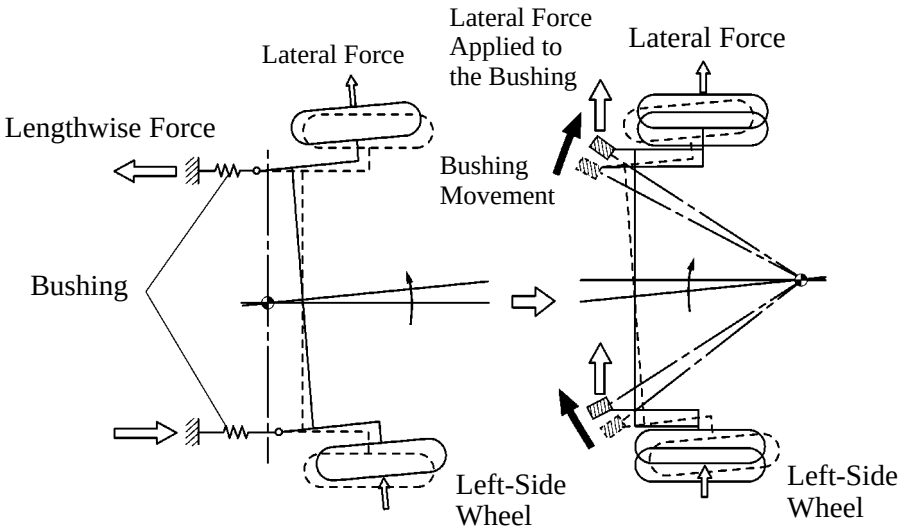

### Anti-Lift Geometry

The lifting of the rear end of the vehicle during braking occurs due to the shifting of the center of gravity caused by inertia.
The intersecting point (OR) supports the braking force (BF), and generates a force (BF1) in the direction of the intersecting point and a component force (BF2) in the direction of the ground contact.
The force BF1 can change the height of the intersecting point (OR). When OR is set high, it acts in the opposite direction (-W) of the load fluctuation (W) in order to restrain the lift.



**Toe-Correct Function**

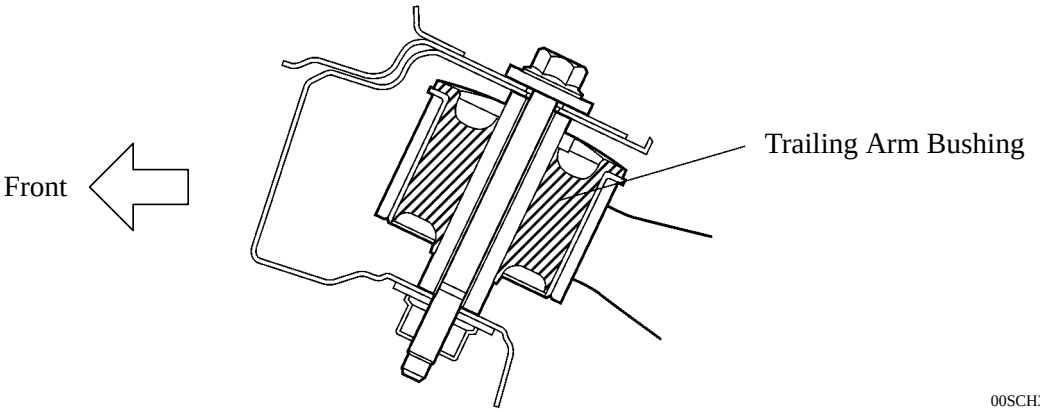
The longitudinal and lateral forces that are created in the vehicle during cornering cause the bushings in the trailing arms to deform.
On a right turn, the right trailing arm moves forward and the left trailing arms moves rearward, creating a tendency for the left wheel to toe out.
In this situation, the bushings that are installed in the trailing arms are designed to utilize the lateral force, which is applied to the bushings during cornering, to correct the left trailing arm towards the toe-in direction.




287CH47

**Axle Beam and Trailing Arm**

The axle beam realizes not only high rigidity but also stability by optimized shearing center position. The axle beam is welded to both trailing arm and spring seat. The trailing arm is fixed on the body via an angled bush.



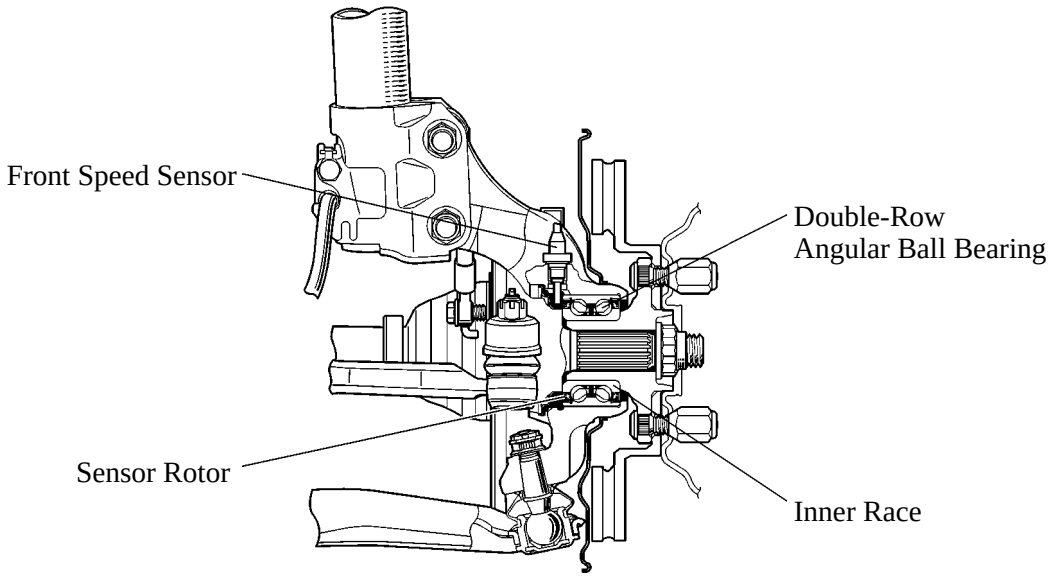

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**Trailing Arm Bushing Cross Section**

## ■AXLE

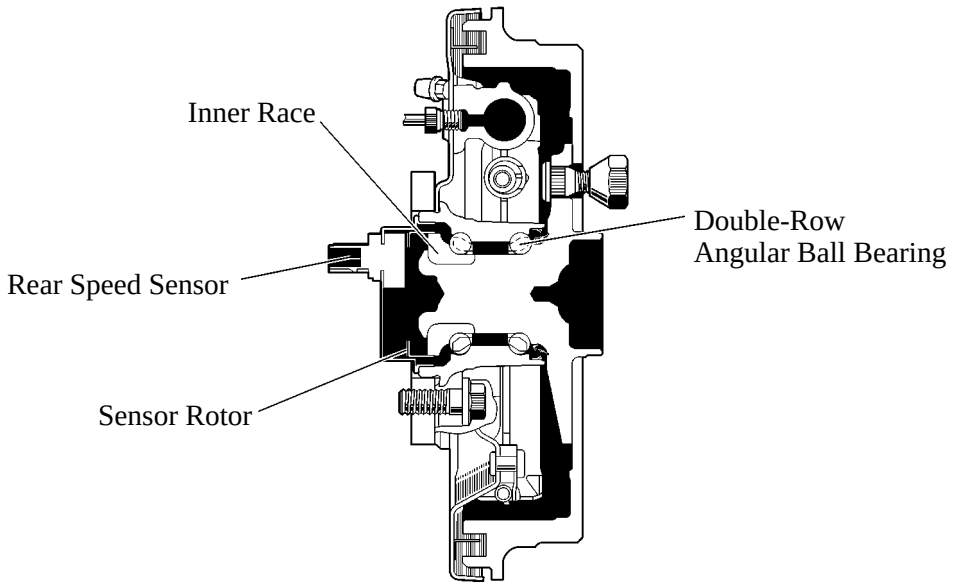
- The double-row angular ball bearings are used in the front and rear axles.
- Due to an active type speed sensor being adopted, a sensor rotor is provided on the bearing inner race. For details on the speed sensor, see page CH-41.

**▶ Front Axle ◀**




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**▶ Rear Axle ◀**

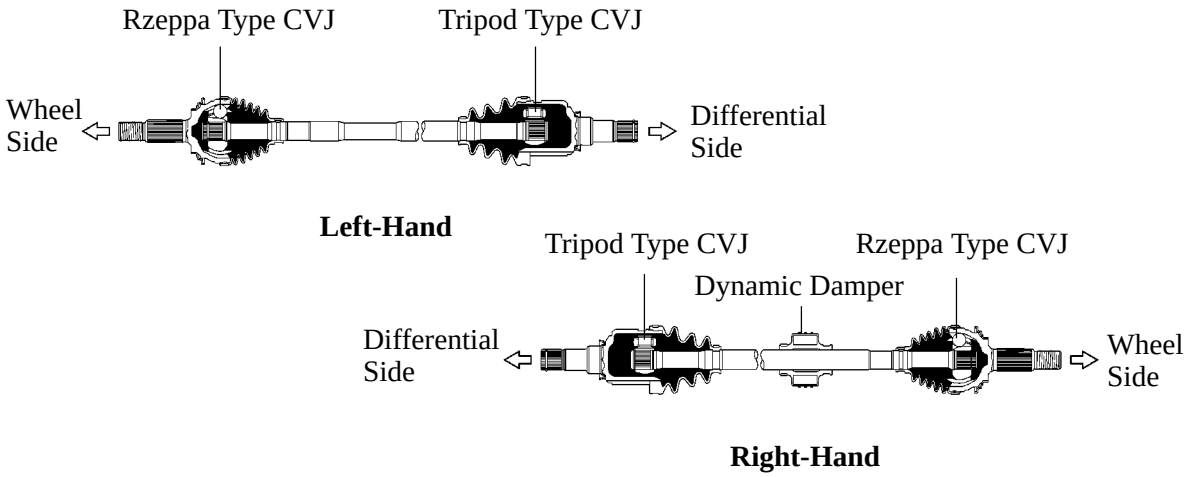



00SCH63Y

# DRIVE SHAFT

## ■DESCRIPTION

- A tripod type CVJ (Constant Velocity Joint) is used on the differential side, and Rzeppa type CVJ is used on the wheel side.
- A dynamic damper is provided on the right drive shaft to reduce vibration and noise.




