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# Industrial trucks — Verification of stability for order-picking trucks with elevating operator position above 1 200 mm

*Chariots de manutention — Vérification de la stabilité pour les chariots préparateurs de commandes avec un poste de l'opérateur élevable au-dessus de 1 200 mm*

ICS 53.060

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## Foreword

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# Industrial trucks — Verification of stability for order-picking trucks with elevating operator position above 1 200 mm

## 1 Scope

This International Standard specifies the basic tests for the verification of stability of order picking trucks with elevating operator position (see 3.1.3.1.6 in ISO 5053) where the operators position can be raised to an elevation above 1 200 mm.

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

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

## 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 3411:1995, *Earth-moving machinery — Human physical dimensions of operators and minimum operator space envelope*

ISO 5053:1987, *Powered industrial trucks — Terminology*

ISO 5353:1995, *Earth-moving machinery — and tractors and machinery for agriculture and forestry — Seat index point*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **normal operating conditions**

conditions under which trucks operate indoors on smooth, level and prepared surfaces

### 3.2

#### **guided**

condition under which trucks operate within aisles with a steering angle of zero degrees, not directly controlled by the operator

- with the load or load handling device at a height where traction speed is not restricted, or
- with the load or load handling device elevated up to a height at which traction of the truck is still allowed, possibly at reduced speed. The braking performance may also be reduced correspondingly, or

- operated when picking, placing, stacking or retrieving at any height up to the maximum. Traction at these heights may be totally inhibited or limited to a maximum of 2,5 km/h.

The guidance system could be mechanical, which guides a truck on a predetermined path by external means not directly controlled by the operator or non mechanical (e. g. inductive guidance, laser sensor, infrared)

### 3.3

#### **restricted steering**

restricted steering operation is considered when the steerable wheels are limited to not more than  $\pm 10$  degrees from the straight forward or reverse travel direction

### 3.4

#### **free ranging**

free ranging operation is considered whenever the truck is not being operated in a 'guided operation' mode. The ability to steer is not limited and the truck is used for:

- a) picking, placing, stacking or retrieving up to a lift height authorised by the manufacturer;
- b) any combination of fork height and travel speed(s) attainable that produces the least platform slope value. Travel speed  $v$  can be zero. Trucks operating in this mode travel free path controlled by the operator only

## 4 Test conditions

### 4.1 Test procedure

Truck stability shall be verified by means of one of the procedures described below.

The truck is considered stable if it passes all tests without overturning or meets the requirements by calculation.

When comparing calculated and test values, the test values are considered the true measure of stability.

### 4.2 Verification procedure

#### 4.2.1 Tilting platform

The truck shall be placed on the test platform under the conditions specified in Table 2. In each of these tests, the test platform shall be tilted smoothly to the slope indicated in the tests.

The truck shall not overturn when the required platform slope is attained for all the specified tests.

For the purposes of these tests overturning is defined as the point at which the truck completely tips over, not the point at which a wheel(s) leaves the platform or the truck frame contacts the platform.

It is permissible that a wheel(s) leaves the platform or parts of the truck frame contact the platform. If this occurs the truck shall be allowed to seek its new stable position or to overturn with no external restraint.

The means for preventing the overturning shall not impose restriction on the truck until overturning moment occurs.

#### 4.2.2 Calculation

Compliance with the specified stability values may be determined by calculation.

Such calculations shall take into account manufacturing variations and deflections of mast, tyres, etc. and shall be verified by empirical data.

Calculations based on empirical data for similar trucks may be used to predict stability.

### 4.3 Condition of the truck

The tests shall be carried out on an operational truck.

The weight of the operator on sit-on and stand-on trucks shall be simulated by an object having a mass of 98 kg according to ISO 3411 if the stability during a test is thereby decreased. For a truck designed for operation with a stand-on operator, the centre of gravity of the object shall be secured 1 000 mm above the floor of the operators platform at the centre of the position normally occupied by the operator. For a truck designed for operation with a sit-on operator, the centre of gravity of the object shall be secured 150 mm above the seat index point (SIP) as determined in accordance with, ISO 5353, with the seat at the mid point of the adjustment if provided.

