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**Industrial trucks — Verification of  
stability —**

**Part 24:  
Slewing variable-reach rough-terrain  
trucks**

*Chariots de manutention — Vérification de la stabilité —*

*Partie 24: Chariots à portée variable rotatifs tout-terrain*



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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

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## 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](http://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](http://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 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 4, *Rough-terrain 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 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 and rough-terrain lorry-mounted trucks are to form the subject of a future ISO 22915-23.

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## Introduction

In this International Standard, verification of stability is intended to be the measure of a slewing variable-reach rough terrain truck's resistance to overturning under rigidly controlled static conditions that include consideration for dynamic factors encountered in normal application and operation. Influencing factors include weight, weight distribution, wheelbase, wheel tread, truck suspension, truck speed, and tyre and boom deflection under load.

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# Industrial trucks — Verification of stability —

## Part 24:

## Slewing variable-reach rough-terrain trucks

### 1 Scope

This part of ISO 22915, together with ISO 22915-1, specifies the tests for verifying the stability of slewing variable-reach rough-terrain trucks (hereafter also referred to as trucks), equipped with fork arms or with load carrying or non-load carrying attachments.

It is not applicable to those trucks equipped with the following:

- integrated and non-integrated personnel work platforms;
- tracks;
- equipment to operate on rails.

### 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, *Powered industrial trucks — Terminology and classification — Part 1: Types of industrial trucks*

ISO 10896-2, *Rough terrain trucks — Safety requirements and verification — Part 2: Slewing variable reach 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, ISO 10896-2, ISO 22915-1, and the following apply.

#### 3.1

##### **longitudinal centre plane of chassis**

vertical plane passing through the longitudinal centreline, A-A, of the lower chassis

Note 1 to entry: See [Figures 2](#) to [5](#).

#### 3.2

##### **longitudinal centre plane of the upper structure**

vertical plane passing through the longitudinal centreline of the upper structure

Note 1 to entry: See [Figure 1](#).

