
INTERNATIONAL STANDARD



3184

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Reach and straddle fork lift trucks – Stability tests

Chariots à mât ou fourche rétractable et chariots à fourche entre longerons – Essais de stabilité

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

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.

International Standard ISO 3184 was drawn up by Technical Committee ISO/TC 110, *Industrial trucks*, and circulated to the Member Bodies in October 1973.

It has been approved by the Member Bodies of the following countries :

Austria	Italy	Switzerland
Belgium	Japan	Thailand
Brazil	Mexico	Turkey
Bulgaria	Netherlands	United Kingdom
Czechoslovakia	New Zealand	U.S.A.
Egypt, Arab Rep. of	Romania	U.S.S.R.
France	South Africa, Rep. of	Yugoslavia
Germany	Spain	
Ireland	Sweden	

No Member Body expressed disapproval of the document.

Reach and straddle fork lift trucks – Stability tests

1 SCOPE

This International Standard specifies the tests for verification of stability of reach (retractable mast or forks) and straddle fork lift trucks (pedestrian and rider controlled).

2 FIELD OF APPLICATION

This International Standard applies to pedestrian and rider controlled reach (retractable mast or forks) and straddle fork lift trucks up to and including 5 000 kg (10 000 lb) capacity with tilting or non-tilting masts or fork arms.

It also applies to trucks operating under the same conditions, but having ancillary attachments other than fork arms.

3 CONDITIONS OF VALIDITY

3.1 Normal operating conditions

The tests specified in this International Standard ensure that the type of truck under consideration has satisfactory stability for operation under general operating conditions :

- a) operating on substantially level surfaces;
- b) travelling with the load in the lowered position;
- c) stacking with the mast substantially vertical.

3.2 Other conditions

When the operating conditions differ from the conditions defined in 3.1 (for example when forward tilt is required during stacking with full load and full elevation), it is necessary to use either :

- a) a truck with a higher rated capacity, or
- b) a truck having design modifications which are agreed upon between the interested parties.

3.3 Complementary tests

In the case where tests other than the eight tests would be necessary, the details should be agreed between the interested parties.

4 STABILITY TESTS FOR REACH AND STRADDLE FORK LIFT TRUCKS

4.1 Specification of tests

The stability of these trucks shall be verified by means of the tests described below, using a platform which can be tilted about one side.

The tests shall be carried out on an operational truck, but without the operator.

For rider controlled trucks the driver shall be represented by an object of corresponding mass if the stability during a test is thereby decreased. For this purpose a unit mass of 90 kg (200 lb) shall be provided, and it shall be secured and centered 250 mm (10 in) above the driver's seat on sit-on trucks, and 1 000 mm (40 in) above the footplate on stand-on trucks.

A truck being tested for stability shall be on the platform, which is initially horizontal, in the conditions specified in 4.2, and, successively, in each of the positions specified in clause 6.

In each of these tests the platform shall be tilted to the slope indicated in the table. The truck is considered stable if it passes all tests without overturning.

In the case of tests 3 to 8, it is permissible for one outrigger wheel to rise from the platform and for the outer edges of the truck to come into contact with the platform, provided that the truck does not overturn under the prescribed platform inclination.

4.2 Conditions for carrying out the tests

4.2.1 Position of truck on test platform

For tests 1 and 2 the truck shall be placed on the platform with the drive (steer) axle and the axle of the outrigger wheels parallel to the axis of tilt, XY, of the platform (see figures 6 and 7).

For tests 3, 4 and 5, the truck, with its brakes applied, shall be placed on the platform with line MN parallel to the tilt axis of the platform XY (see figures 10 to 15 inclusive).

In the case of figure 12, the steerable wheel nearest to the tilting axis shall be parallel with it. Positions of steerable wheels on other designs are shown in figures 10, 11, 13, 14 and 15.

Point N is the centre point of the area of contact between the platform surface and the outrigger wheel nearest to the tilting axis XY (figures 10 to 15 inclusive).

