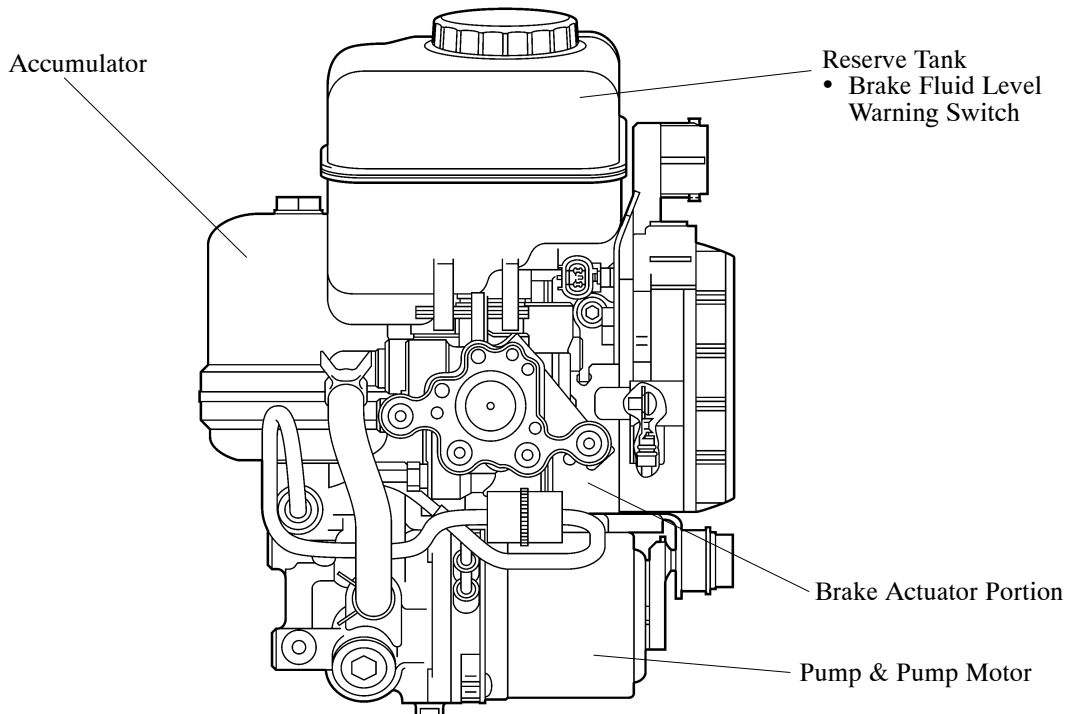
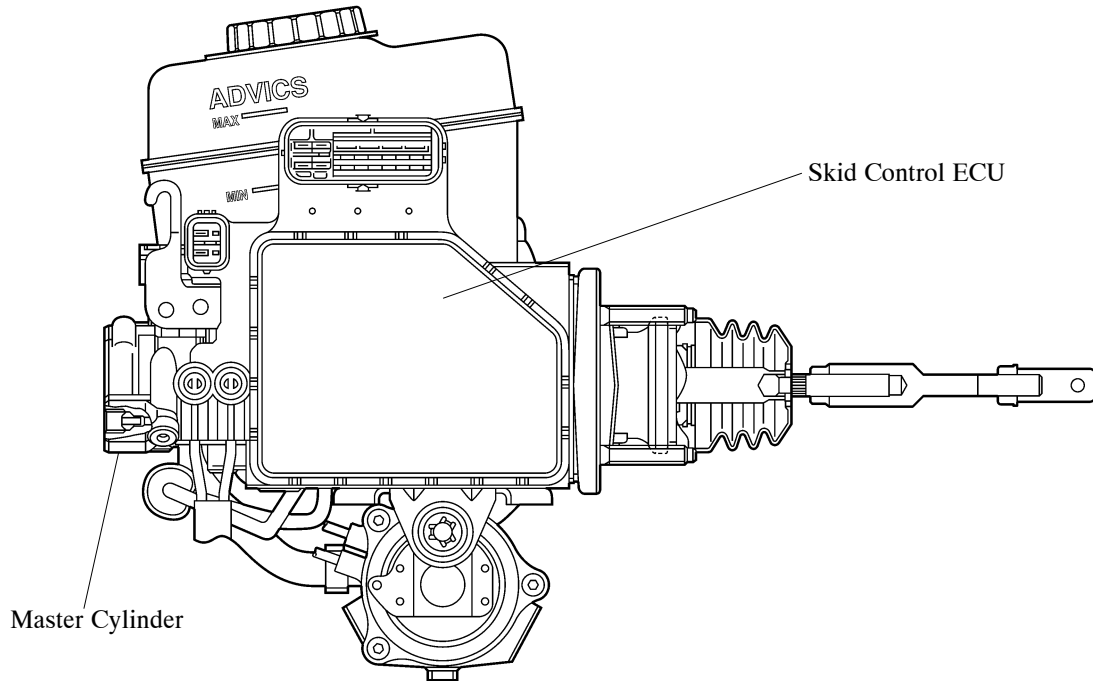


