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Rough-terrain trucks — Visibility test methods and their verification —

Part 1: Variable-reach trucks

Chariots tout-terrain — Méthodes d'essai de la visibilité et leur vérification —

Partie 1: Chariots à portée variable

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Foreword

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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).

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).

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 4, *Rough-terrain trucks*.

This corrected version of ISO 18063-1:2016 incorporates the following corrections:

— the illustration of a load has been removed from Figure 3;

— the second and third title elements have been combined into a single element, *Visibility test methods and their verification*;

— the listing of normative reference ISO 5053-1 has been transferred from the Bibliography to Clause 2.

— hyperlinked references to terminological databases have been added in Clause 3.

A list of all parts in the ISO 18063 series can be found on the ISO website.

Introduction

This document is a type-C standard as stated in ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or -B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

Rough-terrain trucks — Visibility test methods and their verification —

Part 1: Variable-reach trucks

1 Scope

This document applies to rough-terrain variable-reach trucks (hereinafter referred to as 'trucks') that have a specific seated operator's position on the left-hand side of the boom or centre position (excluding operator position on the right side of the boom).

This document specifies a static test method for determining and evaluating the operator's visibility on a rectangular 1 m boundary around the rough-terrain variable-reach truck and on a 12 m radius visibility test circle. Performance requirements for visibility are specified in this document.

This document does not apply to

— trucks designed to handle freight containers (reach stackers),

— articulated telescopic wheel loaders,

— slewing trucks, or

— lorry mounted trucks.

NOTE The method used does not capture all of the aspects of the operator's visibility, but provides information to assist in determining the acceptability of visibility from the truck.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 5053-1, *Industrial trucks — Terminology and classification — Part 1: Types of industrial trucks*

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

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10896-1, ISO 5053-1 and ISO 12100 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

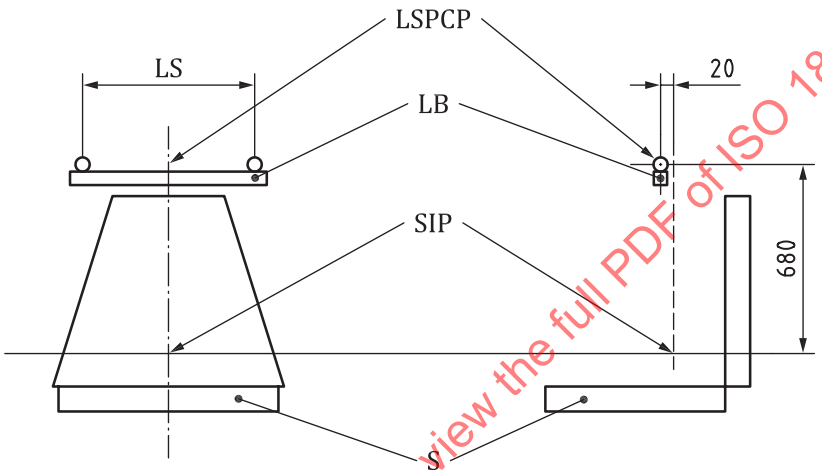
3.1
test surface
area of compacted earth or firm surface that forms the ground reference plane for the visibility measurements, with a gradient of (0 ± 2) %

3.2
light source position centre point
LSPCP
mid-point of the line between light sources, at 65 mm, 205 mm or 405 mm light source spacing, located 680 mm above and 20 mm in front of the seat index point (SIP)

Note 1 to entry: The seat index point is defined in ISO 5353, 3.1.

Note 2 to entry: See Figure 1.

Dimensions in millimetres



Key

LB	light bar
LS	light source spacing (see Annex A)
SIP	seat index point
S	seat
LSPCP	light source position centre point

Figure 1 — Light source apparatus

3.3
test truck boundary
TTB
smallest rectangular boundary that can be placed around the vertical projection of the truck

Note 1 to entry: Truck dimensions do not include equipment such as working lights, mirrors, etc.

Note 2 to entry: See Figure 4.

