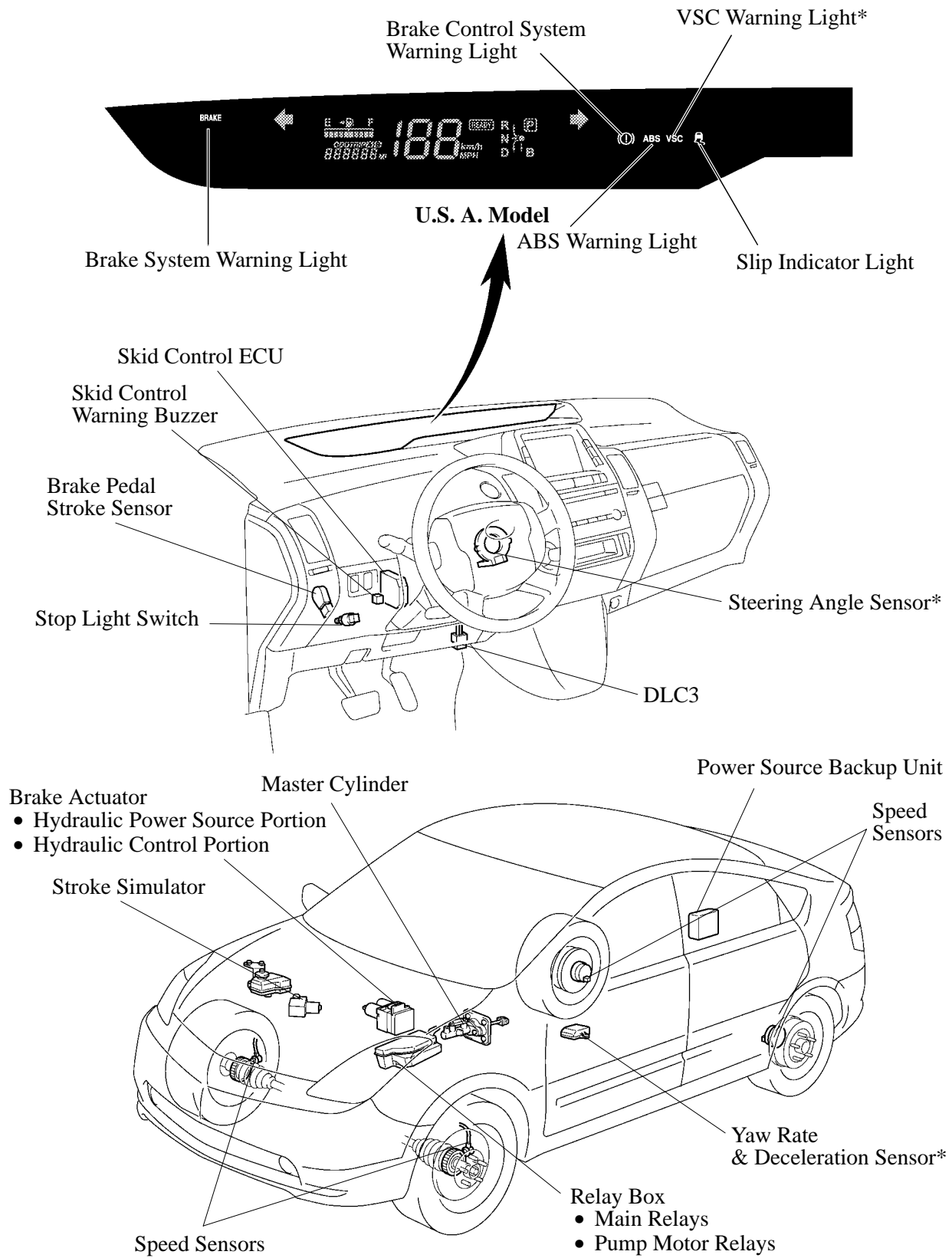


8. Layout of Main Component



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*: Only on model with Enhanced VSC system