4. Hydraulic Brake Booster

General

The hydraulic brake booster consists of the master cylinder & brake actuator portion, reserve tank, pump & pump motor, accumulator, and skid control ECU.

- The master cylinder & brake actuator portion contains a master cylinder & brake booster, 12 solenoid valves, relief valve, accumulator pressure sensor, and master cylinder pressure sensor.
- The reserve tank contains a brake fluid level warning switch.

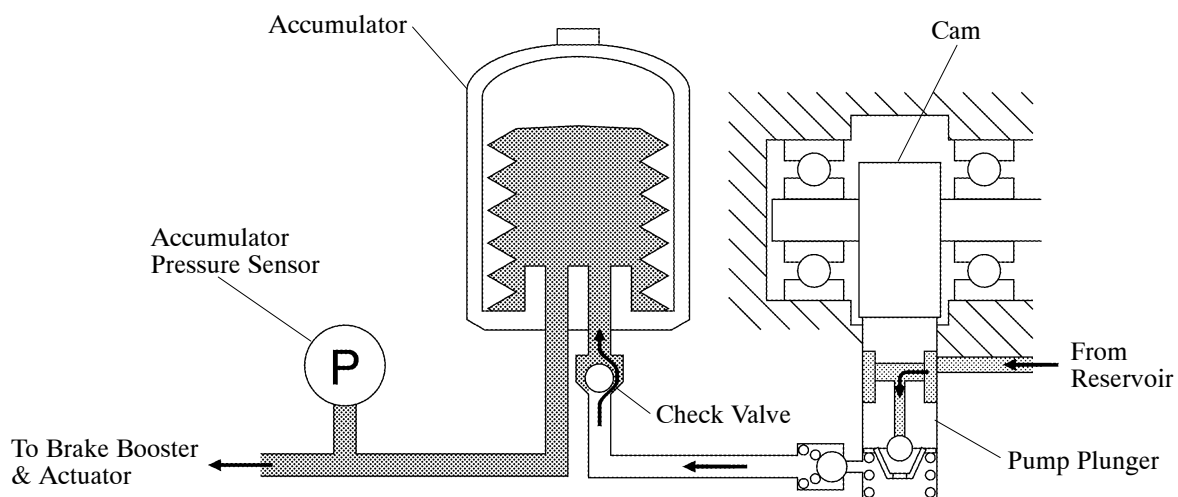


The hydraulic brake booster consists of the following components:

Component		Function
Master Cylinder & Brake Actuator	Master Cylinder & Brake Booster	<ul style="list-style-type: none"> Generates the hydraulic pressure that is provided to the wheel cylinders during normal brake. Regulates the accumulator pressure in accordance with the pedal effort that is applied to the brake pedal and introduces this pressure to the booster chamber in order to provide a power assist to the brakes.
	Switching Solenoid Valves (SMCF, SREC, STR, SREA)	Switches the brake hydraulic path when the brake control system is activated.
	Control Solenoid Valves (SH, SR)	Controls the hydraulic pressure that is applied to the wheel cylinders during brake control.
	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.
	Accumulator Pressure Sensor	Monitors the hydraulic pressure in the accumulator and outputs it to the ECU.
	Master Cylinder Pressure Sensor	Detects the hydraulic pressure that is generated in accordance with the amount of brake pedal effort.
Reservoir Tank		Stores the brake fluid.
	Brake Fluid Level Warning Switch	Detects the low brake fluid level.
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.
Skid Control ECU		<ul style="list-style-type: none"> Controls the ABS, A-TRC, VSC, and Brake Assist in accordance with the information provided by various sensors. Turns the pump motor ON/OFF in accordance with the information provided by the pressure sensor, in order to control the accumulator pressure.

