
**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	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Truck configuration	4
4.1 Testing	4
4.2 Height of load-carrying surface	4
4.3 Tilt of the mast or load-carrying surface	4
4.4 Retractable mast trucks	5
5 Test equipment — Direct visibility	5
5.1 Test body	5
5.2 Test screen	5
5.3 Distance of the lighting equipment to the industrial truck	5
6 Test procedures — Direct visibility	5
6.1 Light source position	5
6.2 Test paths	6
6.3 Measurement procedure	6
7 Test procedures — Indirect visibility	8
8 Other test methods	8
9 Acceptance criteria	8
9.1 General	8
9.2 Direct visibility	8
9.3 Indirect visibility	9
10 Test report	10
10.1 Truck information	10
10.2 Test results	10
Bibliography	21

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 $\pm 5^\circ$), 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

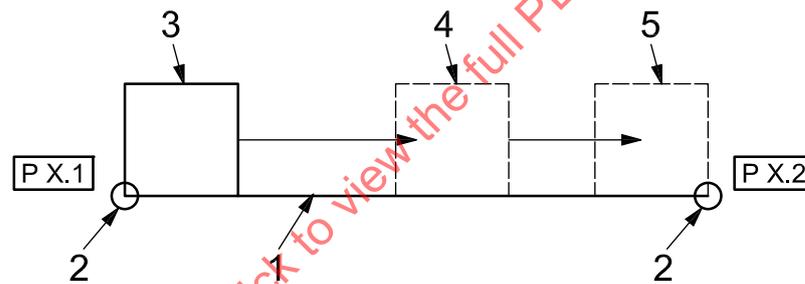
3.12**normal operating position**

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 P X.1
- 4 test body moved along entire length of test path, not extending past end points
- 5 test body at end point P X.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 $\pm 135^\circ$ 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 $\pm 135^\circ$ (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° , $+45^\circ$ and $+135^\circ$ is measured from the 0° axis. If the rotation of the lighting equipment to -135° , -45° , $+45^\circ$ or $+135^\circ$ 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

6.3.4 Fork arms or load platform

The tests shall be performed with up to 13 lights switched on (M1 to M4 and T1 to T9) as shown in Figure 2 or Figure 3. The light source shall be orientated toward the fork arms or load platform, the row of lights perpendicular to the line between their axis of rotation and the load centre. The light source may be moved toward the load centre by up to 150 mm.

7 Test procedures — Indirect visibility

When auxiliary equipment is needed to meet the requirements of this part of ISO 13564, the view through the device shall be tested and shall meet the criteria of 9.3. The light source shall be fixed in a position with the row of lights perpendicular to the connecting line between the axis of rotation of the light source fixture and the centre of the optical device with the rotation limits of $\pm 90^\circ$ for travelling, in 9.2.2, and manoeuvring, in 9.2.3. For all other tests in 9.2.2 to 9.2.4, the light source fixture shall be within the rotation limits of $\pm 135^\circ$.

NOTE When conducting tests with optical devices (e.g. mirrors), a single directed beam light source positioned at T5 for the test being conducted and directed towards the optical device might provide clearer areas of light and shadow. For the evaluation of auxiliary equipment such as a camera and monitor system (e.g. CCTV), it is acceptable to verify the visibility of the test body or screen directly without the use of the light array.

8 Other test methods

Other test methods (such as alternate light recording, cameras, computer imaging, lasers, etc.) may be used to conduct the test provided the alternate method duplicates the test with lights and produces the same results as the light method.

9 Acceptance criteria

9.1 General

The visibility from the self-propelled industrial truck shall be deemed to meet the requirements of this part of ISO 13564 if the requirements of 9.2 or 9.3 are met when tested in accordance with Clause 6. Each illuminated area shall be at least 10 000 mm² and shall have no dimension less than 50 mm.

9.2 Direct visibility

9.2.1 General

Visibility from a self-propelled industrial truck shall be deemed to meet the requirements of this part of ISO 13564 if the requirements of 9.2.2, 9.2.3 and 9.2.4 are met.

