BRITISH STANDARD

BS ISO
14401-1:2009

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

## Part 1: Test methods

ICS 53.100



BSI
British Standards

# National foreword

This British Standard is the UK implementation of ISO 14401-1:2009. It supersedes BS ISO 14401-1:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/513/1, Earth moving machinery (International).

A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL STANDARD

**ISO 14401-1**

Second edition
2009-08-15

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

## Part 1: Test methods

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

*Partie 1: Méthodes d'essai*

Reference number
ISO 14401-1:2009(E)

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# Foreword

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ISO 14401-1 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 14401-1:2004), 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 provides test methods for evaluating the field of vision from surveillance and rear-view mirrors fitted to certain earth-moving machinery.

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 this part of ISO 14401 and in ISO 5006 have been aligned to allow a mirror to fulfil the requirements of both ISO 5006 and ISO 14401-2.

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

**INTERNATIONAL STANDARD** **ISO 14401-1:2009(E)**

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

# Part 1: Test methods

## 1 Scope

This part of ISO 14401 specifies a static test method for determining the field of vision provided by surveillance and rear-view mirrors fitted to earth-moving machinery as defined in ISO 6165.

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

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 14401-2:2009, *Earth-moving machinery — Field of vision of surveillance and rear-view mirrors — Part 2: Performance criteria*

## 3 Terms and definitions

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

**3.1**
**65 mm light spacing**
space between light bulb filaments representing the binocular eye spacing of 50 % of seated earth-moving operators according to ISO 3411

**3.2**
**205 mm light spacing**
space between light bulb filaments representing the eye spacing that can be achieved by 50 % of seated earth-moving machinery operators according to ISO 3411, considering the restrictions on the operator when body torso and both body torso and head are moved from side to side to view an angle of up to 45° to the rear on each side of the operator

**3.3**
**405 mm light spacing**
space between light bulb filaments representing the eye spacing that can be achieved by 50 % of seated earth-moving machinery operators according to ISO 3411, considering that the operator has good capability of moving the upright body torso and head when viewing to the front

**3.4**
**test surface**
area of a substantially level, compacted-earth or paved surface that is the ground reference plane (GRP) for measuring field of vision, having a rectangular area of length of at least 31 m plus machine length by width of 16 m plus machine width

See Figure 1.

**3.5**
**filament position centre-point**
**FPCP**
mid-point of the line between light bulb filaments, at 65 mm, 205 mm or 405 mm light spacing, located 680 mm above and 20 mm in front of the seat index point (SIP) as defined in ISO 5353

See ISO 5006:2006, Figure 1.

NOTE Adapted from ISO 5006:2006, definition 3.2.

**3.6**
**field of vision**
area which can be seen from the operator's position by indirect view through the surveillance and rear-view mirrors

**3.7**
**rear-view mirror**
device which provides a field of vision to the rear and to the side of the machine

**3.7.1**
**interior rear-view mirror**
mirror(s) located in the operator station (enclosure or canopy)

**3.7.2**
**exterior rear-view mirror**
mirror(s) located outside the operator station (enclosure or canopy)

**3.8**
**surveillance mirror**
mirror(s) located inside or outside the operator station (enclosure or canopy) providing a field of vision to a specific area