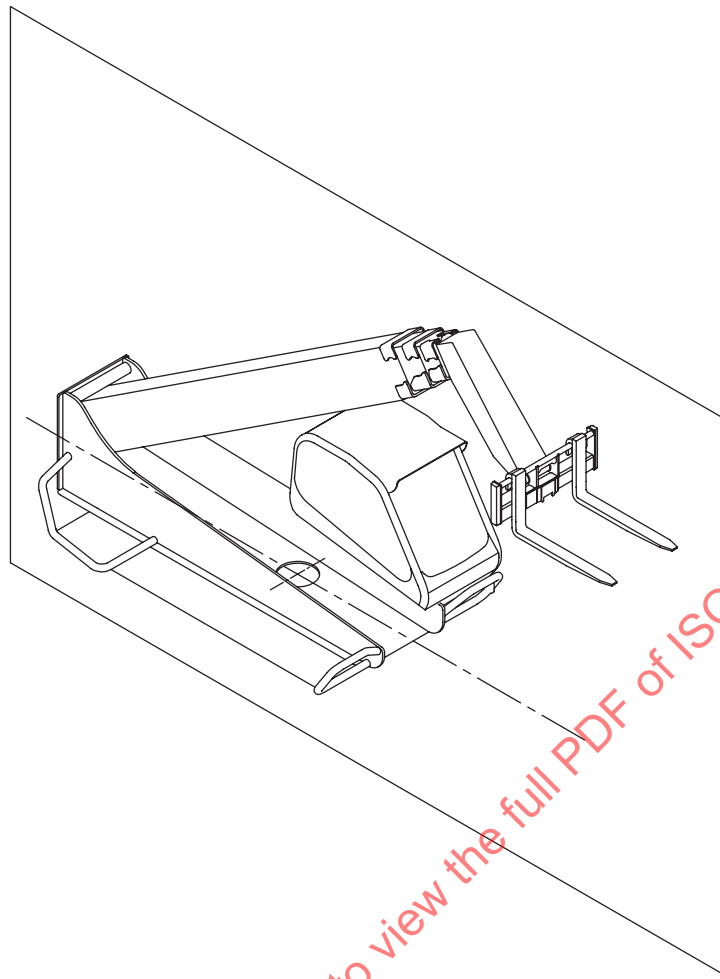


Figure 1 — Longitudinal centre line and plane of the upper structure

## 4 Test conditions

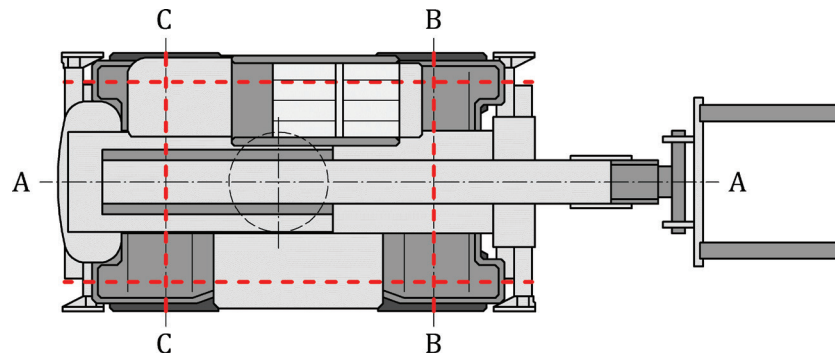
### 4.1 Tipping lines

Tipping lines shall be defined according to the following requirements.

#### 4.1.1 Truck on wheels

##### 4.1.1.1 Truck in non-oscillating axle mode

For trucks in non-oscillating axle mode, tipping lines shall be those lines in the ground reference plane connecting the centres of contact surfaces of the tyres. See [Figure 2](#).

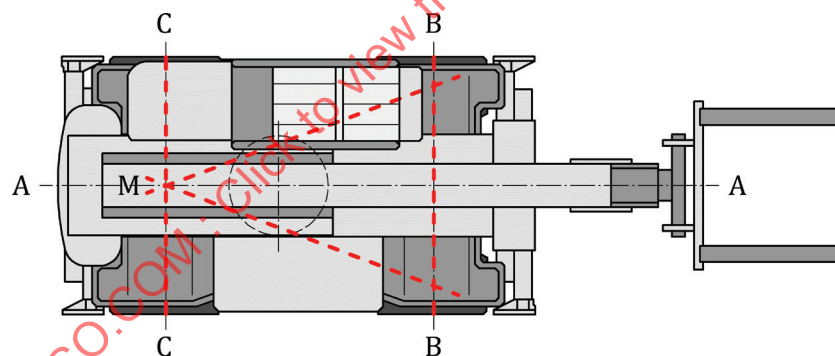
**Key**

- A-A longitudinal centre plane of chassis
- B-B forward tipping line
- C-C rear tipping line
- B-C lateral tipping lines

**Figure 2 — Tipping lines for truck in non-oscillating axle mode**

#### 4.1.1.2 Truck in oscillating axle mode

For trucks in oscillating axle mode, tipping lines shall be those lines in the ground reference plane connecting the centre of contact surfaces of the tyres on the non-oscillating axle and the projection of the vertical line passing through the centre (M) of the oscillating axle. See [Figure 3](#).

