BS ISO 22915-9:2014

BSI Standards Publication

Industrial trucks — Verification of stability

Part 9: Counterbalanced trucks with mast handling freight containers of 6 m (20 ft) length and longer

National foreword

This British Standard is the UK implementation of ISO 22915-9:2014. It supersedes BS ISO 10525:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MHE/7, Industrial trucks.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 81150 0

ICS 53.060

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2014.

Amendments issued since publication

Date	Text affected

BS ISO 22915-9:2014

INTERNATIONAL STANDARD

ISO 22915-9

First edition
2014-10-01

Industrial trucks — Verification of stability —

Part 9: Counterbalanced trucks with mast handling freight containers of 6 m (20 ft) length and longer

Chariots de manutention — Vérification de la stabilité —

Partie 9: Chariots travaillant en porte-à-faux avec mât manutentionnant des conteneurs de 6 m (20 ft) de long et plus

Reference number
ISO 22915-9:2014(E)

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Published in Switzerland

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 110, *Industrial trucks*, Subcommittee SC 2, *Safety*.

This edition cancels and replaces ISO 10525, which has been technically revised.

ISO 22915 consists of the following parts, under the general title *Industrial trucks — Verification of stability*:

— *Part 1: General*

— *Part 2: Counterbalanced trucks with mast*

— *Part 3: Reach and straddle trucks*

— *Part 4: Pallet stackers, double stackers and order-picking trucks with operator position elevating up to and including 1 200 mm lift height*

— *Part 5: Single-side-loading trucks*

— *Part 7: Bidirectional and multidirectional trucks*

— *Part 8: Additional stability test for trucks operating in the special condition of stacking with mast tilted forward and load elevated*

— *Part 9: Counterbalanced trucks with mast handling freight containers of 6 m (20 ft) length and longer*

— *Part 10: Additional stability test for trucks operating in the special condition of stacking with load laterally displaced by powered devices*

— *Part 11: Industrial variable-reach trucks*

— *Part 12: Industrial variable-reach trucks handling freight containers of 6 m (20 ft) length and longer*

— *Part 13: Rough-terrain trucks with mast*

— *Part 14: Rough-terrain variable-reach trucks*

— *Part 15: Counterbalanced trucks with articulated steering*

— *Part 16: Pedestrian-propelled trucks*

— *Part 20: Additional stability test for trucks operating in the special condition of offset load, offset by utilization*

— *Part 21: Order-picking trucks with operator position elevating above 1 200 mm*

— *Part 22: Lateral- and front- stacking trucks with and without elevating operator position*

— *Part 24: Slewing variable-reach trucks*

Industrial and RTT lorry-mounted trucks are to form the subject of a future part 23.

INTERNATIONAL STANDARD **ISO 22915-9:2014(E)**

Industrial trucks — Verification of stability —

Part 9: Counterbalanced trucks with mast handling freight containers of 6 m (20 ft) length and longer

1 Scope

This part of ISO 22915 specifies the tests for verifying the stability of counterbalanced trucks with masts when handling empty or laden freight containers of 6 m (20 ft) length and longer.

It is applicable to these types of industrial trucks that are equipped with forks, a spreader, (top lift and side lift), or other load handling means applicable for container handling.

This International Standard does not apply to trucks when handling a container which has a mobile centre of gravity (see ISO 3874).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 668, *Series 1 freight containers — Classification, dimensions and ratings*

ISO 1496-2:2008, *Series 1 freight containers — Specification and testing Part 2: Thermal containers*

ISO 3691-1:2010, *Industrial trucks — Safety requirements and verification — Part 1: Self-propelled industrial trucks, other than driverless variable reach trucks, and burden carrier trucks*

ISO 3874:1997, *Series 1 freight containers — Handling and securing*

ISO 5353:1995, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

ISO 22915-1, *Industrial trucks — Verification of stability — Part 1: General*

ISO 22915-20, *Industrial trucks — Verification of stability — Part 20: Additional stability test for trucks operating in the special condition of offset load, offset by utilization*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 22915-1 apply.

4 Operating conditions

4.1 General

In addition to ISO 22915-1, the following conditions apply.

Operating the truck (travelling with the freight container at normal travelling height and stacking) in conditions where the wind speed is up to the rated wind speed of 12,2 m/s.

4.2 Partially elevated container

Container elevated for travel so that the bottom of the container is no higher than 900 mm above the seat index point (SIP) as defined in ISO 5353.

NOTE The elevated container permits an operator in a low position on the truck to see underneath the container.

5 Test condition

5.1 General

See ISO 22915-1.

The tests take into account the normal degree of eccentric loading of containers defined in ISO 3874.