9. Function of Main Components

Component		Function
Brake Actuator	Hydraulic Power Source Portion	<ul style="list-style-type: none"> Consisting of a pump, pump motor, accumulator, relief valve, and accumulator pressure, the hydraulic power source portion generates and stores the hydraulic pressure, which the skid control ECU uses for controlling braking. The accumulator pressure sensor is installed in the brake actuator.
	Hydraulic Control Portion	<ul style="list-style-type: none"> Consists of 2 master cylinder cut solenoid valves, 4 pressure appliance solenoid valves, and 4 pressure reduction solenoid valves. The 2 master cylinder cut solenoid valves, which are the two-position type, are controlled by the skid control ECU to open and close the passage between the master cylinder and the wheel cylinders. The 4 pressure appliance solenoid valves and the 4 pressure reduction solenoid valves are the linear type. They are controlled by the skid control ECU to increase and decrease the fluid pressure in the wheel cylinders. The master cylinder pressure sensors and the wheel cylinder pressure sensors are installed in the brake actuator.
Skid Control ECU		<ul style="list-style-type: none"> Processes various sensor signals, regenerative brake signal, to execute control of the regenerative brake coordination control, the ABS with EBD, Enhanced VSC, Brake assist, and normal brake. Judges the vehicle driving condition based on signals from each sensor, and control the brake actuator.
Brake Master Cylinder		When a malfunction occurs in the power supply portion, the brake master cylinder supplies the fluid pressure (which is generated by the brake pedal effort) directly to the wheel cylinders.
Brake Pedal Stroke Sensor		Directly detects the extent of the brake pedal stroke operated by the driver.
Stroke Simulator		Generates a pedal stroke during braking in accordance with the driver's pedal effort.
Combination Meter	ABS Warning Light	Lights up to alert the driver when the skid control ECU detects the malfunction in the ABS, EBD, or Brake Assist system.
	VSC Warning Light*	Lights up to alert the driver when the skid control ECU detects the malfunction in the Enhanced VSC system.
	Slip Indicator Light	Blinks to inform the driver when the ABS system, the Enhanced VSC system or the motor traction control is operated.
	Brake Control System Warning Light	Lights up to alert the driver when a minor malfunction occurs in the brake system, which does not affect the braking force (such as a malfunction in the regenerative brake).
	Brake System Warning Light	<ul style="list-style-type: none"> Lights up to alert the driver when the skid control ECU detect the malfunction in the apportioning of the brake. Lights up to inform the driver when the parking brake is ON or the brake fluid level is low.

*: Only on model with Enhanced VSC system

(Continued)

Component	Function
Skid Control Warning Buzzer	<ul style="list-style-type: none"> • This buzzer sounds continuously to inform the driver when there is a malfunction in the hydraulic pressure or a failure in the power supply. • On a model equipped with the Enhanced VSC, this buzzer sounds intermittently to inform the driver that the S-VSC is active.
HV ECU	<ul style="list-style-type: none"> • Actuates the regenerative brake on receiving signal from the skid control ECU. • Sends the actual regenerative brake control value to the skid control ECU. • Controls the motive force based on output control request signal from the skid control ECU when the Enhanced VSC system is operating. • Sends the rear brake actuation signal to the skid control ECU when brake control is required during the up hill assist control.
Reservoir Tank	Stores the brake fluid.
Brake Fluid Level Warning Switch	Detects the low brake fluid level.
Stop Light Switch	Detects the brake pedal-depressing signal.
Yaw Rate & Decelerator Rate Sensor*	<ul style="list-style-type: none"> • Detects the vehicle's yaw rate. • Detects the vehicle's acceleration in the forward, rearward, and lateral.
Steering Angle Sensor*	Detects the steering direction and angle of the steering wheel.
Pump Motor relay 1,2 relays. (See Page CH-51)	<ul style="list-style-type: none"> • Two types of pump motor relays with different pump actuation speeds. • If one relay fails, the other relay operates to actuate the pump.
Main Relays	Controlled by the skid control ECU, the main relay supplies or cuts off power to the solenoid valves in the brake actuator and the skid control ECU.
Power Source Backup Unit	<ul style="list-style-type: none"> • An auxiliary power supply to provide stable power to the brake system. • Complements the supply of power to the brake system by discharging the electric charge that is stored in the unit when the voltage of the (12 V) power supply of the vehicle is low.

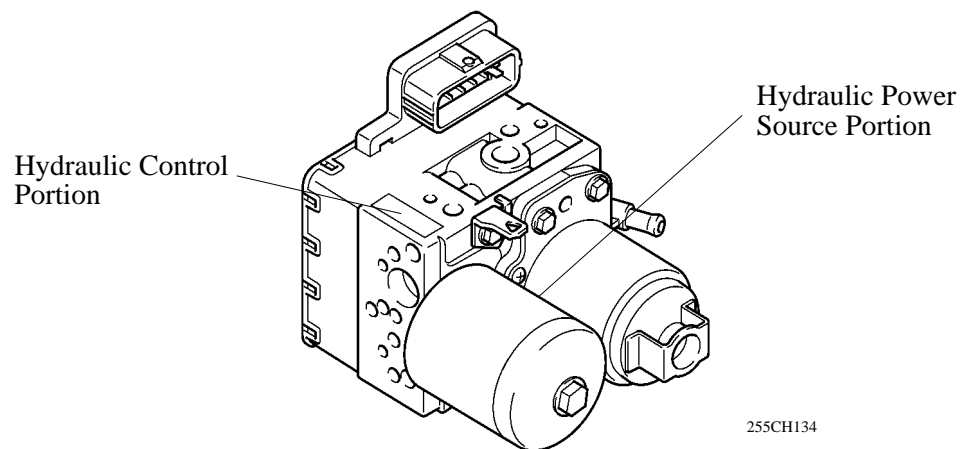
*: Only on model with Enhanced VSC system

10. Construction and Operation of Main Component

Brake Actuator

1) General

- The brake actuator of the '04 Prius consists of hydraulic control and hydraulic power source portions.
- The two master cylinder pressure sensors, four wheel cylinder pressure sensors, and an accumulator pressure sensor are installed in the brake actuator.