00RCH03Y

# BRAKE

## ■DESCRIPTION

### 1. General

The ’06 Yaris has a brake system with the following specifications:

| Destination | | U.S.A. | Canada |
|---|---|---|---|
| Front Brake | Type | Ventilated Disc | ← |
| | Rotor Size | For 14 in. wheel | ← |
| Rear Brake | Type | Leading Trailing Drum | ← |
| | Drum Inner Diameter mm (in.) | 200 (7.78) | ← |
| Brake Control System | ABS with EBD | Option | Standard |
| Brake Control Valve | | P Valve* | — |
| Parking Brake | | Lever Type | ← |

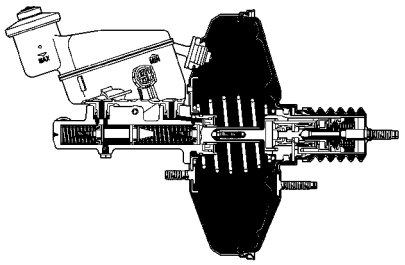
*: Models without ABS with EBD System

**▶ Specification ◀**

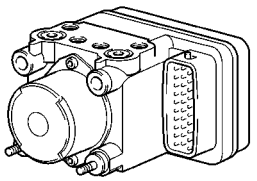
| | | | |
|---|---|---|---|
| Master Cylinder | Type | | Tandem |
| | Diameter | mm (in.) | 20.64 (0.81) |
| Brake Booster | Type | | Single |
| | Diameter | in. | 9 |
| Front Brake | Pad Area | $cm^2$ ($in.^2$) | 39.0 (6.0) x 2 |
| | Rotor Size (D x T)* | mm (in.) | 255 x 22 (10.03 x 0.87) |
| | Pad Material | | PA563H-FF |
| Rear Brake | Lining Area | $cm^2$ ($in.^2$) | 52.0 (8.1) x 2 |
| | Wheel Cylinder Diameter | mm (in.) | 19.05 (0.75) |
| | Drum Inner Diameter | mm (in.) | 200 (7.87) |
| | Lining Material | | LN521-FF |
| Parking Brake | Type | | Drum |
| | Drum Inner Diameter | mm (in.) | 200 (7.87) |

*: (Diameter x Thickness)

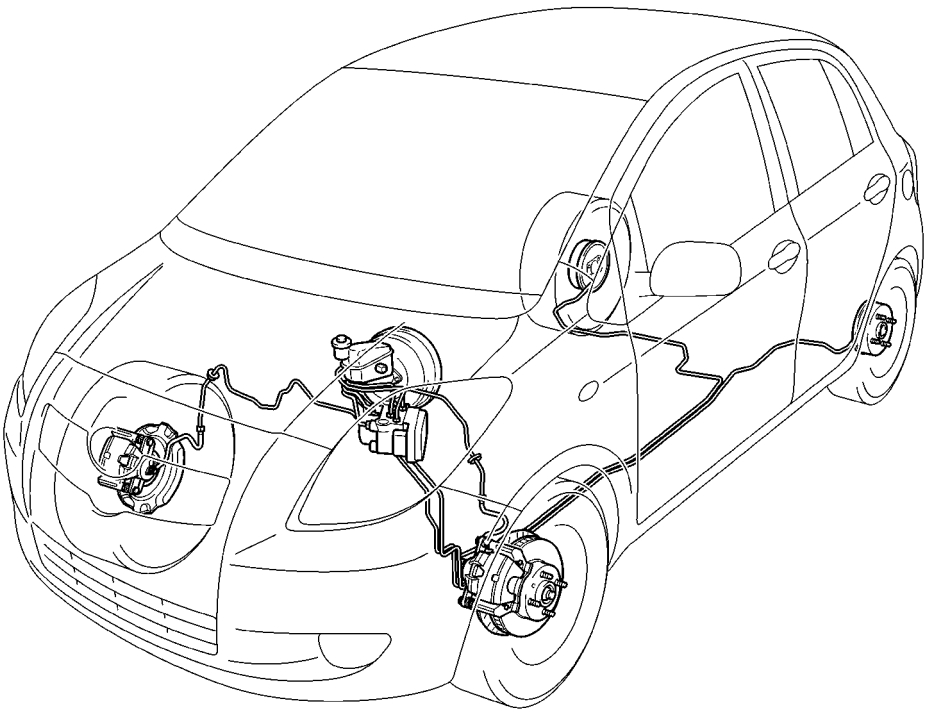
## 2. Components of Brake System

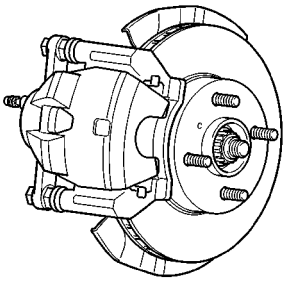


**Master Cylinder & Brake Booster**

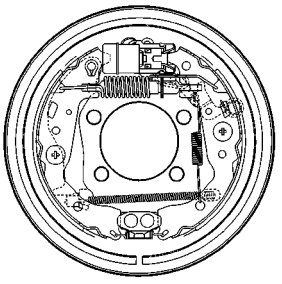


**Brake Actuator**





**Front Brake**



**Rear Brake**

00RCH09Y

## ■BRAKE CONTROL SYSTEM (ABS with EBD)

### 1. General

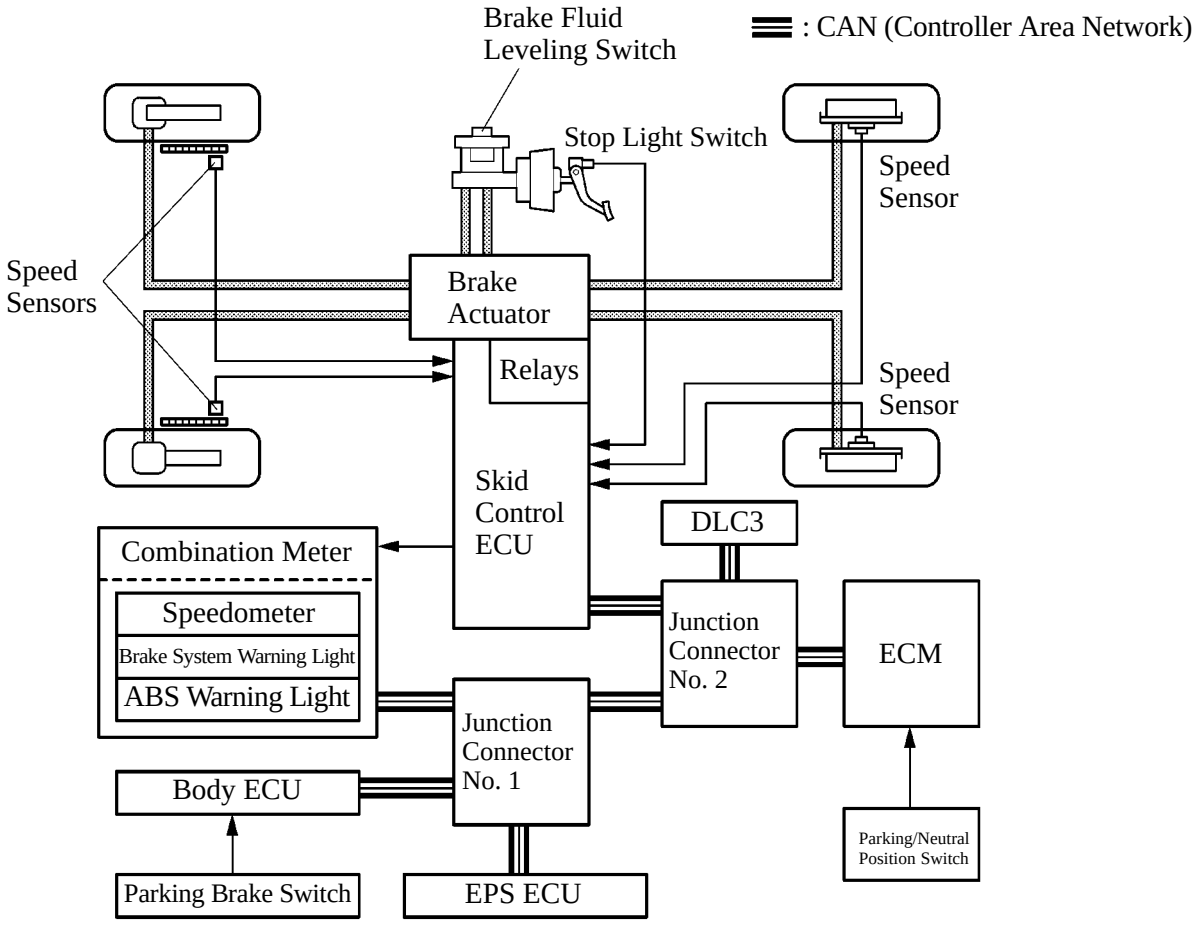
The brake control system (ABS with EBD) of ’06 Yaris has the following functions:

| Function | Outline |
|---|---|
| ABS<br>(Anti-lock Brake System) | The ABS helps prevent the wheels from locking when the brake is applied firmly or applied on a slippery surface. |
| EBD<br>(Electronic Brake force Distribution) | The EBD control utilizes the ABS, realizing the proper brake force distribution between the front and rear wheels in accordance with the driving conditions.<br>In addition, during cornering braking, it also controls the brake forces of the right and left wheels, helping to maintain the vehicle behavior. |

**Service Tip**

When brake control system is activated, the brake pedal could shudder, which is a normal occurrence of the system in operation and should not be considered a malfunction.

