BS ISO 5721-1:2013

BSI Standards Publication

Agricultural tractors — Requirements, test procedures and acceptance criteria for the operator's field of vision

Part 1: Field of vision to the front

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National foreword

This British Standard is the UK implementation of ISO 5721-1:2013. Together with BS ISO 5721-2, it supersedes BS ISO 5721:1989, which will be withdrawn upon publication of BS ISO 5721-2.

The UK participation in its preparation was entrusted to Technical Committee AGE/6, Agricultural tractors and forestry machinery.

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

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Agricultural tractors — Requirements, test procedures and acceptance criteria for the operator's field of vision —

Part 1: Field of vision to the front

Tracteurs agricoles — Exigences, modes opératoires d'essai et critères d'acceptation relatifs au champ de visibilité du conducteur —

Partie 1: Champ de visibilité vers l'avant

Reference number
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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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Contents

Page

Foreword

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The committee responsible for this document is ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 4, *Tractors*.

This first edition of ISO 5721-1, together with ISO 5721-2, cancels and replaces ISO 5721:1989, which has been technically revised.

ISO 5721 consists of the following parts, under the general title *Agricultural tractors — Requirements, test procedures and acceptance criteria for the operator's field of vision*:

— *Part 1: Field of vision to the front*

— *Part 2: Field of vision to the side and to the rear*

INTERNATIONAL STANDARD ISO 5721-1:2013(E)

Agricultural tractors — Requirements, test procedures and acceptance criteria for the operator's field of vision —

Part 1: Field of vision to the front

1 Scope

This part of ISO 5721 specifies the requirements, test procedures and acceptance criteria for the field of vision to the front of the operator of agricultural tractors.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5353:1995, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

3 Terms and definitions

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

3.1
field of vision
area which can be viewed from the seated operators eye position

3.1.1
direct field of vision
visibility by direct line of sight as determined by the light from the light source

3.1.2
indirect field of vision
visibility with the aid of mirrors or with other visual aids such as closed circuit television cameras (CCTV)

3.2
semi-circle of vision to the front
semi-circle described by a radius of 12 m about a point situated in the horizontal plane of the road vertically below the reference point, in such a way that, when facing the direction of motion, the arc of the semi-circle lies in front of the tractor, while the diameter bounding the semi-circle is at right angles to the longitudinal axis of the tractor

Note 1 to entry: See Figure 2.

3.3
angle of vision upwards
angle of vision limited downwards by a horizontal plane passing through the eye position and upwards by planes containing the rays of vision from the eye position to points of obscuration caused by vehicle components other than those which cause *masking effects* (3.4)

3.4
masking effects
chords of the sectors of the semi-circle of vision to the front which cannot be seen owing to structural components such as roof-pillars, air intakes or exhaust stacks and the frame of the windscreen

3.5
sector of vision to the front
<at the top> part of the field of vision limited by a horizontal plane passing through the reference point

3.6
sector of vision to the front
<in the plane of the road> part of the field of vision limited by the zone lying outside the semi-circle of vision to the front, and forming the continuation of the sector of the semi-circle of vision to the front, the chord of which is 9,50 m long, perpendicular to the plane parallel to the longitudinal median plane of the tractor passing through the centre of the driver's seat and bisected by that plane

3.7
swept area of the windscreen wipers
area of the outer surface of the windscreen swept by the windscreen wipers

3.8
reference point
position on the ground vertically below the eye position

4 General provisions for testing

4.1 Measurement accuracy

The equipment and techniques used to make the physical measurements shall be accurate to within ± 2 % of the value measured.

4.2 Eye position

The eye position shall be located 680 mm above and 20 mm in front of the seat index point when determined in accordance with ISO 5353 (see Figure 1).

5 Requirements, test procedures and acceptance criteria

5.1 Requirements

5.1.1 General

The tractor shall be constructed and equipped in such a way that, in road traffic and in farm use, the driver has an adequate field of vision, under all the usual conditions pertaining to highway use and to work undertaken in fields. The field of vision is adequate when the driver has at least a partial view of each front tyre or fender when in the straight ahead position and at track width appropriate for the overall width of single tyres not to exceed 2,55 m.

5.1.2 Masking effects

Masking effects shall not exceed 700 mm.

Masking effects due to adjacent structural components over 80 mm in width shall be so configured that there is an interval of not less than 2 200 mm - measured as a chord of the semi-circle of vision to the front - between the centres of two masking effects.

There shall be no more than six masking effects in the semi-circle of vision to the front and no more than two inside the sector of vision to the front defined in 3.5.