Point M is defined as follows :

- a) For trucks with articulating steering axle (figure 12) or pivoting single point support steering (figure 14) M is the vertical projection onto the platform of the point of intersection between the centre line AB of the truck and the centre line of the axle.
- b) Figures 10, 11, 13 and 15 indicate positions for trucks of other designs.

For tests 6 to 8 the truck shall be placed on the platform with the drive (steer) axle and the axle of the outrigger wheels parallel to the axis of tilt XY, of the platform (see figures 18 and 19).

4.2.2 Test load

The test load should be such that it simulates an unrestrained homogeneous cube the mass of which is equal to the maximum load Q and the dimensions of which are equal to twice the load centre distance D , the values of Q and D corresponding to the manufacturer's rated capacity of the truck (see figure 1).

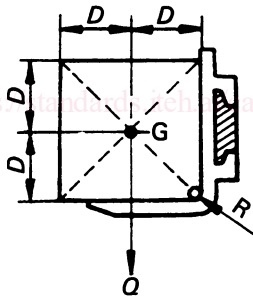


FIGURE 1

For trucks having a lift height greater than 3,3 m (130 in) the test load shall be equal to the load that the truck is able to carry in the stability conditions stated in the following tests.

The distance D for the respective tests is found in clause 6.

The centre of gravity G of the test load (see figure 1) shall be located in the vertical plane of symmetry AB of the truck (see figures 6, 7, 18 and 19).

4.2.3 Location of truck on the test platform

It is essential that the initial position of the truck on the platform be maintained during testing.

This may be achieved by application of hand or service brakes, which can be secured in the "on" position, or by wedging the wheels against the truck frame.

The use of chocks or blocks is allowed if their height does not exceed the values indicated in the following table.

Wheel diameter d mm	Maximum height of chocks or blocks
up to 250	25 mm
250 to 500	$0,1 d$
over 500	50 mm

4.2.4 Verification of the vertical position of the mast

Before proceeding with test 1, the vertical position of the mast shall be verified by means of a plumb-line.

The projection on the horizontal platform of the reference point R (inner corner of the fork arm, see figure 1) shall be the same for the lift height depending on the test load as for the lift height with lowered fork arms (see figures 2 and 3). Deviations caused by deflections shall be corrected by varying the tilt of the mast or by retracting the mast or fork arm within the limits imposed by the design of the truck.

NOTE – This clause does not apply to trucks where the design does not allow such corrections.

4.2.5 Lift height with lowered fork arms

Tests 2, 5 and 8 (travelling) shall be carried out with the fork arms lowered. According to the position of the test load, between the outriggers (see figure 2) or above the outriggers (see figure 3), the lift height of the fork arms shall be :

- a) 300 mm (12 in) from ground to upper face of fork arm, when the test load is located between the outriggers (figure 2).
- b) 150 mm (6 in) minimum from the upper face of the outriggers to the lower face of fork when the test load is located above the outriggers. The minimum distance from the ground to the upper face of the fork arms, however, shall be 300 mm (12 in) as in figure 3.

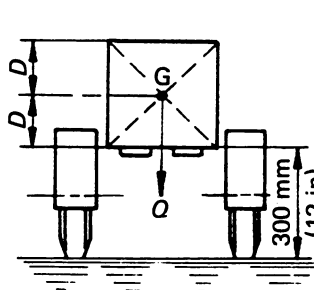


FIGURE 2

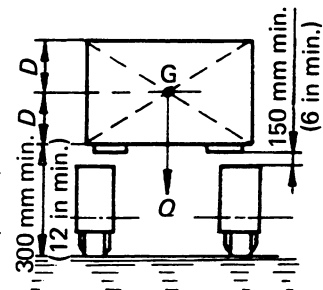


FIGURE 3

5 STABILITY TESTS FOR TRUCKS WITH OTHER ATTACHMENTS

Pedestrian or rider operated reach and straddle fork lift trucks furnished with attachments other than fork arms shall be subjected to the same stability tests, except in cases where the attachment can bring the centre of gravity of the load out of the plane of symmetry AB of the truck.

The test load, however, should be the specified load at the specified distance indicated for the attachment when used on the truck being tested.

