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Powered industrial trucks — Test methods for verification of visibility —

Part 1: Sit-on and stand-on operator trucks and variable-reach trucks up to and including 10 t capacity

Chariots de manutention automoteurs — Méthodes d'essai pour la vérification de la visibilité —

Partie 1: Chariots à conducteur assis et debout et chariots à portée variable ayant une capacité allant jusqu'à 10 t incluses

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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.

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 13564-1 was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 2, *Safety of powered industrial trucks*.

ISO 13564 consists of the following parts, under the general title *Powered industrial trucks — Test methods for verification of visibility*:

— *Part 1: Sit-on and stand-on operator trucks and variable-reach trucks up to and including 10 t capacity*

Variable-reach container-handling trucks with greater than 10 t capacity are to form the subject of a future part 3.

Powered industrial trucks — Test methods for verification of visibility —

Part 1:
Sit-on and stand-on operator trucks and variable-reach trucks up to and including 10 t capacity

1 Scope

This part of ISO 13564 specifies the requirements and test procedures for all-round visibility of self-propelled industrial trucks with a rated capacity up to and including 10 000 kg, and industrial variable-reach trucks with a rated capacity up to and including 10 000 kg, with a sit-on or stand-on operator, without load, and equipped with fork arms or load platform as defined in ISO 5053.

It is not applicable to

— low-lift straddle carriers (as defined in ISO 5053:1987, 3.1.3.2.3),

— high-lift straddle carriers (as defined in ISO 5053:1987, 3.1.3.1.11),

— trucks with an elevating operator position, when the operating position is elevated,

— trucks with a rated capacity greater than 10 000 kg,

— rough-terrain variable-reach trucks,

— container-handling trucks,

— side loaders.

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 3691-1:2011, *Industrial trucks — Safety requirements and verification — Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks*

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

3 Terms and definitions

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

3.1
industrial variable-reach truck
industrial truck equipped with longitudinal articulating or telescopic and elevating boom(s) (swivelling horizontally by no more than ±5°), not including rough-terrain variable-reach trucks

3.2
truck profile
contour which is determined by the largest rectangular width and length parallel to the longitudinal axis of the truck, including the front vertical surface of the fork arms

NOTE The blades of the fork arms are not taken into account.

3.3
seat index point
SIP
point on the central vertical plane of the seat

NOTE Adapted from ISO 5353:1995, definition 3.1.

3.4
standing index point
STIP
perpendicular projection of the mid-axis of the standing operator in the normal operating position

NOTE For determination of the STIP, see Figure 4.

3.5
adjusted standing index point
ASTIP
adjusted STIP located relative to the STIP, as provided in 6.1.3, to simulate body movement of the operator during truck operation

3.6
forward direction
forward direction of travel, dependent on the type of truck and according to ISO 3691-1:2011, Annex A.

3.7
manoeuvring
motion of an industrial truck at slow speed and for short distances

NOTE Manoeuvring can include movements such as operation in narrow aisles, when turning, passing objects close by, load pick-up and put-down, approaching and retreating from loads, and other operations not included when travelling.

3.8
travelling
movement of the truck over relatively long distances and open areas up to the maximum speed

3.9
lighting equipment
system of lights that represents the range of positions of the operator's eyes, including head and body movement

See Figures 2 and 3.

3.10
test body
body that simulates an obstacle, e.g. a person in stooped position, and with which the visibility conditions are evaluated

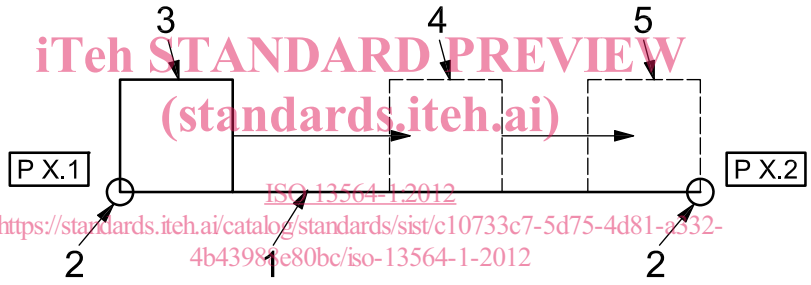
See Figure 5.

3.11
test screen
surface with which the visibility conditions while travelling forward are evaluated

3.12
normal operating position
position in which the operator is able to control all functions for driving and load handling as defined by the manufacturer

3.13
test path
path marked on the floor around the industrial truck to be tested and on which the test body is moved for the visibility measurement tests

See Figures 6, 7 and 8.



Key
1 test path
2 test path end point
3 test body at end point PX.1
4 test body moved along entire length of test path, not extending past end points
5 test body at end point PX.2

Figure 1 — Top view of test path

3.14
illuminated area
surface on the test body or test screen which is illuminated by at least one light of the lighting equipment

3.15
dark shadow
surface on the test body or test screen which is not illuminated by any light of the lighting equipment

NOTE When checking for dark shadows on the test body or test screen, the shadow cast by an object, e.g. clipboard or hand, can help to identify dark shadow areas.

