INTERNATIONAL STANDARD

ISO 6292

First edition
1996-12-15

Powered industrial trucks and tractors — Brake performance and component strength

Chariots de manutention et tracteurs industriels automoteurs — Capacité de freinage et résistance des éléments de frein

Reference number
ISO 6292:1996(E)

Foreword

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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 6292 was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 2, *Safety of powered industrial trucks*.

This first edition of ISO 6292 cancels and replaces ISO 6292-1:1981 and ISO 6500:1980, which have been technically revised and combined.

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Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Powered industrial trucks and tractors — Brake performance and component strength

1 Scope

This International Standard specifies performance, test methods, controls, control forces and component strengths for brakes fitted to powered industrial trucks with rated capacities up to and including 50 000 kg (110 000 lb) and industrial tractors with rated capacities up to and including 20 000 N (4 500 lbf).

It is applicable to the following types of industrial trucks:

a) high-lift, low-lift and non-lifting powered industrial trucks with electric or internal combustion engine power and controlled by a seated or standing rider or a pedestrian;

b) stacking lift trucks with elevating operating platform;

c) lateral-stacking trucks.

NOTE — Remote-controlled trucks will be included at a later date.

2 Definition

For the purposes of this International Standard, the following definition applies.

2.1 braking capacity, C_b: Ratio, expressed as a percentage, of either

a) the fully developed braking deceleration, a, in metres per second squared, of the industrial truck under test to the acceleration of free fall, g, in metres per second squared, i.e.

$$C_b = \frac{a}{g} \times 100$$

or

b) the braking force, F_b, in newtons, developed by the industrial truck under test to the gravitational force on the mass of the industrial truck under test, where m, in kilograms, equals the gross mass of the industrial truck including the rated capacity load, where applicable, i.e.

$$C_b = \frac{F_b}{m \times g} \times 100$$

3 Service brakes

3.1 General

NOTE — Friction-type brakes, electrical brake systems and hydrostatic transmission are among those considered to be suitable for service brakes.

When separate controls are provided for right- and left-hand brakes, it shall be possible to obtain combined and/or equalized operation.

3.2 Performance

Service brakes shall be capable of developing a minimum braking capacity, C_b, with respect to the maximum nominal velocity, v_1, in kilometres per hour (or v in miles per hour), of the truck in accordance with table 1 and as illustrated in figure 1, when tested according to the conditions and procedures specified in 3.3 and 3.4.

If the maximum velocity (v or v_1) is reduced automatically depending on the lift height, this reduced velocity shall be used to determine C_b for that lift height. This additional test requirement does not supplant the basic requirement for testing in the load-transporting position. (See table 1.)

3.3 Test conditions

When conducting the test, the following conditions shall apply.

a) The test road surface shall be dry, clean, smooth and level (± 0,5 % maximum gradient), and made of concrete, asphalt or equivalent to permit the development of the drawbar drag.

b) The truck shall be laden to its rated capacity with the load in the lowered (travelling) position and the mast or forks shall be tilted fully rearward and fully retracted, if this is provided for by the design of the truck. Tractors shall be without load or trailers.

c) If the truck or tractor is fitted with a power boost system (brake servo-assistance), the system shall be operating.

d) Travel controls shall be in neutral (except in the case of hydrostatic transmission braking) and the parking brakes shall be fully disengaged.

e) Burnishing of brakes is optional prior to test.

NOTES

1 Brake testing with a laden fork-lift truck may cause the steer wheel(s) to leave the ground.

2 It is recommended that the load be secured to the truck to avoid shedding under the force of braking.

3.4 Test procedure

3.4.1 The laden truck shall be tested in both forward and reverse directions with the service brake applied using the appropriate control force not exceeding that specified in clause 5 and in table 2.

3.4.2 One test procedure is to measure the drawbar drag whilst towing the truck at a velocity not greater than 1,6 km/h (1,0 mile/h). The drawbar shall be essentially horizontal and attached to a point on the truck not higher than 900 mm (36 in) above the road surface.

3.4.3 Other procedures which give equivalent accuracy may be used, such as accelerometer, chassis dynamometer, or stopping distance.