3.4 Visibility-test locations

3.4.1
visibility test circle
VTC
circle with 12 m radius located on the ground reference plane with its centre vertically below the *light source position centre point* (3.2), which is divided into six sectors of vision

Note 1 to entry: For the six sectors of vision, see 3.4.3 to 3.4.6.

Note 2 to entry: See Figure 2.

3.4.2
rectangular 1 m boundary
RB
line on the ground reference plane located at 1 m distance from the outside *test truck boundary* (3.3)

Note 1 to entry: See Figure 3 and Figure 4.

3.4.3
sector of vision A
segment of the *visibility test circle* (3.4.1) to the front of the truck, defined by a 9,5 m chord length for the 12 m radius that is perpendicular to the longitudinal plane passing through the *light source position centre point* (3.2) with the chord length bisected by the longitudinal plane

Note 1 to entry: See Figure 2.

3.4.4
sectors of vision B and C
segments of the *visibility test circle* (3.4.1) to the front of the truck outside *sector of vision A* (3.4.3) and bounded by the transverse plane through the *light source position centre point* (3.2)

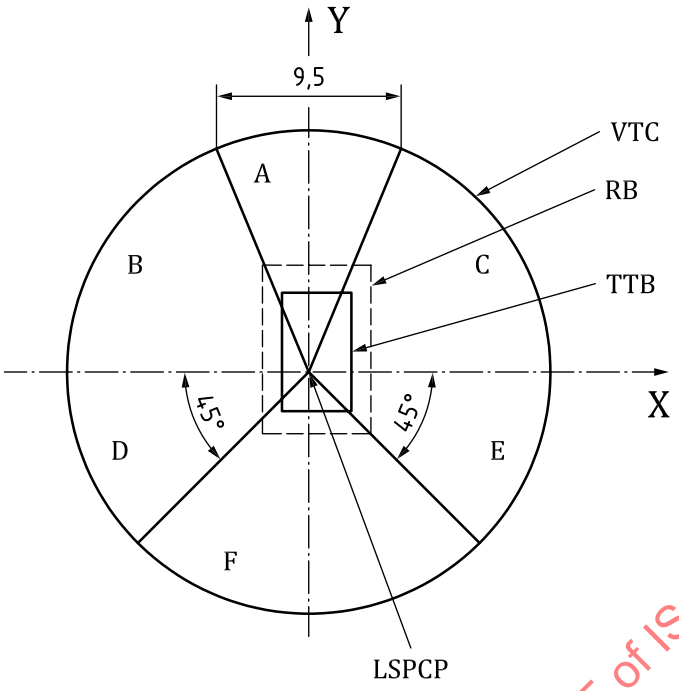
Note 1 to entry: See Figure 2.

3.4.5
sectors of vision D and E
segments of the *visibility test circle* (3.4.1) to the rear defined by an angle of 45° to both the right and left sides of the longitudinal plane passing through the *light source position centre point* (3.2)

Note 1 to entry: See Figure 2.

3.4.6
sector of vision F
segment of the *visibility test circle* (3.4.1) to the rear between *sectors of vision D and E* (3.4.5)

Note 1 to entry: See Figure 2.



Key

VTC	visibility test circle
LSPCP	light source position centre point
RB	rectangular 1 m boundary
TTB	test truck boundary
X	perpendicular to forward direction of the truck
Y	forward direction of the truck
A, B, C, D, E, F	sectors of vision

Figure 2 — Visibility test boundary

3.5
masking
shadow on the 12 m *visibility test circle* (3.4.1) or on the *rectangular 1 m boundary* (3.4.2) created because parts of the base truck and/or its equipment block the light rays from the light sources

3.6
light source apparatus
test unit with at least two light sources that have adjustable light spacing, 360° rotatable, with its rotation point at the *light source position centre point* (3.2) to simulate the range of eye positions for an operator

Note 1 to entry: See Figure 1.

3.7
light source spacing
distance between the vertical centre axis of the considered light sources

3.8
light bar
rigid support on which the light sources are fixed and aligned

3.9
visibility performance criteria
criteria intended to minimize risk to persons in the vicinity of the truck during truck operation

Note 1 to entry: These visibility performance criteria are specified as maximum allowed *maskings* (3.5) at the 12 m *visibility test circle* (3.4.1) or at the *rectangular 1 m boundary* (3.4.2).