3.16
direct visibility
illumination of the test body and test screen without the use of auxiliary equipment

3.17
indirect visibility
illumination of the test body and test screen with the use of auxiliary equipment

3.18
auxiliary equipment
equipment used to compensate the limitation of direct visibility by, for example, mirrors or camera/monitor systems

4 Truck configuration

4.1 Testing

The test shall be conducted with an unladen truck on a level, horizontal floor. The truck shall be equipped with a load platform or two fork arms of a length up to dimension A in Figures 6, 7 and 8, centrally spaced at an outside distance within the normal fork arm adjustment range of the specific configuration tested.

Tests shall be conducted on a truck with basic configuration, not equipped with any attachment, load or other variable/optional equipment. The test shall be valid for the specific configuration tested. The test method of this part of ISO 13564 applies to all configurations and additional tests for various types of mast, external fuel tank, counterweights, cab, etc. are required for those configurations that adversely affect visibility.

4.2 Height of load-carrying surface

a) **For all trucks except industrial variable-reach trucks**

The load-carrying surface of the fork arms, measured at the heel end, shall be positioned from 100 mm to 300 mm above the floor.

b) **Industrial variable-reach trucks, low-mount boom**

For industrial variable-reach trucks with a boom pivot point height lower than the height of the SIP + 650 mm, the load-carrying surface of the fork arms, measured at the heel end, shall be positioned 100 mm to 300 mm above the floor.

c) **Industrial variable-reach trucks, high-mount boom**

For industrial variable-reach trucks with a boom pivot point height equal to or higher than the height of the SIP + 650 mm, the load-carrying surface of the fork arms, measured at the heel end, shall be positioned 500 mm to 900 mm above the floor.

4.3 Tilt of the mast or load-carrying surface

a) **Travelling tests**

The mast or load-carrying surface shall be tilted rearward to the maximum, but by not more than 10°, for all travelling tests. If the means of tilting the mast or load-carrying surface is accomplished by tilting the truck chassis, these tests shall be performed with the chassis horizontal.

b) **Manoeuvring tests**

The mast shall be vertical or the load-carrying surface horizontal for all manoeuvring tests.

c) **Fork arm or load platform tests**

The mast shall be vertical or the load-carrying surface horizontal for the fork arm or load platform test.

4.4 Retractable mast trucks

Trucks with a retractable mast shall have the mast fully retracted.

5 Test equipment — Direct visibility

5.1 Test body

The test body shall be movable, with a vertical test surface height of 1 200 mm and width of 500 mm, as shown in Figure 5. The surfaces may be marked with a 100 mm × 100 mm grid to facilitate measurement of illuminated areas.

5.2 Test screen

The test screen shall have a vertical surface with a width of at least 500 mm and a height starting at 1 200 mm above the floor up to 900 mm above the SIP or 1 900 mm above the STIP. The surfaces may be provided with a grid of 100 mm × 100 mm to facilitate evaluation of the illuminated surface.

5.3 Distance of the lighting equipment to the industrial truck

All lights able to be switched-on shall be at least 50 mm within the plan view of the overhead guard, or the inside surface of the cab, or within the plan view outline of the lift truck if not equipped with an overhead guard or cab.

6 Test procedures — Direct visibility

6.1 Light source position

6.1.1 General

The visibility from the industrial truck shall be determined from the operating position with light sources and a test body or screen. The light sources simulate the range of eye positions of the operator. The test body simulates an obstacle to be seen.

6.1.2 Sit-on operator

The light source fixture shown in Figure 2 shall be positioned relative to the SIP. The seat shall be placed at the adjustment position closest to the mid-point of horizontal and vertical adjustment and the mid-point of the suspension height, if so equipped. For trucks with rotatable seats, the seat may be turned toward the direction of the test being conducted. See Figure 9.

6.1.3 Stand-on operator

The light source fixture shown in Figure 3 shall be positioned relative to the STIP.

The STIP is given for a stand-on operator in the normal operating position, with the operator standing at the platform and controlling all functions while facing in the direction of travel.

Procedure for locating the STIP:

a) determine the appropriate foot positions for the truck being evaluated;

b) determine the position of the ankle pivot point by the shoe outline and the data given in Figure 4;

c) determine the mid-point of the line connecting the ankle pivot points to establish the STIP;

d) the 0° position (before any rotation of the operator's head, shoulders, or torso) is a line through the STIP perpendicular to the line connecting the ankle pivot points as shown in Figure 4; the row of lights may be rotated ±135° as shown in Figure 10;

e) measure the height of the STIP above the floor as well as the location of the STIP relative to a permanent feature of the truck and record.

