INTERNATIONAL STANDARD

ISO 7643

Second edition
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Caravans and light trailers — Trailers of categories O_1 and O_2 with overrun brakes — Linear bench test methods for brake controls

Caravanes et remorques légères — Remorques des catégories O_1 et O_2 à freins à inertie — Méthodes d'essai des dispositifs de commande de freinage sur banc linéaire

Reference number
ISO 7643:1991(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 7643 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Sub-Committee SC 4, *Caravans and light trailers*.

This second edition cancels and replaces the first edition (ISO 7643:1983), certain values of which have been altered and references updated.

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Caravans and light trailers — Trailers of categories O_1 and O_2 with overrun brakes — Linear bench test methods for brake controls

1 Scope

This International Standard specifies test methods for type approval testing of controls on trailers for overrun brakes.[1)]

The test method is based on the requirements of ECE Regulation No. 13 of the United Nations, *Uniform provisions concerning the approval of vehicles with regard to braking*. It is therefore recommended that reference should be made to this Regulation to assist with the use of this International Standard.

These test methods apply to the type approval of categories O_1 and O_2[2)] trailers with inertia brakes by testing the control devices on a linear test bench.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/TR 4114:1979, *Road vehicles — Caravans and light trailers — Static load on ball couplings.*

3 Symbols and definitions (see figure 1)

G'_A	is the trailer total weight capable of being braked by the control device, as declared by the manufacturer;
G'_{A_1}	is the minimum total weight capable of being braked;
G'_{A_2}	is the maximum total weight capable of being braked;
S	is the travel of the control, in millimetres;
S'	is the effective travel of the control in millimetres;
S_o	is the loss of travel, applicable to multi-axle trailers only, i.e. travel in millimetres of coupling head when this is actuated to move from 300 mm above to 300 mm below the horizontal, the transmission remaining stationary;
S''	is the spare travel of the master cylinder, measured in millimetres at the coupling head;
i_{H_o}	is the reduction ratio between the travel of the coupling head and the lever travel at the output side of the control device;

1) Only SI units are used in this International Standard.

2) Definitions from UN/ECE Regulation No. 13, amendment 05:

Category O_1: Single axle trailers, other than semi-trailers, with a maximum mass not exceeding 0,75 t.
Category O_2: Trailers with a maximum mass not exceeding 3,5 t other than trailers of category O_1.

$i^*_{H_o}$ is the reduction ratio measured at the mid-travel position of the control, and with the lever vertical;

i_h is the reduction ratio between the travel of the coupling head and the travel of the piston in the master cylinder (in the case of hydraulic transmission brakes);

i^*_h is the reduction ratio i_h measured at the mid-travel position of the control;

F_{H_z} is the surface area of the piston of the master cylinder (in the case of hydraulic transmission brakes);

K_A is the force threshold of the control device, i.e. the maximum thrust on the coupling head which can be supplied for a short time without placing any force on the output side of the control device;

D is the longitudinal force occurring between the towing vehicle and towed vehicle;

D_1 is the maximum force applied to the coupling head when it is being pushed at the speed specified in 7.1.2, with the transmission uncoupled;

D_2 is the maximum force applied to the coupling head when it is being pulled at the speed specified in 7.2 from the position of maximum compression, with the transmission uncoupled;

η_{H_o} is the efficiency of the inertia control device;

P' is the control device output force;

K is the supplementary force of the control device, conventionally designated by the force D corresponding to the point of intersection with the axis of the abscissae of the extrapolated curve expressing P' in terms of D, measured with the device in the mid-travel position.

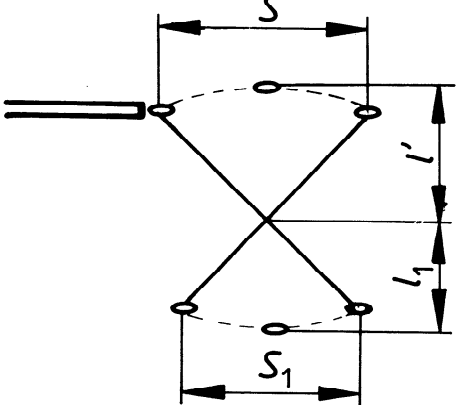
4 Test conditions

Before carrying out any test, the manufacturer shall state:

G'_A, in newtons;

F_{H_z}, in square centimetres (in the case of hydraulic transmission brakes).