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► Function of Main Components ◀

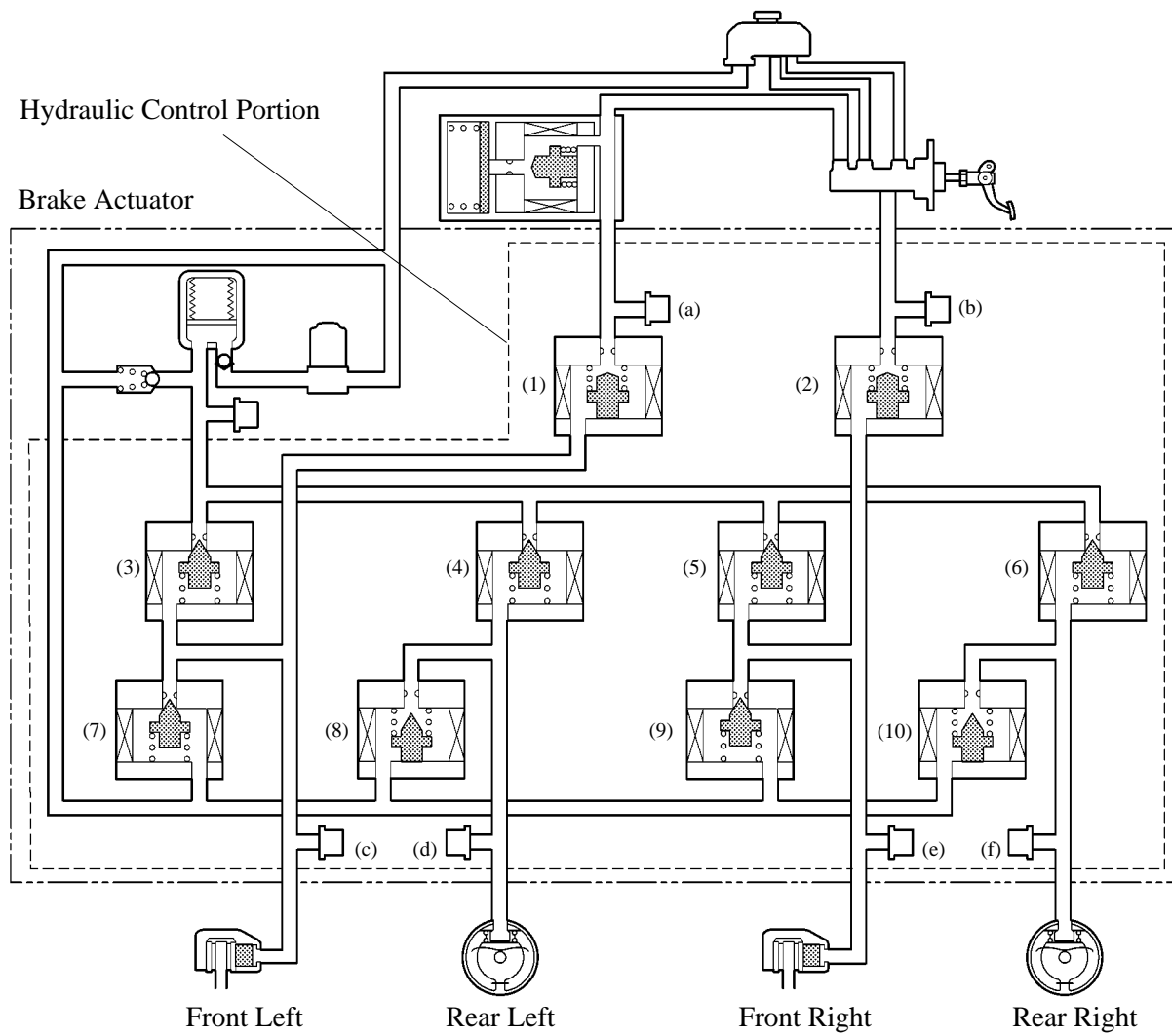
Component	Function
Master Cylinder Cut Solenoid Valve (2-position Type)	<ul style="list-style-type: none"> • When the brake system is started, this valve cuts the hydraulic passage between the master cylinder and the wheel cylinder. • When the brake system is stopped or a failure occurs in the hydraulic power source portion, the valve opens to maintain the hydraulic passage to the front wheel cylinders and ensure braking. However, a greater effort than normal is required to press the brake pedal.
Pressure Appliance Solenoid Valve (Linear Type)	This valve, which is controlled by the skid control ECU, regulates the fluid pressure from the accumulator in order to amplify the fluid pressure to the wheel cylinder.
Pressure Reduction Solenoid Valve (Linear Type)	This valve, which is controlled by the skid control ECU, regulates the fluid pressure in order to reduce the fluid pressure to the wheel cylinder.
Master Cylinder Pressure Sensors	The master cylinder pressure sensor converts the fluid pressure generated by the master cylinder into electrical signals and transmits them to the skid control ECU. Accordingly, the skid control ECU determines the braking force required by the driver.
Wheel Cylinder Pressure Sensors	These sensors detect the fluid pressure that acts on the respective wheel cylinders and transmits them to the skid control ECU in the form of feedback. Accordingly, the skid control ECU monitors the fluid pressure of the wheel cylinders and controls the pressure appliance solenoid valve and the pressure reduction solenoid valve, in order to achieve the optimal wheel cylinder pressures.
Accumulator Pressure Sensor	The accumulator pressure sensor constantly detects the brake fluid pressure in the accumulator and transmits the signals to the skid control ECU. Accordingly, the skid control ECU controls the pump motor.
Pump and Pump Motor	Draws up the brake fluid from the reservoir tank and provides high hydraulic pressure to the accumulator.
Accumulator	Stores the hydraulic pressure that was generated by the pump. The accumulator is filled with high pressure nitrogen gas.
Relief Valve	Returns the brake fluid to the reservoir tank to prevent excessive pressure if the pump operates continuously due to a malfunction of the accumulator pressure sensor.