To simulate body movement during truck operation, an adjusted STIP (ASTIP) may be positioned within an area circumscribed by:

— a 125 mm radius about the STIP for a stand-up rider truck with defined compartment space, e.g. reach truck, pallet stacker truck where the operator's feet/lower body movements are limited due to truck design;

— a 200 mm radius about the STIP for a stand-up platform truck with space for movement, e.g. order-picking trucks, lateral-stacking trucks.

When the STIP for a truck has been established, the location of the STIP shall remain fixed throughout the visibility evaluation. The ASTIP of the test fixture for a particular test may be relocated as defined above, and shown in Figure 4, i.e. Tests 1 to 11 (see Table 3) may have different locations for the axis of rotation. Each test shall have only one location for the ASTIP which shall be referenced from the STIP and recorded.

6.2 Test paths

Test paths P 1.1 to P 9.2 (see Figures 6, 7 and 8) shall consist of lines laid out on the floor around the test truck, parallel and perpendicular to the truck's longitudinal axis. The test paths shall be located from the truck profile which includes the front vertical surface of the fork arms:

— Figure 6 shows the test path for sit-on operator trucks, up to and including 10 000 kg capacity;

— Figure 7 shows the test path for stand-on operator trucks, up to and including 10 000 kg capacity;

— Figure 8 shows the test path for industrial variable-reach trucks, up to and including 10 000 kg capacity.

6.3 Measurement procedure

6.3.1 General

The test body or test screen shall be moved along the test path with the vertical test surface on, and parallel to, the test path. The light source shall be turned on to illuminate the test body or test screen.

Measurements of illuminated surfaces and dark shadow shall be made. Figures 6, 7 and 8 show the arrangements and distances of the test paths from the truck.

Where the operator's body rotation is restricted to less than the angle of rotation allowed to orientate the light source to the test path, the test shall be conducted with the light source rotated to the maximum possible angle of rotation of the operator's body.

6.3.2 Travelling

Tests shall be conducted with reference to Table 1 and Figures 6, 7 and 8 as appropriate.

a) **Forward and rearward travelling tests** (using the test body — Table 3, tests 1 and 2)

Two tests, one for forward travelling and one for rearward travelling, shall be conducted with up to nine lights (T1 to T9) switched on, located 125 mm from the axis of rotation.

For the forward travelling test, the light source shall be orientated towards test path P 1.1 to P 1.2 with the row of lights perpendicular to the longitudinal axis of the truck. Illumination of the test body shall be evaluated from P 1.1 to P 1.2.

For the rearward travelling test, the light source shall be rotated to an angle of ±135° (only one of the light positions shall be used). Illumination of the test body shall be evaluated from P 2.1 to P 2.2.

b) **Forward travelling test** (using the test screen — Table 3, test 3)

The light source, located 125 mm from its axis of rotation, shall be orientated towards test path P 1.1 to P 1.2 with the row of lights perpendicular to the longitudinal axis of the truck. Any two lights 75 mm apart (T1 and T3, T2 and T4, T3 and T5, T4 and T6, T5 and T7, T6 and T8 or T7 and T9) shall be switched on. Only one pair of lights shall be used throughout the test.

The light source shall be rotated for the forward test towards test path P 1.1 to P 1.2, as shown in Figures 6, 7 and 8, with the row of lights perpendicular to the longitudinal axis of the truck.

Table 1 — Travelling tests

Test direction	Orientation of the lights	Test object	Test path
Forward	Forward	Test body	P 1.1 to P 1.2
Rearward	+135° or −135°	Test body	P 2.1 to P 2.2
Forward	Forward	Test screen	P 1.1 to P 1.2

6.3.3 Manoeuvring

Tests shall be performed with reference to Table 2 and Figures 6, 7 or 8 as appropriate.

The lights shall be located 125 mm from the axis of rotation. Up to 13 lights (M1 to M4 and T1 to T9) may be turned on. The forward orientation is with the 0° axis shown in Figure 2 or Figure 3 parallel to the axis of the lift truck, facing in the forward direction of the lift truck movement. The orientation of the lighting equipment for −135°, −45°, +45° and +135° is measured from the 0° axis. If the rotation of the lighting equipment to −135°, −45°, + 45° or +135° is limited by the allowable rotation shown in Figure 9 or Figure 10, by the requirements in 5.3, or by features of the lift truck, the test shall be conducted at the maximum allowable rotation.

Table 2 — Manoeuvring tests

Test direction	Orientation of the lights	Test object	Test path
Forward	Forward	Test body	P3.1 to P3.2
Forward	+45°	Test body	P4.1 to P4.2
Rearward	+135°	Test body	P5.1 to P5.2 P6.1 to P6.2
Forward	−45°	Test body	P9.1 to P9.2
Rearward	−135°	Test body	P7.1 to P7.2 P8.1 to P8.2