4 Parking brakes

4.1 Performance

The parking brake, without the assistance of the operator, shall be capable of holding the truck on a gradient as specified by the manufacturer, or on the following gradient, whichever is the greater, in both forward and reverse directions.

a) Stacking lift trucks with operating position elevating in association with the load-lifting device, lateral-stacking lift trucks, lift truck with both lateral and front stacking, and order-picking trucks: 5 %.

b) Platform and stillage trucks, pallet trucks, platform-lift trucks, pallet-stacking trucks, straddle trucks, reach trucks, bi-directional lift trucks, multi-directional lift trucks, pedestrian-controlled trucks and pedestrian-controlled tractors: 10 %.

c) Any other sit-on and stand-on industrial truck or tractor: 15 %.

4.2 Test conditions

When conducting the test, the following conditions shall apply.

a) The test road surface shall be dry, clean, smooth and level (± 0,5 % maximum gradient), made of concrete, asphalt or equivalent to permit the development of the drawbar drag.

b) The industrial truck shall be laden to its rated capacity with the load in the lowered (travelling) position and the mast or forks shall be tilted fully rearward and fully retracted, if this is provided by the design of the truck. Tractors shall be without load or trailers.

c) Travel controls shall be in neutral and the service brakes fully disengaged.

d) Burnishing of brakes is optional prior to test.

4.3 Test procedure

The laden truck shall be tested in both forward and reverse directions with the parking brake applied using the appropriate control force not exceeding that specified in clause 5 and in table 2.

5 Brake control forces (see tables 1 and 2)

5.1 For brakes applied by depressing a pedal, the required service brake performance specified in table 1 and parking brake performance specified in 4.1 shall be attained with a pedal force not greater than 600 N (135 lbf).

5.2 For brakes applied by an upward movement of a brake pedal (releasing the brake pedal), the required service brake performance specified in table 1 and parking brake performance specified in 4.1 shall be attained with the pedal fully released. The force required to release the brakes and to hold the pedal fully depressed whilst travelling shall not be greater than 300 N (67 lbf).

5.3 For service brakes applied by means of a hand-lever, the required brake performance specified in table 1 shall be attained when a force not greater than 150 N (34 lbf) is applied to the hand-lever at the gripping point.

5.4 For parking brakes applied by means of a hand-lever, the required brake performance specified in 4.1 shall be attained when a force not greater than 500 N (112 lbf) is applied to the hand-lever at the gripping point.

5.5 For service brakes applied by squeezing a hand-grip, the required brake performance specified in table 1 shall be attained when a force not greater than 150 N (34 lbf) is applied at the mid-point of the brake grip.

5.6 For brakes applied by means of a steering tongue/tiller which is biased to the upright position (as on pedestrian-controlled trucks), the required service brake performance specified in table 1 and parking brake performance specified in 4.1 shall be attained at the maximum depressed stroke position of the steering tongue/tiller when a force not greater than 150 N (34 lbf) is applied at the mid-point of the hand-grip, or upon release of the tongue/tiller or the travel control switch.

6 Brake component strengths (see table 2)

6.1 For trucks having a downward movement of a brake pedal (depressing the brake pedal) to apply the service or parking brake(s), the system shall be capable of withstanding a brake pedal force of at least 1 200 N (270 lbf) without failure or permanent deformation of any component.

6.2 For trucks having an upward movement of a brake pedal (releasing the brake pedal) to apply the service or parking brake(s), the system shall be capable of withstanding a force of 200 % of the maximum possible setting of the spring which which applies the brake(s), without failure or permanent deformation of any component.

In addition, the brake pedal, when fully depressed, and its associated mechanical stop shall be capable of withstanding a force of 1 800 N (405 lbf) applied at the centre of the brake pedal actuating surface without failure or permanent deformation of any component.

6.3 For trucks having a hand-lever to apply the service brake(s), the system shall be capable of withstanding a force of at least 300 N (67 lbf) applied at the gripping point on the lever, without failure or permanent deformation of any component.

