INTERNATIONAL STANDARD

ISO 22915-7

Second edition
2016-08-15

Industrial trucks — Verification of stability —

Part 7: Bidirectional and multidirectional trucks

Chariots de manutention — Vérification de la stabilité —

Partie 7: Chariots bidirectionnels et multidirectionnels

Reference number
ISO 22915-7:2016(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

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

This second edition cancels and replaces the first edition (ISO 22915-7:2009), 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 rough-terrain trucks*

Industrial trucks — Verification of stability —

Part 7:
Bidirectional and multidirectional trucks

1 Scope

This part of ISO 22915 specifies the tests for verifying the stability of bidirectional and multidirectional trucks with tilting or non-tilting mast or fork arms.

It is also applicable to trucks operating under the same conditions when equipped with load-handling attachments.

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 5053-1, *Industrial trucks — Terminology and classification — Part 1: Types of industrial trucks*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5053-1 and ISO 22915-1 apply.

4 Test conditions

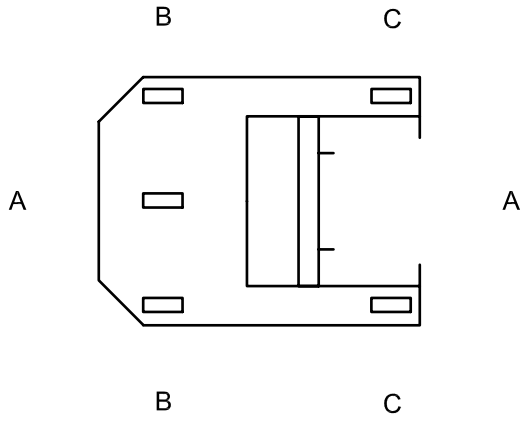
4.1 General

The test conditions shall be in accordance with ISO 22915-1.

4.2 Position of the truck on the tilt table

4.2.1 Load/steer axle and drive/steer axle

The load/steer axle and drive/steer axle are defined by Figure 1.



Key

A–A longitudinal centre plane of the truck

B–B drive/steer axle

C–C load/steer axle

Figure 1 — Load/steer and drive/steer axles

4.2.2 Tests 1 to 5

The truck shall be positioned on the tilt table so that its drive/steer axle, B–B, and outrigger (load/steer) axle, C–C, are parallel to the tilt axis, X–Y, of the tilt table. See Table 1.

4.2.3 Tests 6 to 9

The truck shall be positioned on the tilt table with the line, M–N, or the outrigger (load/steer) axle, C–C, parallel to the tilt axis, X–Y, of the tilt table. See Table 1.

Point M is defined as follows.

a) For trucks with a sprung castor wheel: point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the drive/steer axle and the centreline of the drive wheel width.

b) For trucks with drive/steer wheels in an articulated frame: point M shall be the vertical projection onto the tilt table of the point of intersection between the articulated frame axle and the lateral axis of the articulated frame.

c) For trucks with a single drive/steer wheel: point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the drive/steer axle and the centreline of the drive wheel width.

As shown in Table 1, point N is defined as the centre point of the area of contact between the tilt table surface and the load wheel nearest to the tilt axis, X–Y, of the tilt table.

4.3 Datum point positions

4.3.1 General

Test 1 may be conducted with the horizontal position of the load datum point, E, unchanged when elevated from its lowered position as shown in Figure 2.

With the prescribed test load, set the mast vertical and then elevate to approximately 300 mm above the tilt table. With the shank of the front face of the fork arm set vertical, establish point E, as shown in Figure 2 a) and b), on the fork arms or fork carrier having a fixed relationship to the centre of gravity of

the test load. Point E shall be used to provide a reference datum point, F, on the tilt table. When the mast is elevated, a new point, F_1, on the tilt table might occur, as shown in Figure 2 c) and d). This new point may be returned to the original location of F, as shown in Figure 2 e) and f).

For trucks with tilting masts, changes in the location of F_1 may be corrected by varying the tilt of the mast within the limits provided by the design of the truck. See Figure 2 a), c) and e).