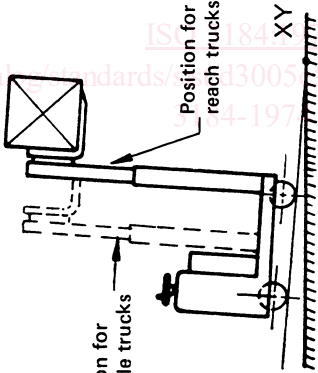
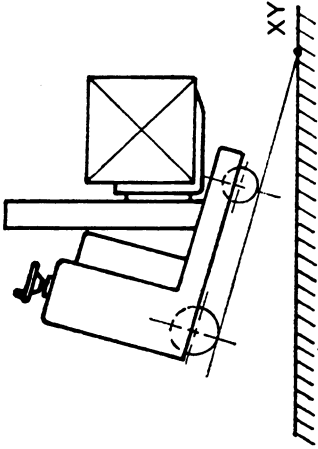
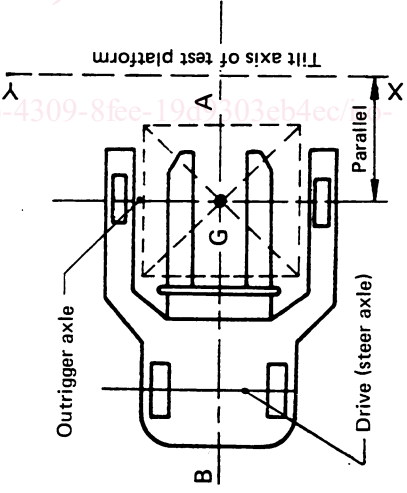
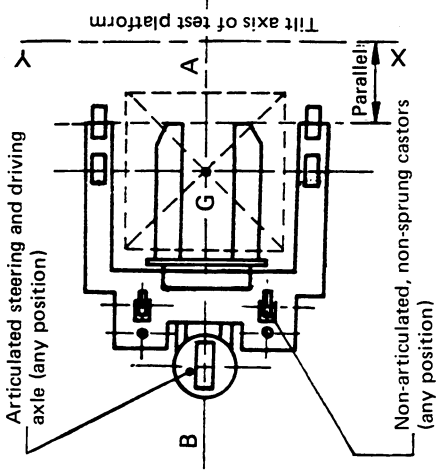
The lift height envisaged for tests 2, 5 and 8 should be measured between the tilting platform or the upper part of the outriggers and the underside of the load or attachment, whichever is the smaller.

