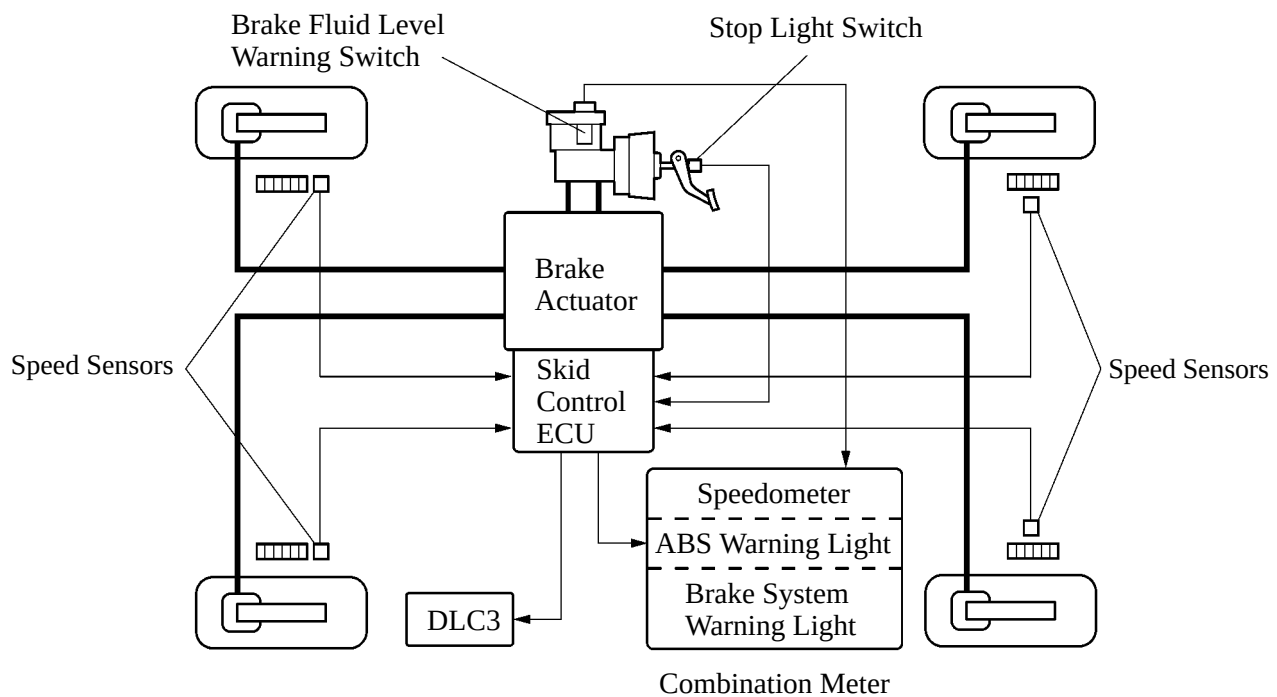


■ ABS with EBD System

1. General

- The primary purpose of the ABS has been to help the vehicle's behavior during braking.
- The EBD control utilizes ABS, realizing the proper brake force distribution between front and rear wheels in accordance with the driving conditions.
In addition, during cornering braking, it also controls the brake forces of right and left wheels, helping to maintain the vehicle behavior.

2. System Diagram



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3. 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 precisely controls the braking force in accordance with the vehicle's driving conditions.

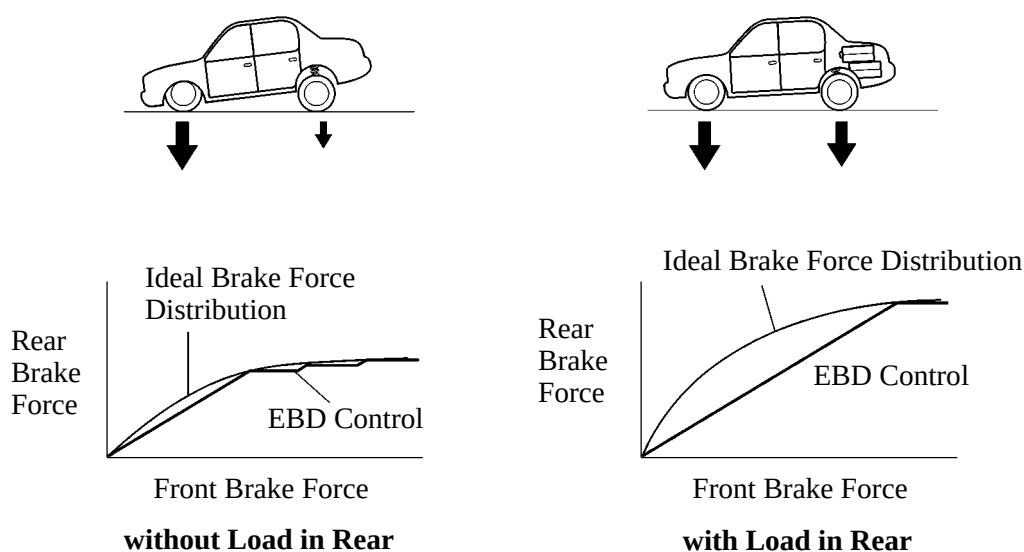
Front/Rear Wheels Brake Force Distribution