For trucks with non-tilting masts, the location of F_1 is subject to regional requirements (see 4.3.2).

4.3.2 Regional requirements for trucks with non-tilting masts

4.3.2.1 North America

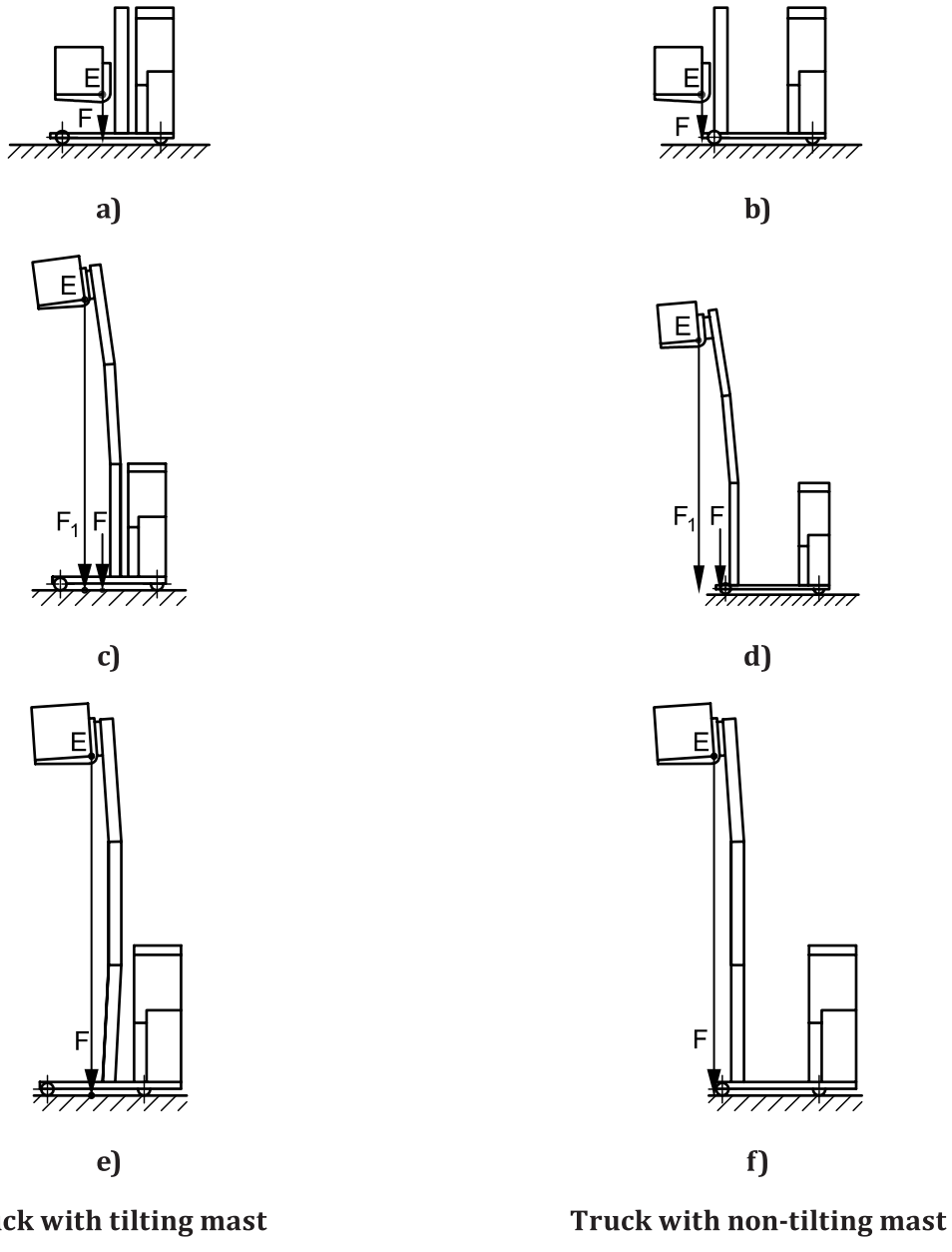
The location of F_1 shall not be corrected. Only correction by varying the mast tilt is permissible.