Tests shall be carried out at an ambient temperature of 20 °C ± 10 °C.



$$i_{H_0} = \frac{S'}{S_1}$$

$$i^*_{H_0} = \frac{l'}{l_1}$$

Figure 1

5 Description of test bench

The test bench shall be able to keep the control device being tested horizontal.

It shall be possible to carry out the following measurements on the test bench:

— input force on the coupling head, D;

— output force on the end part of the control device, P', or hydraulic pressure p;

— travel of the control;

— travel speed of the control.

The test bench shall allow measurement of forces under oscillation to be carried out.

6 Parameters to be measured

The following parameters shall be measured:

— travel of the control, S, in millimetres;

— effective travel of the control, S', in millimetres;

— loss of travel, S_o, in millimetres;

— spare travel of the master cylinder (in the case of hydraulic inertia braking system), S'', in millimetres;

— reduction ratio, i_{H_o};

— reduction ratio, $i^*_{H_o}$, in the case of mechanical transmission brakes;

— reduction ratio, i_h;

— reduction ratio, i^*_h, in the case of hydraulic transmission brakes;

— force threshold, K_A, in newtons;

— insertion force, D_1, in newtons;

— reactive force, D_2, in newtons;

— efficiency of inertia control devices, η_{H_o};

— supplementary force, K, in newtons.

7 Tests — Determination of $G'_{A\,min}$ and $G'_{A\,max}$

The control device shall be mounted horizontally on the test bench and fixed according to the manufacturer's requirements, with the transmission disconnected. No vertical or lateral load on the coupling head is allowed during the test.

7.1 Measurement at insertion

7.1.1 Force threshold, K_A

Measurements shall be made under the following conditions (see figure 2):

a) The device is inserted at a constant speed of $(10\ ^{+1}_{0})$ mm/s. Force is measured at the beginning of the insertion over a travel range corresponding to

$$S_o + S'' + 0{,}25S'$$

b) The device is inserted at a constant speed of $(15\ ^{0}_{-1})$ mm/s. Force is measured at the beginning of the insertion over a travel range corresponding to

$$S_o + S'' + 0{,}25S'$$

The value of K_A is obtained by averaging the forces recorded at 10 mm/s and 15 mm/s.

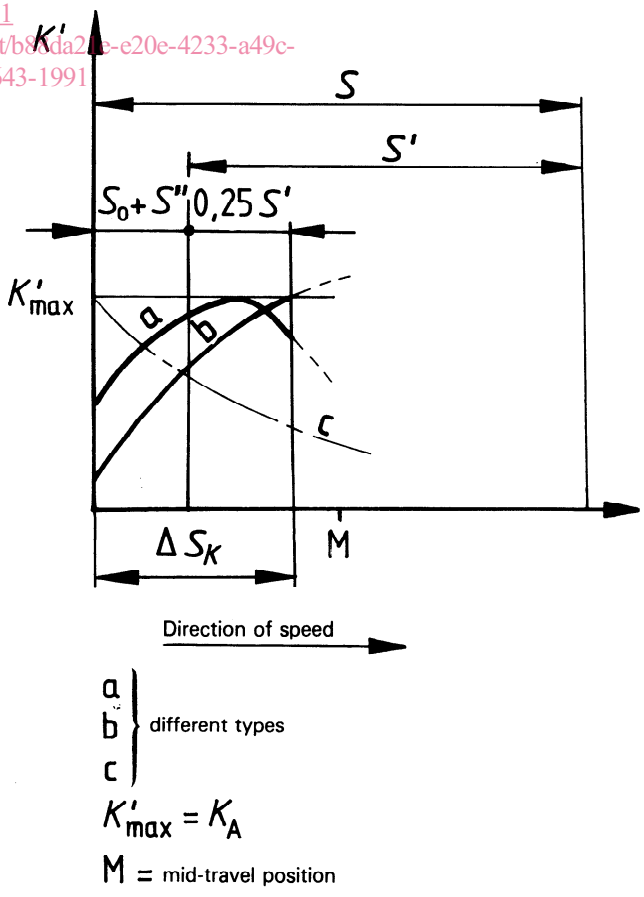


Figure 2

7.1.2 Maximum insertion force, D_1

The control device is inserted a distance S, at a constant speed ± 10 % in millimetres per second. The measured force (at any stroke position outside range of K_A) corresponds to the recorded maximum.

7.2 Measurement at retraction, D_2

The control device is retracted a distance S, at a constant speed ± 10 % in millimetres per second. The measured force (at any stroke position outside range of K_A) corresponds to the recorded maximum.