3.10 Direct and indirect visibility

3.10.1
direct visibility
visibility by direct line of sight as determined by the light from the light source

3.10.2
indirect visibility
visibility with the aid of mirrors or other visual aids, such as closed circuit TV (CCTV)

Note 1 to entry: For more information, see Annex B.

3.11
derivative truck
truck modified or fitted with equipment and/or attachments which can affect visibility

3.12
vertical test object
object used to evaluate the *maskings* (3.5) on the *rectangular 1 m boundary* (3.4.2), considered to be two-dimensional, without depth

4 Test apparatus

4.1 Light source apparatus

The light source apparatus is capable of positioning a light bar horizontally with two light sources (halogen light bulbs, laser, LEDs or equivalent). Each light source shall be horizontally movable on the light bar from 32,5 mm up to 202,5 mm on each side of the light source position centre point. It shall be possible to rotate the light bar through 360° around the light source position centre point. The light source position centre point shall be located 680 mm above and 20 mm in front of the seat index point (SIP) as described in ISO 5353. See Figure 1.

4.2 Vertical test object

The vertical test object shall be 1,5 m high, 100 mm wide and be maintained substantially perpendicular to the test surface throughout the tests.

4.3 Observation mirror

To determine the maskings on the visibility test circle or the rectangular 1 m boundary, a hand-held mirror can be used to detect the line-of-sight between the light source and the ground reference plane or vertical test object. The observation mirror shall have a maximum size of 100 mm × 150 mm.

5 Truck test configuration

5.1 Equipment of the truck

The truck shall be equipped with standard fork arms and equipment according to the manufacturer's standard specification.

5.2 Openings

All truck openings, such as doors and windows, shall be closed.

5.3 Position of the truck and load handling attachment

The truck shall be positioned on the test surface according to Figure 2.

The boom shall be fully retracted and its height adjusted so that dimension A is respected with the upper face of the fork arms above and substantially parallel to the test surface. See Figure 3.

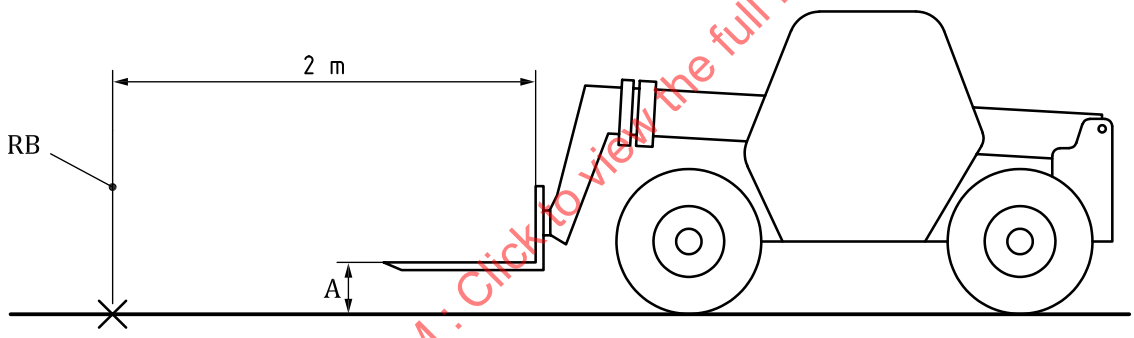
Where:

— A = 300 mm (±50 mm) for compact trucks;

— A = between 300 mm and 900 mm (±50 mm) for other trucks in the position to least affect visibility and stability (according to the manufacturers specification).

NOTE The use of a range between 300 mm and 900 mm for dimension A will allow trucks with different boom configurations to be tested in the manufacturer's recommended travel position. Trucks with a low-mounted boom will have the boom positioned towards the lower end of the range, allowing maximum visibility over the boom. Trucks with a high-mounted boom will have the boom positioned towards the higher end of the range, allowing maximum visibility under the boom.

A rearward tilt of the fork arms < 5° is acceptable.