4.3.2.2 All other regions

Adjustments in the fork arms or fork carrier tilt, fork carrier retraction (where provided) or retraction of the mast may be used to correct for changes in the location of point F_1, within the limits provided by the design of the truck. See Figure 2 b), d) and f).

4.4 Lift height for tests simulating travel

For tests simulating travel (Tests 5, 6 and 7), 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.



Truck with tilting mast **Truck with non-tilting mast**

Figure 2 — Datum point positions

5 Verification of stability

The stability of a truck shall be verified in accordance with Table 1.

Table 1 — Verification of stability

Test criteria		Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8	Test 9
Direction of test	Longitudinal	x	x	x	x	x				
	Lateral						x	x	x	x
Mode of operation	Travelling					x	x	x		
	Stacking/ retrieving	x	x	x	x				x	x
Load at load centre	With	x	x					x	x	
	Without			x	x	x	x			x
Lift height	Maximum	x	x	x	x				x	x
	Travel					x	x	x		
Position of carrying device	Extended	x								
	Retracted		x	x	x	x	x	x	x	x
Position of mast	Vertical	x					x	x	x	
	Full rearward		x (if stability thereby reduced)	x (if stability thereby reduced)	x (if stability thereby reduced)	x	x (if stability thereby reduced)	x (if stability thereby reduced)	x (if stability thereby reduced)	x (if stability thereby reduced)
Tilt table angle for actual capacity	<5 000 kg	4 %	14 %	14 %	14 %	(15 + 0,5i + 1,55v) % or max. (40 + 0,5i) % (see Figure 3)	(15+1,1v) % or max. 40 % (see Figure 4)	18 %	6 %	8 %
	≥5 000 kg	3,5 %								
Position of least stability			x	x	x		x	x	x	x

i is the maximum gradient, expressed as a percentage, on which the unladen truck is designed to travel.

v is the maximum travel speed of the unladen truck, in km/h.

Table 1 — (*continued*)

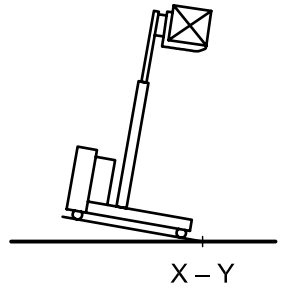
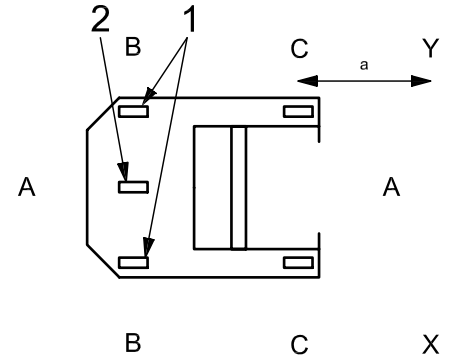
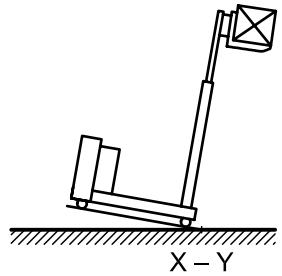
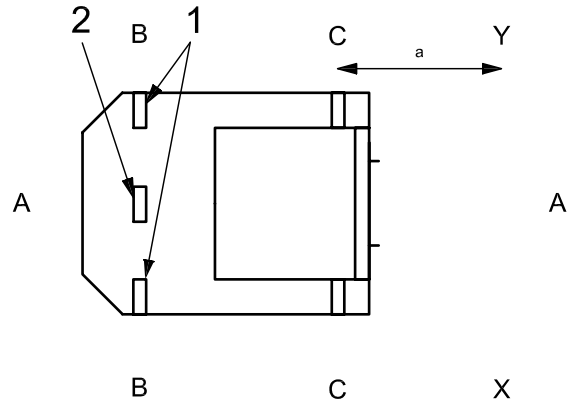
Test criteria	Test 1	
Truck position on tilt table — Without reach mechanism		
Truck position on tilt table — With reach mechanism		
Key 1 position for four-wheeled truck 2 position for three-wheeled truck The wheels shall be orientated to the straight-ahead position for non-retracting mast trucks and to the position of least stability for retracting mast trucks.		
[a] Parallel.		