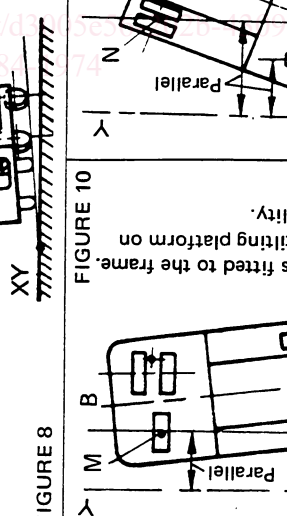
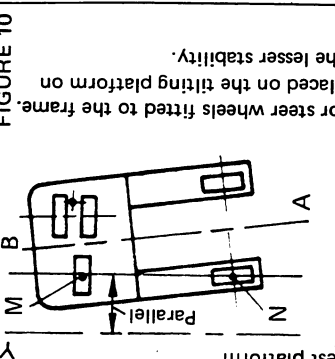
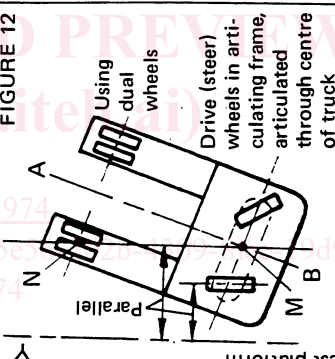
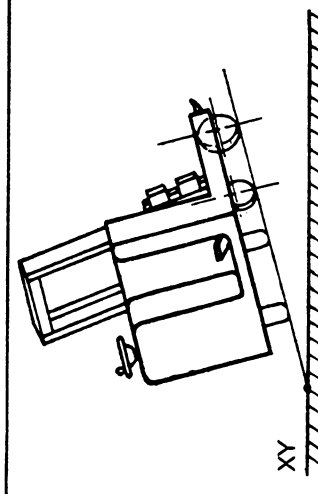
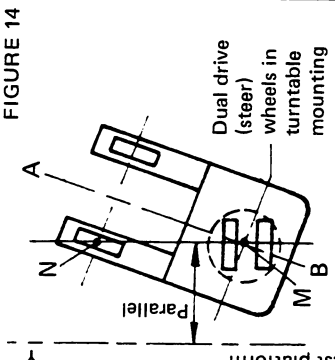
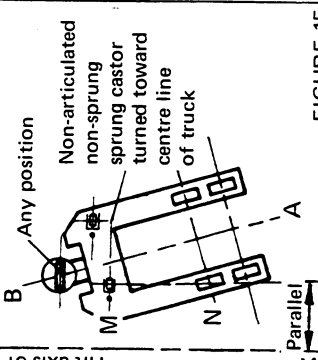
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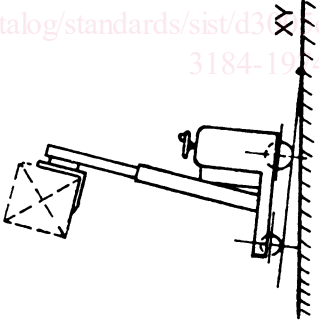
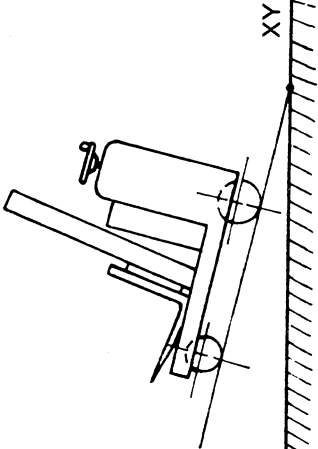
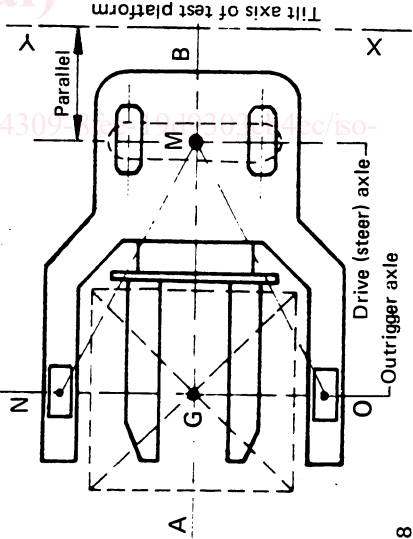
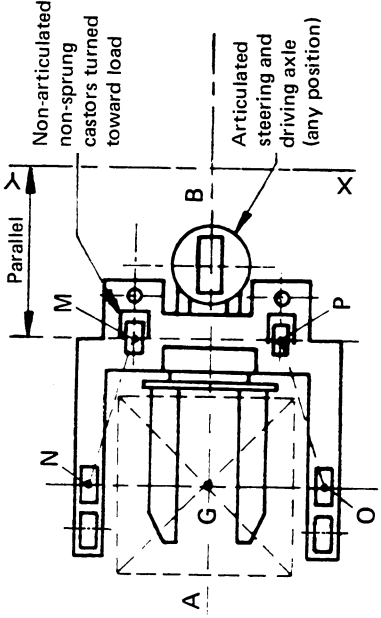
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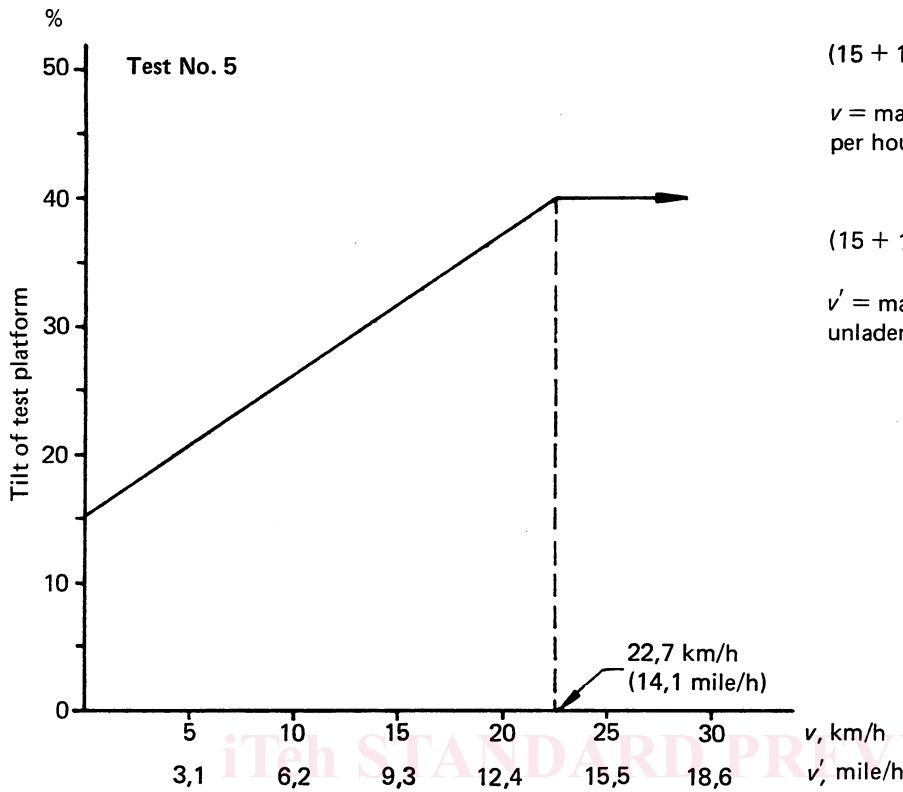
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6 TABLE OF TESTS