Key

RB rectangular 1 m boundary

A height of fork arms above test surface

Figure 3 — Test — Boom position

6 Measurement procedure

6.1 Test-surface marking and truck location on the test surface

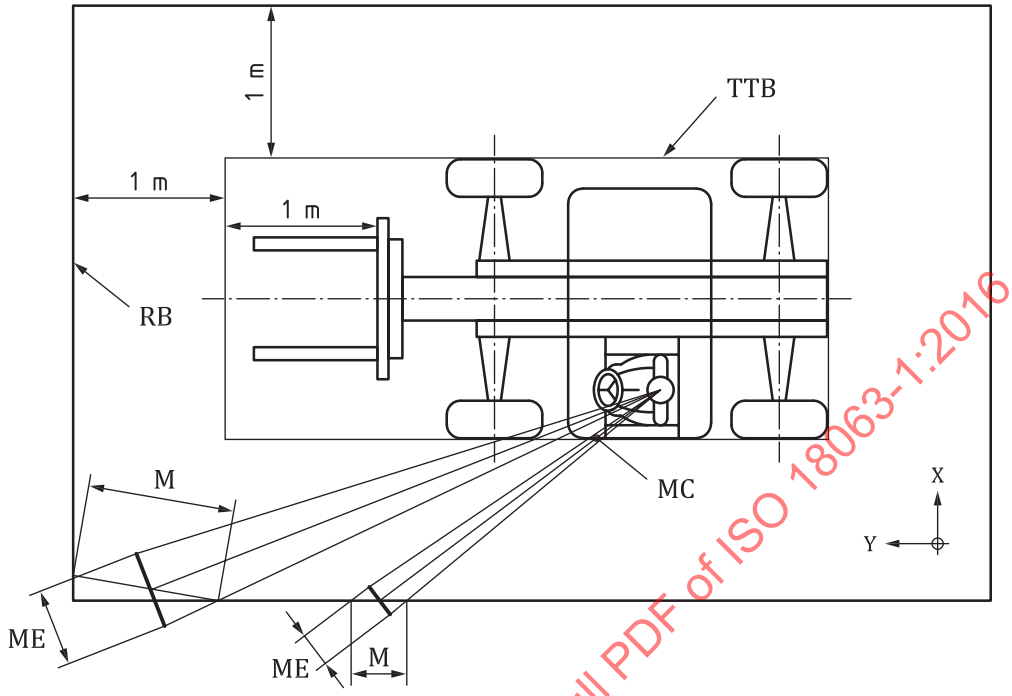
6.1.1 Mark a visibility test circle of 12 m radius on the test surface with the two centrelines as shown in Figure 2. Mark the centre point of the visibility test circle to enable accurate alignment of the truck (see 5.3).

6.1.2 Mark where the sectors of vision A, B, C, D, E and F intersect the line of the circle on the test surface as shown in Figure 2.

6.1.3 Position the truck and adjust the boom and fork arms as defined in 5.3.

6.1.4 Mark the test truck boundary (TTB), as shown in Figure 4.

6.1.5 Mark the rectangular 1 m boundary (RB) on the test surface at a distance of 1 m from the test truck boundary, as shown in Figure 4.



Key

TTB	test truck boundary
MC	masking component
M	masking
ME	masking effective length parallel to light source
RB	rectangular 1 m boundary

Figure 4 — Test truck boundary and rectangular 1 m boundary

6.2 Positioning of the test apparatus

6.2.1 Mount the light source apparatus with the LSPCP as described in 4.1.

6.2.2 Maskings shall be evaluated with respect to the relevant sector of vision in which the centre of the masking lies. To determine the sector of vision in which the masking lies, an initial masking (without increase above the surface) shall be determined with a single light source in the LSPCP. A straight line from the LSPCP to the centre of this initial masking shall be drawn. The sector of vision where this line crosses the VTC is the sector that determines the light source spacing and criteria defined in Tables 1 and 2.

Where:

— 65 mm, the light source spacing shall be symmetrical to the LSPCP;

— 205 mm, the light source spacing does not need to be symmetrical to the LSPCP, provided that each light source is less than or equal to 102,5 mm from the LSPCP;

— 405 mm, the light source spacing does not need to be symmetrical to the LSPCP, provided that each light source is less than or equal to 202,5 mm from the LSPCP.

