INTERNATIONAL STANDARD

ISO 10525

First edition
1997-11-01

Counterbalanced trucks handling freight containers of 6 m (20 ft) length and above — Additional stability tests

Chariots élévateurs travaillant en porte-à-faux manutentionnant des conteneurs pour le transport de marchandises de longueur égale ou supérieure à 6 m (20 ft) — Essais de stabilité supplémentaires

Reference number
ISO 10525:1997(E)

Contents

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X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

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 10525 was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 2, *Safety of powered industrial trucks*.

Counterbalanced trucks handling freight containers of 6 m (20 ft) length and above — Additional stability tests

1 Scope

This International Standard specifies additional tests to verify the stability of counterbalanced lift trucks when handling freight containers of 6 m (20 ft) length and above.

This International Standard specifies tests in addition to those specified in ISO 1074.

The stability tests contained in this International Standard ensure that counterbalanced trucks handling freight containers have satisfactory stability when reasonably and appropriately used under the following conditions.

a) The truck (travelling with the freight container at normal travelling height and stacking) is operating under conditions where the wind speed is up to 12,2 m/s (Beaufort Scale Force 6).

b) Alternative ratings for use in higher wind speeds shall be developed by use of higher values for wind speed, v, in equations (1) and (2) in 3.5.3.

c) The truck is travelling forward with the freight container leading, elevated so that the base is not higher than 1 m above the point of maximum depression of the seat cushion under the operator and the mast is fully tilted back.

NOTE — The elevated load permits an operator to see underneath the freight container.

Stability tests to cover conditions stated in a) or b) are applicable to all trucks.

Stability tests to cover conditions stated in c) are only applicable to a truck which will operate with a partially elevated container.

This International Standard does not apply to trucks when

1) handling suspended loads which may swing freely,

2) handling a container which has a mobile centre of gravity (see ISO 3874).

2 Normative references

The following standards contain provisions, which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were 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 editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1074:1991, *Counterbalanced fork-lift trucks — Stability tests*.

ISO 1496-2:1996, *Series 1 freight containers — Specification and testing — Part 2: Thermal containers*.

ISO 3691:1980, *Powered industrial trucks — Safety code*.

ISO 3691:1980/Amd.1:1983, *Amendment 1 to ISO 3691:1980*.

ISO 3874:—[1)], *Series 1 freight containers — Handling and securing*.

3 Test requirements

The stability of the trucks shall be verified by means of the test methods described below. Any of the methods is an acceptable verification procedure.

3.1 Verification procedure

3.1.1 Tilting platform

A test platform which can be tilted about one side shall be used.

Place the truck under test on the platform, which is initially in the horizontal plane, sequentially in the positions described in table 3. For each of the truck positions, the platform shall be tilted slowly and smoothly to the slope indicated in table 3.

3.1.2 Fixed slope

Fixed slopes with inclinations equivalent to the specified test slope shall be used. The slope surface shall be smooth and capable of supporting the truck weight without deformation likely to affect the test results.

Drive the truck under test onto the fixed slope with the mast lowered and position it according to table 3. For each of the laden truck positions, the load shall be elevated slowly and smoothly to the height indicated in table 3.

3.1.3 Calculation

Compliance with the specified values may be determined by calculation.

Such calculated capacities must allow for manufacturing tolerances, possible deflections of the mast, tyres, etc.

3.1.4 Completion of test

The truck is considered stable if it passes all required tests without overturning (see clause 4). For tests Nos. 1, 2 and 3, the overturning value of the test slope is that which, if increased, would produce complete overturning of the truck. For test No. 4, the overturning value is reached when a wheel loses contact with the test slope.

3.2 Test conditions

Prevailing winds shall not have any significant effect on the test results. For test No. 3, it is permissible for the load wheels on one side of the truck to lose contact with the slope and for parts of the structure or other designed features to make contact with the test slope.