6.4 For trucks having a hand-lever to apply the parking brake(s), the system shall be capable of withstanding a force of at least 1 000 N (226 lbf) applied at the gripping point on the lever, without failure or permanent deformation of any component.

6.5 For trucks having a hand-grip which is squeezed to apply the service brake(s), the system shall be capable of withstanding a force of at least 300 N (67 lbf) applied to the hand-grip, without failure or permanent deformation of any component.

6.6 For trucks having a steering tongue which is depressed or released to apply the service or parking brake(s), the system and associated mechanical stops shall be capable of withstanding a force of at least 900 N (202 lbf) when applied at the mid-point of the hand-grip, without failure or permanent deformation of any component.

7 Brake operating systems

7.1 Service and parking brake operating means

Except for stand-on trucks and those with an operating position elevating in association with the load-handling device, both types having a braking system operated by a pedal with upward movement to apply the brakes or other automatically applied means or pedestrian-controlled trucks (sometimes with rider option), the service and parking brakes shall be operated by means of independent systems and the operation of the service braking system shall not cause the parking brake system to operate simultaneously. Both braking systems may utilize the same brakes; i.e. brake shoes, brake drum and related actuating items.

7.2 Air-operated braking systems

7.2.1 System recovery

If an air-operated service braking system employing stored energy is used, then, with the truck stationary, the service braking system shall have the capability of delivering 70 % of maximum system pressure measured at the brakes when the brakes are fully applied 20 times at the rate of six applications per minute with the engine running at the optimum speed for braking energy recovery.

7.2.2 Warning device

An air-operated service braking system employing stored energy shall be equipped with a warning device which actuates before the stored energy drops below 50 % of the manufacturer's specified maximum operating energy level. The device shall be readily visible and/or audible to the operator, and shall provide a continuous warning. Gauges indicating pressure or vacuum do not meet these requirements.

Table 1 — Service brake performance

Group	Types of truck	Truck rated capacity	Minimum braking capacity, C_b %		
a) For truck velocity			$v_1 \leq 5$ km/h $v \leq 3{,}12$ mile/h	5 km/h < $v_1 \leq 13{,}4$ km/h 3,12 mile/h < $v \leq 8{,}33$ mile/h	$v_1 > 13{,}4$ km/h $v > 8{,}33$ mile/h
A1	All industrial trucks except B, C and D	< 16 000 kg (35 000 lb)	9,3	$1{,}86v_1$ $3v$	25
A2		16 000 kg (35 000 lb) to 50 000 kg (110 000 lb) inclusive	7,5	$1{,}49v_1$ $2{,}4v$	20
B1	Industrial tractors	with 1 or 2 braked wheels	13	$2{,}6v_1$ $4{,}2v$	35
B2		with 4 braked wheels	18,6	$3{,}72v_1$ $6v$	50
b) For truck velocity			$v_1 \leq 4$ km/h $v \leq 2{,}5$ mile/h	4 km/h < $v_1 \leq 9$ km/h 2,5 mile/h < $v \leq 5{,}62$ mile/h	$v_1 > 9$ km/h $v > 5{,}62$ mile/h
C	Stacking lift trucks with operating position elevating in association with the load-lifting device, lateral-stacking lift trucks, lateral- and front-stacking lift trucks, order-picking trucks.		4	$1v_1$ $1{,}6v$	9
c) For truck velocity			All velocities		
D	Rough-terrain truck		25		

Table 2 — Brake control forces and component strengths

Brake type	Service brake		Parking brake	
	Maximum control force	Minimum component strength	Maximum control force	Minimum component strength
Depressed pedal	600 N (135 lbf)	1 200 N (270 lbf)	600 N (135 lbf)	1 200 N (270 lbf)
Released pedal	300 N (67 lbf)	2 x maximum control force and 1 800 N (405 lbf)[1)]	300 N (67 lbf)	2 x maximum control force and 1 800 N (405 lbf)[1)]
Hand-lever	150 N (34 lbf)	300 N (67 lbf)	500 N (112 lbf)	1 000 N (225 lbf)
Squeeze grip	150 N (34 lbf)	300 N (67 lbf)	—	—
Steering tongue	150 N (34 lbf)	900 N (202 lbf)	150 N (34 lbf)	900 N (202 lbf)
1) See 6.2				