9.2.2 Travelling visibility

When tested in accordance with 6.3.2, in all positions along the test path, there shall be one or more illuminated areas for both requirements a) and b) of at least the following:

- a) forward and rearward directions: 20 % of the vertical surface of the test body, as shown in Figure 5;
- b) forward direction: at least 20 % of any 500 mm × 500 mm surface on the test screen (5.2) shall be illuminated, not considering the dark shadows cast by the vertical structural members of the mast (channels, I-beams and/or the vertical section of a telescopic boom).

NOTE The dark shadows cast by these vertical structural members are included in 9.2.2 a).

9.2.3 Manoeuvring visibility

When tested in accordance with 6.3.3, in all positions along the test path, there shall be one or more illuminated areas of at least 20 % of the vertical surface of the test body, as shown in Figure 5.

9.2.4 Fork arms or platform visibility

When tested in accordance with 6.3.4, the following apply.

a) Fork arms

At least 25 % of the load-carrying surface of the forward half of one fork arm shall be illuminated. A portion of the illuminated area shall be connected to the fork arm tip.

b) Load platform

At least 25 % of the load-carrying surface of the left or right forward quarter of the load platform shall be illuminated.

9.3 Indirect visibility

9.3.1 General

If the requirements of 9.2 for direct visibility are not met, appropriate auxiliary equipment shall be fitted to the truck to supplement the direct visibility.

9.3.2 Travelling

9.3.2.1 General

Travelling visibility using auxiliary equipment shall be deemed to be satisfactory if the requirements of 9.2.2 are met.

9.3.2.2 Travelling, except narrow aisle guided steering

9.3.2.2.1 Travelling visibility requirements shall be met primarily with direct visibility.

9.3.2.2.2 Auxiliary equipment may be used to supplement direct visibility to meet the requirements. Travelling test visibility requirements cannot be met by the exclusive use of auxiliary equipment.

9.3.2.2.3 Auxiliary equipment that supplements direct visibility for travelling shall be within the operator's view when facing the direction of travel for direct visibility. The auxiliary equipment shall not restrict the operator's direct visibility according to 9.2.

9.3.2.3 Travelling, narrow aisle guided steering

Travelling visibility test requirements in a narrow aisle with guided steering may be met with auxiliary equipment if the auxiliary equipment provides visibility of the width of the aisle.

9.3.2.4 Manoeuvring

Manoeuvring visibility using auxiliary equipment shall be considered satisfactory only if the requirements of 9.2.3 are met.

9.3.2.5 Fork arm or load platform

Fork arm or load platform visibility using auxiliary equipment shall be considered satisfactory only if the requirements of 9.2.4 are met.

10 Test report

10.1 Truck information

The following information on the truck shall be recorded and included in the test report:

- a) manufacturer;
- b) model;
- c) serial number;
- d) capacity and load centre;
- e) description of lifting mechanism, e.g. lift height, number of stages, lowered height, reach;
- f) tyre information;
- g) location and dimensions of truck profile (3.2);
- h) for sit-on trucks, the location of the SIP and seat information, the direction of the seat (see Figure 9);
- i) for stand-on trucks, the location of the STIP and orientation of the 0° standing direction (see Figure 10);
- j) location and description of auxiliary equipment for indirect visibility;
- k) any other equipment that affects the visibility measurements (see 4.1).