7.3 Conditions to be checked

With the values of K_A, D_1 and D_2 as measured in 7.1.1, 7.1.2 and 7.2, determine the application range between $G'_{A_1\,min}$ and $G'_{A_2\,max}$:

$$G'_{A_1\,min} = \frac{K_A}{0{,}04}$$

$$G'_{A_2\,max} = \frac{K_A}{0{,}02}$$

$G'_{A_1\,min} = D_1/0{,}1$ for single[3] axle trailers

or

$G'_{A_1\,min} = D_1/0{,}067$ for multi-axle trailers

$$G'_{A_1\,min} = \frac{D_2}{0{,}5}$$

$$G'_{A_2\,max} = \frac{D_2}{0{,}1}$$

8 Mechanical transmission control device

8.1 Determination of η_{H_o} and K

Measurements shall be carried out with the control device at mid-travel position.

Forces P' are measured as a function of increasing forces D (see figure 3).

At least three series of measurements are necessary, each including five appropriately distributed points up to the minimum force $D = 0{,}1G'_{A\,max}$ for single[3] axle trailers or $D = 0{,}067G'_{A\,max}$ for multi-axle trailers.

$P' = f(D)$ can be plotted by the average.

From this can be obtained:

the value of K, and

$$\eta_{H_o} = \frac{P'_x}{D_x - K} \times \frac{1}{i^*_{H_o}}$$

with

$D_x = 0{,}1G'_{A\,max}$ for single[3] axle trailers, or

$D_x = 0{,}067G'_{A\,max}$ for multi-axle trailers.

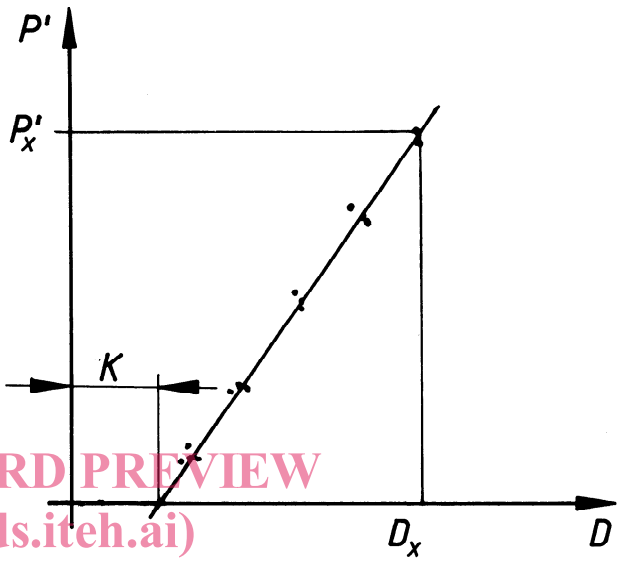


Figure 3

9 Hydraulic transmission control device

9.1 Determination of η_{H_o} and K

Measurements shall be carried out with the braking device at mid-travel position.

Forces P' are measured as a function of increasing forces D (see figure 3).

At least three series of measurements are necessary, each including five appropriately distributed points up to the minimum force $D = 0{,}1G'_{A\,max}$, for single[3] axle trailers or $D = 0{,}067G'_{A\,max}$ for multi-axle trailers.

$P' = f(D)$ can be plotted by the average.

From this can be obtained:

the value of K, and

$$\eta_{H_o} = \frac{P'_x}{D_x - K} \times \frac{F_{H_z}}{i^*_h}$$

3) Or tandem if less than 1 m apart.

with

$D_x = 0{,}1 G'_{A\,max}$ for single[3] axle trailers, or

$D_x = 0{,}067 G'_{A\,max}$ for multi-axle trailers.

10 Static strength test of control device

10.1 The static load on the coupling shall be within the limits set by ISO/TR 4114.

10.2 The control device shall be loaded with a thrust on the coupling head of:

$$D'' = 2{,}5 D_x$$

The force D'' shall be maintained for 5 s, with the transmission coupled.

This test shall be carried out in the mid-travel position of the control using the reduction ratio i_{H_0} or i_h^* as suitable.

After this test the control device and its coupled transmission shall still have a free movement in both directions within the total travel S.

No permanent distortions or breaks are permitted.

After testing, disassemble and inspect the control device, especially the drawbar and its bearings, the reduction lever and its pivot pin.

No visible damage that will affect strength or free movement is permitted.

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Descriptors: road vehicles, caravans, trailers, brakes, braking, tests, braking tests, laboratory tests, test equipment, test benches.

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