Table 1 — (*continued*)

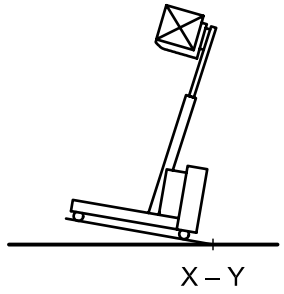
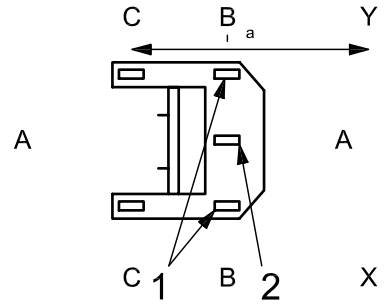
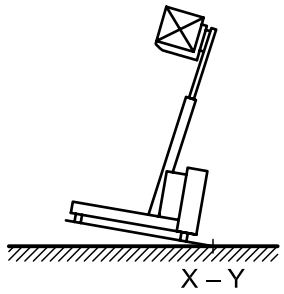
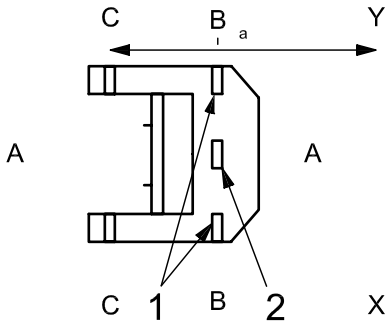
Test criteria	Test 2	
Truck position on tilt table (direction of wheels vertical to tilt axis X–Y)		
Truck position on tilt table (direction of wheels horizontal to tilt axis X–Y)		
Key 1 position for four-wheeled truck 2 position for three-wheeled truck The wheels shall be orientated to the straight-ahead position for non-retracting mast trucks and to the position of least stability for retracting mast trucks.		
[a] Parallel.		

Table 1 — (*continued*)

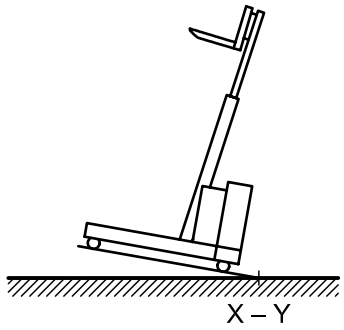
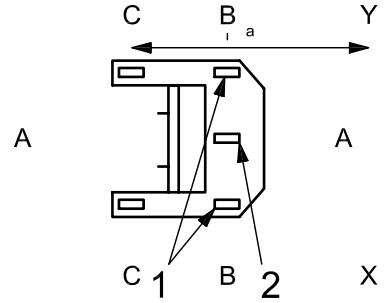
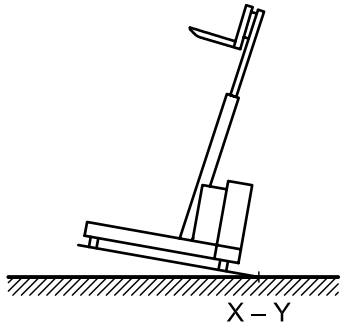
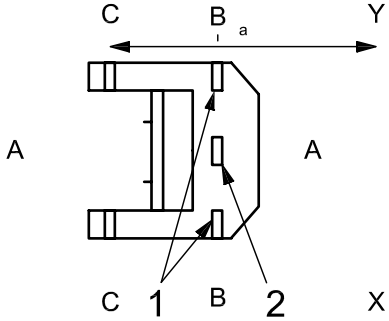
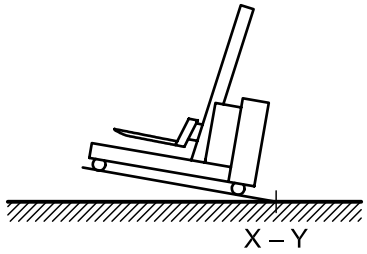
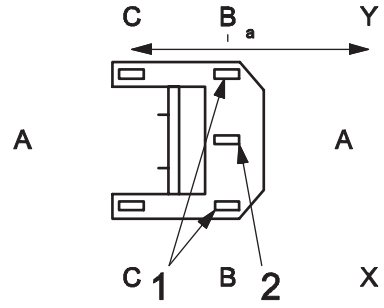
Test criteria	Test 3	
Truck position on tilt table		
	The wheels shall be orientated to the straight-ahead position for non-retracting mast trucks and to the position of least stability for retracting mast trucks.	
	Test 4	
		
