BRAKING SYSTEMS

8.0 Definitions

8.0 Braking Equipment

All the braking systems fitted to a vehicle, are to reduce its speed or bring it to a halt, or to hold the vehicle stationary if already halted.

8.1 Braking Systems

Service braking system

This includes all the elements, whose action may be modulated, allowing the driver to reduce, directly or indirectly, the speed of a vehicle during normal driving or to bring the vehicle to a halt.

Secondary braking system

This includes all the elements, whose action may be modulated, allowing the driver to reduce, directly or indirectly, the speed of a vehicle or to bring the vehicle to a halt in case of failure of the service braking system.

Parking braking system

This includes all the elements which allow the vehicle to be held stationary mechanically even on an inclined surface, and particularly in the absence of the driver.

Additional retarding braking system

All the elements that allow the driver directly or indirectly to stabilize or to reduce the speed of the vehicle, particularly on long inclines.

Automatic braking system

All the elements which automatically brakes the towed vehicle as a result of intended or accidental separation from the towing vehicle.

Antilock braking system (ABS)

An assembly of all devices within the service-braking system which provide automatic slip control (in the direction of rotation) for one or several wheels under braking conditions. The braking force at wheels featuring direct control is controlled using data provided by the wheel's own wheel-speed sensor, while indirectly controlled wheels rely on data provided by the wheel-speed sensor(s) at one or more of the other wheels. An ABS system with "Select High" control has directly and indirectly controlled wheels. With an ABS system with "Select Low" control, all wheels with speed sensors are directly controlled.

8.3 Design and Components of a Braking System

Basic components of a braking system

The braking system consists of:

- Energy supply,
- A control device
- A transmission device for controlling braking force, and for activating the engine brake, parking brake, and retarder,
- Additional equipment in the towing vehicle for braking the trailer.
- Wheel brakes.

Each of those components affects the braking forces which are decisive for slowing down the vehicle or vehicle combination.

8.4 Braking-System Applications

Legal regulations stipulate that the braking system on a heavy commercial vehicle will consist of:

- Service brakes,
- Secondary brakes,
- Parking brake,
- Additional retarding braking systems, and
- Self-actuated braking system.

The service and parking brakes are equipped with separate individual control and transmission devices. The service brakes are generally applied with the foot, while the parking brake can be actuated with either hand or foot. The secondary braking system frequently shares components with the service or parking brakes. For instance, when one circuit in a dual-circuit service-braking system also functions as secondary brake, the additional retarding braking system, which acts as a supplementary, wear-free unit, is especially useful for relieving the service brakes on long downgrades. Self-actuated (automatic) braking systems apply to trailers only.

8.5 Brake-Circuit Configurations

Legal regulations stipulate a dual-circuit transmission system as mandatory. There are five available options, but versions II and X have become standard in use. As the brake lines, hoses, connections, and static and dynamic seals remain at a low level of complication, the probability of failure due to leaks is comparable to that achieved with a single-circuit system. The potential response to failure of a circuit due to overheating at one wheel points up a serious weakness in the HI, LL and HH distribution patterns, where loss of both brake circuits on a wheel could lead to total brake-system failure.

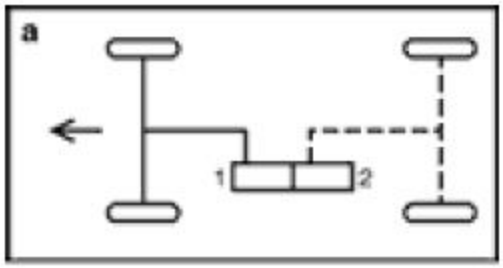
Vehicles with a forward weight bias use distribution pattern X to fulfil the regulatory requirements. The II distribution pattern is an excellent solution for vehicles with rear weight bias and mid-range and heavy commercial vehicles.

