

Tips & Technology

For Bosch business partners

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Brake Technology



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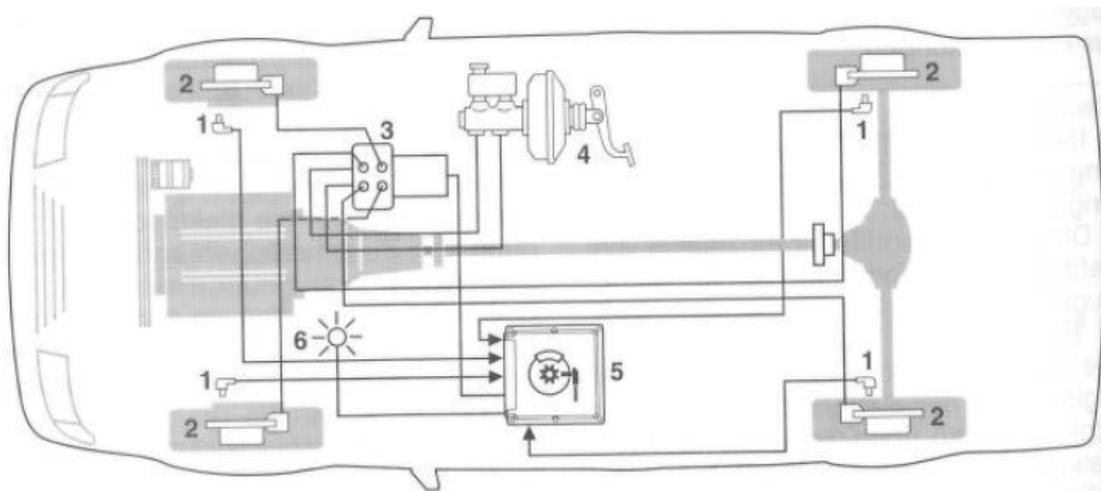
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Passenger Car Brake Systems - Parking Brake

Brake systems for passenger cars and light commercial vehicles must satisfy the requirements of various directives and legal regulations, e.g. 71/320/EEG [1], ECE R13 [2], ECE R13-H [3] and in Germany §41 of the StVZO [4]. The requirements for operation, effectiveness and testing method are specified in these documents.

The overall system is divided into the service brake system, parking brake system and auxiliary brake system.

Hydraulic dual-circuit brake system with anti-lock device:



- 1 Wheel speed sensors
- 2 Wheel brakes (disk brakes, drum brakes also possible on the rear axle)
- 3 Hydraulic unit (for anti-lock device or vehicle dynamics control system)
- 4 Actuator with brake booster, tandem brake master cylinder and expansion tank
- 5 Electronic control module (direct attachment to the hydraulic unit is possible)
- 6 Warning lamp for anti-lock device

Service brake system

The service brake system allows the driver to reduce the speed of the vehicle during operation in a controlled manner to a complete standstill. On passenger cars and light commercial vehicles, it is normally designed as a power brake system.

The driver controls the braking action continuously via the pressure applied to the brake pedal. The braking power is transmitted to the wheel brakes through two independent hydraulic transmitting devices via the tandem master brake cylinder (see figure, p. 1). The service brake system acts on all four wheels.

Parking brake system

The parking brake system ("hand brake") is a separate brake system that keeps the vehicle stationary even on a sloped roadway and especially in the absence of the driver. The parking brake mechanism is integrated into the wheel brake. Legal regulations stipulate that the parking brake must have a continuous mechanical connection between the actuator and wheel brake, e.g. through a linkage or cable. Usually, the parking brake is actuated by a hand brake lever; in many cases, also by a foot pedal.

An exception here is the electrically actuated parking brake system. In electrically actuated parking brake systems, the parking brake is set or released by an electric operating device (switch). Accordingly, the service brake system and the parking brake system have separate actuating and transmitting devices. The parking brake system can be designed to act with an adjustable force; it acts on the wheels of only one axle.

The holding action is determined in accordance with ECE R13-H on a downward incline with fully loaded vehicles. For a vehicle without trailer, the incline is 18%. If the vehicle is equipped for pulling a trailer, the holding action must also be achieved with a trailer without brakes on a downward incline of 12%.

Auxiliary brake system

When a problem occurs, e.g. a leak or broken line, the functional part of the brake system must still be able to provide the auxiliary braking action – with the same actuating force applied to the actuator. The auxiliary braking action must be controllable and at least 50% (ECE R13-H) or 44% (§41 para. 4a). The vehicle must not leave its lane upon actuation of the auxiliary brake.

The auxiliary brake system does not need to be an independent, third brake system (in addition to the service and parking brake systems) with a separate actuator. Either the intact brake circuit of a dual-circuit service brake system or an adjustable parking brake system can be used as the auxiliary brake system.

Parking brake on disk brakes

Most disk brake operate with a floating-caliper brake together with a parking brake mechanism.

Brakes with a parking brake:

Upon actuation of the parking brake, the force is transmitted to the parking brake lever by the hand brake cable. This causes the lever to rotate and the rotary motion is transmitted to the cam plate by the shaft. As a result of the motion of the balls on the ramps of the cam plate, the piston in the parking brake mechanism is moved by the thrust sleeve; the threaded spindle moves in the direction of the brake pad. After traversing the air gap, first the piston side and then the outer brake pad is pressed against the brake disk.

Releasing the parking brake:

After the hand brake lever is released, the parking brake lever, the shaft and the cam plate return to their original positions. The thrust sleeve, the threaded spindle and the piston are pushed back into their original positions by the spring in the parking brake mechanism. The final air gap is provided by the rebound of the seal ring.

Parking brake on drum brakes

With the aid of the brake cable and the hand brake lever, the drum brake can be used as the parking brake. The parking brake lever is mounted at the top of the trailing brake shoe. Upon actuation of the parking brake system, the cable pulls the hand brake lever down and toward the back; in turn, the hand brake lever presses the brake shoes against the brake drum by means of a push rod.

The hand brake cable

Dirt and wear can prevent the brake cable from moving properly. This reduces the functionality of the parking brake. For this reason, the brake cable needs to be checked regularly and replaced when necessary.

Workshop tips for changing hand brake cables:

- Always loosen the adjustment screws on the hand brake lever inside the vehicle first before raising the vehicle on the lift. This facilitates disassembly.
- After removing the rear wheels and lifting the hand brake cable out of the fastener on the disk or drum brake, lift the exhaust out of the rubber holders and support it. This makes it easier to remove the old hand brake cable and install the new one.
- Following installation, adjust the new hand brake cable: The adjustment procedure and the number of stops differ for each vehicle type (as a rule of thumb: after 3-7 stops, the parking brake should be closed).
- If the brake disks/brake pads are replaced together with the hand brake cable, the brake pedal must be actuated hydraulically before the hand brake cable is adjusted to allow the air gap to be set.
- The hand brake cable must always be replaced in the manner specified by the vehicle manufacturer. Furthermore, the ESI[tronic] contains additional, more detailed and vehicle-specific SIS troubleshooting instructions, installation locations, removal, installation and adjustment instructions as well as tightening torques, test and adjustment values.