For the purpose of evaluating the 205 and 405 mm light spacings, more than two light bulbs could be used simultaneously.

To take measurements, rotate the light bar so that the line between the two light sources is perpendicular to the line between the filament position centre point and the edge of the visibility masking component. This first point denotes the start of the masking. Continue to rotate the light bar to the next edge of the visibility masking component, i.e. where the masking ceases to occur. This second point denotes the end of the masking.

6.3 Measurements of the maskings

6.3.1 General

As a first step, all measurements shall be made considering the direct visibility.

As a second step, additional devices like mirrors or CCTV may be incorporated in the measurements to conform to the visibility performance criteria. If, when having incorporated additional devices, a direct visibility masking is broken into two or more parts, the remaining masking portions shall be re-evaluated with respect of the relevant sector of vision in which the centre of remaining masking lies. See 7.3.

For defining the indirect visibility for mirrors, use the same measurement procedure as for direct visibility to measure and record the reflection of the light source in the mirrors to the visibility test circle and the rectangular boundary. Use the same light source spacing as specified in 6.3.2 for the visibility test circle and in 6.3.3 for the rectangular 1 m boundary for the sectors of vision where the mirror is located.

Mirror systems requiring the use of one mirror to view another mirror will not be allowed (no “mirror to mirror” systems).

The measurements shall be made for the test configuration specified in 5.3.

Where an observation mirror is used to take measurements, the masking points on the visibility test circle and rectangular 1 m boundary shall be marked where the light source is cut off at the centre of the mirror.

NOTE The test can be carried out in a dark environment where the shadows of truck components can be directly noted on the visibility test circle or a mirror located on the test surface, or the vertical test object can be used to develop a line of sight to the light source to determine the points where a masking occurs.

6.3.2 Measurement at the visibility test circle

Adjust the light source spacing as specified in Table 1 for the relevant sector of vision. Position the light source as described in 6.2.2.

Record the masking at the visibility test circle, so that the cord length of the masking on the visibility test circle can be determined.

When a truck has two or more vertical components that are near each other, a light source spacing less than the maximum specified for the sector of vision may be used to determine the minimum maskings (see also 6.2.2).

The requirements for a minimum spacing between two adjacent maskings as specified in 7.1 shall be considered.

If a masking exists at the visibility test circle in any sector of vision, the measurements shall be recorded. A masking will also be considered meeting the criteria of Table 1, if it does so within a vertical distance of 950 mm from the test surface at the 12 m radius.

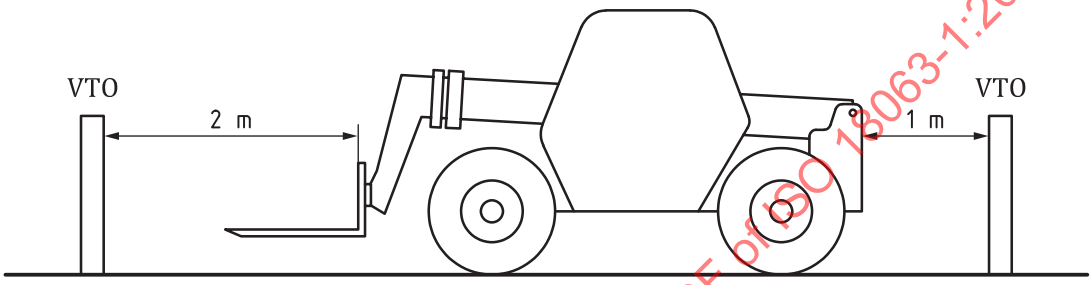
NOTE The 950 mm dimension is calculated from small operator dimensions in ISO 3411:2007, Figure 3, dimensions A, B, C and E.

Do not record a masking that has a width of less than 100 mm.

