INTERNATIONAL STANDARD

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Second edition
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Earth-moving machinery — Field of vision of surveillance and rear-view mirrors —

Part 2: **Performance criteria**

Engins de terrassement — Champ de visibilité des rétroviseurs et des miroirs de surveillance —

Partie 2: Critères de performance

Reference number
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Foreword

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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 14401-2 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 1, *Test methods relating to safety and machine performance*.

This second edition cancels and replaces the first edition (ISO 14401-2:2004), which has been technically revised.

ISO 14401 consists of the following parts, under the general title *Earth-moving machinery — Field of vision of surveillance and rear-view mirrors*:

— *Part 1: Test methods*

— *Part 2: Performance criteria*

Introduction

This part of ISO 14401 gives performance criteria for surveillance and rear-view mirrors fitted to certain earth-moving machinery. The field of vision described is intended to define the minimum visibility area behind the machine in order to provide adequate visibility for the operator when working around other moving machines — during operation in a forward/reverse mode or during transport on roadways with other traffic.

As specified in ISO 5006, mirrors may also be fitted on earth-moving equipment to help meet the visibility performance requirements of ISO 5006 when those requirements cannot be met by direct visibility alone. The testing procedures for mirrors in ISO 14401-1 and in ISO 5006 have been aligned to allow a mirror to fulfil the requirements of both ISO 5006 and this part of ISO 14401.

Mirrors can also be fitted for the purpose of compliance with national or local regulations, e.g. on-road requirements.

Earth-moving machinery — Field of vision of surveillance and rear-view mirrors —

Part 2: Performance criteria

1 Scope

This part of ISO 14401 specifies criteria for the field-of-vision performance of surveillance and rear-view mirrors on earth-moving machinery. It is applicable to the ride-on machines of the machine families and sizes listed herein (see Annex A), used both on and off public roads.

NOTE 1 For machines not listed in Annex A, the criteria of similar machine types and/or sizes can be used as guidance for the fitting of optional mirrors to these machines.

NOTE 2 Additional national road regulations can apply for machines travelling on public roads.

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, *Earth-moving machinery — Physical dimensions of operators and minimum operator space envelope*

ISO 5006:2006, *Earth-moving machinery — Operator's field of view — Test method and performance criteria*

ISO 6016, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*

ISO 6165, *Earth-moving machinery — Basic types — Identification and terms and definitions*

ISO 14401-1, *Earth-moving machinery — Field of vision of surveillance and rear-view mirrors — Part 1: Test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14401-1 apply.

4 Classification of fields of vision

The fields of vision are classified as follows.

Class A: field of vision as specified in 5.4.2 and shown in Figure 1.

Class B: field of vision as specified in 5.4.3 and shown in Figure 2.

Class C: field of vision as specified in 5.4.4 and shown in Figure 3.

Class D: field of vision as specified in 5.4.5 and shown in Figure 4.

5 Requirements

5.1 General

Mirrors and their mounting shall meet the following requirements.

a) Earth-moving machinery according to Annex A shall be equipped as appropriate with a mirror or mirrors conforming to the corresponding field of vision class(es).

b) Mirrors shall be installed so as to minimize the effect of vibration during conditions of intended use as specified by the manufacturer.

c) Part or parts of the rear end, left and right of the machine, shall be visible to the operator by means of a mirror or mirrors.

Alternatively, closed circuit television cameras (CCTV) may be used to achieve the required fields of vision.

5.2 Mirror positions

The following is applicable.