When handling empty containers with integral refrigeration unit (reefer), as specified in ISO 1496-2, account needs to be taken of the offset loading according to ISO 22915-20.

5.2 Prevailing wind

The tests shall not be carried out in a prevailing wind that would significantly affect the test results.

5.3 Wind force

5.3.1 Longitudinal tests

For the longitudinal tests, the wind force acting on the freight container is calculated by Formula (1):

$$F = \frac{\rho}{2} \cdot h \cdot L \cdot {v_w}^2 \cdot C_{f1} \tag{1}$$

where

F wind force (N);

ρ air density 1,225 kg/m^3 (at 15 °C);

h freight container height 2,90 m (9 ft 6 in);

L freight container length (m) (longest container length the truck is designed for);

v_w rated wind speed 12,2 m/s;

C_{f1} shape coefficient 1,3.

For trucks intended for use in higher wind speeds than the rated wind speed of 12,2 m/s, v_w shall be changed to the actual wind speed.

NOTE Reference sources, e.g. crane and building standards, confirm that a value of 1,3 for C_{f1} is appropriate for wind acting normal to the longitudinal axis of freight containers.

5.3.2 Lateral tests

The effect of wind in lateral stability tests has been shown to be significant only when handling containers. For the lateral tests, the wind force acting on the container shall be calculated by Formula (2) (see also Figure 1):

$$F = \frac{\rho}{2} \cdot v_w{}^2 \cdot C_{f2} \cdot h \cdot (L \sin a + w \cos a) \tag{2}$$

where

F wind force [N];

ρ air density 1,225 kg/m^3 (at 15 °C);

v_w rated wind speed 12,2 m/s;

C_{f2} shape coefficient 0,8;

h freight container height 2,90 m (9 ft 6 in);

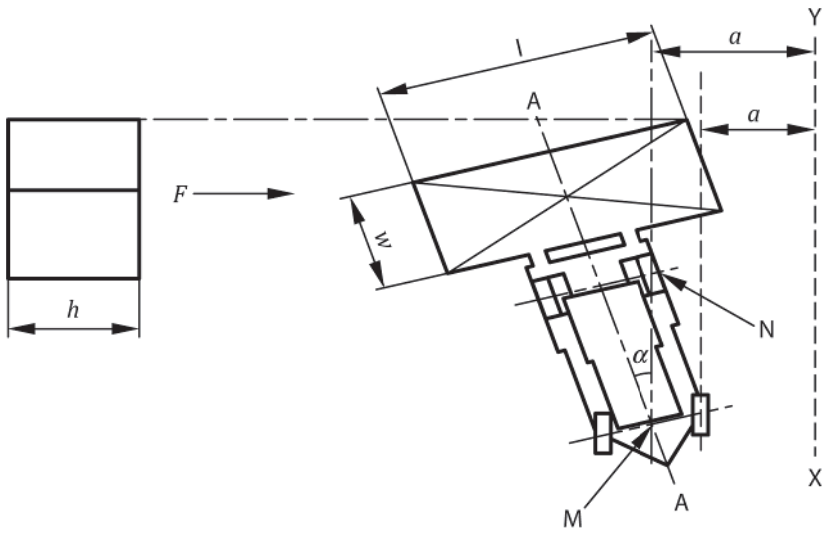
L freight container length (m) (longest container length the truck is designed for);

α angle of lateral tipping axis relative to the longitudinal axis of the truck (degrees);

w container width 2,44 m.

For trucks intended for use in higher wind speeds than the rated wind speed of 12,2 m/s, v_w shall be changed to the actual wind speed.

NOTE Reference sources, e.g. crane and building standards, confirm that a value of 0,8 for C_{f2} is appropriate for a wind acting normal to the lateral tipping axis of a freight container handling counterbalanced truck.



Key

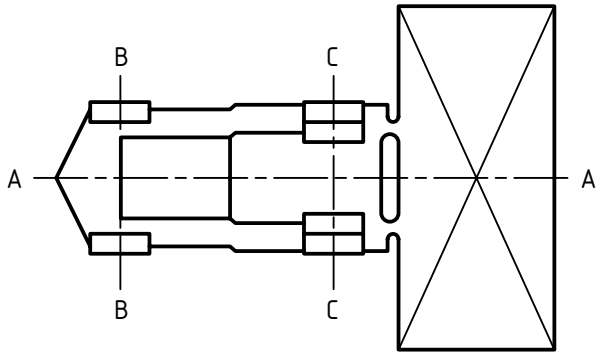
F wind force

a parallel

Figure 1 — Wind force for lateral tests

5.4 Position of the truck on the tilt table

The truck shall be positioned on the tilt table according to Table 1. The indication of load and steer axle is the centreline of the load and steer axle. The allocation of the indication is defined in Figure 2.