3.2.1 Condition of the truck

The tests shall be carried out with the truck ready for use without an operator. Fuel tanks of engined trucks shall be full if stability is thereby reduced; all other tanks shall be filled to their correct operating levels. The load-carrying means shall be fully equipped with any protective or supplementary lifting apparatus as included in the rating. The mast or fork arms, if adjustable for tilt, shall be positioned in accordance with table 3. Where applicable, tyres shall be inflated to the pressure specified by the manufacturer, and where tyre ballast is permitted it shall be used in accordance with the manufacturer's instructions.

1) To be published. (Revision of ISO 3874:1988)

3.2.2 Verification of verticality of the lift of the load-engaging means

Before proceeding with test No.1, the verticality of the lift of load-engaging means shall be verified by means of a plumb-line or other suitable equipment.

Elevate the load-engaging means and the specified test load to approximately 300 mm (12 in) above the test platform. Establish a point E (see figure 1) on the load-engaging means. This point E shall be used to provide a reference datum, F, on the test platform (see figure 1). When the mast is elevated, a new point F_1 on the test platform occurs (see figure 2). By the adjustments described below this new point F_1 can be returned to the original location of F (see figure 3).

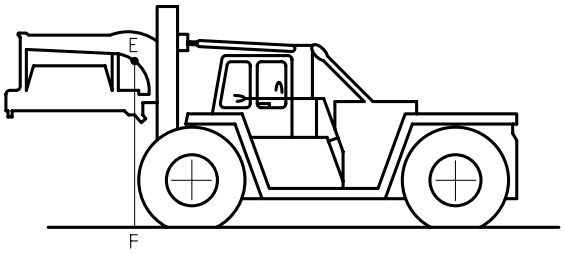

Figure 1

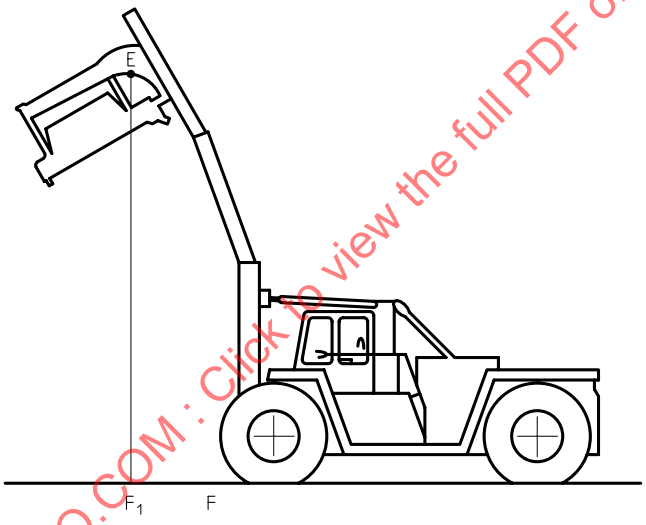

Figure 2

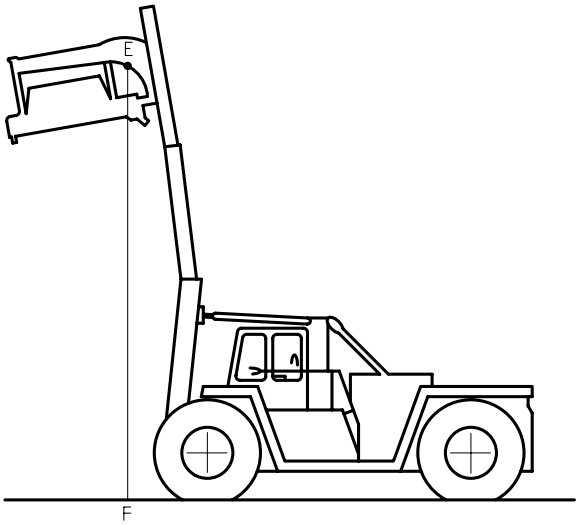

Figure 3

For trucks with tiltable masts, changes in the location of F_1 shall be corrected by varying the tilt of the mast within the limits of the truck design.

For trucks with fixed masts, adjustments in the load-engaging means or fork carrier tilt (where provided) may be used to correct for changes in location of point F_1 within the limits of the truck design.

This procedure does not apply to trucks where the design does not allow such corrections.