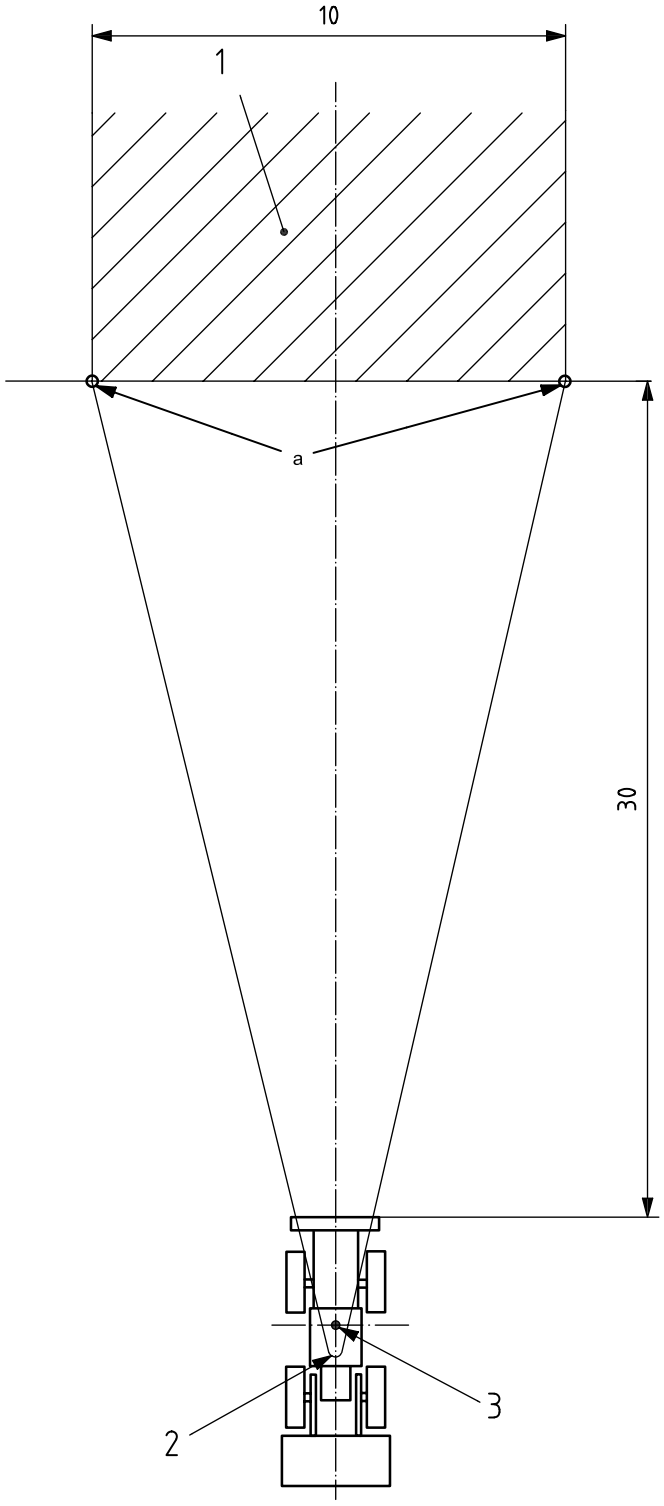
a) If equipped with a cab, exterior rear-view mirrors shall be visible through the portion of the windscreen that is swept by the windscreen wiper or through the side windows.

   If equipped with a canopy, exterior rear-view mirrors shall be visible through openings in the canopy.

b) A rear-view mirror should not project laterally beyond the outer contour of the machine by more than is necessary to obtain the field of vision specified in 5.4. For machines intended to be used on the road, mirrors that project laterally by more than 0,20 m from the machine (and installed more than 2 m above ground level) shall be of the foldable type so that they can easily be put back in position if knocked out of alignment.

c) Where the bottom edge of an exterior rear-view mirror is less than 2 m above ground level, the mirror shall not project more than 0,3 m beyond the overall width of the machine.