Key

A-A longitudinal centre plane of the truck

B-B steer axle

C-C load axle

Figure 2 — Longitudinal centre plane and axles

For tests 1 and 2 (see Table 1), the truck shall be positioned on the tilt table, so that the load axle C-C is parallel to the tilt axis X-Y of the tilt table.

For tests 3, 4, and 5 (see Table 1), the truck shall be positioned on the tilt table in a turning position with line M-N parallel to the tilt axis X-Y of the tilt table. The steer wheel nearest to the tilt axis of the tilt table shall be parallel to the tilt axis.

Point M is defined as the intersection of the longitudinal centre plane, A-A, of the truck with the projection of the pivot point of the articulated steer axle onto the tilt table.

Point N indicates the centre point of the area of contact between the tilt table surface and the load wheel nearest the tilting axis.

5.5 Test load

5.5.1 General

The test load shall consist of a load corresponding to the weight of the container and a load or force simulating the effect of the wind on the container.

5.5.2 Basic load

The test load shall be equivalent to a container 2,90 m (9 ft 6 in) high (see ISO 668), in either the laden or unladen condition, with a mass equivalent to the rated load as specified by the manufacturer, acting through its centre of gravity.

When using fork arms to handle containers, the test load shall act through the centre of gravity positioned 1 220 mm horizontally from the front face of the fork arm shank and at a height that corresponds to the midpoint of the height of a 2,90 m (9 ft 6 in) container.

When using top lift, side lift, or other load handling means, the position of the centre of gravity shall be determined by the connection points to the test load, e.g. twist locks into the corner fittings.

Where the load handling means can be adjusted laterally to the truck longitudinal centre line, ISO 22915-10 can apply.

Where the load handling means has positional adjustment capability in the direction of the truck longitudinal centre line, other than mast tilt, the tests shall be carried out at both extremes of adjustment.

5.5.3 Wind force

The effect of this force can be simulated in the tests by one or the other of the following methods:

a) applying this force normal to the lateral tipping axis of the truck horizontally through the load centre of gravity;

b) applying a vertical load, in addition to the test load, giving an equivalent moment to the wind force acting when the slope is at the required tilt angle as specified in the table of tests.

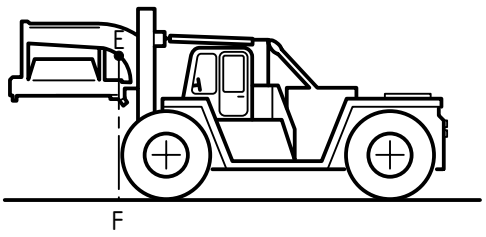
5.6 Lift height

5.6.1 Lift height for tests simulating stacking

Test 1 (see Table 1) shall be conducted with the horizontal position of the load datum point (e.g. point E) unchanged when elevated from its lowered position [see Figure 3 a), b) and c)].

With the prescribed test load, set the mast vertical and perpendicular to the tilt table and then elevate to approximately 300 mm. Using the shank of the front face of the fork arm or load-engaging means, establish a point E [see Figure 3 a)], on the fork arms or load-engaging means having a fixed relationship to the centre of gravity of the test load. This point E shall be used to provide a reference datum F on the tilt table. When the mast is elevated, a new point F1 on the tilt table may occur [see Figure 3 b)]. By the following adjustments, this new point F1 can be returned to the original location of F [see Figure 3 c)].

Changes in the location of F1 shall be corrected by varying the tilt of the mast within the limits provided by the design of the truck.



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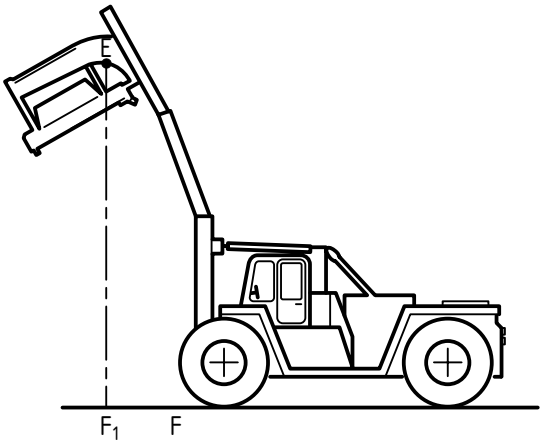

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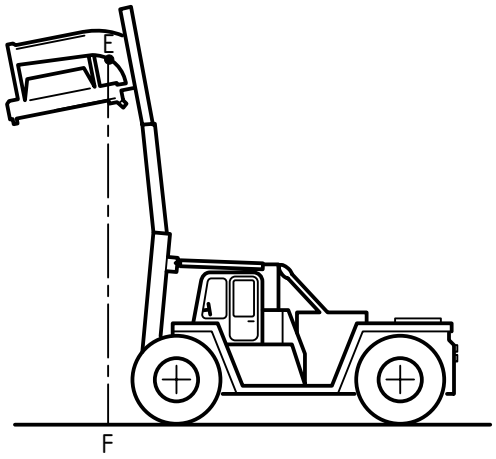


c)

Figure 3 — Datum point position

5.6.2 Lift height for tests simulating travelling with the container

For tests simulating travelling with a container, the centre of gravity of the test load shall be positioned 2 350 mm above the seat index point (SIP) as defined in ISO 5353.