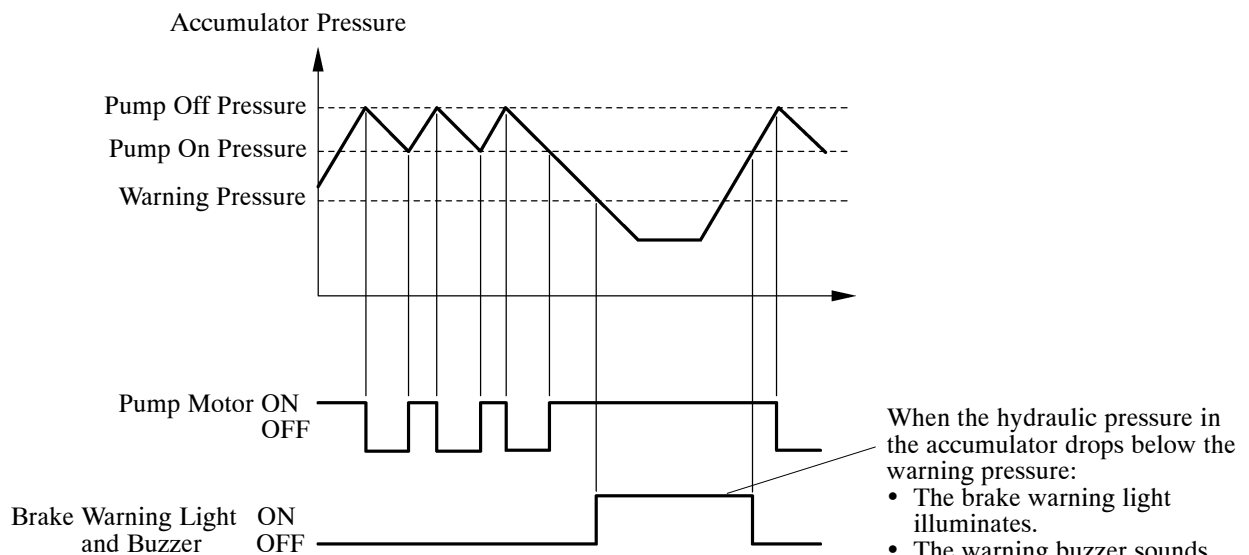
Pump & Pump Motor, Accumulator, Pressure Sensor and Relief Valve

- During normal braking, the hydraulic pressure of the power supply system that is necessary for operating the ABS and VSC operates the pump and pump motor as indicated in the timing chart below, in order to accumulate the generated hydraulic pressure in the accumulator.
- The pressure sensor monitors the hydraulic pressure in the accumulator. When the hydraulic pressure drops to the pump ON pressure, the ECU actuates the pump motor.
- When the hydraulic pressure rises to the pump OFF pressure, the ECU stops the operation of the pump motor.
- If the accumulator pressure sensor malfunctions, the pressure relief valve opens to prevent the pressure from rising excessively.



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► Timing Chart ◀



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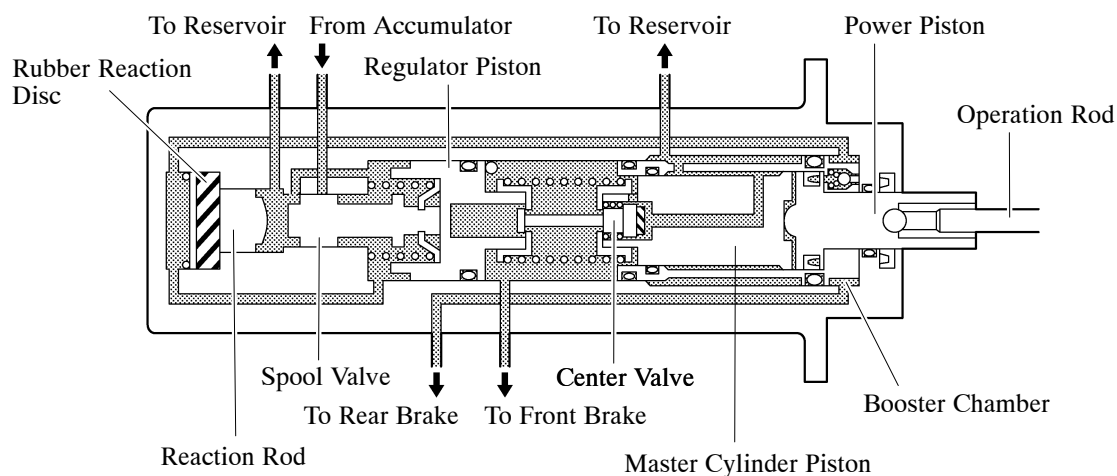
Master Cylinder & Brake Booster