Dimensions in metres



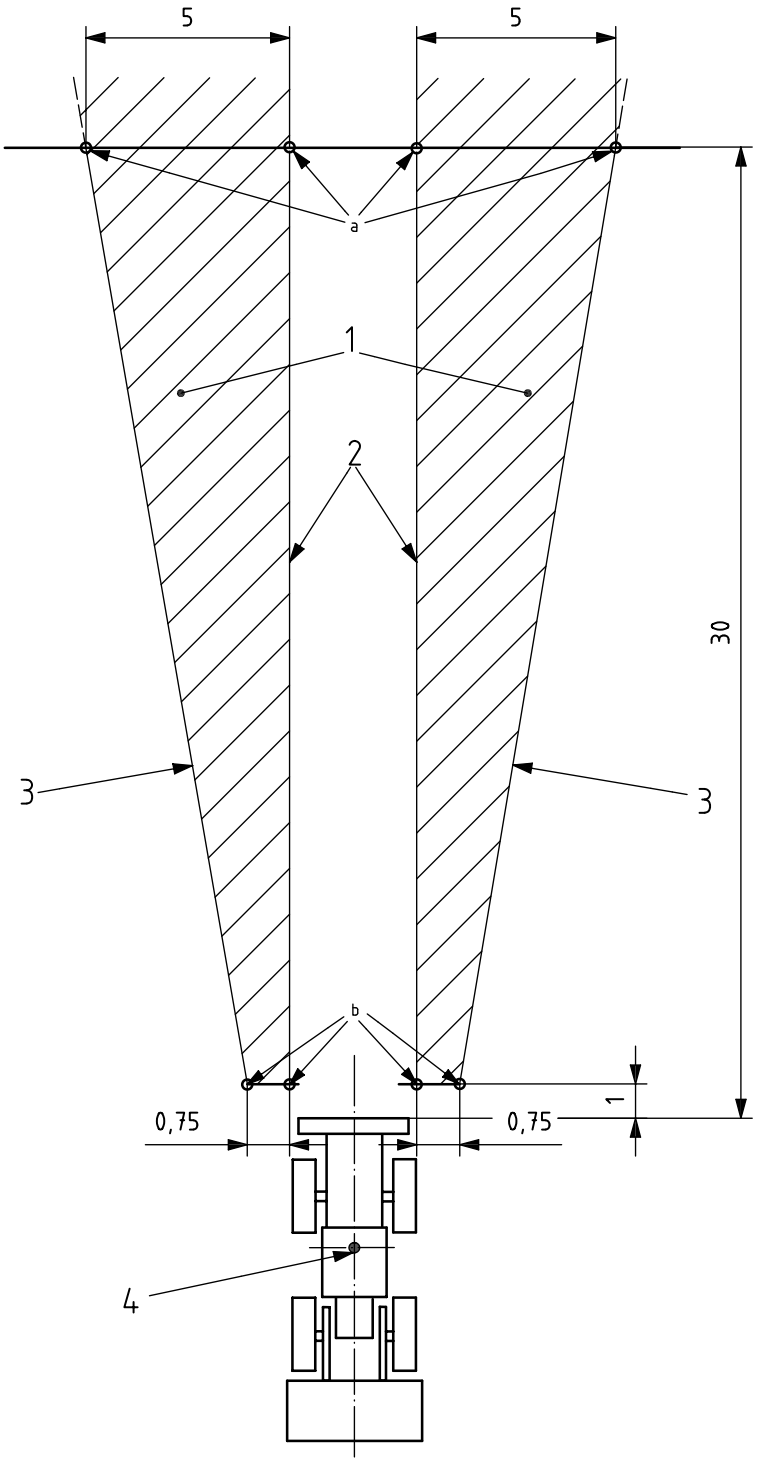
Key

1 field of vision
2 rear-view mirror
3 filament position centre-point (FPCP)

a Measurement at ground level.