If the brakes are applied while the vehicle is moving straight forward, the transfer of the road reduces the load that is applied to the rear wheels. The skid control ECU determines this condition by way of the signals 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 whether or not the vehicle is carrying a load. 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 ◀

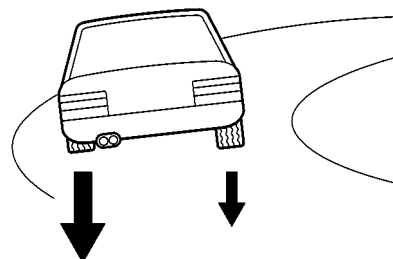


182CH56

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

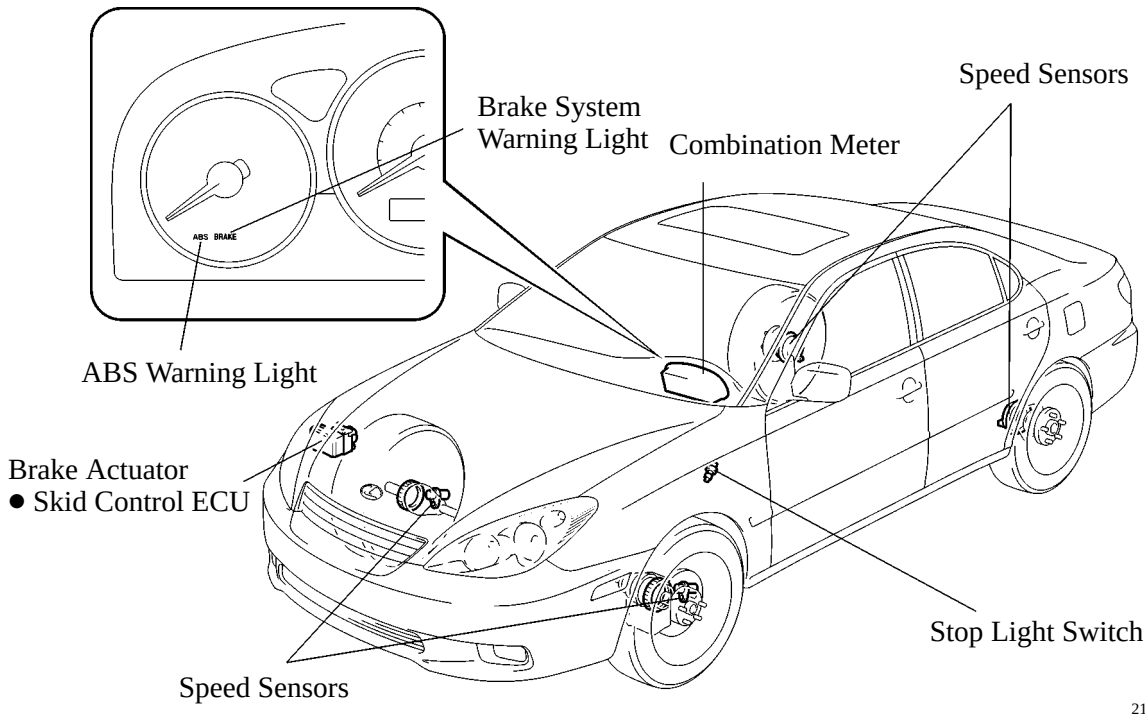
When the brakes are applied while the vehicle is cornering, the load that applied to the inner wheel decreases to the outer wheel increases.

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

4. Layout of Component



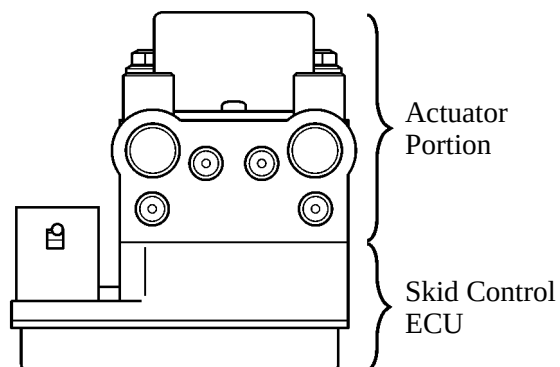
5. Function of Component

Component		Function
Combination Meter	ABS Warning Light	Lights up to alert the driver when the skid control ECU detects the malfunction in the ABS.
	Brake System Warning Light	Lights up together with the ABS warning light to alert the driver when the skid control ECU detects the malfunction in the EBD control.
Brake Fluid Level Warning Switch		Detects the brake fluid level.
Stop Light Switch		Detect the brake pedal depressing signal.
Speed Sensors		Detect the wheel speed of each four wheels.
Brake Actuator	Actuator Portion	Charges the fluid path based on the signals from the skid control ECU during the operation of the ABS with EBD system, in order to control the fluid pressure that is applied to the wheel cylinders.
	Skid Control ECU	Judges the vehicle driving condition based on signals from each sensor, and sends brake control signal to the brake actuator.