6.3.3 Measurement at the rectangular 1 m boundary

The measurement on the RB shall be made with light source spacing up to 405 mm perpendicular to the maskings for determination of the actual masking in the near field vision area. Use the vertical test object as specified in 4.2 and check along the rectangular boundary as illustrated in Figures 5 and 6. Mark on the rectangular boundary where the direct view to the light source is masked. Record the maskings with their *x* and *y* coordinate. If the masking width (M) exceeds 300 mm on the RB, measure the width ME (masking effective length) of the masking parallel to the light source (see Figure 4). Record ME as the width of the masking.

If the top of the vertical surface of the vertical test object is masked, then the vertical test object may be considered visible if the observation mirror (or equivalent) can direct the light source for a continuous 200 mm height of the vertical test object (see Figure 6).



Key

VTO vertical test object

Figure 5 — Measurement at the rectangular 1 m boundary

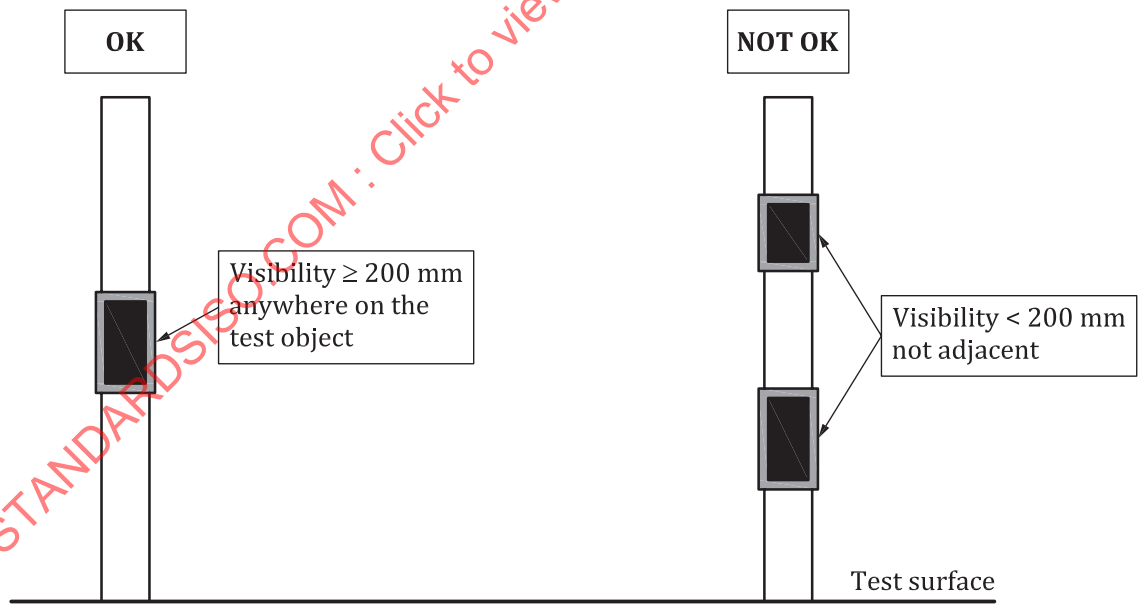


Figure 6 — Observation of the vertical test object

NOTE The visibility on the vertical test object below the 1,5 m height can be checked by the use of a mirror moved up and down the test object.

When a truck has two or more vertical components that are near each other, a light source spacing less than the maximum could be used to determine the minimum maskings (see also 6.2.2).

6.4 Requirements for derivative trucks

The impact on visibility created by attachments authorized by the manufacturer shall be assessed.

NOTE It is sufficient to measure the truck with the attachment that reduces the visibility the most, within the limits of the truck's intended use.

7 Evaluation method and performance criteria

7.1 Visibility performance criteria on the visibility test circle

The space between any two adjacent maskings on the visibility test circle shall be equal to or greater than 700 mm. If this is not the case, the two maskings and the space between them shall be combined to result in one reported masking.

The truck meets the requirements of this document if the measurement results show no maskings or maskings smaller than or equal to the performance criteria as specified in Table 1.

7.2 Visibility performance criteria for the rectangular 1 m boundary

The truck meets the requirements of this document if the measurement results show no maskings or maskings smaller than or equal to the performance criteria as shown in Table 2.