Test No.	1	2
Stability	Longitudinal	
Operation	Stacking	Travelling
Load	Test load	Test load
Centre of gravity distance	<i>D</i>	<i>D</i>
Lift height	Maximum	Lowered (see 4.2.5)
Position of carrying device	Extended (for reach trucks)	Retracted
Position of mast or fork arms	Vertical (see 4.2.4)	Maximum backward tilt
Platform slope	4 %	18 %
Position of the truck on the tilting platform (see 4.2.3)	 <p style="text-align: center;">FIGURE 4</p>	 <p style="text-align: center;">FIGURE 5</p>
	 <p style="text-align: center;">FIGURE 6</p>	 <p style="text-align: center;">FIGURE 7</p>

Test No.	3	4	5
Stability	Lateral		
Operation	Stacking		
Load	Unladen	Unladen	Travelling Unladen
Centre of gravity distance	D or 400 mm (16 in) (see note 2)	Maximum	Lowered (see 4.2.5)
Lift height	Retracted	Retracted	Retracted
Position of carrying device	See note 1	See note 1	See note 1
Position of mast or fork arms	6 %	8 %	See figure 20
Platform slope	6 %	8 %	See figure 20
Position of the truck on the tilting platform (see 4.2.3)	<p>FIGURE 8</p>  <p>FIGURE 10</p>  <p>FIGURE 12</p> 	<p>FIGURE 9</p>  <p>FIGURE 14</p>  <p>FIGURE 15</p> 	<p>The positioning of vehicles on the platform for lateral tests depends on the type of truck to be tested (see figures 10 to 15). The true tip line MN must be parallel to the tilt axis XY of the test platform. The test should be conducted to the side to which the truck is least stable.</p> <p>NOTES</p> <ol style="list-style-type: none"> 1) The tilting mast or tilting arms shall be so positioned that the truck is in the condition of minimum stability. 2) Nominal distance <i>D</i> or 400 mm (16 in) if this latter distance corresponds to minimum stability and if the truck has been designed for this distance. <p>If the truck is designed only for distance <i>D</i>, this shall be mentioned on the load plate.</p>