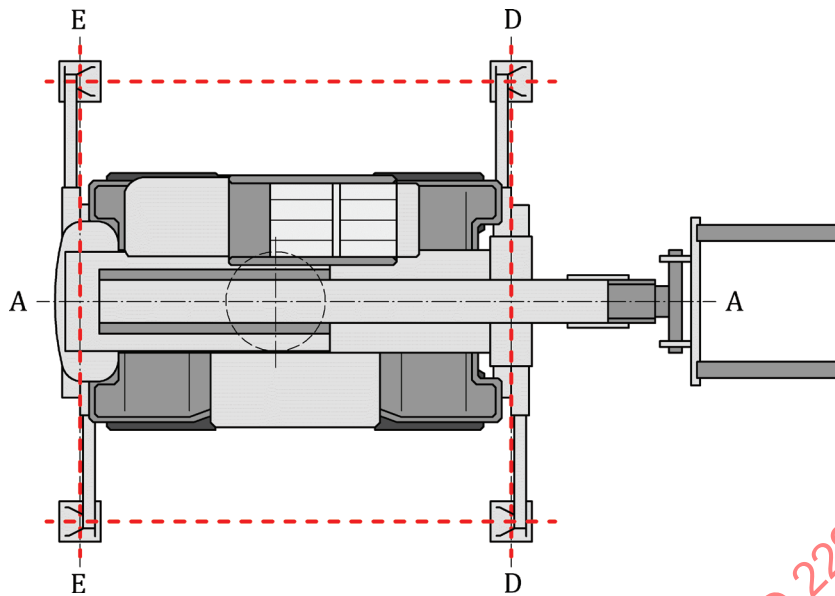
**Key**

- M centre of the oscillating axle
- A-A longitudinal centre plane of chassis
- B-B forward tipping line (vertical plane through the forward axle in forward aligned position defined by the manufacturer)
- B-M lateral tipping lines

**Figure 3 — Tipping lines for truck in oscillating axle mode**

#### 4.1.2 Truck on stabilizers

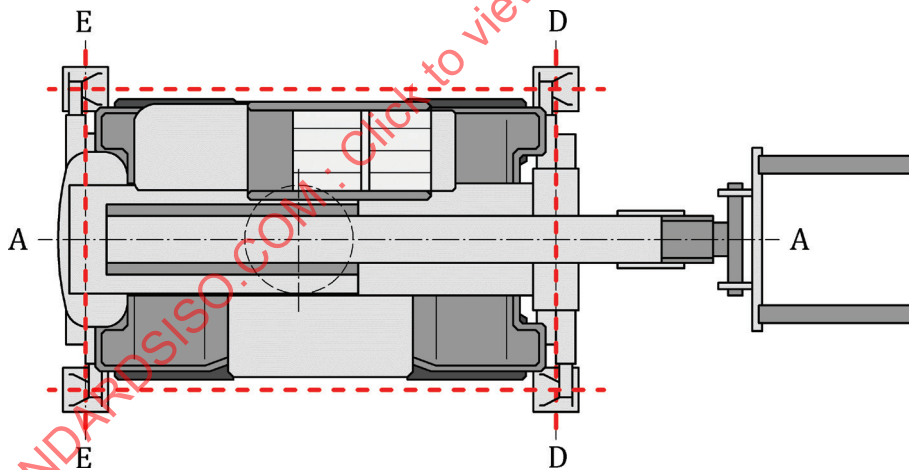
For trucks on stabilizers, tipping lines shall be lines in the ground reference plane connecting the centres of contact of the stabilizer pads. See [Figure 4](#) and [Figure 5](#).



**Key**

- A-A longitudinal centre plane of chassis
- D-D forward tipping line
- E-E rear tipping line
- D-E lateral tipping lines

**Figure 4 — Tipping lines for truck on stabilizers with stabilizers fully deployed**



**Key**

- A-A longitudinal centre plane of chassis
- D-D forward tipping line
- E-E rear tipping line
- D-E lateral tipping lines

**Figure 5 — Tipping lines for truck on outriggers with outriggers fully retracted**

## 4.2 Position of the truck on the tilt table on wheels

### 4.2.1 Tests 1

The truck shall be positioned on the tilt table according to the following:

- in Test T1A, each of the two tipping lines, B-B and C-C, shall be parallel to the tilt axis, X-Y, of the tilt table and one at a time the nearest to the tilt axis, X-Y, of the tilt table (see [Table 1](#));
- in Test T1B, each of the two lateral tipping lines, B-C, shall be one at a time parallel and the nearest to the tilt axis, X-Y, of the tilt table (see [Table 1](#)).

### 4.2.2 Test 2

The truck in forward aligned position (see ISO 10896-2) shall be positioned on the tilt table so that its forward tipping line, B-B, is parallel and the nearest to the tilt axis, X-Y, of the tilt table. See [Table 1](#).

### 4.2.3 Test 3

The truck shall be positioned on the tilt table according to the following:

- in Test T3A, each of the two lateral tipping lines, B-C, shall be one at a time parallel and the nearest to the tilt axis, X-Y, of the tilt table;
- in Test T3B, each of the two tipping lines, B-B and C-C, shall be parallel to the tilt axis, X-Y, of the tilt table and one at a time the nearest to the tilt axis, X-Y, of the tilt table.