10.2 Test results

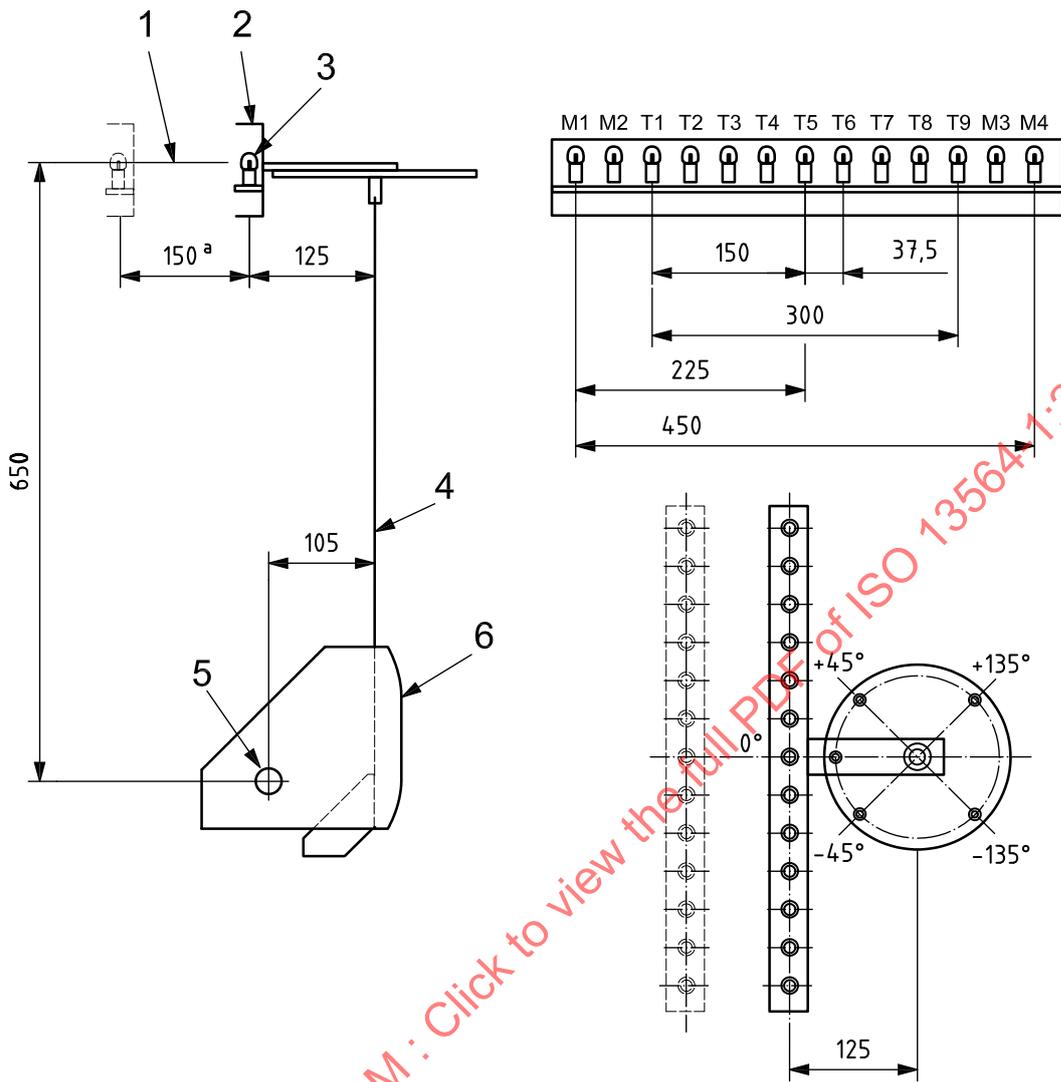
The results from each test summarized in Table 3 shall be recorded, as shall the following information:

- a) test number;
- b) position of test body on the test path or location of the screen on which the percentage of illuminated area is the lowest;
- c) percentage of illuminated area of test body or screen in the position according to b);
- d) height of load-carrying surface and tilt of mast;
- e) for test 3, which two lights were used;
- f) for test 11, the distance of the lights from the axis of rotation;
- g) lights that are not usable, in accordance with 5.3;
- h) tests in which auxiliary equipment for indirect visibility is used to meet the requirements of this part of ISO 13564.

Table 3 — Summary of visibility tests

Test no.	Tests	Test direction	Distance of lights to axis of rotation	Number of lights	Test path	Test object	Required minimum illuminated area of test surface	Refer to subclause
1	Travelling	Forward	125	9	P 1.1 to P 1.2	Test body	20 % of vertical surface	6.3.2 a)
2	Travelling	+ or -135°	125	9	P 2.1 to P 2.2	Test body	20 % of vertical surface	6.3.2 a)
3	Travelling	Forward	125	2	P 1.1 to P 1.2	Test screen	20 % of any 500 mm × 500 mm surface	6.3.2 b)
4	Manoeuvring	Forward	125	13	P 3.1 to P 3.2	Test body	20 % of vertical surface	6.3.3
5	Manoeuvring	+45°	125	13	P 4.1 to P 4.2	Test body	20 % of vertical surface	6.3.3
6	Manoeuvring	+135°	125	13	P 5.1 to P 5.2	Test body	20 % of vertical surface	6.3.3
7	Manoeuvring	+135°	125	13	P 6.1 to P 6.2	Test body	20 % of vertical surface	6.3.3
8	Manoeuvring	-135°	125	13	P 7.1 to P 7.2	Test body	20 % of vertical surface	6.3.3
9	Manoeuvring	-135°	125	13	P 8.1 to P 8.2	Test body	20 % of vertical surface	6.3.3
10	Manoeuvring	-45°	125	13	P 9.1 to P 9.2	Test body	20 % of vertical surface	6.3.3
11	Fork arms or load platform	Direction of load centre	125 ≤ X ≤ 275	13	—	Load-carrying device	25 % of forward upper loading surface of fork arm or load platform	6.3.4