3.2.3 Lift height for tests simulating travelling with the freight container substantially elevated

For tests simulating travel, the centre of gravity of the test load shall be positioned 2 300 mm above the point of maximum depression of the operator's seat cushion. These tests shall 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 (freight container trailing)].

3.3 Effect of the operator's mass on stability

The operator on rider-controlled trucks shall be represented by a weight of mass 90 kg if the stability during a test is thereby decreased. The weight shall be secured with its centre of gravity 250 mm above the operator's seat when in the compressed condition.

3.4 Location of the truck on the test slope

The specified position of the truck on the test slope shall be maintained during each test. Wheel rotation shall be prevented by application of the parking brake or service brakes, which may be secured in the “on” position. Additionally, the wheels may be wedged against the truck frame but in such a way that any axle/frame articulation is not affected.

Blocks (chocks) having a maximum height of 80 mm may be used, if necessary, to maintain the initial position of the truck on the test platform. Blocks (chocks), if used, shall not artificially improve stability.

3.5 Test load

3.5.1 General

The test load shall consist of a basic load corresponding to the mass of the freight container, and a load or force simulating the effect of wind on the container.

3.5.2 Basic load

The basic test load shall be equivalent to a 2,590 m (8 ft 6 in) high container (which conforms to ISO 3874 and ISO 1496-2) in either the laden or unladen condition with its centre of gravity, G, acting at its centroid (see figures 4 and 5).

Dimensions in metres

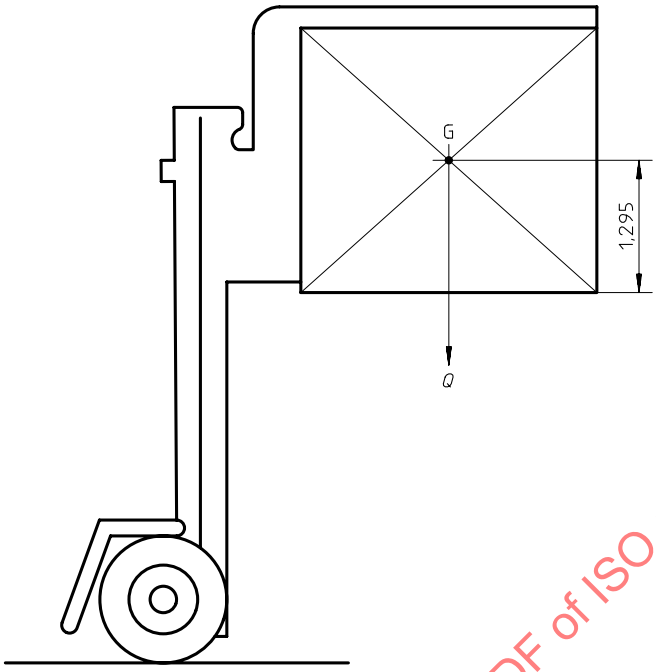

Figure 4

Dimensions in metres

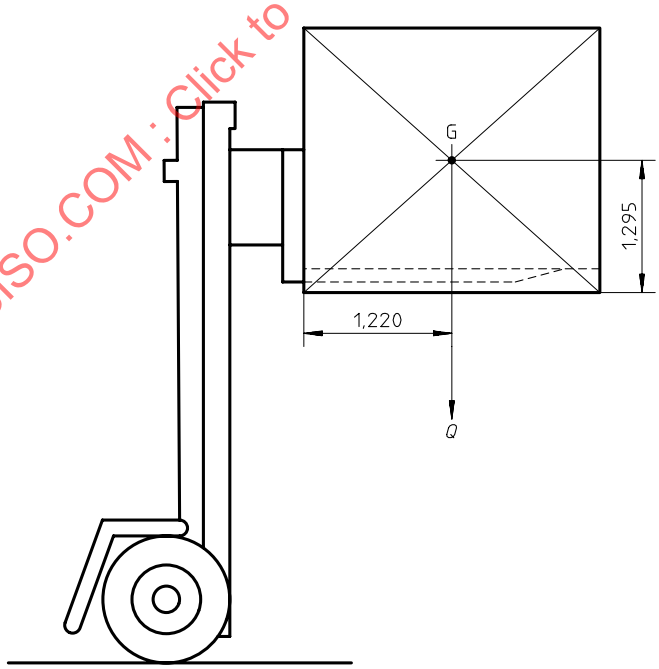

Figure 5

When using fork arms, the basic test load shall be positioned using the container fork pockets with one side of the load touching the front face of the fork shank (see figure 5).

