International Standard 611

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Road vehicles — Braking of automotive vehicles and their trailers — Vocabulary

Véhicules routiers — Freinage des véhicules automobiles et de leurs remorques — Vocabulaire

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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Australia	Japan	Spain
Austria	Korea, Rep. of	Sweden
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United Kingdom

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Road vehicles — Braking of automotive vehicles and their trailers — Vocabulary

0 Scope and field of application

This International Standard defines the principal terms of braking and of braking equipment. These terms can designate either the systems or elements involved during the operation of braking or the values characterizing the whole or a part of the said operation. The terms thus defined apply to road vehicles, i.e. to automotive vehicles, to towed vehicles, and to combinations of vehicles.

1 Braking equipment

braking equipment : All the braking systems fitted to a vehicle and whose function is to reduce the speed of a moving vehicle or to bring it to a halt or to hold the vehicle stationary if it is already halted.

2 Braking systems

2.1 service braking system : All the elements allowing the driver to reduce or halt directly or indirectly, the speed of a vehicle during normal driving. Its action is gradual.

2.2 secondary braking system : All the elements allowing the driver to reduce or halt directly or indirectly, the speed of a vehicle in case of failure of the service braking system. Its action is gradual.

2.3 parking braking system : All the elements allowing the vehicle to be held stationary mechanically even on an inclined surface, and particularly in the absence of the driver.

2.4 additional retarding braking system : All the elements allowing the driver directly or indirectly to stabilize or to reduce the speed of the vehicle, particularly on a long incline.

2.5 automatic braking system : All the elements which automatically brake the towed vehicle as a result of intended or accidental separation from the towing vehicle.

3 Constituent elements

A braking system comprises devices for supplying energy, for its control, for its transmission, for braking, and, if necessary, a supplementary device on the towing vehicle for the towed vehicle.

3.1 energy supplying device : Parts of a braking system which supply, regulate and, if necessary, condition the energy required for braking. It terminates at the point where the transmission device starts, i.e. where the various circuits[1)] of the braking systems, including, the circuits of accessories if fitted are protected either towards the energy supplying device or from each other. It is equally applicable in the case of a towed vehicle.

3.1.1 energy source : Part of the energy supplying device which generates the energy. It may be located away from the vehicle (for example in the case of a compressed air braking system for a trailer) and can also be the muscular strength of an individual.

3.2 control device : Parts of a braking system which initiate the operation, and control the effect of this braking system. The control signal can be conveyed within the control device by, for example, mechanical, pneumatic, hydraulic or electrical means, including the use of auxiliary or non-muscular energy.

The control device starts :

— at the point of application when directly operated by the driver (or another person);

— at the point where the control signal is fed into the braking system when indirectly operated by the driver or when operated without his intervention.

It terminates either at the point where the energy necessary to produce the application force is distributed or where a part of that energy is distributed for the control of that application force.

1) See 4.2.1 and 4.2.2.

The control device can be operated :

— by direct action of an individual, either by hand or foot;

— by indirect action of the driver or without any action (only in the case of towed vehicles);

— by variation of the pressure in a connecting pipe or of the electric current in a cable between the towing and the towed vehicle at the time of operation of one of the braking systems of the towing vehicle, or in the case of a failure;

— by the inertia of the vehicle or by its weight or that of one of its constituent elements (for example by approach or separation of the towing and towed vehicles or by the lowering of a constituent element).

3.3 transmission device : Parts of a braking system which transmit the energy distributed by the control device.

It starts either at the point where the control device terminates or at the point where the energy supplying device terminates.

It terminates at those parts of the braking system in which are created the forces opposing the movement or the tendency towards movement of the vehicle.

It can for example, be of mechanical, hydraulic, pneumatic (pressure above or below atmospheric), electric, or combined (for example hydro-mechanical, hydro-pneumatic) type.

3.4 brake : Parts of a braking system in which the forces opposing the movement or tendency to movement of the vehicle are produced.

3.4.1 friction brake : Brake in which the components attached to a fixed part of the vehicle are applied by the application force against one or more components attached or coupled to a wheel or an assembly of wheels.

The friction brake in which the effect of application force is increased by the friction forces is called a "self-servo" type.

3.4.1.1 drum brake : Friction brake in which the friction forces are produced between the components attached to a fixed part of the vehicle and the internal or external surface of a drum.

3.4.1.2 disc brake : Friction brake in which the friction forces are produced between the components attached to a fixed part of the vehicle and the faces of one or more discs.

3.4.2 positive engagement brake (lock) : Brake in which non-rotating elements of the vehicle prevent, by positive engagement, the movement of components attached in a permanent manner to a wheel or an assembly of wheels. Positive engagement brakes normally shall only be applied when the vehicle is stationary.