2) Hydraulic Control Portion

The 10 solenoid valves and 6-pressure sensors consists of the following:

- 2 master cylinder cut solenoid valves [(1), (2)]
- 4 pressure appliance valves [(3), (4), (5), (6)]
- 4 pressure reduction valves [(7), (8), (9), (10)]
- 2 master cylinder pressure sensor [(a), (b)]
- 4 wheel cylinder pressure sensor [(c), (d), (e), (f)]

► Hydraulic Circuit ◀



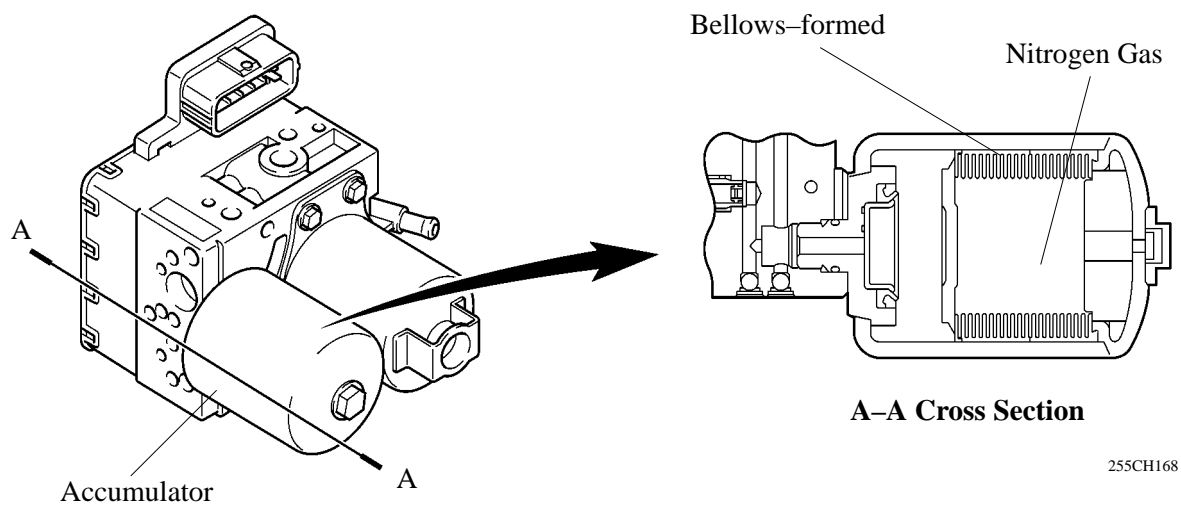
3) Hydraulic Power Source Portion

a. General

The hydraulic power source portion consists of pump, pump motor, accumulator, relief valve, 2 motor relays, and accumulator pressure sensor.