When using other handling means such as a top lift or side lift spreader, the position of the centre of gravity, G, shall be determined by the connection points to the test load (e.g. twistlocks into the corner fittings) (see figure 4).

Where the handling means has positional adjustment capability lateral to the truck centreline, the lateral adjustment shall be at its midpoint.

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

The mass of the basic test load shall be equivalent to the rated load, Q, specified by the truck manufacturer. This takes into account the normal degree of eccentric loading of laden containers as defined in ISO 3874.

When handling empty refrigerated containers with integral refrigeration units (reefers), account shall also be taken of the specifications given in ISO 1496-2.

3.5.3 Wind force

3.5.3.1 Longitudinal tests

For the longitudinal tests, the critical wind force acting on the freight container is calculated by the following formula:

$$F = khlv^2C_{f1} \quad \text{. . . (1)}$$

where

F is the wind force, in newtons;

k = 0,613 [in $N \cdot s^2/m^4$];

h is the freight container height [= 2,59 m];

l is the freight container length, in metres;

v is the wind speed [= 12,2 m/s (Beaufort Scale 6)];

C_{f1} is the shape coefficient [= 1,3].

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

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

a) by applying this force in the direction of longitudinal forward overturn acting horizontally through the centre of gravity of the test load; or

b) by 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 table 3.

3.5.3.2 Lateral tests

The effect of wind in lateral stability tests has been shown to be significant only when stacking empty containers. For the lateral tests, the critical wind force, F, acting on the container is calculated by the following formula (see also figure 6):

$$F = kv^2C_{f2}h(l \sin\alpha + w \cos\alpha) \quad \text{. . . (2)}$$

where

w is the container width = 2,44 m;

C_{f2} is the shape coefficient = 0,8;

α is the angle of lateral tipping axis relative to the longitudinal axis of the truck, in degrees;

and the other symbols are as in equation (1).

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 in a direction normal to the lateral tipping axis of a freight-container-handling counterbalanced truck.

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

a) by applying this force in a direction normal to the lateral tipping axis of the truck horizontally through the centre of gravity of the test load; or

b) by 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 table 3.