Test No.	6	7	8
Stability	Longitudinal rearward		
Operation	Stacking		
Load	Unladen	Unladen	Travelling
Centre of gravity distance	D or 400 mm (16 in) (see note 2)	Unladen	Unladen
Lift height	Maximum	Maximum	Lowered (see 4.2.5)
Position of mast or fork arms	See note 1	See note 1	See note 1
Position of carrying device	Retracted	Retracted	Retracted
Platform slope	14 %	14 % when one or no brake and 18 % when two brakes are fitted to the wheels at the operator's end of the truck	See figure 21
Position of the truck on the tilting platform (see 4.2.3)	 <p style="text-align: center;">FIGURE 16</p>	 <p style="text-align: center;">FIGURE 17</p>	<p>Every safety precaution shall be taken when tilting toward the driver's side during stability tests. To prevent any danger of overturning at tilting limit, right of axis MN or left of axis MO, the articulation of the drive (steer) axle may be locked on trucks with centro-articulated axle.</p>
Position of the truck on the tilting platform (see 4.2.3)	 <p style="text-align: center;">FIGURE 18</p>	 <p style="text-align: center;">FIGURE 19</p>	<p>Notes 1 and 2 : see page 5.</p>



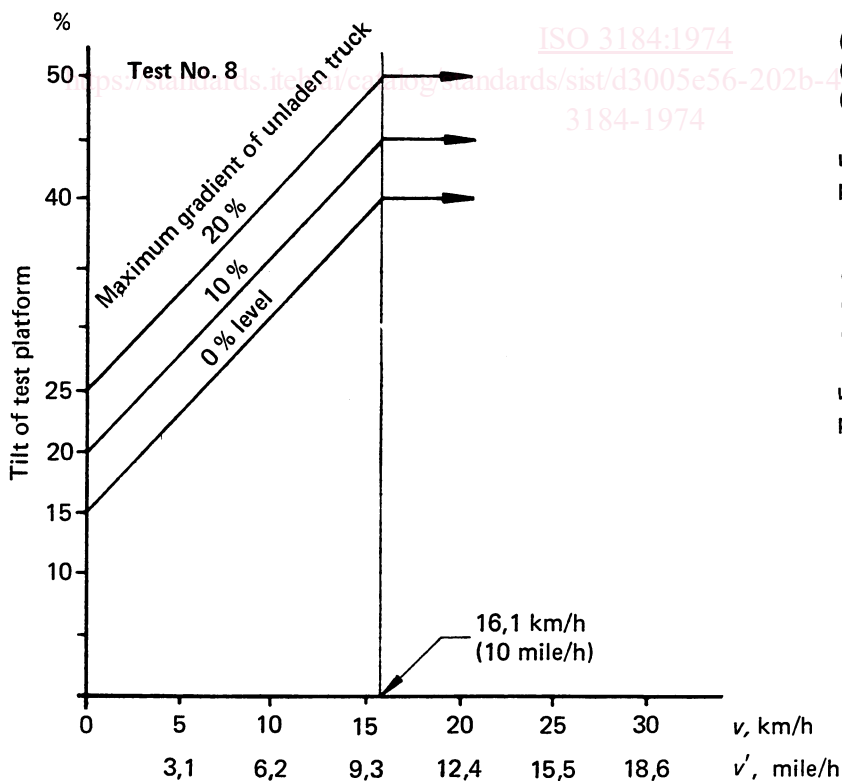
$(15 + 1,1 v) \% - \text{max. } 40 \%$

v = maximum speed of truck, in kilometres per hour, unladen, on level ground.

$(15 + 1,75 v') \% - \text{max. } 40 \%$

v' = maximum speed of truck, in miles per hour, unladen on level ground.

FIGURE 20



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$(25 + 1,55 v) \% - \text{max. } 50 \%$

$(20 + 1,55 v) \% - \text{max. } 45 \%$

$(15 + 1,55 v) \% - \text{max. } 40 \%$

v = maximum speed of truck, in kilometres per hour, unladen, on level ground.

$(25 + 2,5 v') \% - \text{max. } 50 \%$

$(20 + 2,5 v') \% - \text{max. } 45 \%$

$(15 + 2,5 v') \% - \text{max. } 40 \%$

v' = maximum speed of truck, in miles per hour, unladen on level ground

FIGURE 21