For the purpose of determining the masking effects in the sector of vision to the front, the masking effects due to the frame of the windscreen and to any other obstacle may be considered as a single effect, provided that the distance between the outermost points of this masking effect does not exceed 700 mm.

Outside the sector of vision to the front, masking effects exceeding 700 mm but not exceeding 1 500 mm are, however, permissible if the components causing them cannot be redesigned or relocated: on each side there may be a total of either two such masking effects, one not exceeding 700 mm and the other not exceeding 1 500 mm, or two such masking effects, neither exceeding 1 200 mm.

5.1.3 Blind spots

Blind spots caused by rear-view mirrors shall be disregarded if the design of these mirrors is such that they cannot be installed in any other way.

5.1.4 Windscreen wipers

Tractors fitted with windscreens shall be equipped with power-driven windscreen wipers and the area swept by these wipers shall ensure an unobstructed forward view corresponding to a chord of the semi-circle of vision to the front at least 8 m long within the sector of vision to the front.

The rate of operation of the windscreen wipers shall have at least one setting that provides a minimum of 20 cycles per minute.

5.1.5 Equivalent requirements

The requirements of ISO 5006:2006 are considered equivalent for the purpose of this International Standard.

5.2 Test procedures

5.2.1 Checking of the field of vision

The tractor shall be placed on a horizontal surface as shown in Figure 2. On a horizontal support level with the reference point, there shall be mounted two point sources of light, e.g. two × 150 W, 12 V, 65 mm apart and symmetrically located with respect to the reference point. The support shall be pivotable at its centre point about a vertical axis passing through the reference point. For the purpose of measuring the masking effects, the support shall be so aligned that the line joining the two light sources is perpendicular to the line joining the masking component and the reference point.

The silhouette (deepest shadow) overlaps projected on to the semi-circle of vision to the front by the masking component when the light sources are switched on simultaneously or alternately shall be measured in accordance with 3.4 (Figure 3).

5.2.2 Mathematical determination of masking effects for binocular vision

As an alternative to the procedure set out in 5.2.1, the acceptability of individual masking effects (see Figure 3, dimension *x*) can be determined mathematically. For binocular vision with an inter-ocular distance of 65 mm, the masking effect expressed in mm is given by the formula:

$$x = \frac{b-65}{a} \cdot 12\,000 + 65$$

where

a is the distance in millimetres between the component obstructing vision and the reference point measured along the visual radius joining the reference point, the centre of the component and the perimeter of the semi-circle of vision to the front;

b is the width in millimetres of the component obstructing vision measured horizontally and perpendicular to the visual radius.

5.2.3 Additional tests

The tractor shall be placed on a horizontal surface as shown in Figure 2. On a horizontal support level with the reference point, there shall be mounted two point sources of light, e.g. two × 150 W, 12 V, 65 mm apart and symmetrically located with respect to the reference point. The support shall be pivotable at its centre point about a vertical axis passing through the reference point. For the purpose of measuring the masking effects, the support shall be so aligned that the line joining the two light sources is perpendicular to the line joining the masking component and the reference point.

From this position, the light sources are moved first to one side and then to the other within the limits shown in Table 1 until the area of each obstructing part (or parts considered together according to 5.1.2 if applicable) not covered by the light sources in either of the two positions becomes smallest on the semi-circle of vision (deepest shadow, dimension *x*, Figure 3). The areas determined in this way shall be considered as masking effects.

Table 1 — Movement of light sources

Maximum design speed	Maximum lateral movement of light sources to each side
≤ 25 km/h	170 mm
≤ 50 km/h	100 mm
> 50 km/h	50 mm

5.2.4 Equivalent procedures

The test methods referred to in 5.2.1, 5.2.2 and 5.2.3 may be replaced by others if the latter can be shown to be equivalent.

NOTE Equivalent procedures are e.g. the procedures described in ISO 5006:2006.

5.3 Acceptance criteria

5.3.1 General

When testing according to 5.2 the requirements of 5.1 shall be met.

5.3.2 Special

If the tractor does not comply with the requirements of 5.1.2 due to its design, then an additional test according to 5.2.3 shall be performed. All other requirements in 5.1 shall be met.

There shall also be a minimum distance of 2 500 mm between the centres of two masking effects, measured as a chord on the semi-circle of vision.