Dimensions in millimetres



Key

- 1 operator's eye level
- 2 shroud
- 3 row of lights
- 4 axis of rotation
- 5 SIP
- 6 device for determination of SIP

The axis of rotation shall be perpendicular to the floor level. The lower area of the SIP fixture may be sloping to the floor level.

Each light shall have an individual switch to turn it on or off.

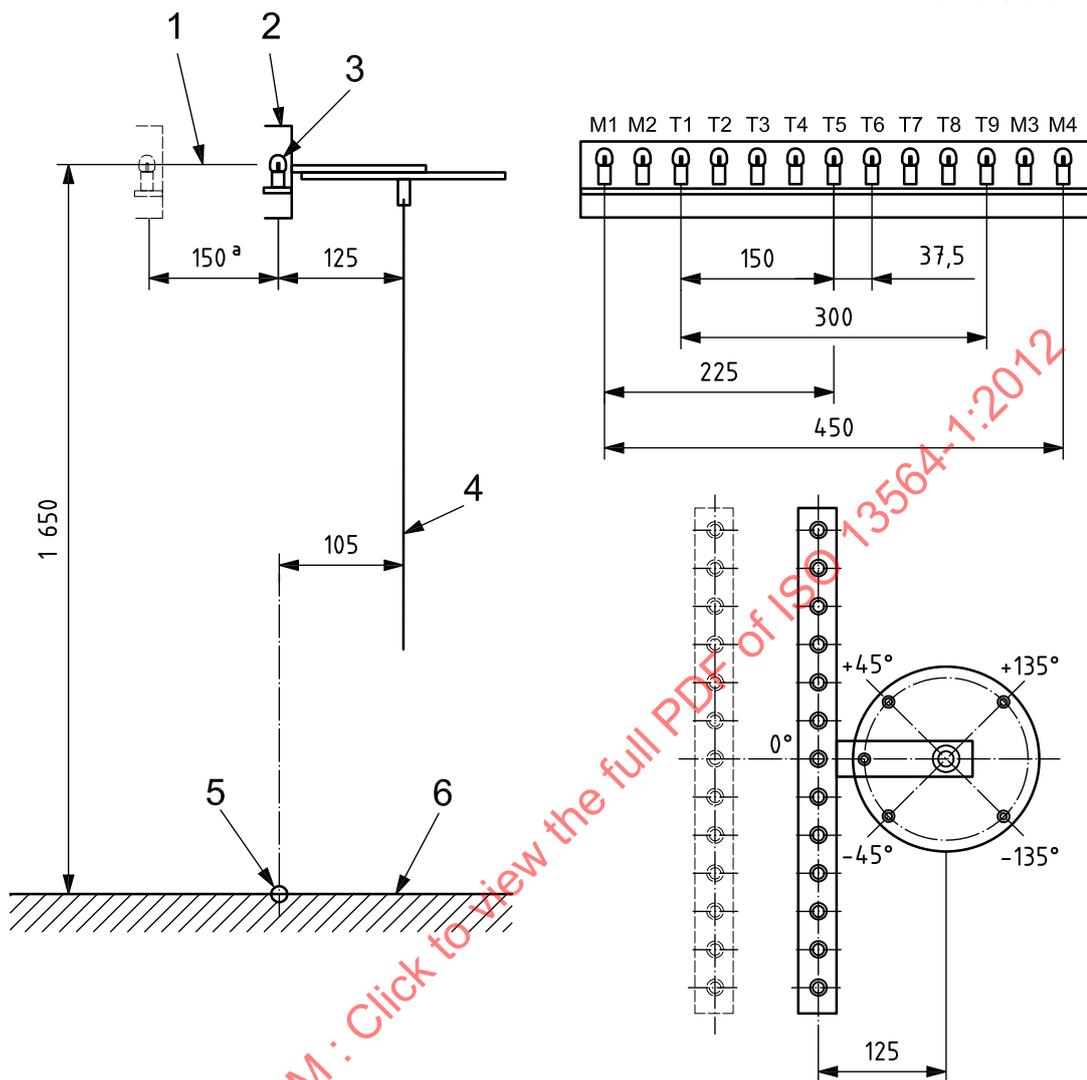
The lights shall be 55 W halogen or equivalent with a spot light source to provide a sharp demarcation of the shadow.