**▶ System Diagram ◀**




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## 2. Outline of EBD Control

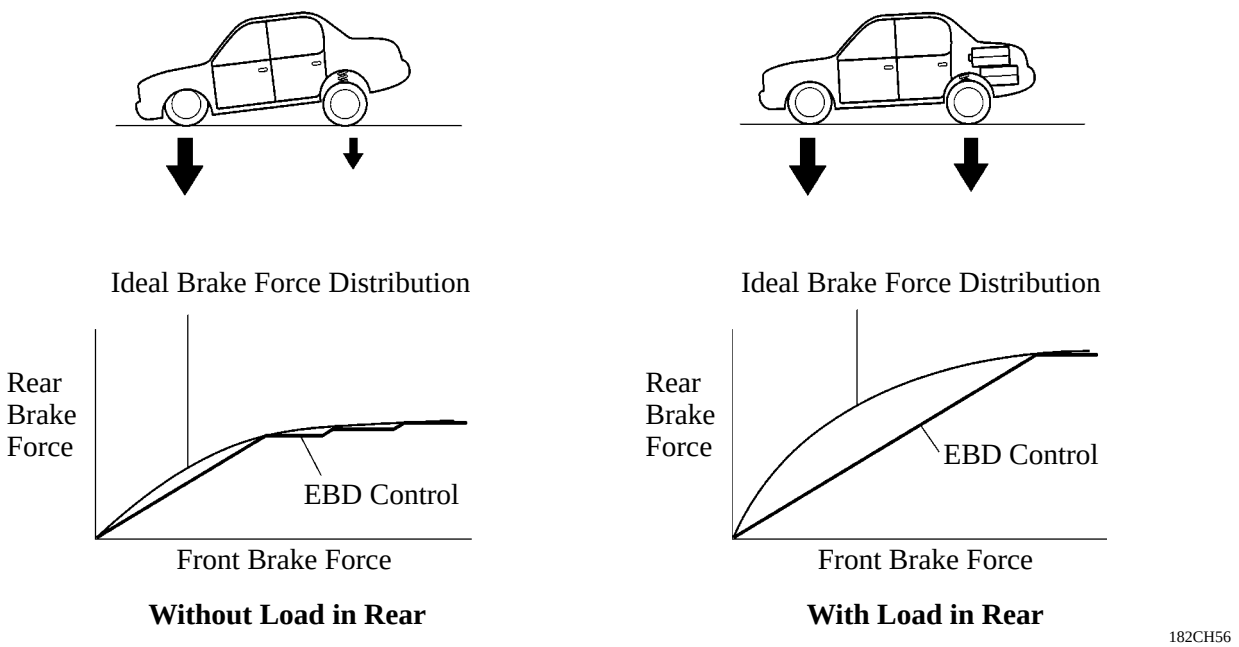
### General

The distribution of the brake force, which was performed mechanically in the past, is now performed under electrical control of the skid control ECU, which controls the braking force in accordance with the vehicle's driving conditions.

### Front/Rear Wheels Brake Force Distribution

If the brakes are applied while the vehicle is moving straight forward, the transfer of the load reduce the weight that is applied to the rear wheels. The skid control ECU determines this condition by way of the signal from the speed sensor, and the brake actuator regulates the distribution of the brake force of the rear wheels to optimally control.
For example, the amount of the brake force that is applied to the rear wheels during braking varies depending on whether the vehicle is carrying load or not. The amount of the brake force that is applied to the rear wheels also varies in accordance with the extent of the deceleration.
Thus, the distribution of the brake force to the rear is optimally controlled in order to effectively utilize the braking force of the rear wheels under these conditions.

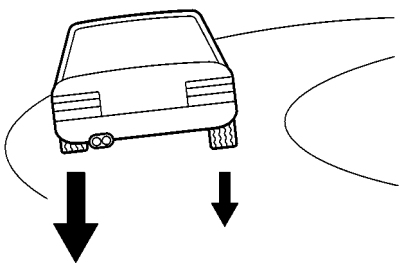
**▶ EBD Control Concept ◀**




182CH56

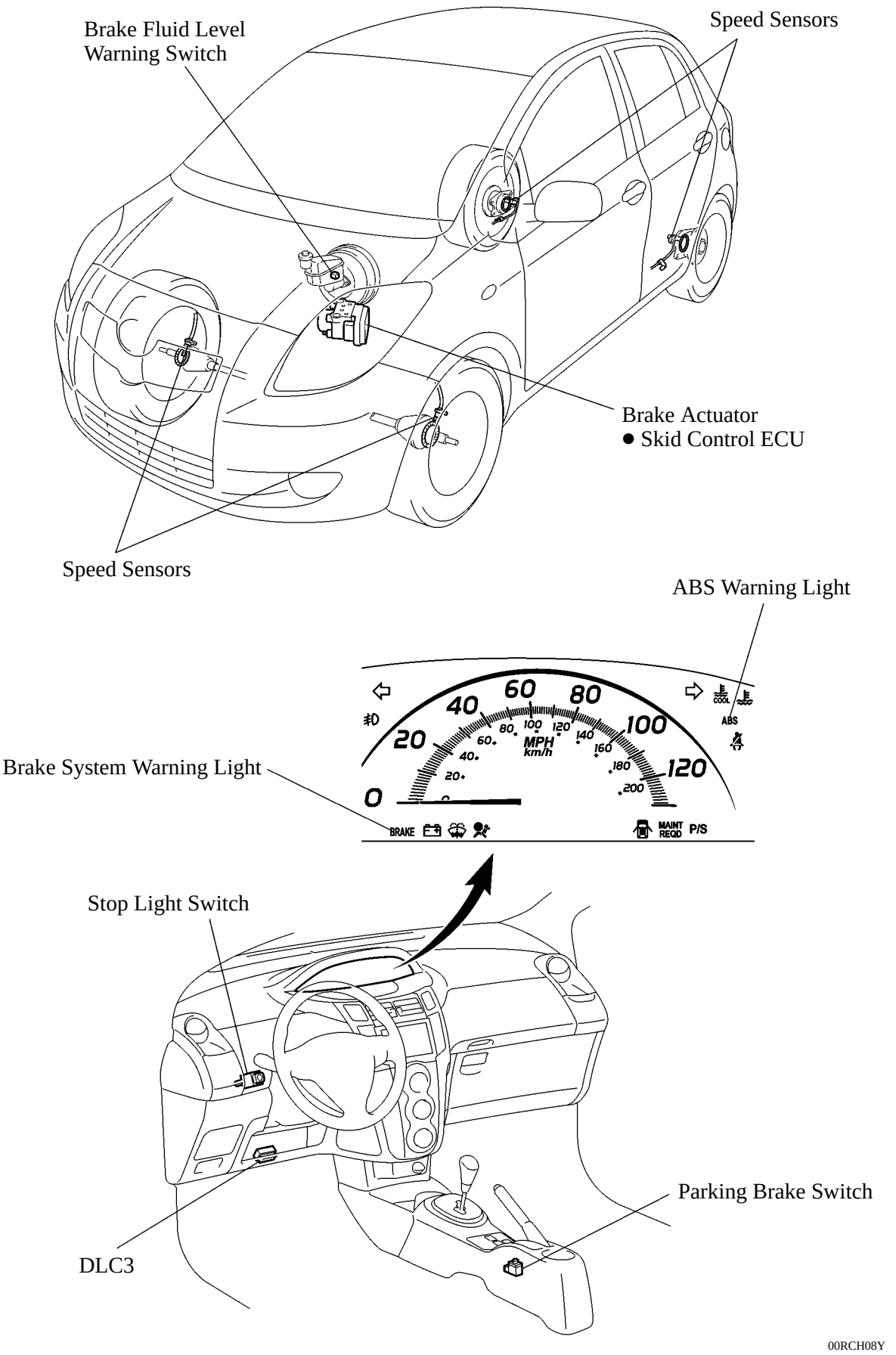
### Right/Left Wheels Brake Force Distribution (During Cornering Braking)

When the brakes are applied while the vehicle is cornering, the load that is applied to the inner wheel decreases as the load to the outer wheel increases.
The skid control ECU determines this condition by way of the signals from the speed sensor, and the brake actuator regulates the brake force in order to optimally control the distribution of the brake force to the inner wheel and outer wheel.



181CH56

### 3. Layout of Main Components




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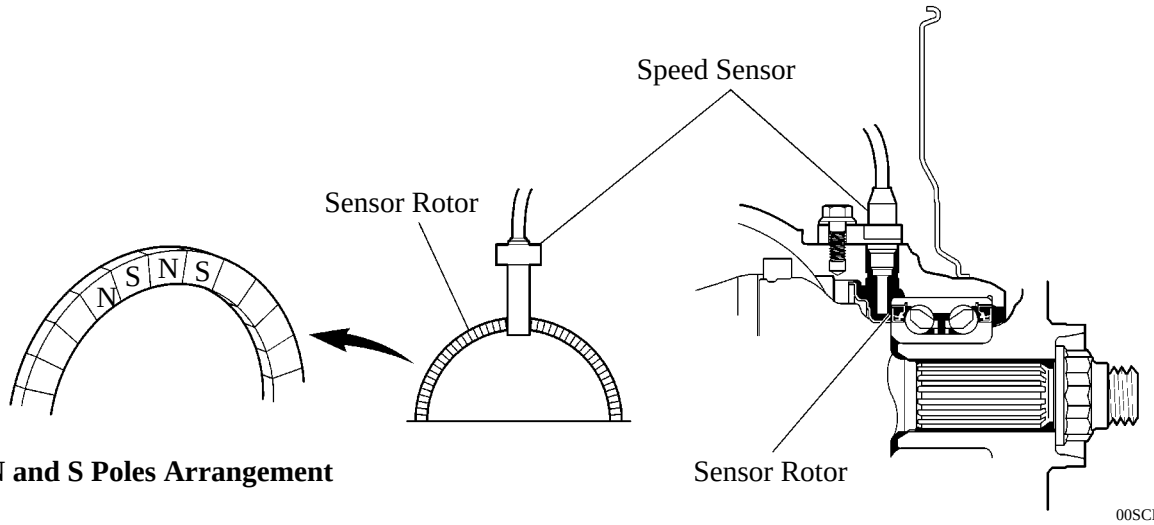
## 4. Function of Main Component

| Component | | Function |
|---|---|---|
| Combination Meter | Brake System Warning Light | ● Lights up together with the ABS warning light to alert the driver when a malfunction occurs in the EBD or skid control ECU.<br>● Lights up to inform the driver when the parking brake lever is pulled up.<br>● Lights up to alert the driver when the brake fluid level is low. |
| | ABS Warning Light | Lights up to alert the driver when the skid control ECU detects the malfunction in the ABS. |
| Brake Fluid Level Warning Switch | | Detects the brake fluid level. |
| Stop Light Switch | | Detects the brake pedal depressing signal. |
| Parking Brake Switch | | Detects when the parking brake lever is pulled up. |
| Speed Sensors | | Detect the wheel speed of each of four wheels. |
| Brake Actuator | | Changes the fluid path based on the signals from the skid control ECU during the operation of the ABS with EBD, in order to control the fluid pressure that is applied to the wheel cylinders. |
| | Skid Control ECU | Based on signals from each sensor, it judges the vehicle driving condition and sends brake control signal to the brake actuator. |
| | ABS Solenoid Relay | Supplies or cuts off power to the solenoid valves in the brake actuator. |
| | ABS Motor Relay | Supplies or cuts off power to the motor in the brake actuator. |