6. Brake Actuator

General

The brake actuator consists of actuator portion and skid control ECU.



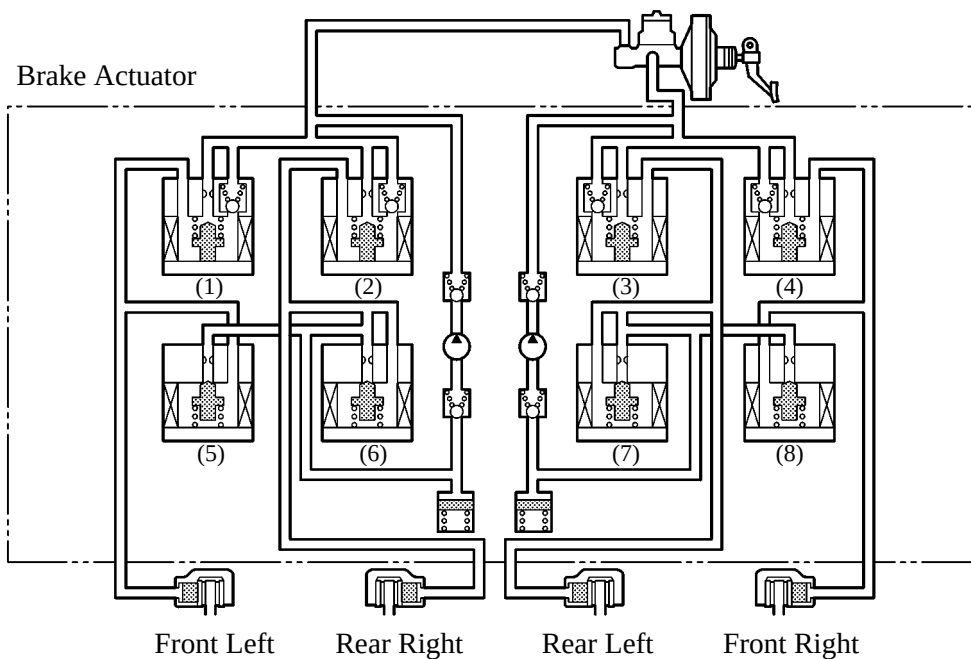
211CH30

Actuator Portion

1) Construction

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

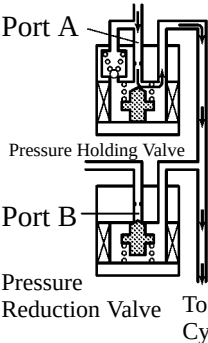
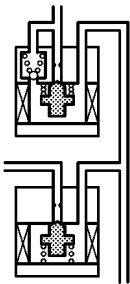
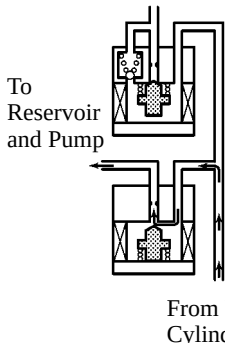
► Hydraulic Circuit ◀



208CH25

2) ABS with EBD Operation

Based on the signals received from the 4 wheel speed sensors, the skid control ECU calculates each wheel speed and deceleration, and checks wheel slipping condition. And according to the slipping condition, the ECU controls the pressure holding valve and pressure reduction valve in order to adjust the fluid pressure of 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

3) Skid Control ECU

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 corresponds to the function in which the malfunction has been detected indicates or lights up, indicated in the table below, to alert the driver of the malfunction.

○: Light ON –: Light OFF

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

- At the same time, the DTCs (Diagnosis Trouble Codes) are stored in memory. The DTCs can be read by connecting the SST (09843-18040) between the Tc and CG terminals of DLC3 and observing the blinking of the ABS warning light, or by connecting a hand-held tester.
- This system has a sensor signal check function. The DTCs can be read by connecting the SST (09843-18040) between the Tc and CG terminals of DLC3 and observing the blinking of the ABS warning light after check the function or by connecting a hand-held tester.
- The DLC1 has been discontinued.
- The DTCs listed below have been added.

DTC No.	Detection Item
C1235/35	Foreign matter is attached on the tip of the right front sensor
C1236/36	Foreign matter is attached on the tip of the left front sensor
C1238/38	Foreign matter is attached on the tip of the right rear sensor
C1239/39	Foreign matter is attached on the tip of the left rear sensor

For details on the DTCs that are stored in skid control ECU memory and the DTCs that are output through the sensor check function, see the 2002 LEXUS ES300 Repair Manual (Pub. No. RM911U).

4) Fail-Safe

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