NOTE The indirect light can be reduced using the shroud without impairing the passage of light to the test screen and test body.

^a Adjustable up to 150 mm for the fork arm or load platform visibility test only.

Figure 2 — Lighting equipment for trucks with sit-on operator

Dimensions in millimetres



Key

- 1 operator's eye level
- 2 shroud
- 3 row of lights
- 4 axis of rotation
- 5 STIP
- 6 standing level of operator

The axis of rotation shall be perpendicular to the floor level.

Each light shall have an individual switch to turn it on or off.

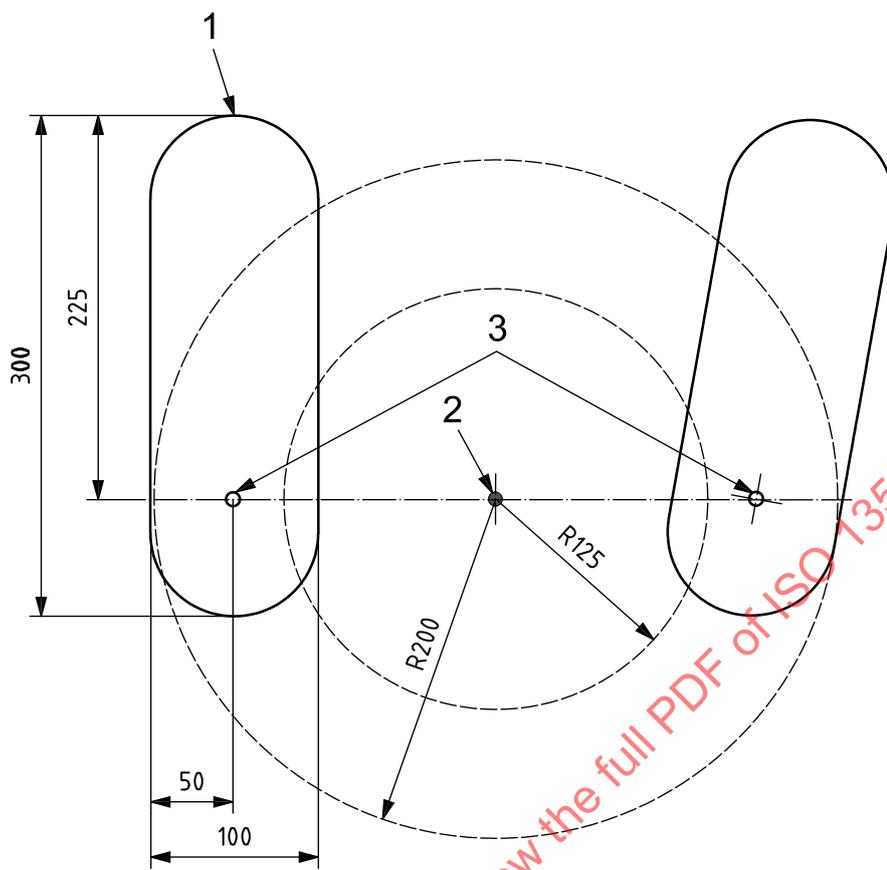
The lights shall be 55 W halogen or equivalent, with a spot light source to provide a sharp demarcation of the shadow.

NOTE The indirect light may be reduced using the shroud without impairing the passage of light to the test screen and test body.

^a Adjustable up to 150 mm for the fork arm or load platform visibility test only.