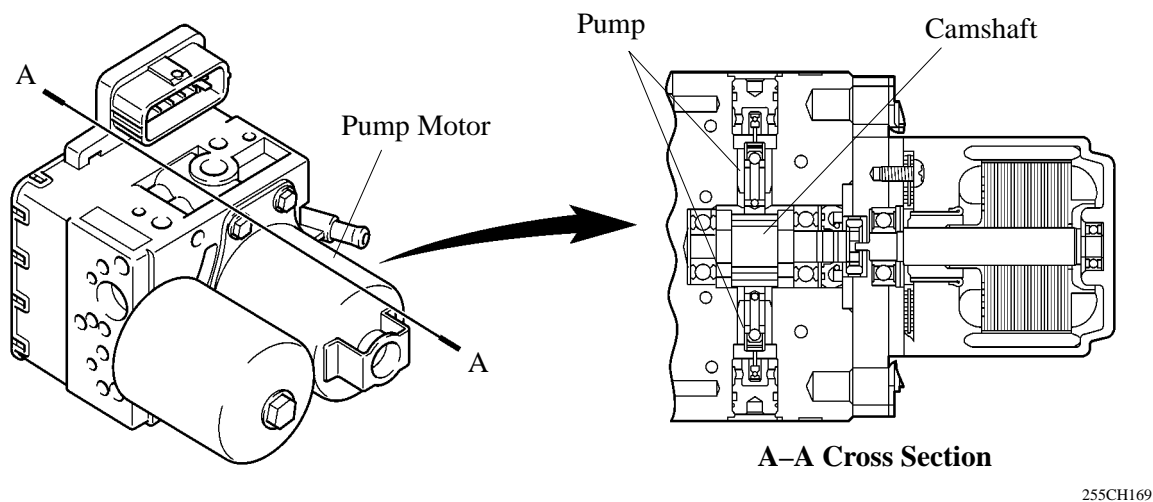
b. Accumulator

Inside the accumulator of the '04 Prius, as same as the '03 Prius, the high-pressurized nitrogen gas is charged and sealed. On the '04 Prius, metallic bellows-formed tube has been adopted, in order to enhance the gastight performance of the accumulator.



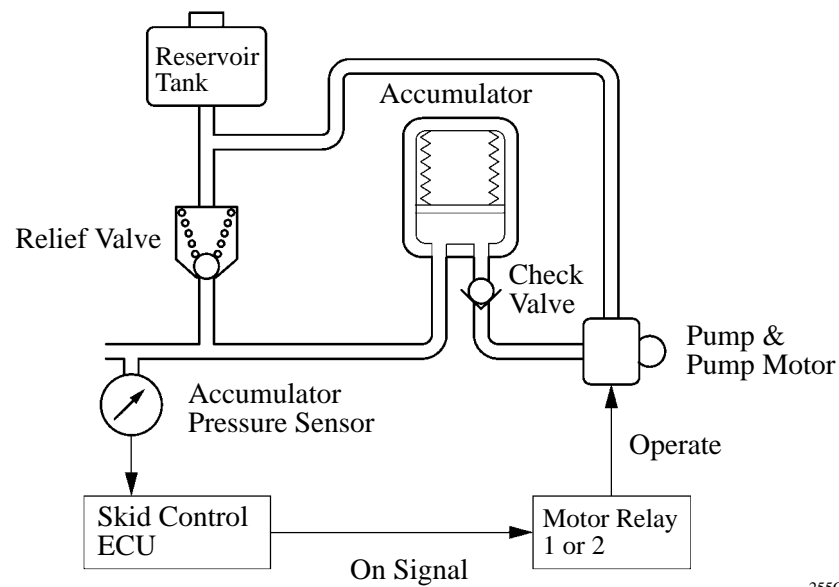
c. Pump and Pump Motor

A plunger type pump has been adopted. This pump is operated by the rotation of the camshaft driven by the motor, and then supplies high-pressurized fluid to the accumulator.