## 5. Speed Sensor

### General

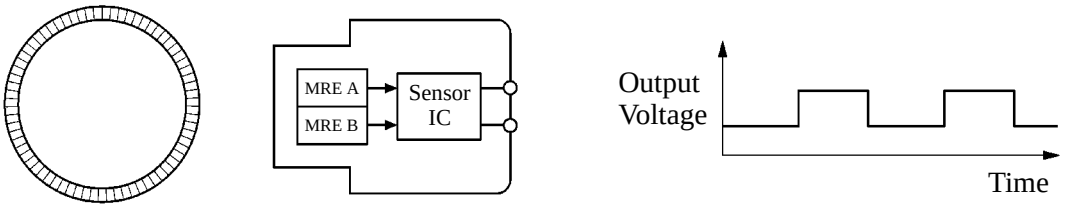
- An active type speed sensor is used. A Hall IC is used in the sensing portion of this sensor.
- The sensor rotor, which consists of N and S poles that are arranged in a circle, is integrated with the hub bearing inner race.




**N and S Poles Arrangement**

00SCH100Y

**▶ Active Type Speed Sensor ◀**

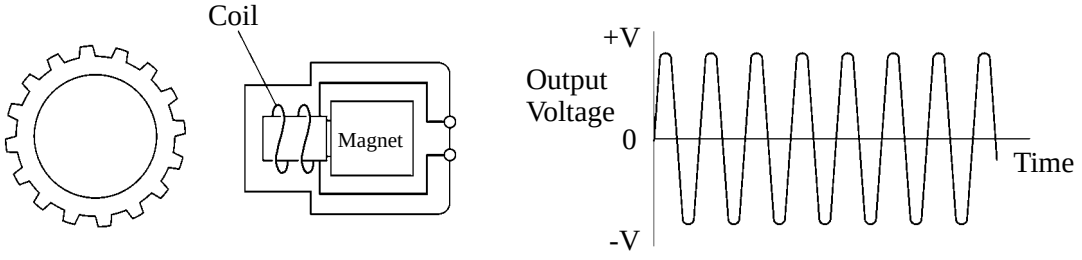



**Sensor Rotor (Hub Bearing Inner Race)**

**Forward and Backward**

00SCH97Y

**▶ Passive Type Speed Sensor ◀**




**Sensor Rotor (Drive Shaft or Axle Shaft)**

232CH39

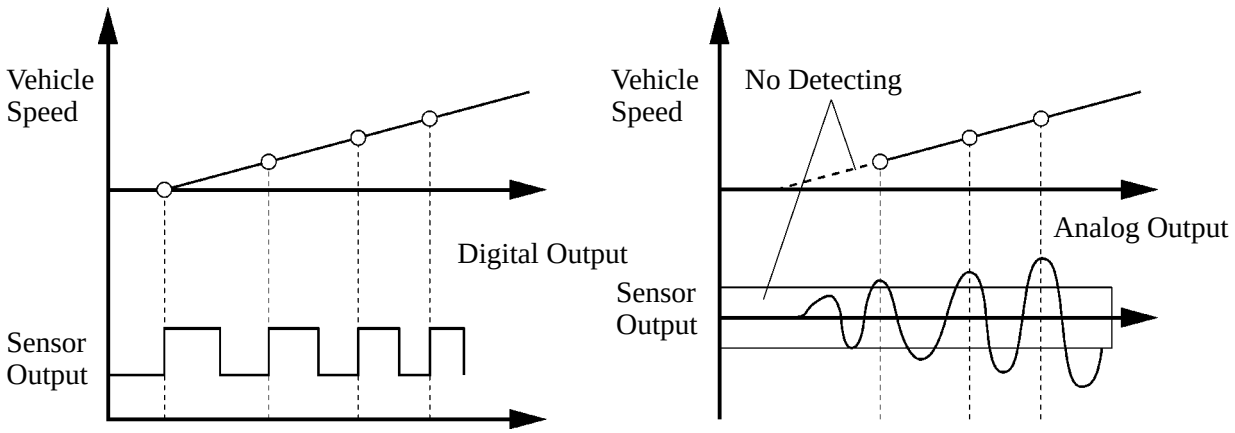
**Forward and Backward**

232CH147

**Operation**

- Along with the rotational movement of the sensor rotor, the N and S poles of the sensor rotor pass alternately near the sensing portion of the speed sensor. This speed sensor outputs magnetic flux as a current value. The skid control ECU detects the changes in the output current to determine the wheel speed.
- Unlike the passive type speed sensors used on conventional models that output analog pulses, the active type speed sensor outputs digital pulses. Therefore, it can start detecting vehicle speeds at approximately 0 km/h.

**▶ Comparison between Active Type and Passive Type Output Waveform Image ◀**

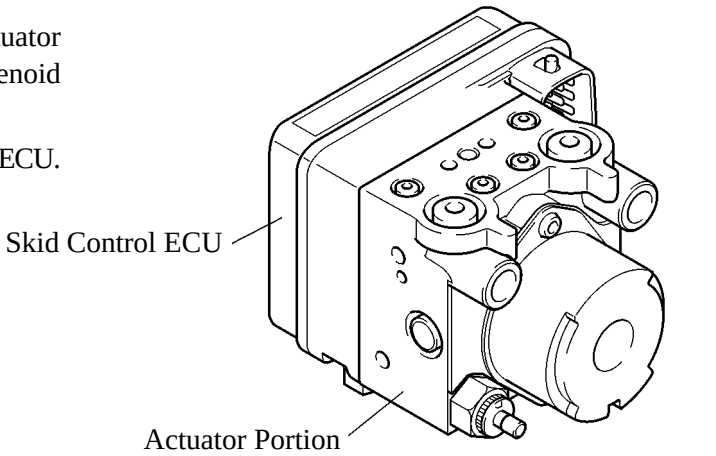



232CH41

## 6. Brake Actuator

### General

- The brake actuator consists of the actuator portion, skid control ECU, ABS solenoid relay, and ABS motor relay.
- The 2 relays are built into the skid control ECU.

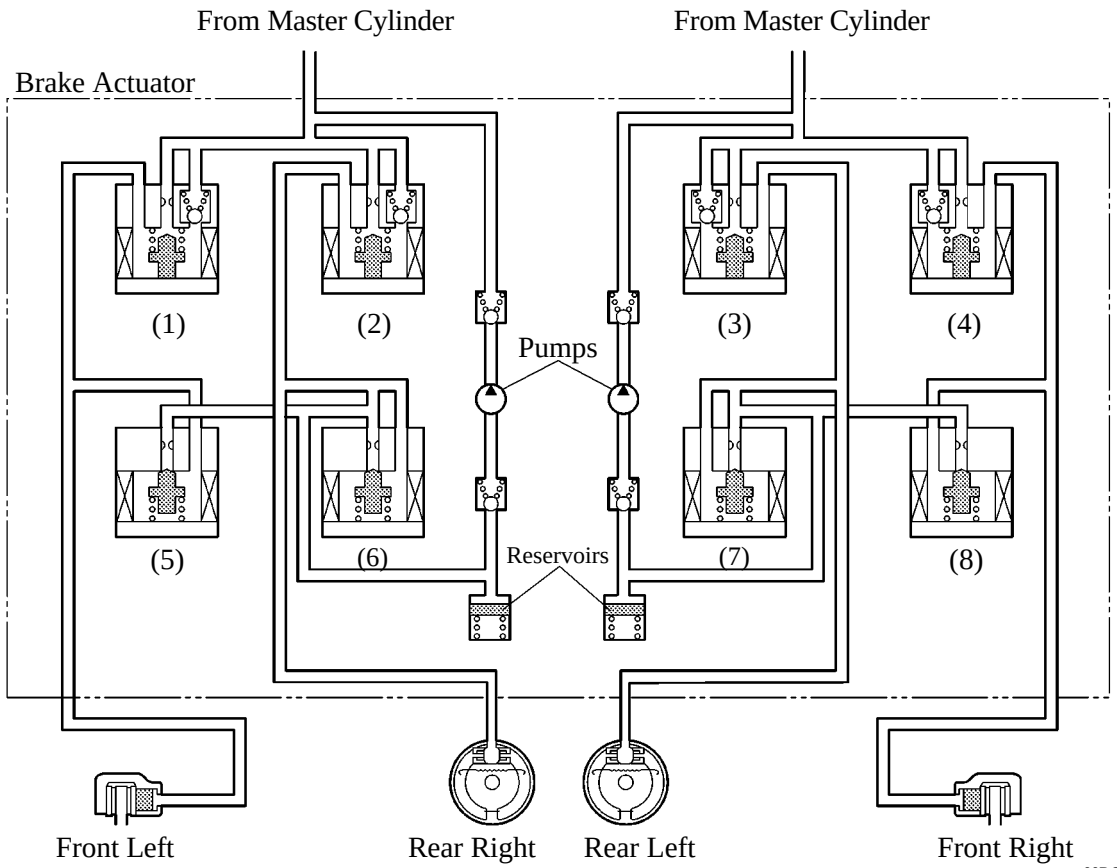



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### Actuator Portion

The actuator portion consists of 8 two-position solenoid valves, 1 motor, 2 pumps and 2 reservoirs. The 8 two-solenoid valves consist of 4 pressure holding valves [(1), (2), (3), (4)] and 4 pressure reduction valves [(5), (6), (7), (8)].