Figure 3 — Lighting equipment for trucks with stand-on operator

Dimensions in millimetres

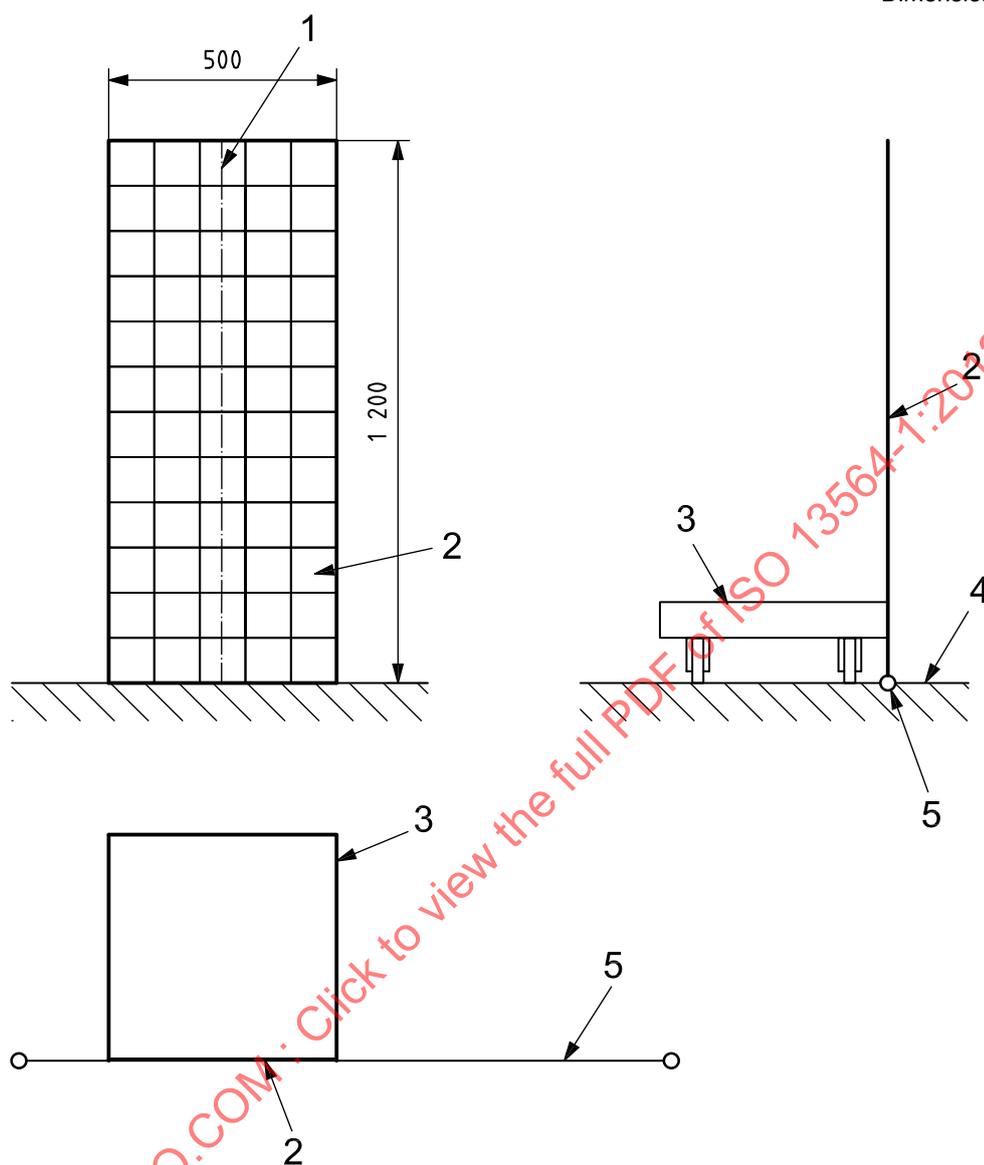


Key

- 1 foot/shoe profile
- 2 STIP
- 3 ankle pivot points

Figure 4 — Determination of standing index point (STIP)