3.4.3 retarder : Mechanism whose the function is to reduce or to stabilize the speed of a vehicle particularly on a long incline but not to stop it; there are different types of retarders such as the following :

3.4.3.1 retarder by combustion engine : The combustion engine, linked to the driving wheels, exercises a retarding effect on the moving vehicle, caused for example by a reduction in the fuel supply, by a throttling of the air supply, by a throttling of the outlet of the exhaust gases or by a modification of the valve opening times.

3.4.3.2 retarder by electric traction motor : The electric traction motor, linked to the driving wheels, exercises a retarding effect on the moving vehicle, caused for example by functioning as a current generator.

3.4.3.3 hydro-dynamic retarder : Mechanism in which a retarding effect is obtained by the action of a liquid on components linked to one or more wheels, or to elements of the power transmission of the vehicle which are themselves linked to the wheels.

3.4.3.4 aerodynamic retarder : Mechanism in which a retarding effect is obtained by causing an increase in the air resistance (for example by the deployment of movable surfaces).

3.4.3.5 electromagnetic retarder : Mechanism in which a retarding effect is obtained by the action of a magnetic field on a rotating metallic disc (eddy current, hysteresis) linked to one or more wheels or to elements of the power transmission of the vehicle which are themselves linked to the wheels.

3.5 supplementary device on the towing vehicle for the towed vehicle : Parts of a braking system on a towing vehicle which are intended for the supply of energy to, and control of, the braking systems on the towed vehicle. It comprises the components between the energy supplying device of the towing vehicle and the supply line coupling head (inclusive) and between the transmission device(s) of the towing vehicle and the control line coupling head (inclusive).

4 Definitions relating to the nature of the braking devices

4.1 Definitions relating to the energy supplying device (in the sense of 3.1)

4.1.1 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.

4.1.2 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.

4.1.3 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.

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.

4.1.4 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.

4.1.5 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, due to gravity.

4.2 Definitions relating to the arrangement of the transmission device

4.2.1 single-circuit braking system : Braking system having a transmission device embodying a single circuit.

The transmission device comprises a single circuit if in the event of a failure in the transmission device no energy for the production of the application force can be transmitted by this transmission device.

4.2.2 multi-circuit braking system : Braking system having a transmission device embodying several circuits.

The transmission device comprises several circuits if, in the event of a failure in the transmission device, energy for the production of the application force can still be transmitted, wholly or partly, by this transmission device.

4.3 Definitions relating to vehicle combinations

4.3.1 single-line braking system : Assembly in which the braking systems of the individual vehicles act in such a way that a single line is used both for the energy supply to, and for the control of, the braking system of the towed vehicle.

4.3.2 two or multi-line braking systems : Assembly in which the braking systems of the individual vehicles act in such a way that several lines are used separately and simultaneously for the energy supply to, and for the control of, the braking system of the towed vehicle.

4.3.3 continuous braking system : Combination of braking systems for vehicles forming a vehicle combination offering the following characteristics :

— the driver, from his driving seat, can operate gradually by a single operation a directly-operated control device on the towing vehicle and an indirectly-operated control device on the towed vehicle;

— the energy used for the braking of each of the vehicles forming the combination is supplied by the same energy source (which can be the muscular effort of the driver);

— simultaneous or suitably phased braking of each of the vehicles forming the combination.

4.3.4 semi-continuous braking system : Combination of braking systems for vehicles forming a vehicle combination offering the following characteristics :

— the driver, from his driving seat, can operate gradually by a single operation a directly-operated control device on the towing vehicle and an indirectly operated control device on the towed vehicle;

— the energy used for the braking of each of the vehicles forming the combination is supplied by at least two different energy sources (one of which can be the muscular effort of the driver);

— simultaneous or suitably phased braking of each of the vehicles forming the combination.

4.3.5 non-continuous braking system : Combination of the braking systems of the vehicles forming a combination which is neither continuous nor semi-continuous.

5 Additional definitions

5.1 Energy transmission lines

5.1.1 cable of wire : Conductor for transmission of electrical energy.

5.1.2 pipe : Conductor for transmission of hydraulic or pneumatic energy.

5.1.2.1 rigid pipe : Connection of permanently-formed shape between two parts fixed relative to each other. Any deformation suffered by such a connection is permanent.

5.1.2.2 semi-rigid pipe : Connection of non-permanent shape between two parts fixed relative to each other.

5.1.2.3 flexible pipe : Flexible connection between two parts which are movable with respect to each other.