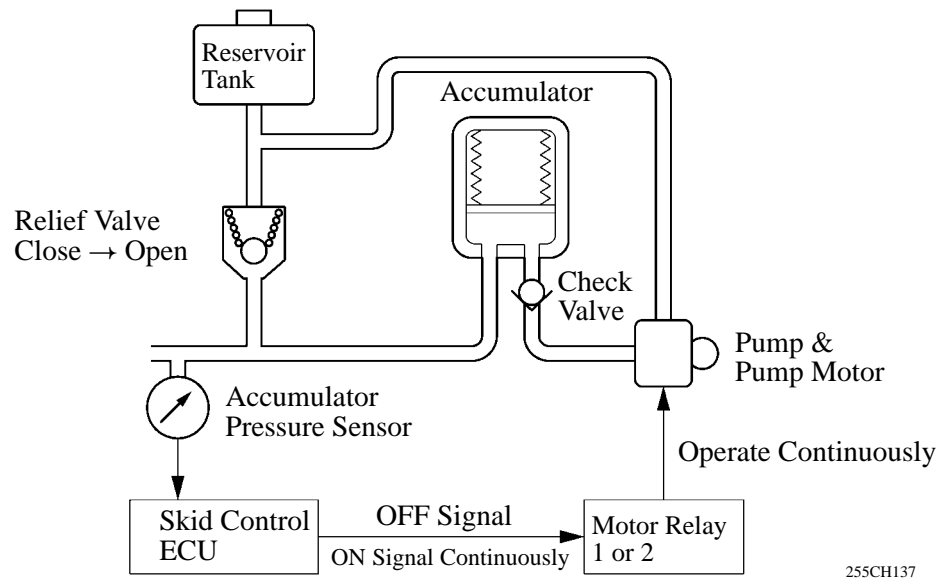


d. Operation

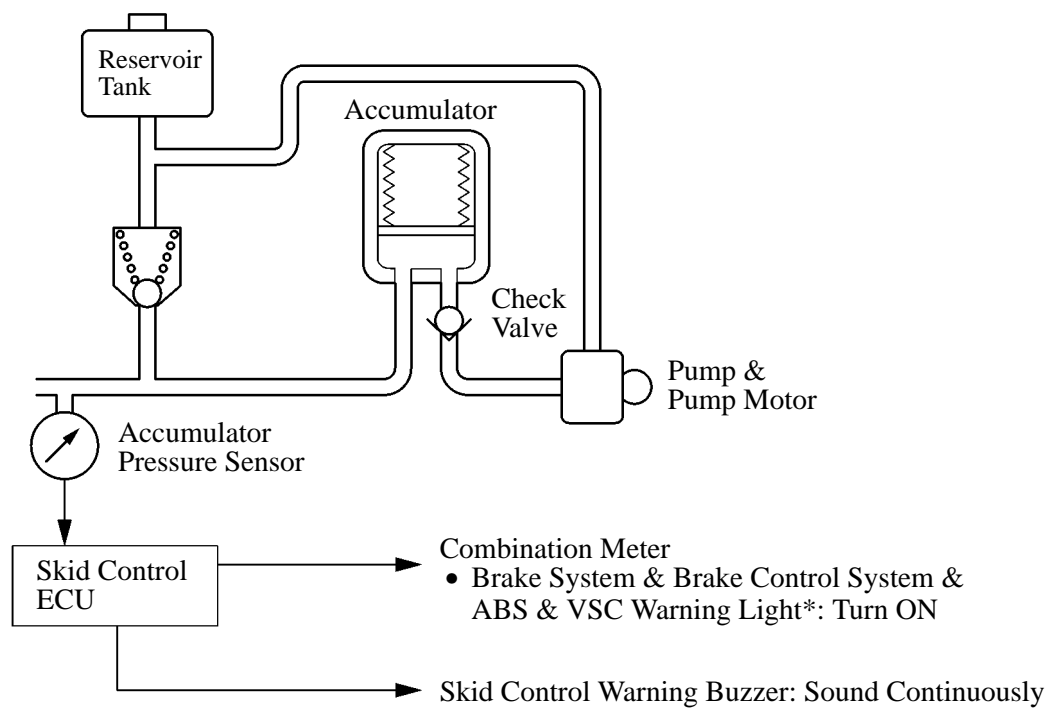
- The brake fluid that is discharged by the pump passes through the check valve and is stored in the accumulator. The hydraulic pressure that is stored in the accumulator is used for providing the hydraulic pressure that is needed for normal braking and for operating the brake control.
- The motor relays consist of the following relays with different pump actuation speeds: relay 1 (low speed) and relay 2 (high speed). Normally, relay 1 with the slow pump speed is used. When the fluid pressure drops quickly because more fluid pressure is required, such as in ABS fluid pressure control, relay 2 with the fast pump speed is used. If one of the relays malfunctions, the other is used for actuating the pump.
- The accumulator pressure sensor constantly monitors the pressure in the accumulator and transmits it to the skid control ECU. If the accumulator pressure drops below the set pressure, the skid control ECU sends an activation signal to the motor relay in order to actuate the pump motor until the pressure in the accumulator reaches the set pressure.



- If the pump and the pump motor continue to operate unintendedly, creating a high pressure in the accumulator, and accumulator pressure sensor failed, the relief valve opens to return the brake fluid to the reservoir tank, in order to reduce the accumulator pressure.



- If the accumulator pressure drops abnormally to a level below the pressure set at the ECU, the skid control ECU illuminates the brake system warning light, brake control system warning light, ABS warning light, and the VSC warning light* and sounds a warning buzzer to alert the driver of the abnormal fluid pressure.