Key 1 position for four-wheeled truck 2 position for three-wheeled truck		
[a] Parallel.		

Table 1 — (*continued*)

<table>
<tr><th>Test criteria</th><th colspan="4">Test 5</th></tr>
<tr><td>Truck position on tilt table</td><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
<tr><td colspan="5">Key
1 position for four-wheeled truck
2 position for three-wheeled truck

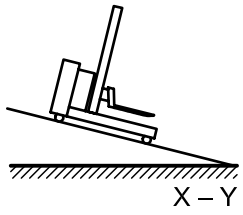
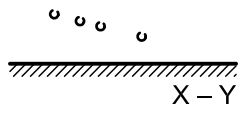
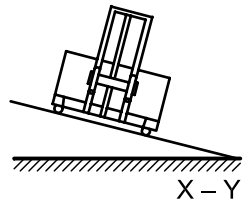
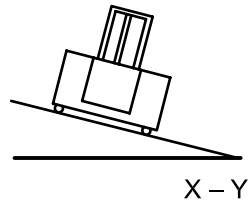
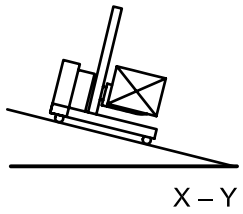
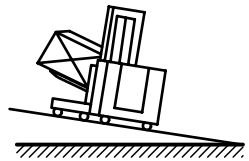
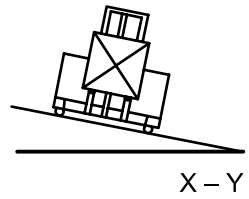
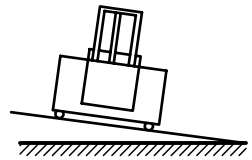
The truck shall be placed on the platform with the fork arms generally directed away from the tilt axis, X–Y, of the tilt table, and with the truck in the position of least stability, which need not be the normal operating position. The wheels shall be orientated so that their axis remains as far as possible parallel to the tilt axis.</td></tr>
<tr><th>Test criteria</th><th colspan="4">Test 6</th></tr>
<tr><td rowspan="2">Truck position on tilt table</td><td> 
</td><td> 
</td><td> 
</td><td> 
</td></tr>
<tr><td colspan="4">Test 7</td></tr>
<tr><td></td><td> 
</td><td> 
</td><td> 
</td><td> 
</td></tr>
<tr><td colspan="5">The wheels shall be orientated to the straight-ahead position for non-retracting mast trucks and to the position of least stability for retracting mast trucks.</td></tr>
<tr><td colspan="5">[a] Parallel.</td></tr>
</table>

Table 1 — (*continued*)