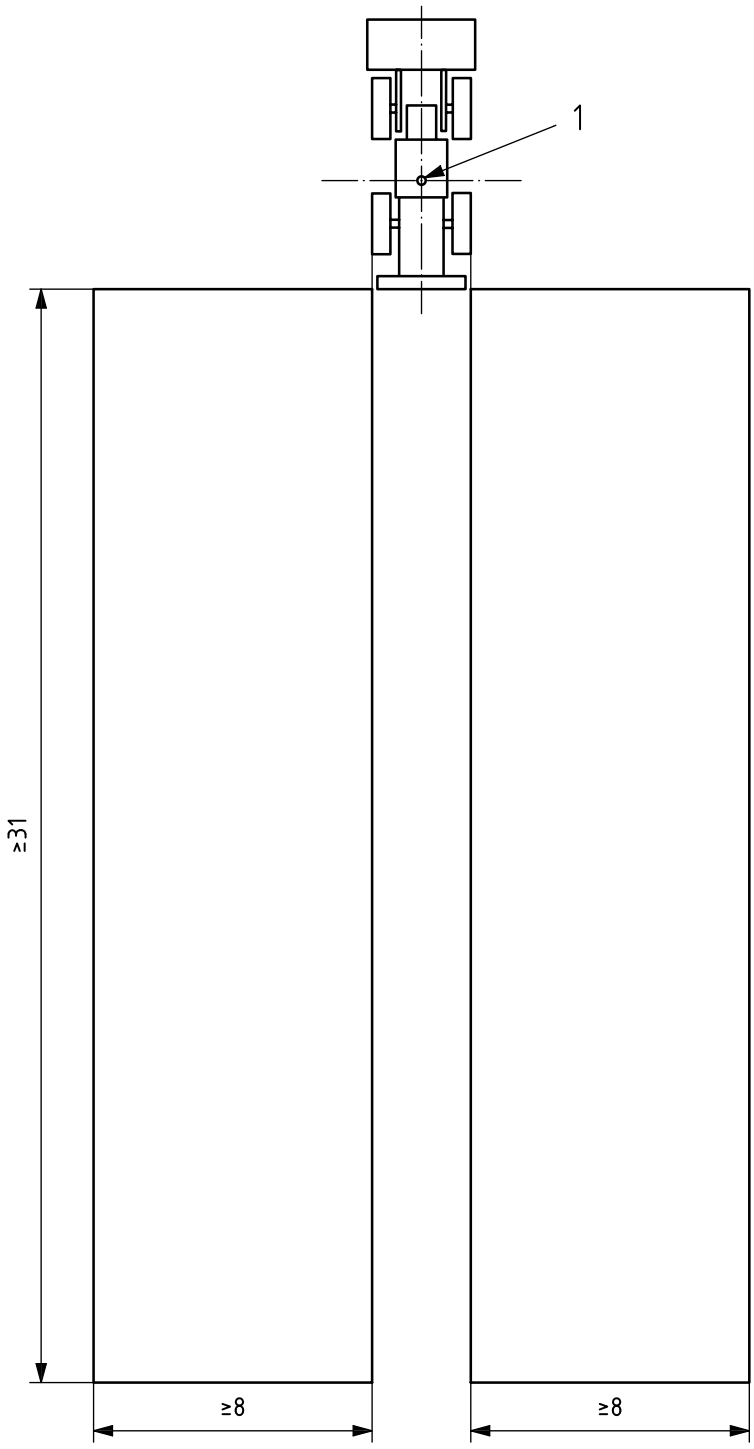
## 4 Test apparatus

**4.1 Light source**, apparatus capable of positioning a light bar having two halogen light bulbs (or equivalent) with the bulbs mounted vertically. Each light bulb should be horizontally movable on the light bar from 32,5 mm up to 202,5 mm, with one on each side of the filament position centre-point (FPCP). It shall be possible to rotate the light bar through 360° about the FPCP.

**4.2 Test surface** having a gradient of not more than 3 % in any direction.

**4.3 Hand-held test mirror**, which may be used to view the light source reflection from the surveillance and rear-view mirror(s) and the field of vision. Other apparatus giving equivalent results are permitted.

Dimensions in metres




**Key**

1 filament position centre-point (FPCP)

**Figure 1 — Test surface and machine positioning**

## 5 Machine test configuration

**5.1** The machine shall be equipped with attachment(s) and equipment according to the manufacturer's specification for operation on work sites and/or for travelling on public roads. The worst-case machine configuration shall be used in respect of visibility to and through the mirrors.

**5.2** All machine openings, such as doors and windows, shall be closed.

**5.3** The machine shall be positioned on the test surface with the equipment and attachments located in the travel mode according to the manufacturer's specification — see ISO 5006:2006, Annex A, for examples. The machine shall be positioned on the test surface such that there is an unobstructed view of at least 31 m to the rear of the machine and 8 m on either side of the machine (see Figure 1).