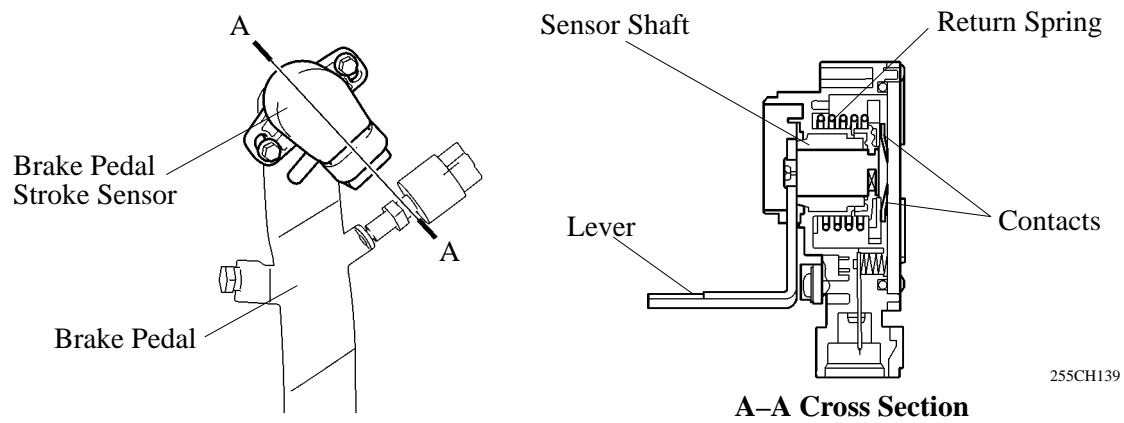


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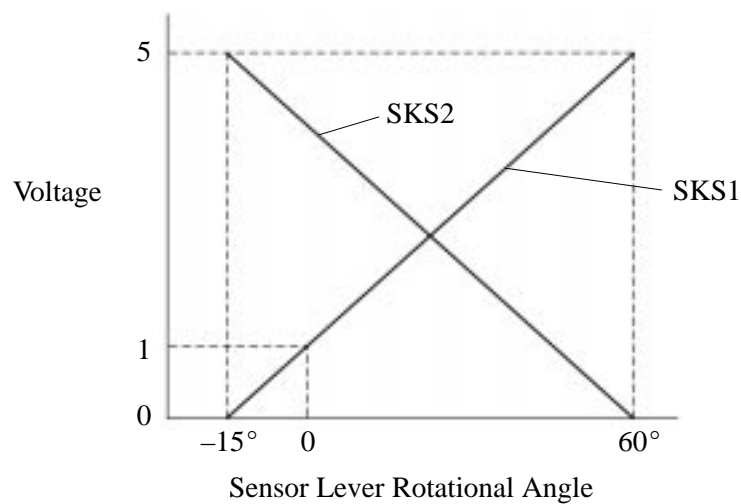
*: Only on model with Enhanced VSC system

Brake Pedal Stroke Sensor

This sensor, which contains a contact type variable resistor, detects the extent of the brake pedal stroke and transmits it to the skid control ECU.



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Service Tip

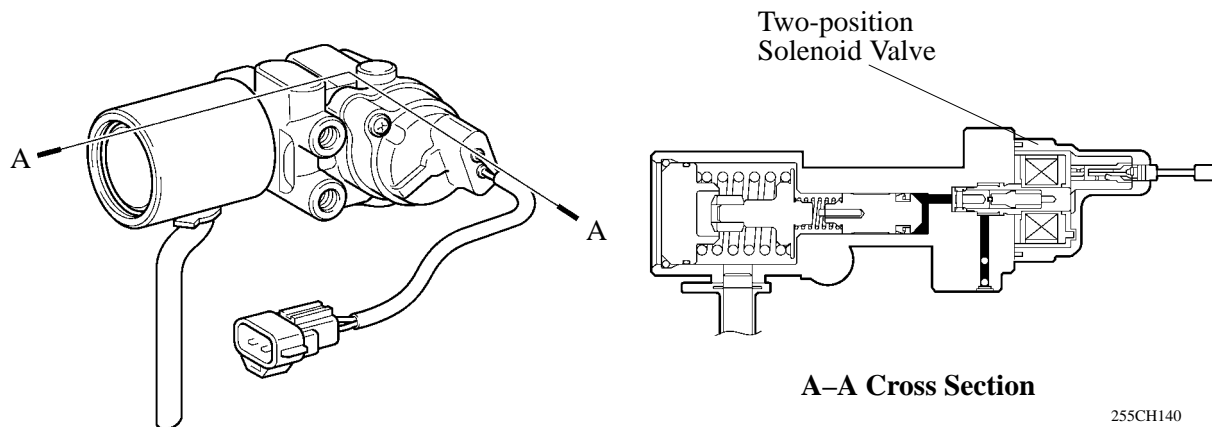
To install a brake pedal stroke sensor, which is available as a service part, perform as follows:

- The sensor lever is secured with a pin to "0" stroke. (Do not detach the pin until the installation has been completed.)
- In this state, install the sensor on the brake pedal (in the OFF state) on the vehicle.
- After completing the installation, firmly press the brake pedal once to break off the pin that is securing the sensor in place.
- Make sure the broken pin does not remain in the sensor lever.