NOTE This lift height does not apply where it is not necessary to elevate the container to obtain adequate visibility in the direction of travel, e.g. high-level operator position or driving in reverse (container trailing). In these circumstances, the load can be positioned in the actual position defined by the manufacturer.

5.6.3 Lift height for tests simulating travelling without the container

For tests simulating travelling without a container, the upper face of the fork arms, measured at the heel of the fork arm, shall be positioned 300 mm above the tilt table for trucks with a rated capacity less than or equal to 10 t and 500 mm for trucks with a rated capacity of greater than 10 t.

Load handling means other than forks shall be positioned in a way that the bottom surface of the load handling means is positioned 900 mm above the seat index point (SIP) as defined in ISO 5353.

NOTE This lift height does not apply where it is not necessary to elevate the load handling means to obtain adequate visibility in the direction of travel, e.g. high-level operator position. In these circumstances, the load handling means can be positioned in the actual position defined by the manufacturer.

6 Verification of stability

Stability shall be verified according to Table 1.

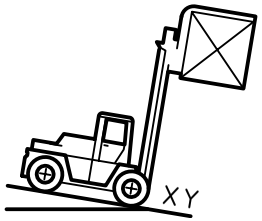
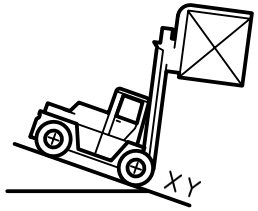
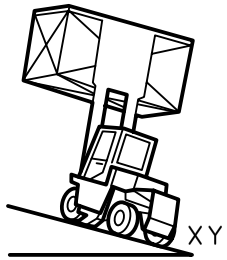
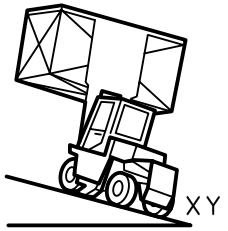
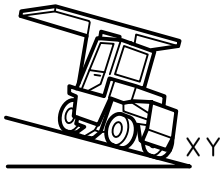
When performing tests 4 and 5, no wheels shall lose contact with either the tilt table or any part of the structure or other feature make contact with the tilt table.

7 Marking

The actual capacity for container handling as determined by these stability tests shall be indicated on a capacity plate as specified in ISO 3691-1, 6.3.

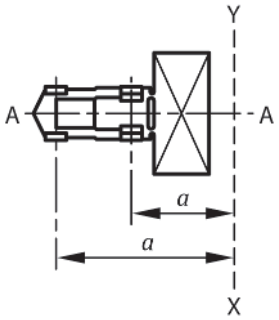
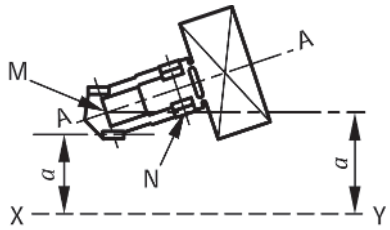
The wind speed, according to the calculation in 5.3, exceeding the rated wind speed of 12,2 m/s shall be indicated.

Table 1 — Verification of stability

Test criteria		Test 1	Test 2	Test 3	Test 4	Test 5
Direction of test	Longitudinal	X	X			
	Lateral			X	X	X
Mode of operation	Travelling		X		X	X
	Stacking/retrieving	X		X		
Test load (container)	With	X	X	X	X	
	Without					X
Wind force	With	X	X	X	X	
	Without					X
Lift height	Maximum	X		X		
	Travel		X		X	X
Position of mast	Vertical	X				
	Full rearward		X	X	X	X
Tilt-table slope for rated capacity		3,5 %	20 %	6 %	(5 + 1,1 *v*) % (20 % max.)	(15 + 1,4 *v*) % (40 % max.)
Truck position on tilt-table						

v maximum speed in km/h

Table 1 — *(continued)*

Test criteria	Test 1	Test 2	Test 3	Test 4	Test 5
Truck position on tilt-table	 **As per 5.4**		 **As per 5.4**		
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