Figure 1 — Field of vision — Class A

Dimensions in metres



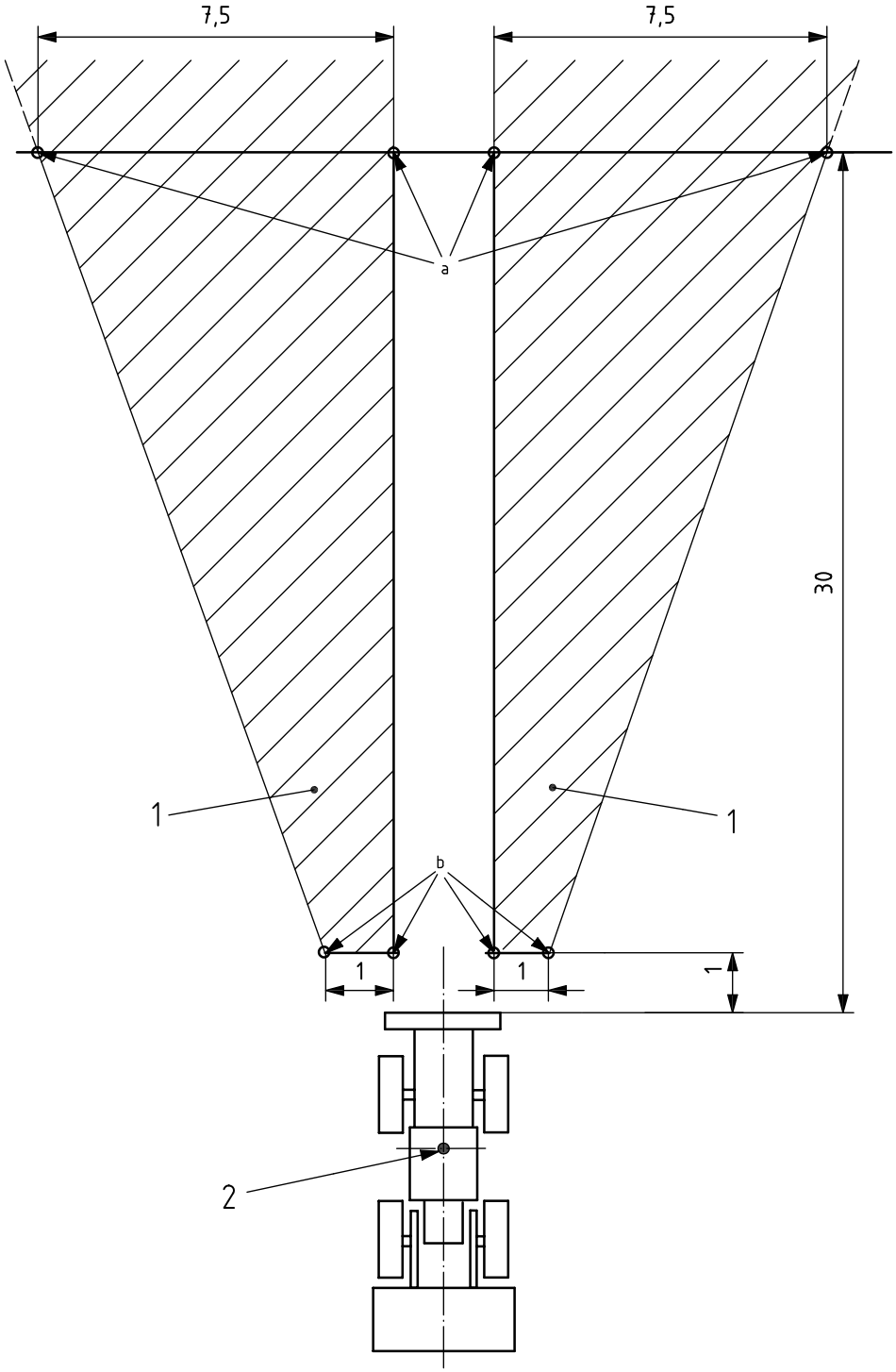
Key

1 field of vision
2 inner borderline
3 outer borderline
4 filament position centre-point (FPCP)

a Measurement at ground level.
b Measurement at 1,5 m above ground level.