For Tests T3A and T3B, the upper structure shall be in the least favourable position in accordance with [Table 1](#).

For these tests, if necessary, it is advisable to secure the slewing upper structure to the lower chassis to avoid the risk of uncontrolled movement.

### 4.2.4 Test 4

The truck in forward aligned position (see ISO 10896-2) shall be positioned on the tilt table so that each of the two lateral tipping lines, B-M, is one at a time parallel and the nearest to the tilt axis of the tilt table. Lateral test shall be carried out in the least favourable condition to the side, which the truck is less stable.

### 4.2.5 Test 5

The truck shall be positioned on the tilt table so that each of the two lateral tipping lines, B-C, is one at a time parallel and the nearest to the tilt axis, X-Y, of the tilt table.

The longitudinal centre plane of the upper structure shall be perpendicular to the X-Y plane with the boom facing up the slope. See [Table 1](#).

### 4.2.6 Test load

Test 1 and test 3 shall be conducted with the test load in the least stable combination of lift and reach, with the fork arms parallel to the tilt table, and this shall remain unchanged during the tests.

The centre of gravity, according to ISO 10896-2, shall be positioned on the longitudinal centre plane of the upper structure, except where a lateral slope correction device is used, which is the case for Tests 3. See [Table 1](#).

#### 4.2.7 Lift height

For tests simulating travel, i.e. test 2 and test 4, the upper face of the fork arms, measured at the heel of the fork arm when fully tilted rearward, shall be positioned 500 mm from the ground.

Test 5 shall be conducted with the boom fully retracted, at the maximum boom angle and with the fork arms in the horizontal position. See [Table 1](#).

#### 4.2.8 Lateral test procedure

For trucks fitted with chassis levelling, Test 3 shall be performed with the maximum lateral slope correction provided by the truck without exceeding 7 %. Lateral slope correction shall only be achieved by chassis levelling.

For trucks not fitted with automatic non-freely oscillating axle, Test 3 shall be conducted both in the oscillating and the non-oscillating axle modes. When the axle is in the oscillating mode, lateral tipping lines for the axle in the non-oscillating mode, B-C, shall be replaced by lateral tipping lines for the axle in oscillating mode, B-M, in accordance with [4.1.1.2](#).

For the other tests, the lateral slope correction shall not be used.

### 5 Verification of stability

#### 5.1 Truck on wheels

Trucks shall be positioned on the tilt table in accordance with [Table 1](#) and specifications in [4.2](#).

#### 5.2 Truck on stabilizing devices

Trucks shall be placed on a firm, level supporting surface so that the longitudinal centre plane of the upper structure is perpendicular to the vertical plane passing through one tipping line at a time. The chassis shall be levelled.

Where the truck is rated for lifting operations on stabilizing devices on a gradient exceeding 1 %, then tests shall be carried out with truck positioned at the slope designated by the manufacturer.

The stability of the truck on stabilizing devices under static conditions shall be such that the actual capacity at the least stable boom angle and length combination is not greater than the 80 % (coefficient 1,25) of the minimum load that brings the truck to instability.

### 6 Marking

The additional capacity, as determined by stability tests with stabilizers and or chassis levelling (see [4.2.8](#)), shall be indicated on the load chart (see [Annex A](#)).

