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**Industrial trucks — Verification of  
stability —**

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

*Chariots de manutention — Vérification de la stabilité —*

*Partie 21: Chariots préparateurs de commandes avec un poste de  
l'opérateur élevant au-dessus de 1 200 mm*



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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 22915-21 was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 2, *Safety of powered industrial trucks*.

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

The following parts are under preparation:

- *Part 9: Counterbalanced trucks with mast handling freight containers of 6 m (20 ft) length and longer*
- *Part 11: Industrial variable reach trucks*

- *Part 12: Industrial variable reach trucks handling freight containers of 6 m (20 ft) length and longer*
- *Part 14: Rough-terrain variable reach trucks*
- *Part 15: Counterbalanced trucks with articulated steering*
- *Part 16: Pedestrian-propelled trucks*
- *Part 17: Burden and personnel carriers*

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# Industrial trucks — Verification of stability —

## Part 21:

## Order-picking trucks with operator position elevating above 1 200 mm

### 1 Scope

This part of ISO 22915 specifies the tests for verifying the stability of order-picking trucks with an elevating operator position, as defined in ISO 5053, where the operator's position can be raised to an elevation above 1 200 mm.

It is applicable to industrial trucks fitted with fork arms, platforms and/or integrated attachments under normal operating conditions.

It is not applicable to trucks fitted with a load carrier that can be shifted laterally or pivoted out of the truck's longitudinal centre plane.

### 2 Normative references

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

ISO 5053, *Powered industrial trucks — Terminology*

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

### 3 Terms and definitions

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

#### 3.1 normal operating conditions

operating conditions corresponding to the truck travelling indoors on smooth, level floors of sufficient strength such as those of concrete

NOTE This definition is different from the one given for *normal operating conditions* in ISO 22915-1:2008.

#### 3.2 guided steering

steering mode, either mechanical (e.g. guidance rails) or non-mechanical (e.g. inductive guidance, laser sensor or infrared) not controlled directly by the operator, used to steer the truck on a predetermined straight path while travelling

**3.3 restricted steering**  
operation under which the truck's steering is controlled by the operator and the steering angle is limited to not more than  $\pm 10^\circ$  from the forward or reverse travel direction

**3.4 unrestricted steering**  
steering mode controlled by the operator with no limitation of the steering angle

## 4 Test conditions

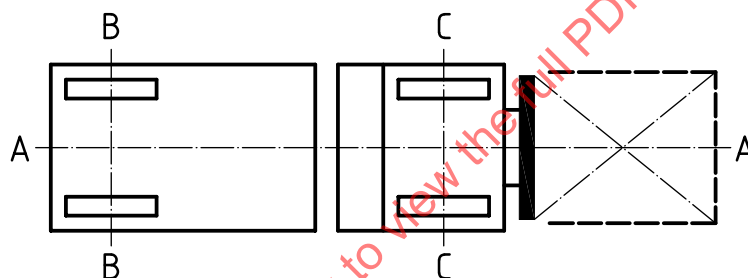
### 4.1 General

See ISO 22915-1.

### 4.2 Position of truck on tilt table

#### 4.2.1 Load and drive/steer axles

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



#### Key

A-A longitudinal centre plane of truck  
B-B drive/steer axle  
C-C load axle

**Figure 1 — Load and drive/steer axles**

#### 4.2.2 Test 1

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

#### 4.2.3 Tests 2, 3, 4 and 5

The truck shall be positioned on the tilt table with the line, M-N, parallel to the tilt axis, X-Y, of the tilt table. See Table 1.

Point M is defined as follows.

- 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.
- For trucks with a drive/steer axle in an articulating frame articulated in the centre plane of the truck: point M shall be the vertical projection onto the tilt table of the point of intersection between the lateral axis of the articulating frame and the centre plane, A-A, of the truck.

- c) For trucks with dual drive (steer) wheels: 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 centre plane, A–A, of the truck.
- d) For trucks with non-articulated, non-sprung castors: point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the castor wheel width, with the non-sprung castor positioned with the centreline of the castor wheel axle nearer to the centre plane of the truck.
- e) For trucks with non-articulated, non-sprung castors or wheels and a non-articulated drive wheel:
  - 1) for the non-sprung castor or wheel, point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the castor or wheel axle and the centreline of the castor wheel or drive wheel width, with the non-sprung castor or wheel being positioned with the centreline of the castor wheel axle nearer to the centre plane of the truck;
  - 2) for the non-articulated drive wheel, point M shall be the vertical projection onto the tilt table of the point of intersection between the centreline of the drive wheel axle and the centre line of the drive wheel width.
- f) For trucks with a sprung castor or wheel point: point M shall be the vertical projection onto the tilt table of the point of intersection between the centre line of the drive wheel axle and the centre line 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 front load wheel closest to the tilt axis, X–Y, of the tilt table.

### 4.3 Lift height

Lift heights for tests shall be measured from the tilt table to the upper-most point of the load-carrying surface.

## 5 Verification of stability

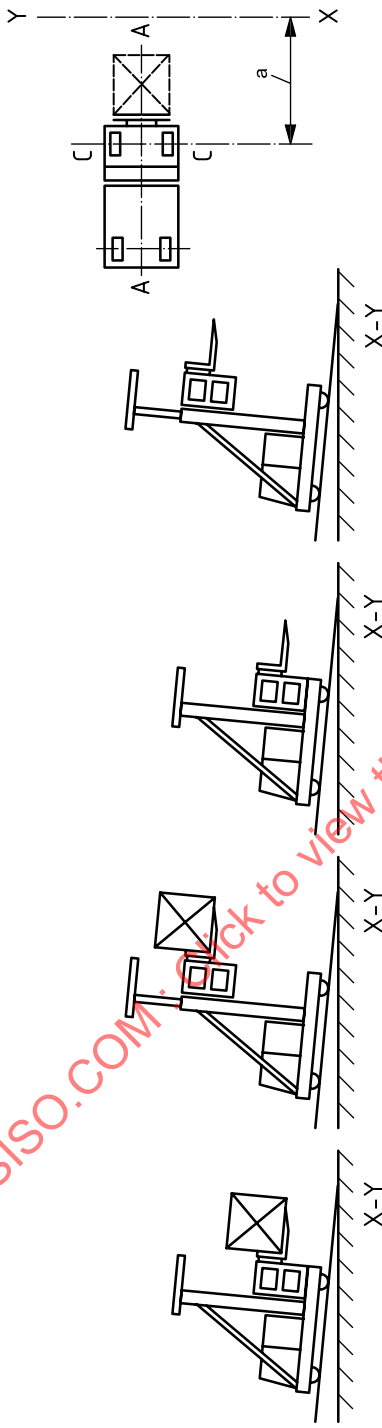
The stability shall be verified in accordance with Table 1.

Table 1 — Verification of stability

Test criteria	Test 1	Test 2	Test 3	Test 4	Test 5
Steering	Guided	x			
	Restricted	x			
	Unrestricted	x	x	x	x
Direction of test	Longitudinal	x			
	Lateral	x	x	x	x
Load	With	x	x		x
	Without	x		x	x
Lift height	b	b	c	c	d
Tilt-table angle	$(4 + 1,24v) \%^e$ $(8 + 1,24v) \%^f$	6 %	$(6 + 1,24v) \%$	$(6 + 2,48v) \%$	$(15 + 1,1v) \%$
$v$ is the maximum travel speed of the unladen truck, in km/h.					



Table 1 (continued)

Test 1 — As per 4.2.2	
Test criteria	
Truck position on tilt table — Load leading	
Truck position on tilt table — Load trailing	