Dimensions in millimetres

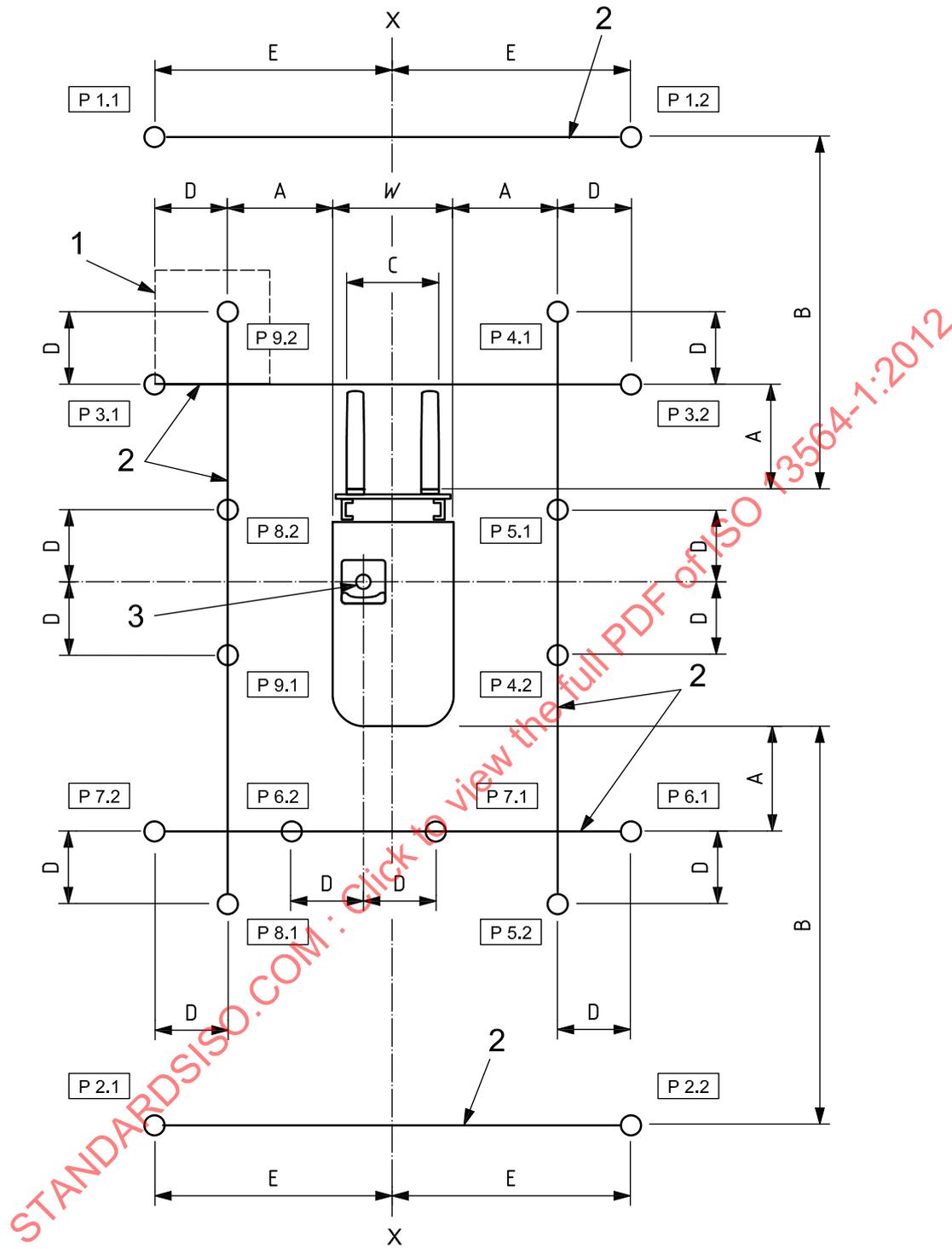
**Key**

- 1 centreline
- 2 vertical test surface
- 3 test body carrier (for illustration only)
- 4 floor level
- 5 test path

Test surfaces shall be white or light in colour.

NOTE Construction details and gridlines on test surfaces are not specified by this part of ISO 13564.

Figure 5 — Test body



Key

- | | |
|------------------------|-----------------------------------|
| A = 1 200 mm | W maximum truck width |
| B = 4 000 mm | 1 test body |
| C = 800 mm to 1 000 mm | 2 test path |
| D = 250 mm | 3 axis of rotation |
| E = $W/2 + 500$ mm | XX longitudinal axis of the truck |

NOTE Drawing not to scale.

Figure 6 — Test paths, sit-on operator truck up to and including 10 000 kg