**5.4** The machine shall be equipped with the specified mirrors.

## 6 Performance criteria for mirrors

Rear-view mirrors for field-of-vision classes A, B and C in accordance with ISO 14401-2 shall have a minimum convex radius of curvature of 1 000 mm. For field-of-vision class C, a rear-view mirror having a minimum convex radius of curvature of 300 mm may additionally be used.

For machines with a maximum level travel speed of less than 40 km/h [1)], surveillance mirrors, if fitted, should have a minimum convex radius of curvature in accordance with Table 1.

For machines with a maximum level travel speed greater than or equal to 40 km/h[1)], surveillance mirrors, if fitted, shall have a minimum convex radius of curvature in accordance with Table 1.

NOTE Further research is anticipated on the relationship between the radius of curvature and viewing distance for an earth-moving machine in its intended application.

**Table 1 — Mirror distance and minimum convex radius of curvature**

| Mirror distance from FPCP<br>m | Minimum convex radius of curvature<br>mm |
|---|---|
| < 2,5 | 200 |
| < 3,5 | 300 |
| < 5 | 400 |

## 7 Measurement and evaluation procedure

### 7.1 Test surface marking and machine location on test surface

**7.1.1** Position the machine on the test surface in accordance with 5.3.

**7.1.2** For the assessment of the field of vision in accordance with ISO 14401-2, mark the minimum requirements for the field of vision as specified in ISO 14401-2:2009, Clause 4 and Annex A (measuring locations).

1) See ISO 6014, *Earth-moving machinery — Determination of ground speed.*

### 7.2 Positioning of the test apparatus

**7.2.1** Mount the light source with its FPCP in accordance with 4.1.

**7.2.2** For rear-view mirrors, e.g. field-of-vision classes A, B or C (see ISO 14401-2), an up to 205 mm light spacing is permissible.

For surveillance mirrors, e.g. field-of-vision class D (see ISO 14401-2), an up to 405 mm light spacing is permissible.

NOTE The left and right light bulbs can each be positioned so that the measurement provides a maximum field of vision. During this procedure, they do not have to be symmetric to the FPCP as long as the maximum distance from the FPCP is 102,5 mm or 202,5 mm, as appropriate.

**7.2.3** To take measurements, rotate the light bar so that the line between the two light bulbs is perpendicular to the line between the FPCP and the centre of the mirror.

### 7.3 Measurement of field of vision

**7.3.1** The light source reflection from the mirror(s) fitted onto the machine defines the field of vision of the mirror(s). A hand-held test mirror can be used to recognize the light source reflection at the field of vision measuring locations. The reflection in the hand-held test mirror shall be measured as close as possible at the ground level or at other heights as specified in ISO 14401-2.

**7.3.2** For the assessment of the field of vision with respect to ISO 14401-2:

— adjust the mirror(s) so that measuring locations close to the machine can be verified using the hand-held mirror;

— without readjusting the mirrors, verify that, at the field of vision marked on the test surface according to 7.1.2, there is light source reflectance (see 5.4) from at least one of the light bulbs.

**7.3.3** In all cases, mark and record the limits where light from at least one of the light bulbs can be seen on the test surface.

**7.3.4** This measurement procedure may be used for assessing the field of vision of other mirrors fitted to the machine, i.e. surveillance mirrors fitted to overcome direct visibility maskings identified during the tests according to ISO 5006.

NOTE The test can be carried out in a dark environment where the outer and inner borderlines of the field of vision at the ground level can be directly determined.

## 8 Calculation and computer simulation procedure

The measurement procedure described in Clause 7 may be simulated using mathematical techniques to calculate the field of vision.

## 9 Test report

### 9.1 Machine details

The test report shall include the following information:

— manufacturer;

— model;

— operating mass as defined in ISO 6016;

— product identification number;

— operator enclosure and/or protective structure description or identification;

— equipment installed on the machine;

— mirror types, sizes, radius of curvature and locations;

— any other information which affects the visibility measurements;

— pictures or illustrations.

### 9.2 Drawing

The test report shall include a drawing illustrating the measured field of vision.

**ICS 53.100**
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