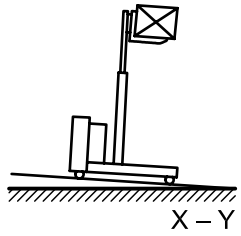
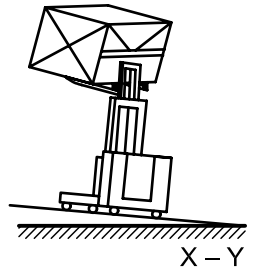
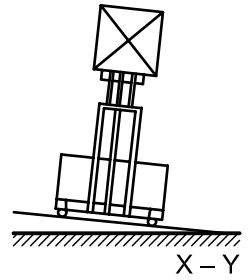
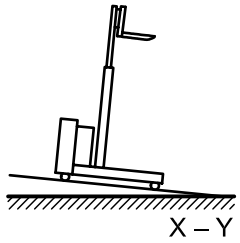
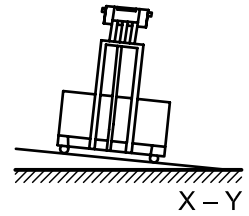
Test criteria	Test 8			
Truck position on tilt table				
	Test 9			
				
The wheels shall be orientated to the straight-ahead position for non-retracting mast trucks and to the position of least stability for retracting mast trucks.				
[a] Parallel.				

Table 1 — (*continued*)

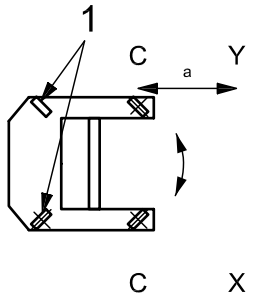
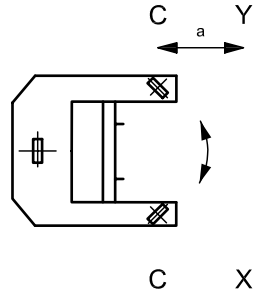
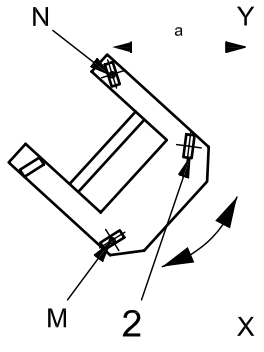
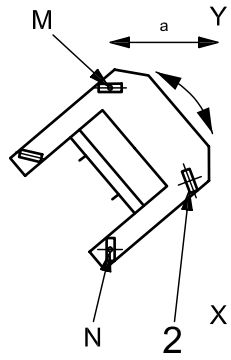
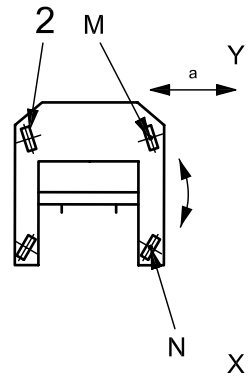
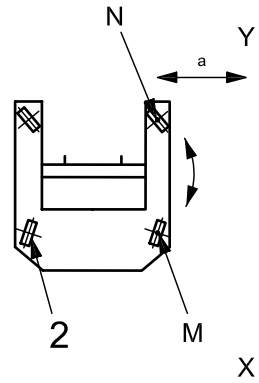
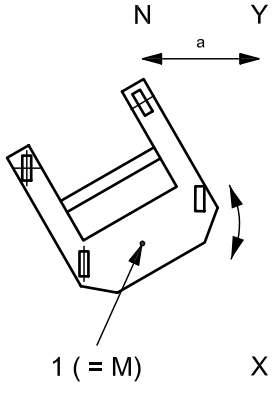
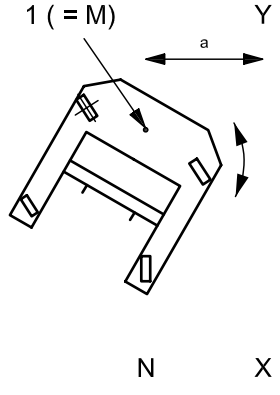
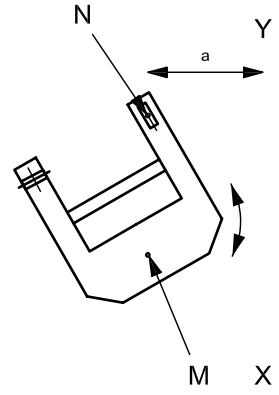
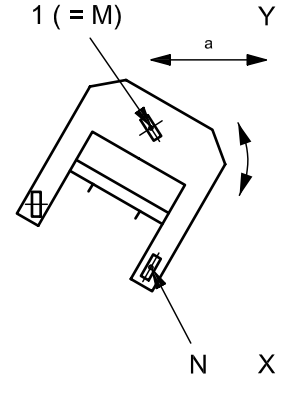
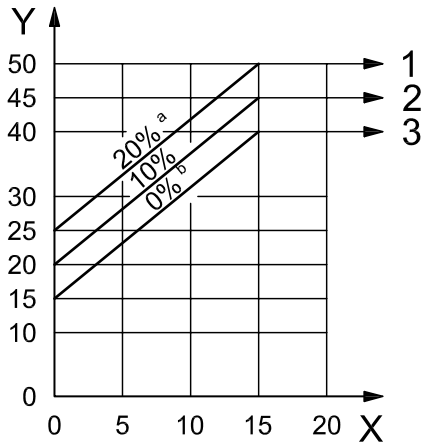
<table>
<tr><th>Test criteria</th><th colspan="4">Test 6 to Test 9
Outrigger axle C–C</th></tr>
<tr><td>Truck position on tilt table</td><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
<tr><td></td><td colspan="4">Points M and N — As per 4.2.3 a)</td></tr>
<tr><td></td><td> 
</td><td> 
</td><td> 
</td><td> 
</td></tr>
<tr><td colspan="5">Key
1 sprung castors or articulate axle
2 sprung castors or wheel</td></tr>
<tr><td colspan="5">[a] Parallel.</td></tr>
</table>