5.1.3 Lines of the braking equipment defined according to their function

5.1.3.1 feed line : Line linking the energy source or the energy reservoir to the device controlling the energy flow (this device could be, for example, a brake valve).

This definition is not applicable to the lines linking two vehicles in a vehicle combination.

5.1.3.2 actuating line : Line linking the device controlling the energy flow (for example a brake valve) to the device converting the energy of the agent into mechanical energy (for example a brake cylinder).

5.1.3.3 **pilot line** : Line linking a control device (for example a brake valve) to another control device (for example a relay valve), the energy flow serving only to control the second control device.

This definition is not applicable to the lines linking two vehicles in a vehicle combination.

5.1.4 Lines connecting the braking equipment of vehicles in a vehicle combination

5.1.4.1 **supply line** : A supply line is a special feed line transmitting energy from the towing vehicle to the energy reservoir of the towed vehicle.

5.1.4.2 **control line** : A control line is a special pilot line by which the energy essential for the control is transmitted from the towing vehicle to the towed vehicle.

5.1.4.3 **common supply and control line** : Line serving equally as supply line and as control line (single-line braking system).

5.1.4.4 **secondary line** : Special actuating line transmitting from the towing vehicle to the towed vehicle the energy essential for the secondary braking of the towed vehicle.

5.2 **gradual braking** : Braking which, within the normal range of operation of the control device, permits the driver, at any moment, to increase or reduce, to a sufficiently fine degree, the braking force by operation of the control device.

When an increase in braking force is obtained by action of the control device, an inverse action shall lead to a reduction of that force.

5.3 **protection pressure** : Stabilized pressure in a part of the braking systems after another part of the braking equipment, or its accessories, has become faulty.

5.4 **alarm pressure** : Limit pressure below which the alarm device comes into action.

5.5 **alarm device** : Device warning the driver no later than when certain conditions of operation of the braking systems have become critical.

5.6 **application mechanism** : All the mechanical components of the transmission device linking the operating element (for example, a cylinder) to the brake.

5.7 **wear compensation device** : Device compensating, automatically or otherwise, the wear of the brake linings in the case of friction brakes (drum brakes or disc brakes).

5.8 **auxiliary release device for spring-brake actuator** : Device cancelling the braking force due to the spring-brake actuator when its feed pressure has fallen below the actuation threshold as a result of a failure.

5.9 **device to apply correction to braking force** : Device whose function is to modify, automatically or otherwise, the braking force as a function of certain parameters, which may include the following :

— load,

— fluid pressure,

— deceleration,

— etc.

5.9.1 **automatic device for correcting the braking force as a function of load** : Device which automatically adjusts the braking force on one or more wheels of the vehicle in accordance with the static or dynamic load on the wheel or wheels.

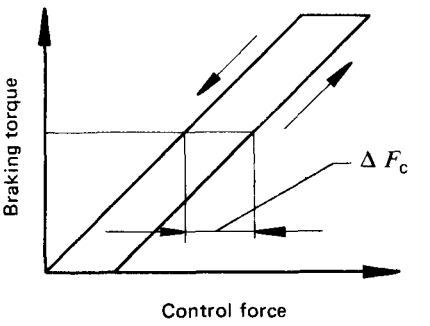
5.9.2 **anti-lock device** : Device which automatically controls the level of slip, in the direction of rotation of the wheel, on one or more wheels of a vehicle during braking.

For the definitions, refer to clause 7.

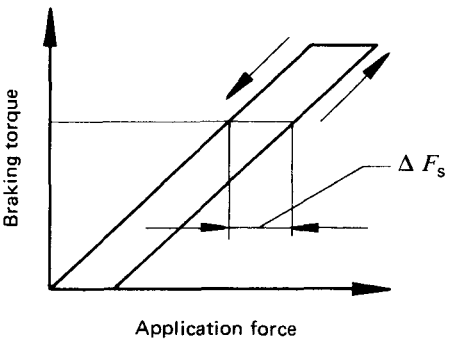
6 Braking mechanics

braking mechanics : Mechanical phenomena occurring between the initiation of the control device and the end of the braking action.

6.1 **braking system hysteresis** : Difference in control forces between application and release for the same braking torque.



6.2 **brake hysteresis** : Difference in application force between application and release for the same braking torque.



6.3 Forces, torque

6.3.1 control force, F_c : Force exerted on the control device.

6.3.2 application force, F_s : In friction brakes, the total force, applied to the lining, which causes the braking force by friction effect.

6.3.3 braking torque : Product of the frictional forces resulting from the application force and the distance between the points of application of these forces and the axis of rotation.