Position of the truck on the test platform

The truck shall be positioned on the test platform as defined in the requirement and figures for the specific tests for the truck type. Lateral tests shall be conducted to the side that is least stable.

The initial location of the truck on the test platform may be maintained by:

- application of parking or service brakes, which can be secured in the "on" position, or by wedging the wheels against the truck frame, ensuring however that articulation is not affected;
- blocks (chocks) having a maximum height not exceeding the value indicated in Table 1 may be used, if necessary or allowed, to maintain the initial position of the truck on the test platform. Blocks (chocks), if used, shall not artificially improve stability;
- the coefficient of friction of the platform surface may be increased if necessary by an appropriate friction-increasing material.

**Table 1 — Maximum height of blocks and chocks**

Tyre outside diameter, mm	Maximum height of blocks or chocks
$d \leq 250$	25
$d > 250$	0,1d

### 4.4 Lift height

#### 4.4.1 Lift height for tests simulating travelling

For tests simulating travelling, the upper face of the load platform or fork arms at the heels shall be positioned in accordance with the safety features embodied and the mode of travel being simulated.

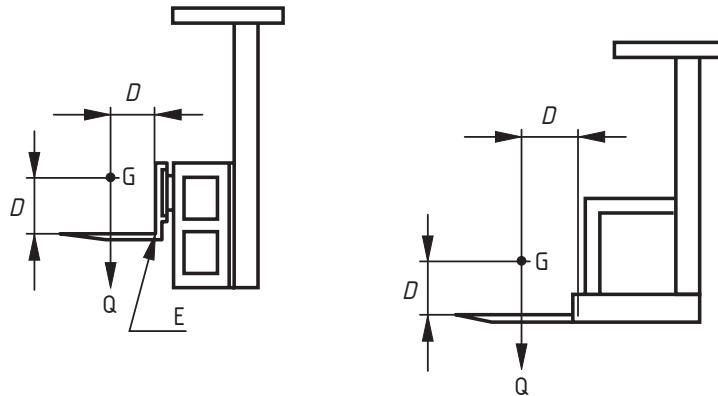
#### 4.4.2 Lift height for tests simulating stacking

For tests simulating stacking, the lift height shall be measured between the surface of the tilting platform and the upper surface of the fork blade at the heel.

### 4.5 Test load

The test load shall be a weight (mass) equivalent to the rated load  $Q$  acting through a centre of gravity  $G$ , nominally positioned at the standard load centre distance  $D$ , horizontally from the front face of the fork arm shank and vertically from the upper face of the fork arm blade, see Figure 1.

The centre of gravity  $G$  shall be on the centre plane between the mast uprights.



**Key**

$D$  load centre distance  
 $E$  inside heel of fork arm

$G$  centre of gravity  
 $Q$  rated load

**Figure 1 — Position of the centre of gravity with and without supplementary lift**

If the manufacturer shows other possible ratings on the capacity plate, tests shall be carried out with maximum load at the corresponding height as well as with the load corresponding to the maximum height.

**4.6 Safety precautions for testing**

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

- a) Complete overturning of the truck shall be prevented by means such as:
  - wire ropes, straps or chains;
  - overhead crane;
  - other means.
- b) Displacement of the test load shall be prevented by means such as:
  - firmly securing the test load to the load carrier or equivalent structure;
  - suspending the test load near to the ground from an appropriate support placed on the fork so that the suspension point is at the point where the centre of gravity,  $G$ , of the test load would be if the test load were to be placed on the fork.

**5 Verification of stability**

The stability shall be verified according to Table 2.

**6 Tests for trucks fitted with attachments**

Trucks fitted with attachments shall be subjected to the foregoing stability tests.

The test load and its position shall be those specified on the capacity plate(s) of the truck fitted with the attachment and used in compliance with the instructions of the manufacturer.



The lift heights required in the tests shall be measured between the surface of the tilting platform and the underside of the load or attachment, whichever is less.

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