Figure 2 — Field of vision — Class B

Dimensions in metres



Key

1 field of vision

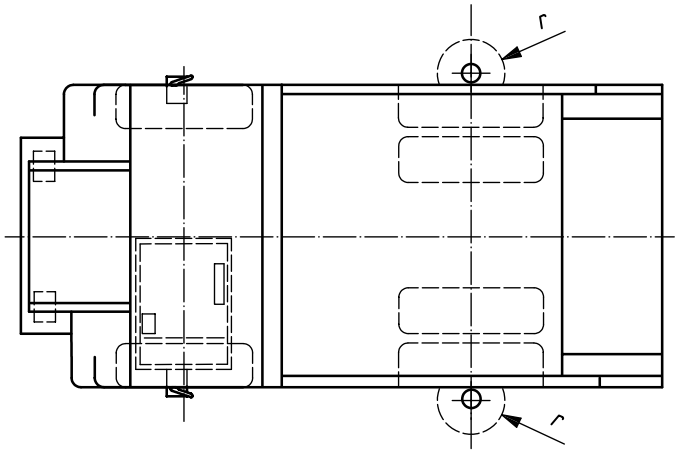
2 filament position centre-point (FPCP)

a Measurement at ground level.

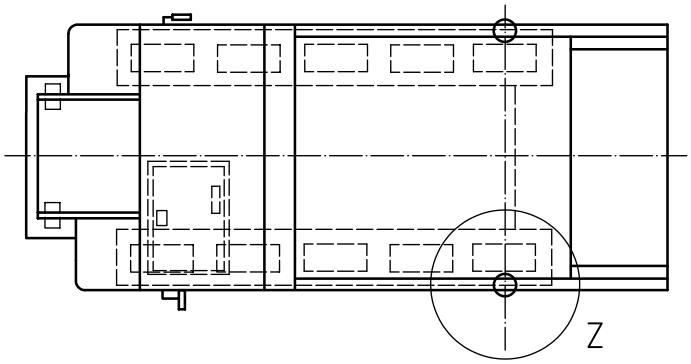
b Measurement at 1,5 m above ground level.

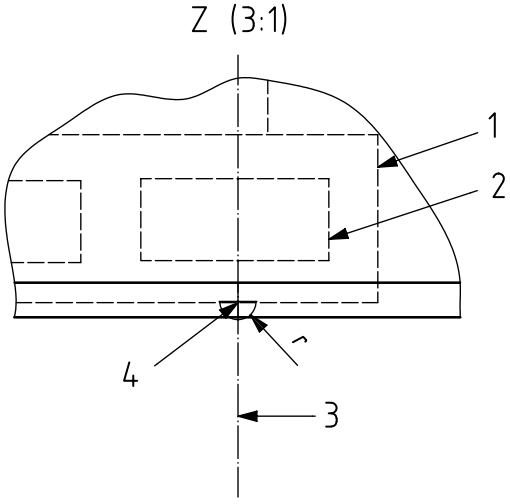
Figure 3 — Field of vision — Class C

Dimensions in millimetres



a) Wheeled dumpers





b) Crawler dumpers

Key

r radius (= 100 mm)
1 track
2 rearmost sprocket or idler
3 centreline of rearmost sprocket or idler
4 outermost ground contact point of track

Figure 4 — Field of vision — Class D

5.3 Adjustment

Mirrors shall be adjustable as follows:

a) interior rear-view mirrors shall be adjustable by the operator;

b) the adjustment of an exterior mounted mirror shall be accomplished either from the operator's station, the ground, from steps or platforms attached to the machine, or from auxiliary platforms:

   — the adjusting mechanism shall retain the mirror position during machine operation;

   — folding-type mirror installations shall return to their prior adjustment position when unfolded.

5.4 Fields of vision

5.4.1 General

The field of vision shall be determined with the machine test configuration specified in ISO 14401-1. For the evaluation of compliance with the performance criteria given in Annex A, measurements need only be made at the measuring locations specified in Figures 1 to 4.