**▶ Hydraulic Circuit ◀**

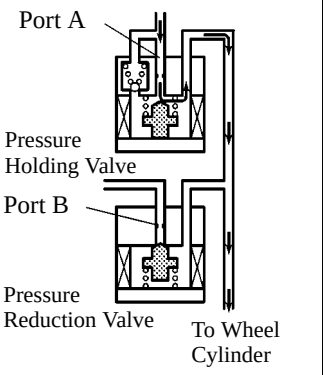
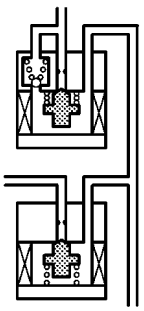
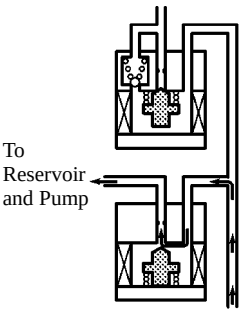



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## 7. System Operation

### ABS with EBD Operation

Based on the signals received from the 4 speed sensors, the skid control ECU calculates each wheel speed and deceleration, and checks wheel slipping conditions. According to the slipping condition, the skid control ECU controls the pressure holding valve and pressure reduction valve in order to adjust the fluid pressure of the each wheel cylinder in the following 3 modes: pressure reduction, pressure holding, and pressure increase modes.

| Not Activated | Normal Braking | — | — |
|---|---|---|---|
| Activated | Increase Mode | Holding Mode | Reduction Mode |
| Hydraulic Circuit |  169CH54 |  169CH55 |  169CH56 |
| Pressure Holding Valve (Port A) | OFF (Open) | ON (Close) | ← |
| Pressure Reduction Valve (Port B) | OFF (Close) | ← | ON (Open) |
| Wheel Cylinder Pressure | Increase | Hold | Reduction |

### Initial Check

After the ignition is turned ON, and the vehicle attains an approximate speed of 6 km/h (4 mph) or more only at first time, the skid control ECU performs the initial check.
The functions of each solenoid valve and pump motor in the brake actuator are checked in order.

**Self-Diagnosis**

- If the skid control ECU detects a malfunction in the ABS with EBD system, the ABS and brake system warning lights that correspond to the function in which the malfunction has been detected indicate or light up to alert the driver of the malfunction as indicated in the table below.

○: Light ON — : Light OFF

| Item | ABS | EBD | Skid Control ECU |
|---|---|---|---|
| ABS Warning Light | ○ | ○ | ○ |
| Brake System Warning Light | — | ○ | ○ |

- At the same time, the DTCs (Diagnostic Trouble Codes) are stored in the memory. The DTCs can be read by connecting a hand-held tester, or by connecting the SST (09843-18040) between the Tc and CG terminals of DLC3 and observing the blinks of the ABS warning light.
- This system has a sensor signal check (test mode) function. This function is activated by connecting a hand-held tester.
- If the skid control ECU detects a malfunction during a sensor signal check (test mode), it stores the DTC in its memory. This DTCs can be read during a sensor check operation by connecting a hand-held tester or by connecting the SST (09843-18040) between the Tc and CG terminals of the DLC3 and observing the blinking of the ABS warning light.

For details of the DTCs that is stored in skid control ECU memory and the DTCs that are output through the sensor signal check (test mode) functions, see the ’06 Yaris Repair Manual (Pub. No. RM00R0U).

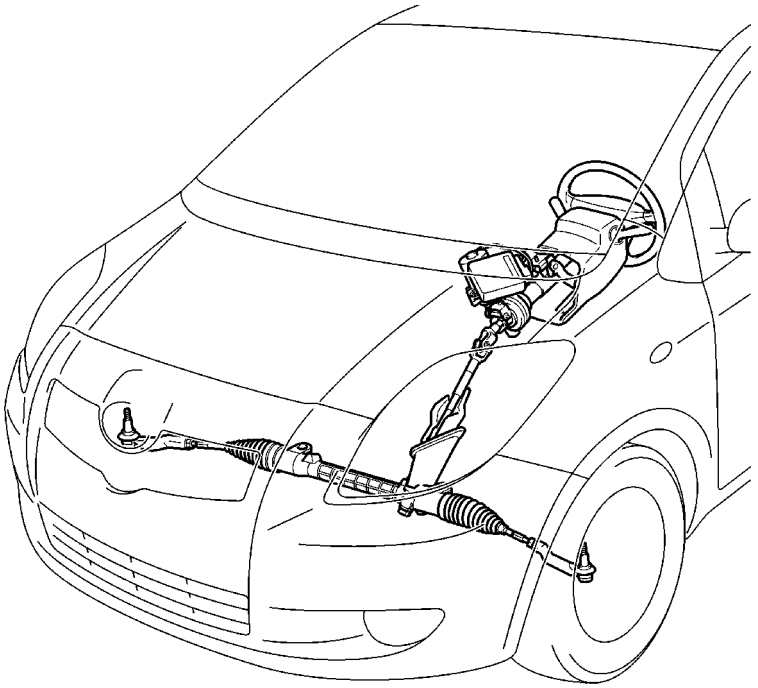
**Fail-Safe**

- In the event of a malfunction in the ABS, the skid control ECU prohibits the ABS operation.
- In the event of a malfunction in EBD control, the skid control ECU prohibits EBD control. Thus, the brake will be operated in the same condition as the system without the ABS with EBD.

# STEERING

## ■DESCRIPTION

- Rack and pinion type steering gears are used on all models.
- A vehicle-speed sensing type EPS (Electric Power Steering) and tilt steering mechanism are provided as standard equipment on all models.
- An energy absorbing mechanism is used in the steering column.



00SCH16Y

**▶ Specification ◀**

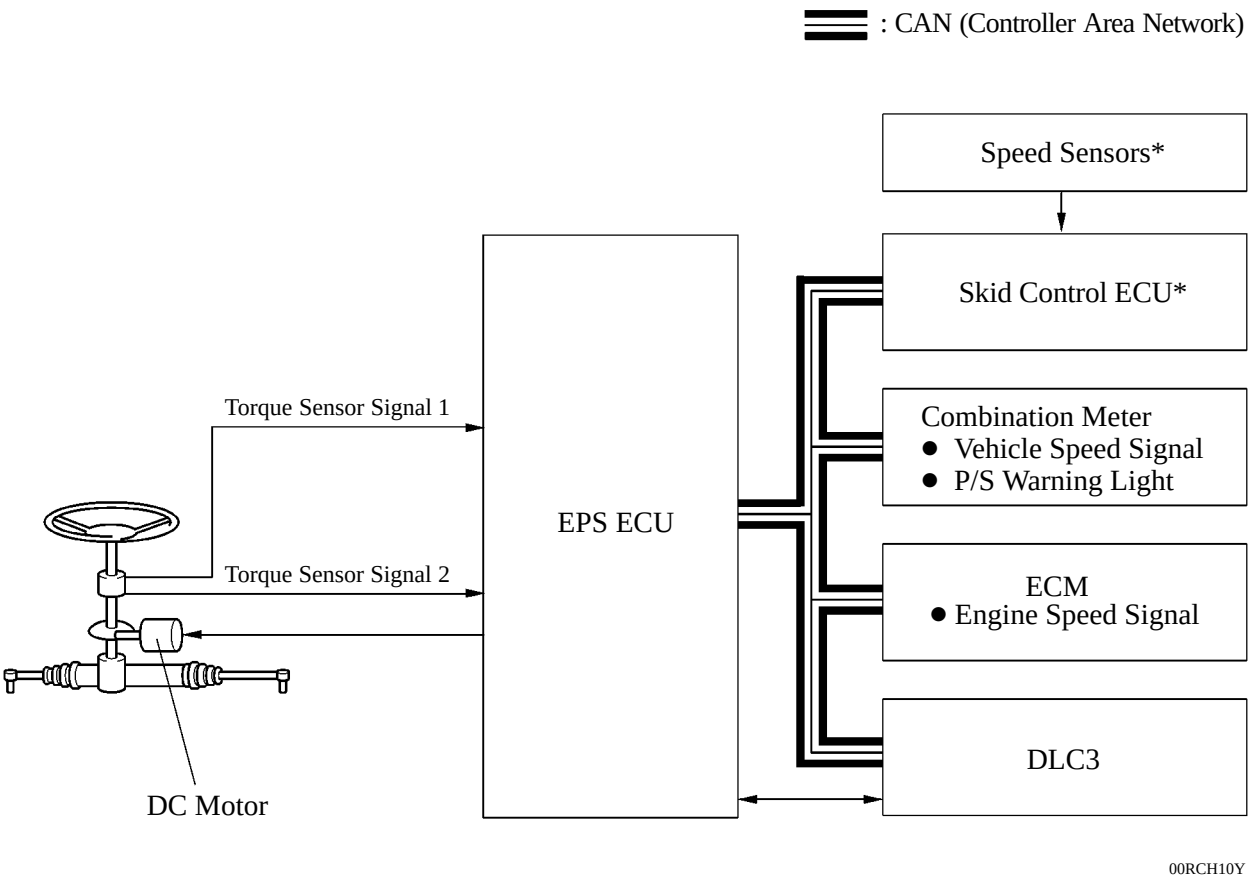
| | | |
|---|---|---|
| Steering Type | | Electric Power Steering |
| Gear Ratio | | 14.2 |
| No. of Turns Lock to Lock | | 3.02 |
| Rack Stroke | mm (in.) | 151 (5.94) |