Table 1 — (*continued*)

Test criteria	Test 6 to Test 9 Points M and N			
	As per 4.2.3 b)		As per 4.2.3 c)	
Truck position on tilt table				
	Key 1 articulated axle (same as point M)			
[a] Parallel.				



Key

X speed, km/h

Y gradient, %

1 $\left(\frac{20}{2} + 15 + 1,55v\right)$ % – max. 50 %

2 $\left(\frac{10}{2} + 15 + 1,55v\right)$ % – max. 45 %

3 $\left(15 + 1,55v\right)$ % – max. 40 %

v max. speed of unladen truck on smooth and level ground, km/h

a Maximum gradient of the unladen truck.

b 0 % to level.

Figure 3 — Tilt table angle — Test 5 (see **Table 1**)

The various values of the gradient, or those calculated using the appropriate formula, are applied according to the intended performance of the truck. Thus, if the truck is designed and intended solely for use on level floors, only the curve marked 0 % in Figure 3 should be used for determining the tilt table angle. If the truck is designed and intended for travelling unladen up and down a gradient of 10 %, the tilt table angle value indicated by the 10 % curve should be used; similarly for the curve marked 20 %.

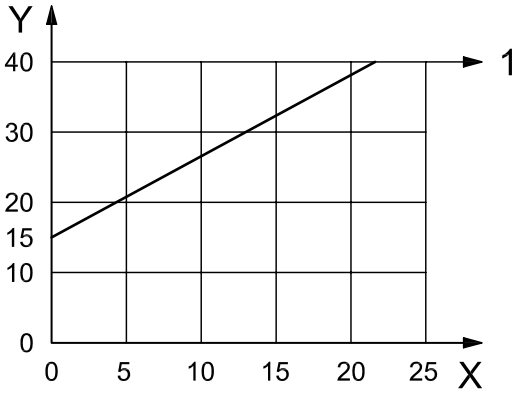
However, for trucks designed and intended for travelling up and down gradients between those curves, the tilt table angle, α, should be calculated as a percentage from the following formula:

$$\alpha = 15 + 0,5i + 1,55v \text{ (max. } 40 + 0,5i \text{ %)}$$

where

v is the maximum speed of the unladen truck on smooth and level ground, in km/h;

i is the maximum gradient on which the unladen truck is designed to travel, in %.



Key

1 $\left(15 + 1,1v\right)$ % – max. 40 %
X speed, km/h
Y gradient, %
v max. speed of unladen truck on smooth and level ground, km/h

Figure 4 — Tilt table angle — Test 6 (see Table 1)

ICS 53.060

Price based on 14 pages