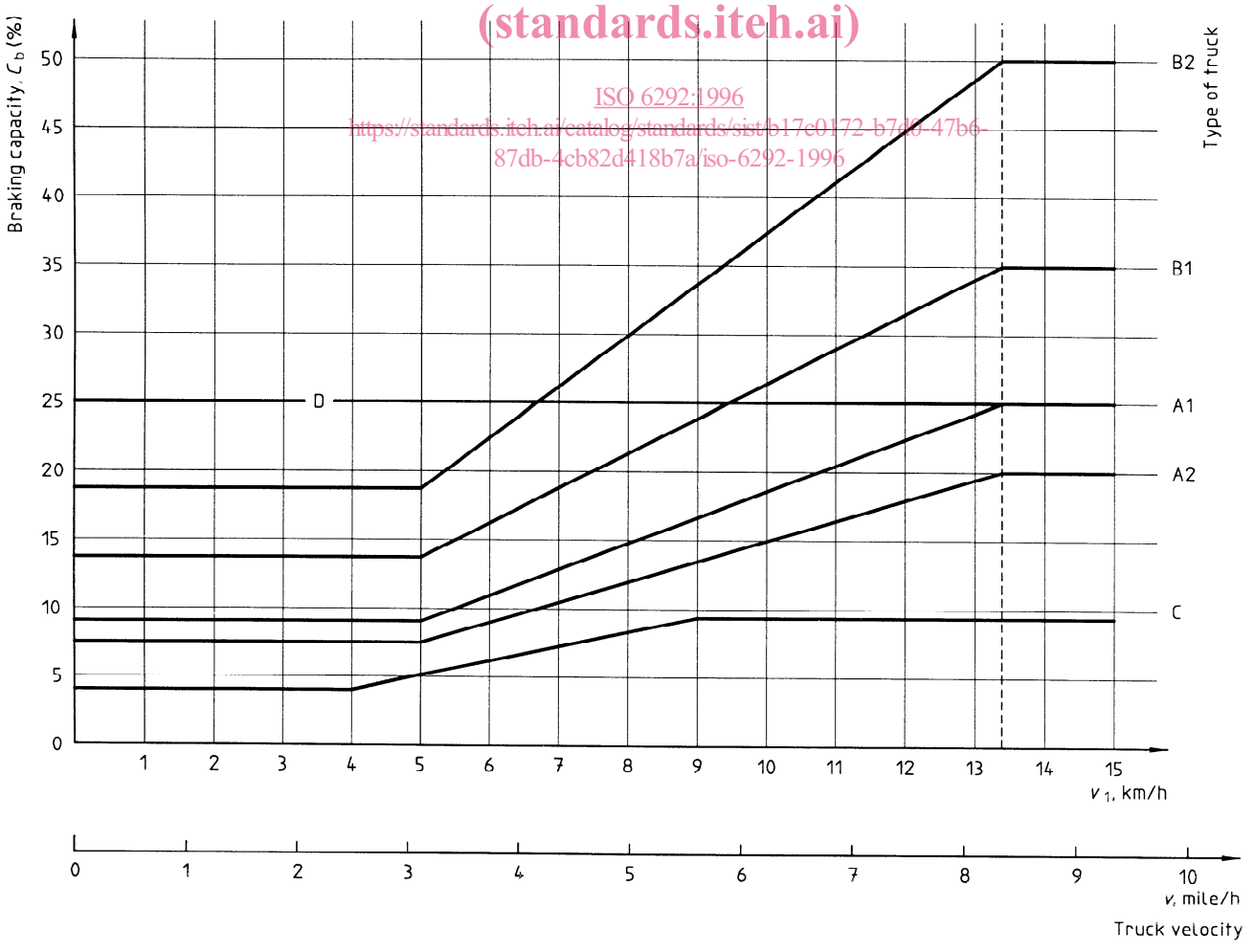

Figure 1 — Graph of braking capacity against truck velocity

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