6.3.4 total braking force, F_f : Sum of the braking forces at the interfaces between all the wheels and the ground, produced by the effect of the braking system, which oppose the movement or the tendency to movement of the vehicle.

6.4 Times

6.4.1 actuating time : Elapsed time between the moment when the component of the control device on which the control force acts starts to move and the moment when it reaches its final position corresponding to the applied control force (or its travel). (This is equally true for application and release.)

6.4.2 initial response time : Elapsed time between the moment when the component of the control device on which the control force acts starts to move and the moment when the braking force takes effect.

6.4.3 build-up time : Elapsed time between the moment when the braking force takes effect and the moment when this force reaches a certain value.

6.4.4 active braking time : Elapsed time between the moment when the braking force takes effect and that at which it ceases. If the vehicle stops before the braking force ceases, the time of the end of movement constitutes the end of the active braking time.

6.4.5 release time : Elapsed time between the moment when the actuating time for release starts and the moment when the braking force ceases.

6.4.6 total braking time : Elapsed time between the moment when the component of the control device on which the control force acts starts to move and the moment when the braking force ceases. If the vehicle stops before the braking force ceases, the time of the end of movement constitutes the end of the total braking time.

6.5 braking distance, s : Distance travelled by the vehicle during the total braking time. If the time of the end of movement constitutes the end of the total braking time, this distance is called the "stopping distance".

6.6 braking work, W : Integral of the product of the instantaneous total braking force, F_f, and the elementary movement, ds, over the braking distance, s :

$$W = \int_0^s F_f \, ds$$

6.7 instantaneous braking power, P : Product of the instantaneous total braking force, F_f, and of the vehicle speed, v :

$$P = F_f v$$

6.8 braking deceleration : Reduction of speed obtained by the braking system in the considered time, t. The following can be identified :

6.8.1 instantaneous deceleration :

$$a = \frac{dv}{dt}$$

6.8.2 mean deceleration : The deceleration between two instants, separated by a time, t, of the braked movement :

$$a_m = \frac{v_1 - v_2}{t}$$

6.9 braking factor, z : Ratio between the total braking force, F_f, and the static weight, G, on the axle or the axles of the vehicle :

$$z = \frac{F_f}{G}$$

7 Anti-lock device

See 5.9.2.

7.1 Components of the system

7.1.1 sensor : The component responsible for sensing the conditions of rotation of the wheel(s) or the dynamic condition of the vehicle, and for transmitting this information to the controller.

7.1.2 controller : The component responsible for evaluating the information supplied by the sensor, and for transmitting an order to the modulator.

7.1.3 modulator : The component responsible for modulating the force developed by the brake actuators as a function of the order received from the controller.

7.2 Types of wheel control

7.2.1 individual wheel control : Control where the force developed by the brake actuator of each wheel is individually modulated.

7.2.2 multi-wheel control : Control where the force developed by the brake actuators of a group of wheels is modulated by a common command.

7.2.2.1 axle control : Multi-wheel control where the wheels on one side axle are controlled by a common command.

7.2.2.2 side control : Multi-wheel control where the wheels on one side of the vehicle are controlled by a common command.

7.2.2.3 diagonal control : Multi-wheel control where the wheels diagonally opposite each other on the vehicle are controlled by a common command.

7.2.2.4 combined multi-axle control : Multi-wheel control where all the wheels of a multi-axle combination are controlled by a common command.

7.2.3 Selection of sensor signals for system control

7.2.3.1 Variable selection

7.2.3.1.1. select-low : Multi-wheel control where the signal of that wheel which is the first to tend to lock, controls the system for all the wheels of the group.

7.2.3.1.2 select-high : Multi-wheel control where the signal of that wheel which is the last to tend to lock, controls the system for all the wheels of the group.

7.2.3.2 Predetermined selection

7.2.3.2.1 selection by wheel : Multi-wheel control where the signal of a predetermined wheel controls the system for all the wheels of the group.

7.2.3.2.2 average selection : Multi-wheel control where the instantaneous speeds from several wheels are averaged and the signal used to control the system for all the wheels of the group.

7.3 Definitions relating to the control operation

7.3.1 minimum control speed : The speed of the vehicle below which the anti-lock system is no longer capable of overriding the control forces transmitted to the brakes by the driver.

7.3.2 sensor signal : Information supplied by the sensor.

7.3.3 resolution (of an impulse wheel speed sensor) : The number of impulses supplied by the sensor for one revolution of the wheel.

7.3.4 control cycle : One complete cycle of the anti-lock system function from one imminent wheel-lock to the next.

7.3.5 control frequency : The number of control cycles occurring per second, on a homogeneous road surface.

Alphabetical index