8.5.1 Brake-Circuit Configuration: Variants

1 Brake circuit 1; 2 Brake circuit 2.;

II distribution pattern

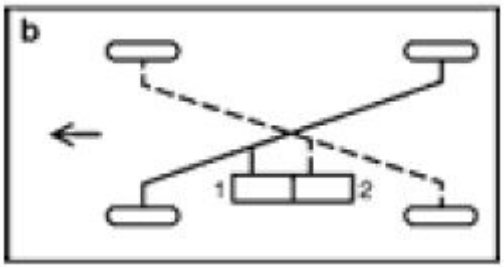
Front-axle/rear-axle split. One circuit brakes the front axle and the other the rear axle.



(a) II-distribution

X distribution pattern

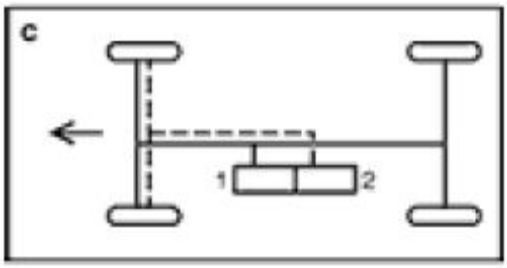
Diagonal distribution pattern. Each circuit brakes a given front wheel and the diagonally opposite rear wheel.



(b) X-distribution

HI distribution pattern

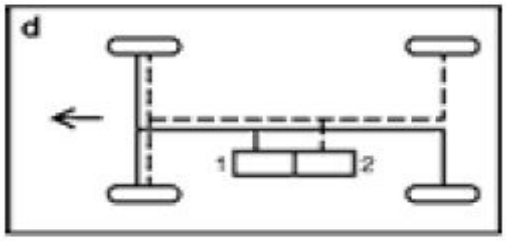
Front-axle and rear-axle/front-axle split. One circuit brakes the front and rear axles, and one circuit brakes only the front axle.



(c) HI-distribution

LL distribution pattern

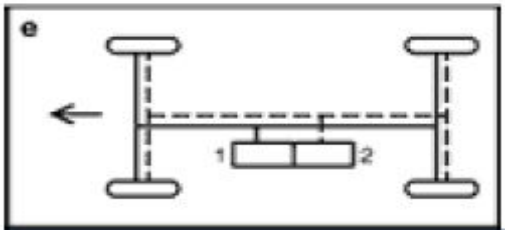
Front-axle and rear-wheel/front-axle and rear-wheel split. Each circuit brakes the front axle and one rear wheel.



(d) LL distribution

HH distribution pattern

Front-axle and rear-axle/front-axle and rear-axle split. Each circuit brakes the front axle and the rear axle.



(e) HH-distribution

8.6 Braking Systems for Passenger Cars and Light Utility Vehicles Control Devices

The control device consists of:

- Brake pedal,
- Vacuum brake booster,
- Master cylinder,
- Brake-fluid reservoir,
- Device to warn of a brake-circuit failure and/or low brake-fluid level.

In addition to the basic equipment listed above, hydraulic boosters or hydraulic non muscular- energy braking systems may be used in certain applications. In non muscular-energy systems, the brake booster and master cylinder are replaced by a brake valve. The force at the pedal is modulated to achieve the desired brake pressure. High-pressure pumps and accumulators are included to generate and to store the requisite energy.

8.7 Definitions of the Energy Supplying Devices

- **Muscular-energy braking system**

Braking system in which the energy necessary to produce the braking force is supplied solely by the physical effort of the driver.

- **Energy-assisted braking system**

  Braking system in which the energy necessary to produce the braking force is supplied by the physical effort of the driver and one or more energy supplying devices.

- **Non-muscular-energy braking system**

  Braking system in which the energy necessary to produce the braking force is supplied by one or more energy supplying devices excluding the physical effort of the driver. This is used only to control the system. Note: However, a braking device in which the driver can increase the braking force, in the total failed energy condition, by muscular effort acting on this device, is not included in the above definition.

- **Inertia braking system**

  Braking system in which the energy necessary to produce the braking force arises from the approach of the trailer to its towing vehicle.

- **Gravity braking system**

  Braking system in which the energy necessary to produce the braking force is supplied by the lowering of a constituent element of the trailer (e.g. trailer drawbar), due to gravity.