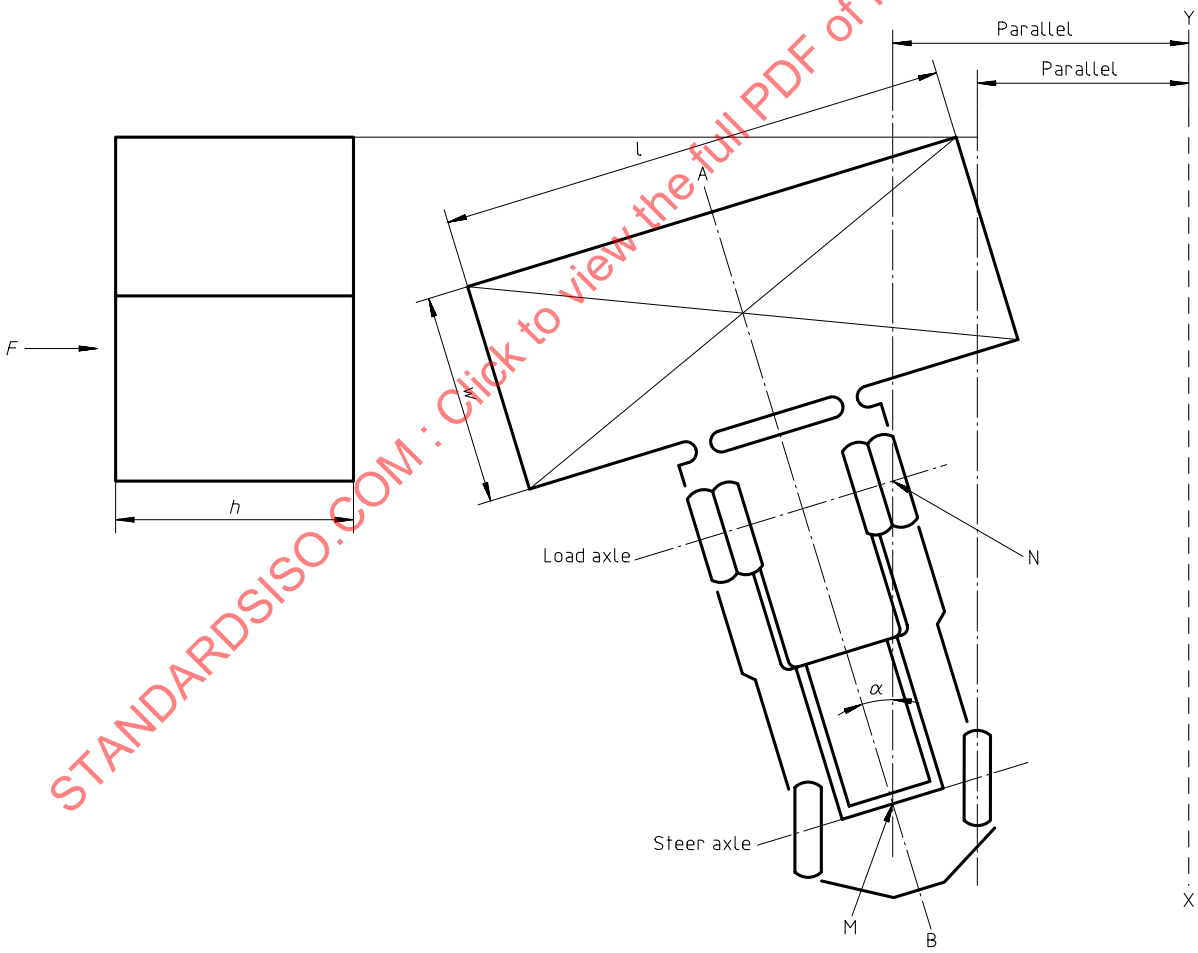

Figure 6

3.6 Safety precautions

Precautions shall be taken to prevent the overturning of the truck or displacement of the test load during the course of the tests.

Where lashings are used to prevent the truck overturning completely, they shall be sufficiently supple and arranged with sufficient slack so that no appreciable restriction is imposed on the truck until the overturning movement starts.

Displacement of the test load shall be prevented by such means as:

a) firmly securing the test load to the load carrier;

b) suspending the test load near the ground by a rope, chain, etc. in such a manner that the upper end of the suspension means acts at the point G where the centre of gravity of a fixed test load would otherwise be located.

4 Test procedure

The truck shall be positioned in accordance with table 3.

Lateral tests shall be conducted to that side of the truck which is least stable.

Point N is the centre point of the area of contact between the slope surface and the load wheel nearest to the tilting axis XY (figure 12). Outrigger wheels are not classed as load wheels for this purpose.

For trucks with articulating steering axle (figure12), point M is defined as the vertical projection onto the slope of the point of the intersection between the centre plane AB of the truck and the centreline of the axle.

5 Schedule of tests

5.1 For all trucks, additional stability tests as shown by a “plus” sign in table 1 shall be made, based on the standard wind speed as specified in clause 1 a) or a higher wind speed in accordance with clause 1 b).

Table 1

Laden container-handling trucks				Empty container-handling trucks			
Test 1	Test 2	Test 3	Test 4	Test 1	Test 2	Test 3	Test 4
+	–	–	–	+	–	+	–

5.2 For trucks which also operate under the conditions described in clause 1 c), additional stability tests as shown by a “plus” sign in table 2 shall be made.

Table 2

Laden container-handling trucks				Empty container-handling trucks			
Test 1	Test 2	Test 3	Test 4	Test 1	Test 2	Test 3	Test 4
–	+	–	+	–	+	–	+