For the actual procedure, refer to the 2004 Prius Repair Manual (Pub. No. RM1075U).

Stroke Simulator

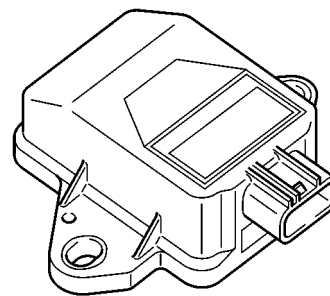
The stroke simulator is located between the master cylinder and the brake actuator. It generates a pedal stroke in accordance with the driver's pedal effort during braking. Containing 2 types of coil springs with different spring constants, the stroke simulator provides pedal stroke characteristics in 2 stages in relation to the master cylinder pressure.



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Yaw Rate Sensor (With Enhanced VSC system)

A deceleration rate sensor is built into the yaw rate sensor. This sensor detects the yaw rate and lateral acceleration, and sends this signal to the skid control ECU.



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Service Tip

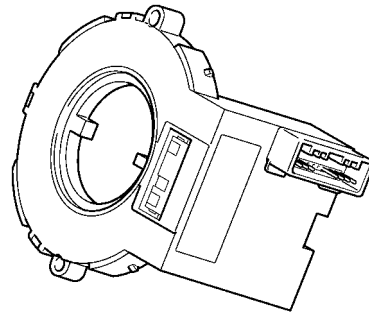
After replacing the yaw rate sensor or the skid control ECU, initialization of both deceleration sensor and yaw rate sensor must be required on the skid control ECU side.

For the initialization procedure, refer to the 2004 Prius repair manual (Pub. No. RM1075U).

Steering Angle Sensor (With Enhanced VSC system)

This steering angle sensor detects the steering direction and angle, and sends this signal to the skid control ECU.

The sensor contains 3 photo interrupters with phases, and a slotted disk interrupts the light to turn the photo IC ON and OFF to detect the steering direction and angle.



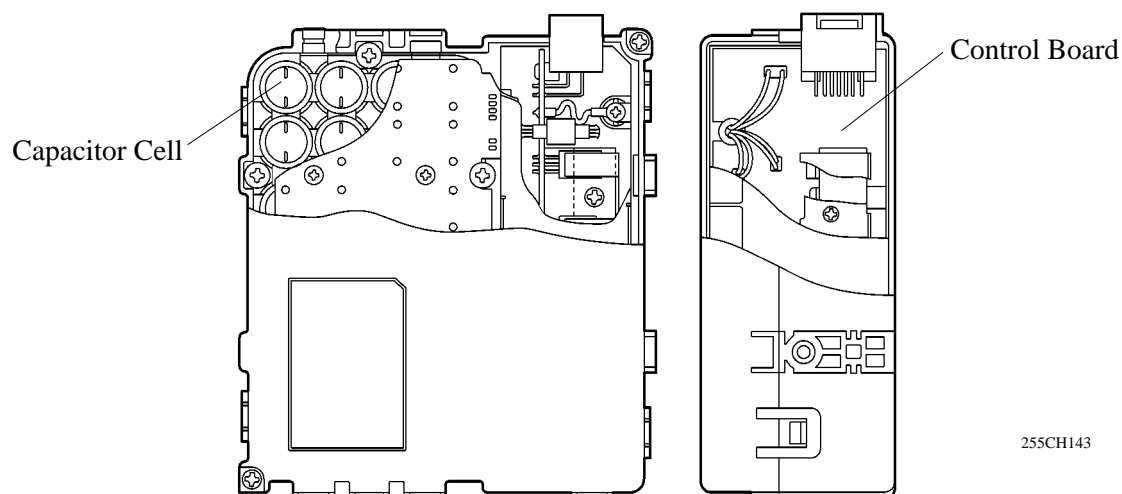
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Service Tip

The steering angle sensor will be automatically calibrated after repairing or replacing the steering angle sensor or steering column assembly.

Power Source Backup Unit

- The power source backup unit has been adopted as an auxiliary power source, in order to supply power to the brake system in a stable manner
- This unit contains 28 capacitor cells, which store an electrical charge provided by the (12 V) vehicle power supply. When the voltage of the (12 V) vehicle power supply drops, the electrical charge stored in the capacitor cells is used as an auxiliary power supply to the brake system.
- The electrical charge stored in the capacitor cells becomes discharged when the HV system stops operating after the power switch is turned OFF.



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Service Tip

Immediately after the power switch is turned OFF, this unit is in the discharging state, and some voltage remains in the capacitors. Therefore, make sure to check for residual voltage and discharge it if necessary, before removing the power source backup unit from the vehicle or opening and inspecting the inside of the power source backup unit case.

For details, refer to 2004 Prius Repair Manual (Pub. No. RM1075U).