## ■EPS (ELECTRIC POWER STEERING)

### 1. General

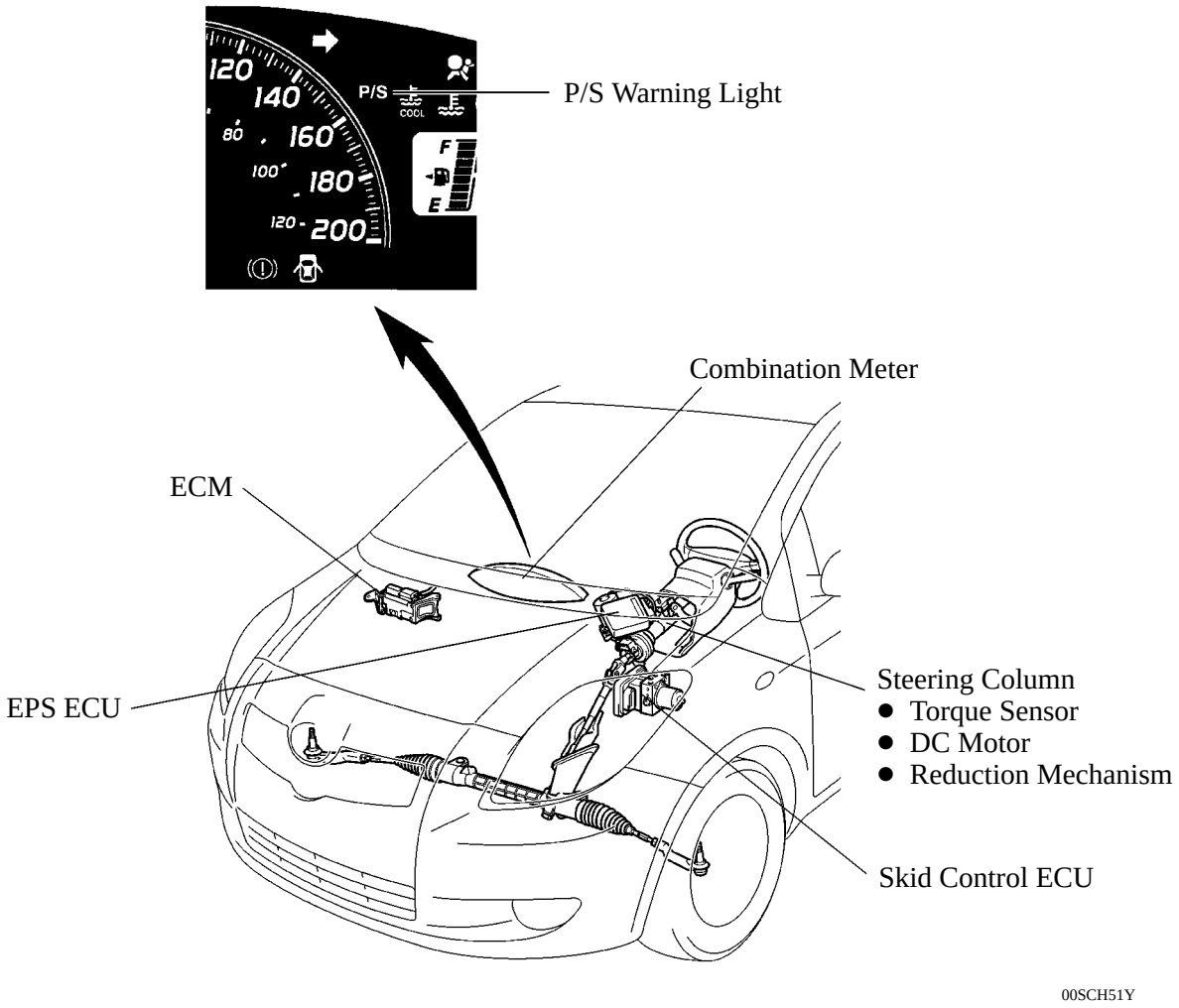
- This system generates torque using a DC motor and a reduction mechanism that are mounted on the steering column to assist the driver's steering. The amount of power assist is calculated by the EPS ECU.
- This system offers excellent fuel economy characteristics because the DC motor that is mounted on the steering column provides power assist, and this motor consumes energy only when power assist is required.
- Unlike the conventional hydraulic power steering system, this system excels in serviceability because it does not require pipes, vane pump, pulley and power steering fluid.

### 2. System Diagram




*: Models with ABS with EBD System

### 3. Layout of Main Components




### 4. Function of Main Component

| Component | | Function |
|---|---|---|
| Steering Column | Torque Sensor | Detects the twist of the torsion bar, calculates the torque that is applied to the torsion bar by changing it into an electrical signal, and outputs this signal to the EPS ECU. |
| | DC Motor | Generates power assist in accordance with a signal received from the EPS ECU. |
| | Reduction Mechanism | Reduces the speed of the DC motor through the use of a worm gear and a wheel gear and transmits it to the column shaft. |
| EPS ECU | | Actuates the DC motor mounted on the steering column to provide power assist, based on the signals received from various sensors and vehicle speed. |
| ECM | | Outputs engine speed signal to EPS ECU. |
| Combination Meter | Speedometer | Outputs vehicle speed signal to EPS ECU. |
| | P/S Warning Light | In case of a malfunction in the system, turns on the P/S warning light. |
| Skid Control ECU* | | Outputs vehicle speed signal to EPS ECU. |

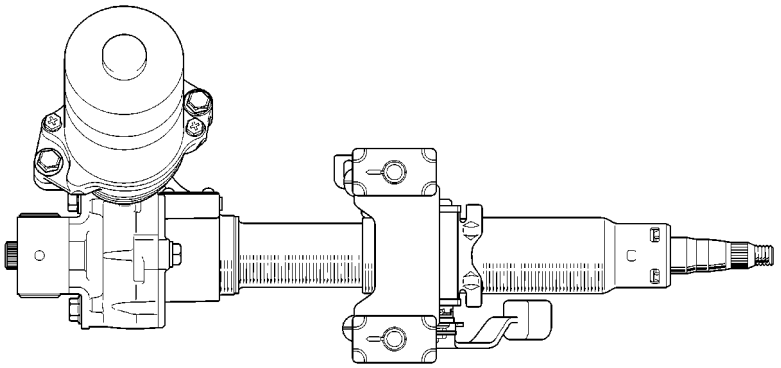
*: Models with ABS with EBD System

## 5. Construction and Operation of Main Components

### Steering Column

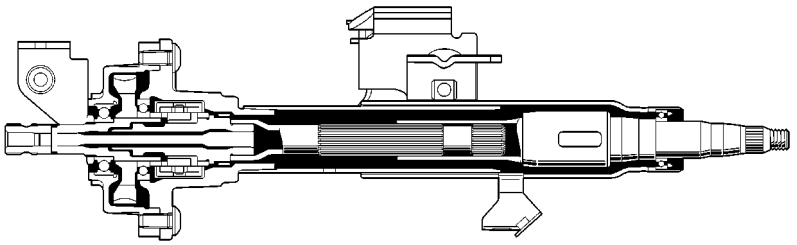
#### 1) General

A DC motor, reduction mechanism, and torque sensor are mounted on the steering column.



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**Top View**

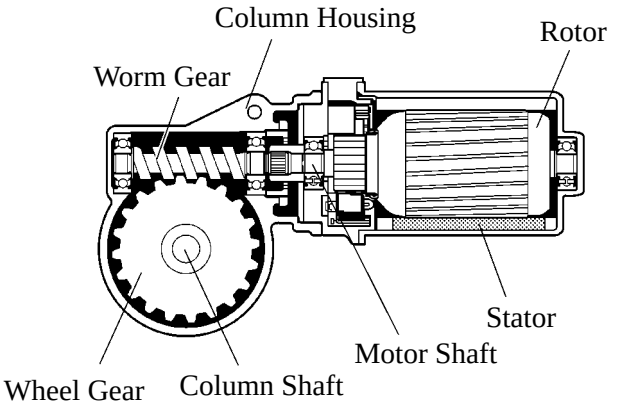


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**Cross Section**

#### 2) DC Motor

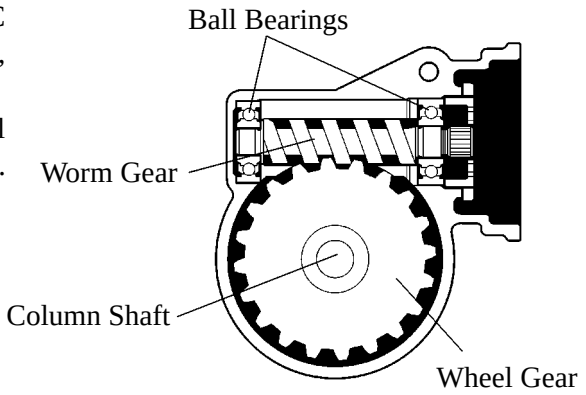
The DC motor consists of the rotor, stator, and motor shaft.
The torque that is generated by the motor is transmitted via the joint to the worm gear.
Then this torque is transmitted via the wheel gear to the column shaft.




287CH25

### 3) Reduction Mechanism

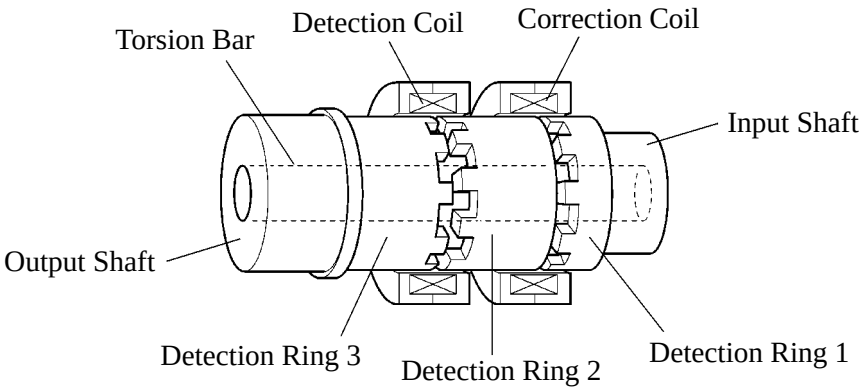
This mechanism reduces the speed of the DC motor via the worm gear and the wheel gear, and transmits it to the column shaft.
The worm gear is supported by the ball bearings in order to reduce noise and frictions.