1) Construction

The master cylinder & brake booster consists of a brake booster portion, master cylinder portion, and regulator portion. These are positioned coaxially to achieve a simple and compact construction.

- The brake booster portion consists of an operation rod, power piston and booster chamber.
- The master cylinder portion consists of a master cylinder piston (large diameter piston and small diameter piston), return spring and center valve.
- The regulator portion consists of a regulator piston, return spring, spool valve, reaction rod, and rubber reaction disc.

► Simplified Diagram ◀

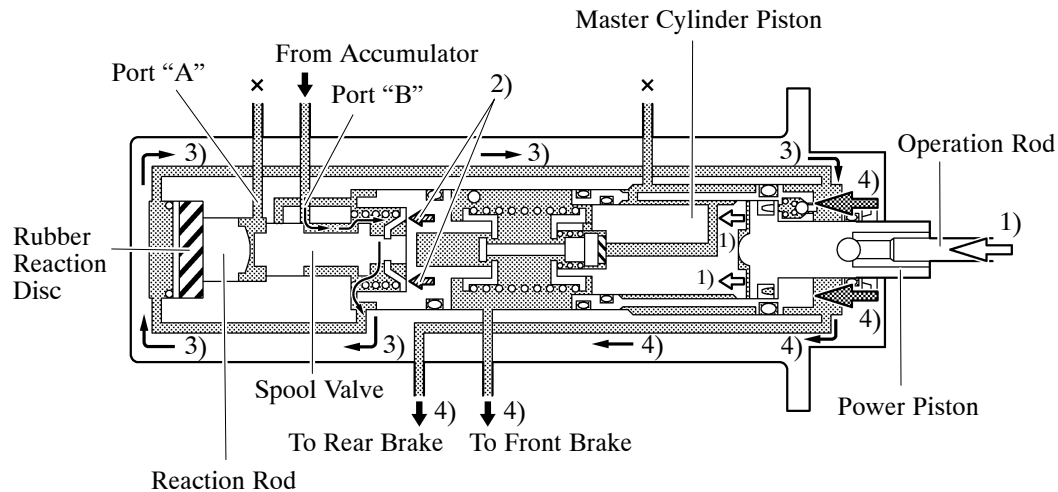


273GX38

2) Operation

a. Pressure Increase (Low Pressure)

- 1) The pedal operation force transmits as follows: Operation Rod → Power Piston → Master Cylinder Piston (Small Diameter Piston).
- 2) Because the load setting of the master cylinder's return spring is higher than that of the regulator piston's return spring, the regulator piston gets pushed before the volume in the master cylinder becomes compressed.
- 3) The spool valve closes the port "A" (between the reservoir tank and booster chamber) and opens the port "B" (between the reservoir tank and accumulator). Then, the pressurized brake fluid is introduced into the booster chamber to provide a power assist to the pedal effort. The pressure of the pressurized brake fluid is transmitted to the large diameter master cylinder piston.
- 4) At this time, the power assist overcomes the force of the master cylinder's return spring. This causes the volume in the master cylinder to become compressed and increases the pressure that is applied to the front brakes. At the same time, the pressure in the booster chamber increases the pressure that is applied to the rear brakes.