NOTE Additional measurements closer to the machine could be required to determine the suitability of the mirror(s) meeting the requirements for the appropriate field of vision class, for the purpose of meeting the visibility performance requirements of ISO 5006.

5.4.2 Class A

The field of vision at ground level shall be such that the operator can see, using the mirror(s), at least a 10 m wide, flat and horizontal portion of the ground, centred on the vertical longitudinal median plane of the machine, from 30 m behind the rear end of the machine (see Figure 1).

5.4.3 Class B

The field of vision shall be such that the operator can see, using the mirror(s), at least a flat portion bounded on the left and right of the machine by a plane parallel to the median longitudinal axis of the machine, passing through the outermost point of the machine's overall width. This plane shall start 1 m behind the rear end of the machine at a height of 1,5 m above ground level and at a width of 0,75 m, continuing to a width of 5 m at ground level 30 m behind the machine (see Figure 2).

5.4.4 Class C

The field of vision shall be such that the operator can see, using the mirror(s), at least a flat portion bounded on the left and on the right of the machine by a plane parallel to the median longitudinal vertical plane passing through the outermost point of the machine on the right and left. This plane shall start 1 m behind the rear end of the machine at a height 1,5 m above ground level and at a width of 1 m, continuing to a width of 7,5 m at ground level 30 m behind the machine (see Figure 3).

5.4.5 Class D — Dumpers

For wheeled dumpers, the field of vision at ground level shall be such that the operator can see, using the mirror(s), at least the outer ground contact point (within a radius of 100 mm) of the rear tyres on the left and right of the machine [see Figure 4 a)].

For crawler dumpers, the field of vision at ground level shall be such that the operator can see, using the mirror(s), at least the ground projection (within a radius of 100 mm) of the outermost points of the tracks at the centre lines of the rearmost sprockets or idlers on the left and right of the machine [see Figure 4 b)].

5.4.6 Number of mirrors

A combination of interior and exterior mirrors may be used to provide the fields of vision specified in 5.4.2 to 5.4.5.

6 Visibility information in operator's instructions

The machine operator’s instructions shall contain the following, so that the operator can minimize visibility hazards when operating the machine:

— information regarding the positioning and use of mirrors;

— information to the effect that modifications of the machine configuration by the user of the machine that will result in a restriction of machine visibility must be verified according to this part of ISO 14401.

Annex A
(normative)

Surveillance and rear-view mirrors — Field of vision

Mirrors for field of vision class A are not applicable to machines without cab, ROPS or canopy, but shall be covered by the mirrors used, for example, for class B or C.

Applicability shall be in accordance with Table A.1.

Table A.1 — Minimum mirror field-of-vision requirements for different machine families

Machine family according to ISO 6165 **Operating mass according to ISO 6016**	**Field of vision class(es)** (see Clause 4)
Crawler dozers < 18 000 kg	A
Wheel dozers < 30 000 kg	A [a], B
Crawler loaders < 30 000 kg	A
Wheel loaders [b] > 4 500 kg ⩽ 30 000 kg	A [a], B
Compact loaders [b]	A [c] or B [a]
Backhoe loaders < 15 000 kg	B
Wheeled excavators < 25 000 kg	B [d, e]
Dumpers < 50 000 kg	C and D
Articulated dumpers < 50 000 kg	C and D
Graders ⩽ 15 000 kg	A [a], B
Rollers < 25 000 kg	A [a], B

[a] Provided as optional mirror(s), but can be required by national road regulations.

[b] Excluding skid steer loaders.

[c] If the criteria cannot be fulfilled, class B is required.

[d] At boom side with boom in transport position for road travelling as specified by the manufacturer.

[e] Field of vision covered by mirrors on wheeled excavators at boom side is limited to the boom in travelling position only and may be blocked in any other boom position during operation.

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