287CH26

### 4) Torque Sensor

- The torque sensor detects the twist of the torsion bar, calculates the torque that is applied to the torsion bar by changing it into an electrical signal, and outputs this signal to the EPS ECU.
- Detection ring 1 and detection ring 2 are mounted on the input shaft, and detection ring 3 is mounted on the output shaft. The input shaft and the output shaft are joined by the torsion bar. A detection coil and a correction coil are placed on the outside of the respective detection rings to complete an excitation circuit without making a contact.
- The function of detection ring 1 and 2 is to correct temperature. They detect the temperature changes that occur in the correction coil and correct the deviation that is caused by the temperature changes.
- The detection coil consists of a dual circuit that outputs two signals, VT1 and VT2. The ECU controls the assist amount based on these two signals and at the same time detects a sensor malfunction.




193CH29

**Service Tip**

If the steering column, or steering gear is removed and reinstalled, the zero point of the torque sensor must be adjusted. For details, see the ’06 Yaris Repair Manual (Pub. No. RM00R0U).

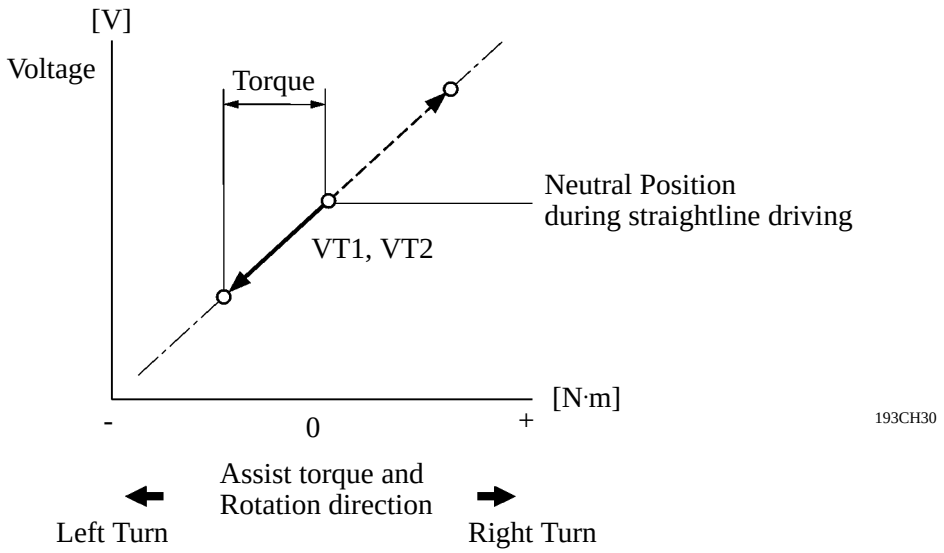
| | Initialization | Calibration |
|---|---|---|
| Steering Wheel, Column and Gear | ○ | ○ |
| EPS ECU | — | ○ |

### a. Straightline Driving

If the vehicle is driven straight and the driver does not turn the steering wheel, the specified voltage that is output at this time is determined by the EPS ECU to indicate the neutral position of the steering wheel. Therefore, it does not apply current to the DC motor.

### b. When Steering

When a driver turns the steering wheel to the right or left, the twist that is created in the torsion bar creates a relative displacement between detection ring 2 and detection ring 3.
This change is then converted into two electrical signals, VT1 and VT2, and sent to the EPS ECU. When the steering wheel is turned to the left, a voltage that is lower than the neutral is output as shown in the diagram below.
The direction of the turn is thus detected according to these outputs. Furthermore, the amount of steering assist is determined by the magnitude of the output value.



**EPS ECU**

**1) General**

- The EPS ECU receives signals from various sensors, judges the current vehicle condition, and determines the assist current to be applied to the DC motor accordingly.
- In case a malfunction occurs in the system, the fail-safe function stops the output current and reverts the control to manual steering. At this time, a P/S warning light illuminates to alert the driver of the malfunction.
- The EPS ECU of '06 Yaris has following functions:

| Item | Function |
|---|---|
| Basic Control | Calculates the assist current from the steering torque valve and the vehicle speed, and actuates the motor. |
| Inertia Compensation Control | Ensures the starting movement of the motor when the driver starts to turn the steering wheel. |
| Recovery Control | During the short interval between the time the driver fully turns the steering wheel and the wheels try to recover, this control assists the recovery force. |
| Damper Control | Regulates the amount of assist when the driver turns the steering wheel while driving at high speeds, thus damping the changes in the yaw rate of the vehicle body. |
| System Overheat Protection Control | Estimates the motor temperature based on the amperage and the current duration. If the temperature exceeds the standard, it limits the amperage to prevent the motor from overheating. |

**2) Fail-Safe**

If the EPS ECU detects a malfunction in the EPS system, it turns on the warning light in the combination meter to inform the driver and stops the assist control. As a result, the EPS system operates in the same way as manual steering.

**▶ Fail-Safe Chart ◀**

| Item | Function |
|---|---|
| Torque Sensor System Malfunction | Disables the assist. |
| Motor Overheating | Limits the assist force. |
| Motor Short (including drive system malfunction) | Disables the assist. |
| Motor Overcurrent | Disables the assist. |
| EPS ECU Internal Temperature Sensor Malfunction | Limits the assist force. |
| EPS ECU System Malfunction | Disables the assist. |
| Vehicle Speed and Engine Speed Signals Malfunction | Temporarily limits the assist, returning to normal control when normal conditions are reestablished. |
| Power Supply Voltage Malfunction | Temporarily limits the assist, returning to normal control when normal conditions are reestablished. |

**3) Self-Diagnosis**

- If the EPS ECU detects a problem in the EPS system, the warning light that corresponds to the function in which the malfunction has been detected lights up to alert the driver of the malfunction.
- At the same time, the DTCs (Diagnosis Trouble Codes) are stored in memory. The DTCs can be read by connecting a hand-held tester, or by connecting the SST (09843-18040) between the Tc and CG terminals of the DLC3 and observing the blinking of the power steering warning light.

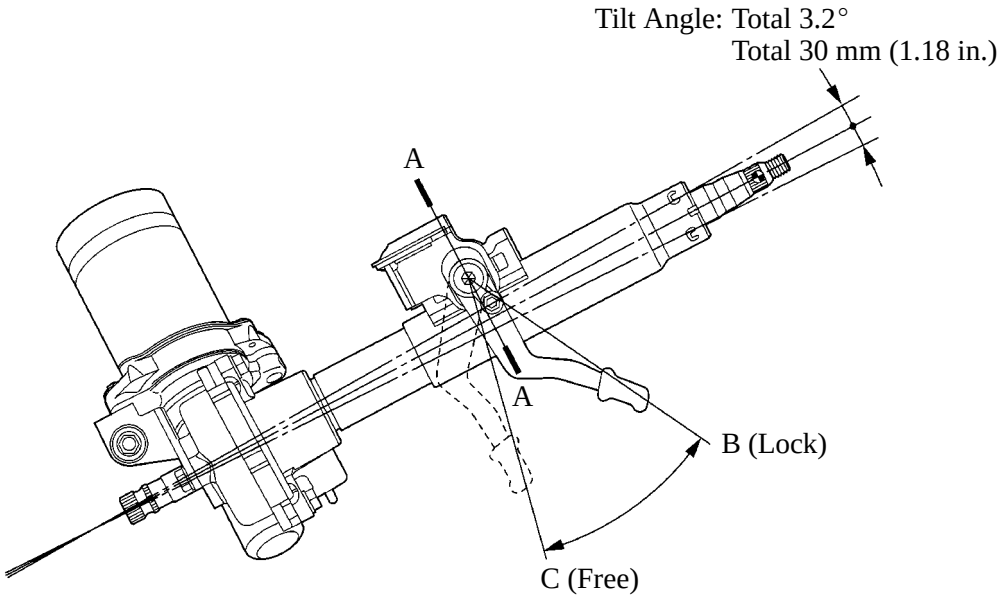
For details of the DTCs that are stored in EPS ECU memory, see the '06 Yaris Repair Manual (Pub. No. RM00R0U).

**▶ DTC Chart (Blinking Power Steering Warning) ◀**

| DTC No. | | Detection Item |
|---|---|---|
| 5-digit | 2-digit | |
| C1511 | 11 | Torque sensor circuit malfunction |
| C1512 | 12 | |
| C1513 | 13 | |
| C1514 | 14 | Torque sensor power source circuit malfunction |
| C1515 | 15 | Torque sensor zero point adjustment undone |
| C1516 | 16 | Torque sensor zero point adjustment incomplete |
| C1517 | 17 | Torque sensor hold malfunction |
| C1524 | 24 | Motor circuit malfunction |
| C1531 | 31 | EPS ECU malfunction |
| C1532 | 32 | |
| C1533 | 33 | |
| C1534 | 34 | |
| C1551 | 51 | IG power source voltage malfunction |
| C1552 | 52 | Motor power source voltage malfunction |
| C1554 | 54 | Power supply relay malfunction |
| C1555 | 55 | EPS motor relay malfunction |
| C1581 | 81 | Assist map number un-written |
| U0073 | 91 | Control module communication bus off |
| U0105 | 92 | Lost communication with powertrain ECU |
| U0121 | 93 | Lost communication with anti-lock brake system (ABS) control module |

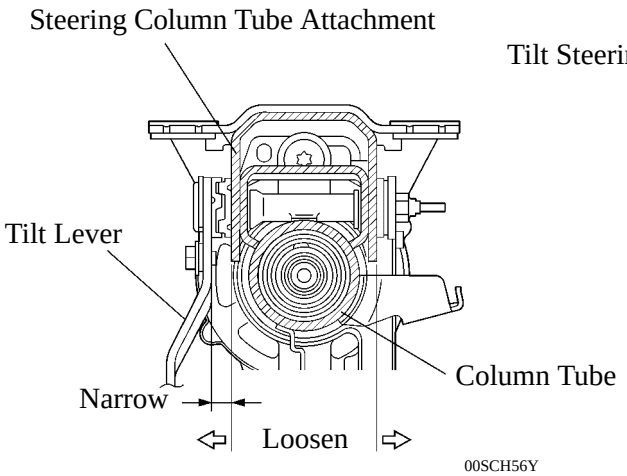
## ■TILT STEERING

- The tilt mechanism mainly consists of a tilt lever, steering column tube attachment, breakaway bracket and tilt steering stopper.
- When the tilt mechanism is in its locked state, the tilt lever at B position causes the cam of the tilt steering stopper to tighten the steering column tube attachment.
- When the tilt mechanism is in its free state, the tilt lever at C position causes the cam of the tilt steering stopper to loosen the steering column tube attachment.