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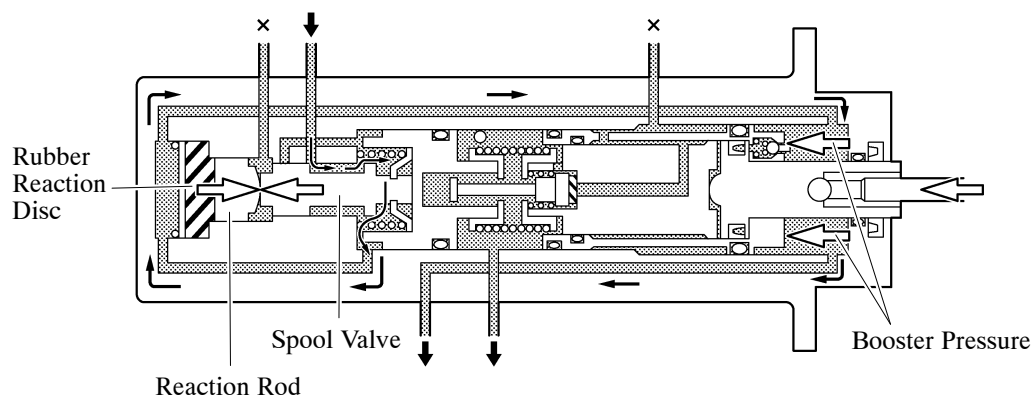
During the initial stage of the brake operation, the booster pressure that is applied to the rubber reaction disc is small. Therefore, a return force in the rightward direction does not apply to the spool valve via the reaction rod.

b. Pressure Increase (High Pressure)

In contrast to the time when the pressure is low, the booster pressure that is applied to the rubber reaction disc increases when the pressure is high. Accordingly, the rubber reaction disc deforms and causes a return force in the rightward direction to be applied to the spool valve via the reaction rod.

Therefore, in contrast to the time when the pressure is low, a greater reaction force is transmitted to the brake pedal.

As a result, a variable servo mechanism is realized, in which the servo ratio is lower during high pressure than during low.

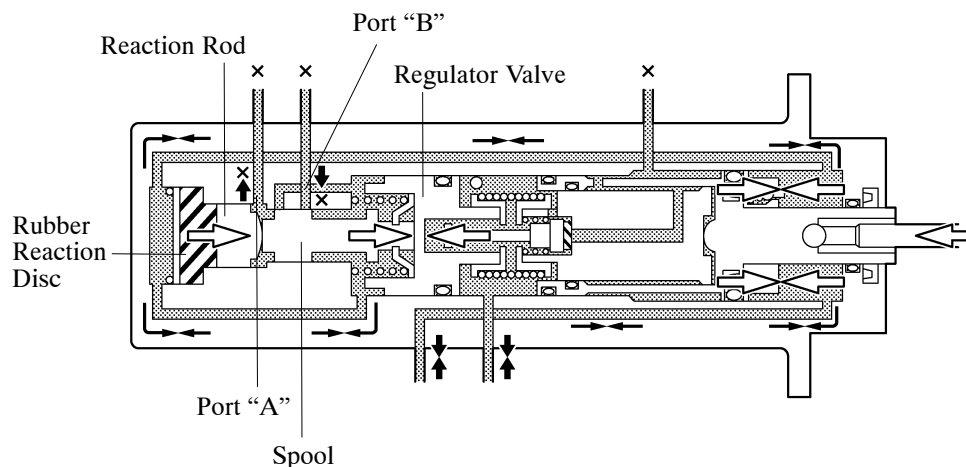


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c. Holding

This is a state in which the force that is applied via the brake pedal and the master cylinder pressure are balanced.

The forces that are applied to the front and rear of the regulator piston, in other words, forces that are generated by the master cylinder pressure and the regulator pressure become balanced. This causes the spool valve to close both port "B" from the booster chamber to the accumulator and port "A" to the reservoir. As a result, the brake is in the holding state.