7.3 Visibility maskings that exceed the visibility performance criteria with direct view

If the direct view does not conform to the performance criteria specified in 7.1 for the visibility test circle and in 7.2 for the rectangular 1 m boundary, additional visual aids shall be provided (e.g. mirrors, CCTV).

If CCTV is provided, the visibility performance criteria shall be verified through visual confirmation of the CCTV screen.

The truck meets the requirements of this document if the visibility with the additional devices conforms to the performance criteria in Table 1, Table 2, 7.1 and 7.2.

8 Calculation method and computer simulation

Calculation or computer simulation based on the requirements specified in this document may be used to determine the visibility masking and provide results for the test report. Annex C gives an example of a calculation method for symmetrical eye spacing.

9 Test report

9.1 Truck details

The test report shall include the following information:

a) the business name and full address of the manufacturer and, where applicable, their authorized representative;

b) the designation of the truck (including the type of truck considered: compact, other);

c) the model identification and serial number;

d) the equipment installed on the truck (e.g. CCTV, mirrors);

e) any other information that affects the visibility measurements;

f) the pictures (or illustration) of the truck configuration for the visibility test;

g) the record of the position dimension(s) of the equipment in its tested positions.

9.2 Drawing

A drawing shall illustrate the test results including the maskings (dimensions in millimetres) on the visibility test circle by the designated visibility sector with the specific light source spacing (see Annex D). The distance between maskings and their positions shall be provided. Also, the maskings at the rectangular 1 m boundary line shall be provided.

10 Information for use

The instructions shall contain the following as a way to minimize visibility hazards:

a) recommendation that the operator surveys his or her field of vision when operating the truck;

b) recommendation that the operator positions the boom and attachments in the position to least affect visibility and stability;

c) information regarding the position, setting, use and maintenance of mirrors or visual aids (CCTV), when provided;

d) information that if any of the mirrors or visual aids (CCTV) are damaged or not working, the truck is not to be used until repaired;

e) information that modifications of the truck may affect the operator's visibility.

Table 1 — Visibility performance criteria on visibility test circle

Dimensions in millimetres

Test configuration: Position of the truck and load handling attachment per 5.3	**Sector of vision**					
	A	**B**	**C**	**D**	**E**	**F**
Compact trucks	405 1–1 500	405 0	405 1–1 850	205 1–700 and 1–1 300	205 1–700 and 1–1 300	65 (1–700 and 1–1 300) or (1–2 000) or (3–700)
Other trucks	405 1–1 500	405 0	405 1–1 300	205 1–700 and 1–1 300	205 1–700 and 1–1 300	65 (1–700 and 1–1 300) or (1–2 000) or (3–700)

NOTE The first line of each row of Table 1 defines the light source spacing for the relevant sector of vision. The remaining lines define the number and maximum size of masking(s) permitted for that sector of vision.

For example:

65 (1–700 and 1–1 300)

Defines a light source spacing for the sector of vision of 65 mm and permits two maskings; one of a maximum size of up to 700 mm and a second of up to 1 300 mm.

Table 2 — Visibility performance criteria on rectangular 1 m boundary

Test configuration: Position of the truck and load handling attachment per 5.3	**Sector of vision**					
	A	**B**	**C**	**D**	**E**	**F**
All trucks	405 mm light source spacing No masking more than 500 mm Only one masking greater than 300 mm and up to 500 mm shall be allowed and, in this case, the result shall be reported in the information for use.	405 mm light source spacing No masking more than 300 mm A gap of minimum 300 mm is required between two maskings				

Annex A
(informative)

Light source spacing dimensions

The light source spacings are derived from the following operator physical characteristics:

— 65 mm, the light source spacing that represents the binocular eye spacing of 50 % seated operators as described in ISO 3411;

— 205 mm, the light source spacing that represents the range of eye movement (considering body torso and head movement) of 50 % of operators as described in ISO 3411 when looking to a 45° angle to the rear (135° clockwise or anti-clockwise from straight ahead position);

— 405 mm, the light source spacing that represents the range of eye movement (considering body torso and head movement) of 50 % operators as described in ISO 3411 when looking to the front (90° clockwise and anti-clockwise from the straight ahead position).