Table 1 — Verification of stability for trucks on wheels

| Test criteria                                                                                      |                                           | Test 1 | Test 2 | Test 3       | Test 4                     | Test 5 |
|----------------------------------------------------------------------------------------------------|-------------------------------------------|--------|--------|--------------|----------------------------|--------|
| <b>Direction of test<br/>(with respect to<br/>the longitudinal<br/>centreline of the<br/>boom)</b> | Longitudinal                              | x      | x      |              |                            | x      |
|                                                                                                    | Lateral                                   |        |        | x            | x                          |        |
| <b>Mode of operation</b>                                                                           | Travelling                                |        | x      |              | x                          |        |
|                                                                                                    | Stacking/Retrieving                       | x      |        | x            |                            | x      |
| <b>Load</b>                                                                                        | With                                      | x      | x      | x            |                            |        |
|                                                                                                    | Without                                   |        |        |              | x                          | x      |
| <b>Lift/reach position</b>                                                                         | Min. boom extension<br>at max. boom angle |        |        |              |                            | x      |
|                                                                                                    | Least stable combi-<br>nation             | x      |        | x            |                            |        |
|                                                                                                    | Travel                                    |        | x      |              | x                          |        |
| <b>Chassis/operator<br/>selectable stabi-<br/>lizer levelling</b>                                  |                                           |        |        | x (max. 7 %) |                            |        |
| <b>Position of fork<br/>arms</b>                                                                   | Horizontal                                |        |        | x            |                            | x      |
|                                                                                                    | Full rearward                             |        | x      |              | x                          |        |
|                                                                                                    | Parallel to the tilt<br>table             | x      |        |              |                            |        |
| <b>Tilt-table angle for<br/>rated capacity</b>                                                     | ≤10 000 kg                                | 7 %    | 22 %   | 12 %         | 20 + 0,75 v % <sup>a</sup> | 10 %   |
|                                                                                                    | >10 000 kg                                | 6 %    | 22 %   | 10 %         | 20 + 0,75 v % <sup>a</sup> | 10 %   |

<sup>a</sup> Max slope 50 %; v: maximum travelling speed by design of the unladen truck, expressed in km/h.



Table 1 — (continued)

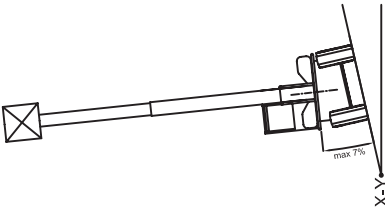
| Test criteria                | Test 1 | Test 2 | Test 3                                                                                        | Test 4 | Test 5 |
|------------------------------|--------|--------|-----------------------------------------------------------------------------------------------|--------|--------|
| Truck position on tilt table |        |        | <div></div> |        |        |

Table 1 — (continued)

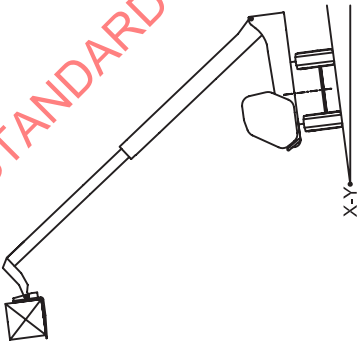
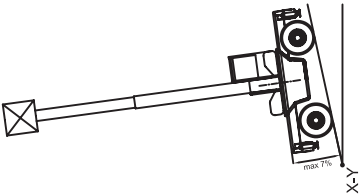
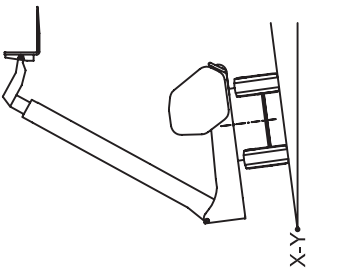
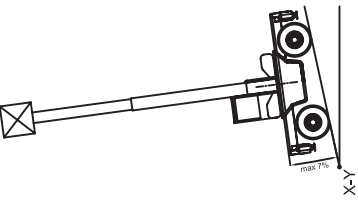
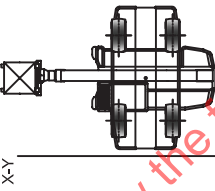
| Test criteria                | Test 1                                                                                                       | Test 2 | Test 3                                                                                                        | Test 4 | Test 5                                                                                                     |
|------------------------------|--------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------|
| Truck position on tilt table | <div><div>T1B</div></div> |        | <div><div>T3B-1</div></div> |        | <div><div>T5B</div></div> |

Table 1 — (continued)

| Test criteria                | Test 1 | Test 2 | Test 3                                                                                                                                                                             | Test 4 | Test 5 |
|------------------------------|--------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|
| Truck position on tilt table |        |        | <p>T3B-2</p>   |        |        |

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