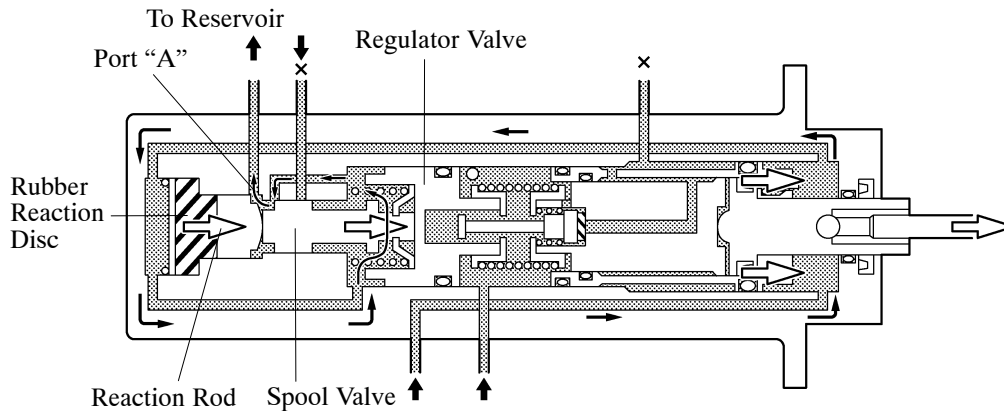


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d. Pressure Reduce

When the pressure that is applied to the brake pedal is relaxed, the master cylinder pressure decreases. Then, the regulator piston's return (rightward) force becomes relatively greater, causing the regulator piston to retract and the spool valve to also retract. As a result, the port "A" between the reservoir tank and the booster chamber opens.

The booster pressure becomes reduced in this state, creating a balance that corresponds to the force that is newly applied via the brake pedal. This process is performed repetitively to reduce the booster pressure and the master cylinder pressure in accordance with the force that is applied via the brake pedal.



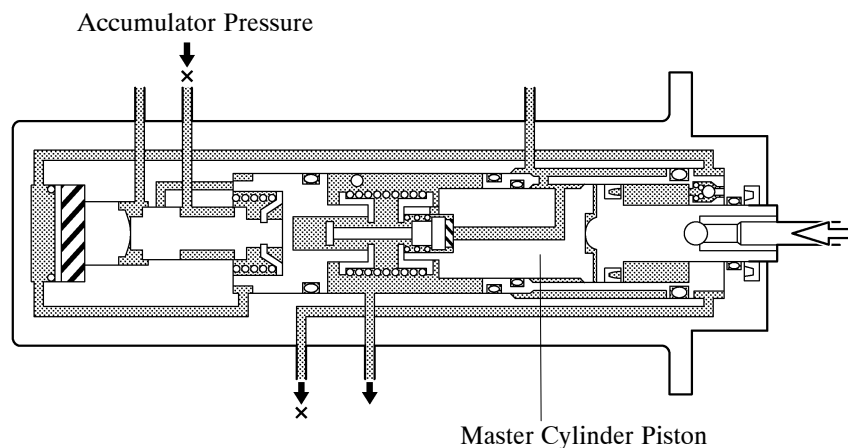
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e. During Power Supply Malfunction

If the accumulator pressure is affected by any malfunction, no hydraulic pressure will be supplied to the booster chamber. For this reason, a power assist cannot be provided to the force that is applied via the brake pedal and the pressure to the rear brakes cannot be increased. Since there is no pressurized brake fluid in the large diameter master cylinder piston at this time, the piston does not move from the original position.

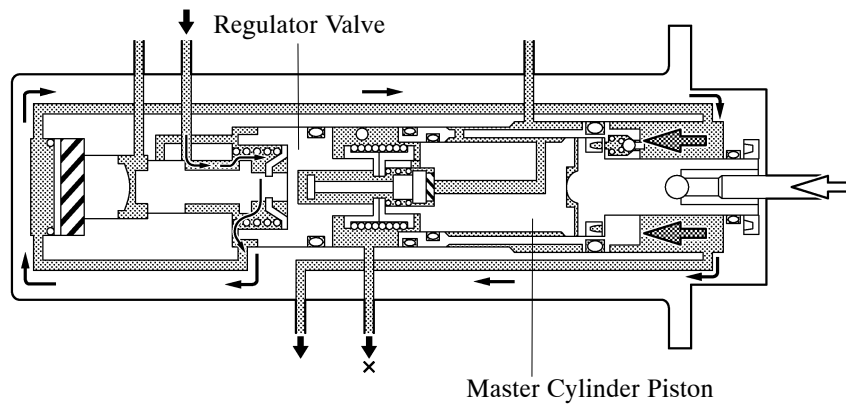
However, the pressure to the front brakes will be increased at the small diameter master cylinder piston in accordance with the pedal effort applied to the brake pedal.



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f. Front Brake System Malfunction

- In the front brake system, the master cylinder piston is moved by the booster chamber pressure but the hydraulic pressure does not increase. The piston moves until it hits the regulator piston while the brake fluid in the master cylinder is drained.
- The rear brake system operates the same as in the normal operation.



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