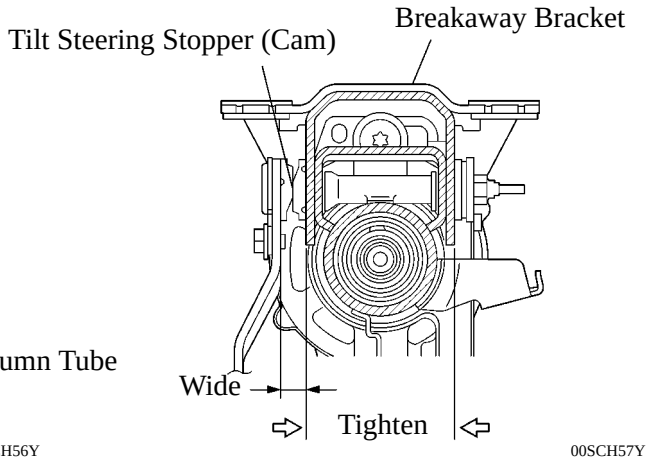

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**▶ A - A Cross Section ◀**




00SCH56Y

**Free**




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**Lock**

## ■ENERGY ABSORBING MECHANISM

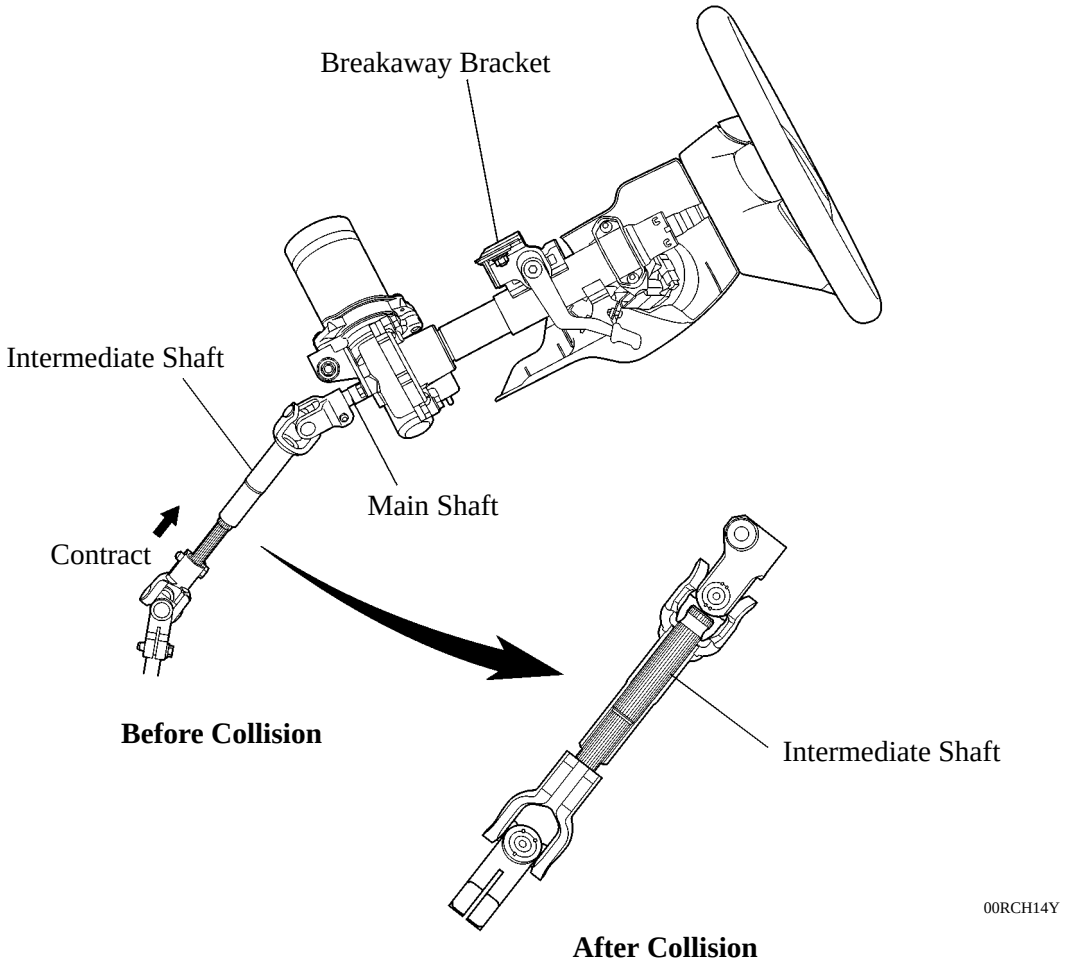
### 1. General

The energy absorbing mechanism in the steering column consists of breakaway bracket, intermediate shaft, pinion shaft, and column tube. The steering column is mounted on the instrument panel reinforcement via a breakaway bracket. The steering column and the steering gear box are connected with a contractile intermediate shaft.

### 2. Operation

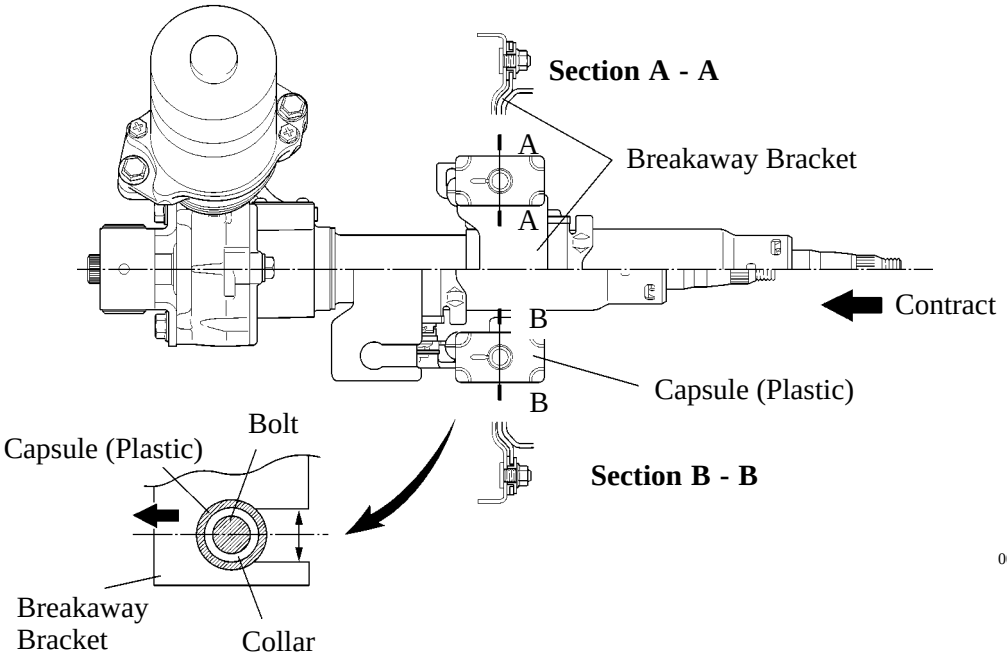
- When the steering box moves during a collision (primary collision), the intermediate shaft contracts, thus helps reduce the possibility of the steering column and the steering wheel protruding into the cabin.

**▶ Primary Collision ◀**

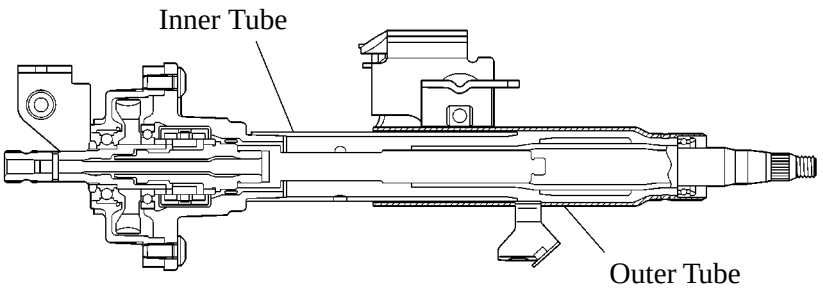


- When a collision impact is transmitted to the steering wheel (secondary collision), the steering wheel and the driver's airbag help absorb the impact. In addition, the breakaway bracket separates, and the column tube contracts. At this time, the friction resistance of the sliding portion, which is staked to the column tube, absorbs the energy. This sequential energy absorbing mechanism helps absorb the impact of the secondary collision.

**▶ Secondary Collision ◀**

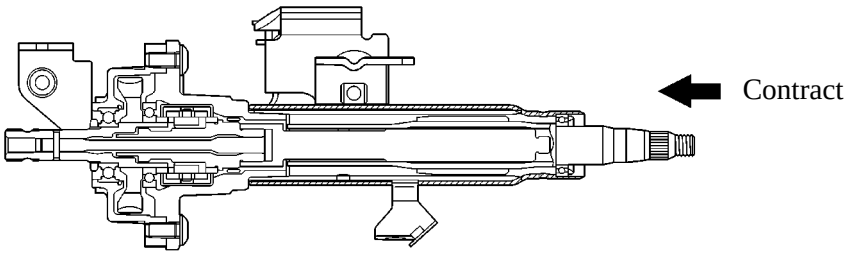



00RCH15Y




00RCH16Y

**Before Collision**




00RCH17Y

**After Collision**
**(Maximum Contraction)**