The field of vision to the front shall also be accepted when the masking effect requirements of 5.1.2 are met inside the sector of vision to the front, but are not met outside the sector of vision to the front:

— in vehicles with a maximum design speed ≤ 25 km/h, the masking effect shall not exceed 5 500 mm and the open area adjacent to the masking effect shall be ≥ 1 300 mm; or

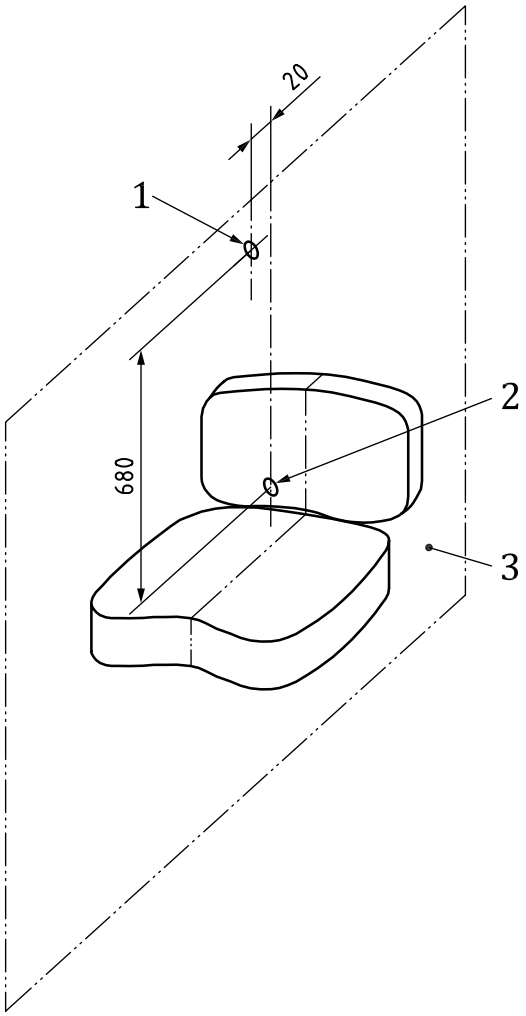
— in vehicles with a maximum design speed > 25 km/h, the masking effect shall not exceed 4 500 mm and the open area adjacent to the masking effect shall be ≥ 1 300 mm; or

— the distance between the vertical transverse planes touching the forward-most point of the tractor chassis or grill screen and the centre of the steering wheel, or in vehicles without a steering wheel the reference point, is > 3 500 mm from the reference point.

In each of the cases a), b) and c) above, suitable operational measures shall be taken to alleviate the restricted field of vision to the front at yard exits, road merges and intersections. The operator's manual shall contain the necessary information.

Suitable operational measures shall be acceptable by the use of a bystander advising the driver when it is safe to proceed or by the use of indirect field of vision.

Dimensions in millimetres

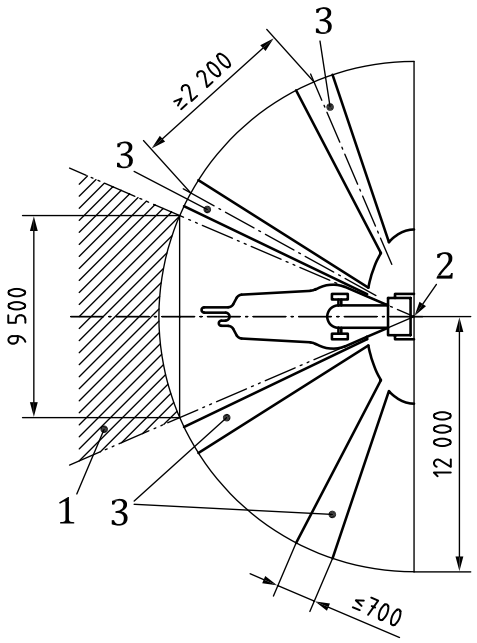


Key

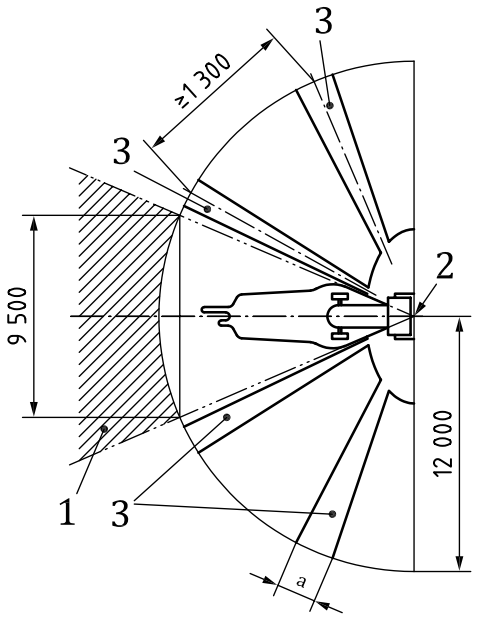
1 filament position centre point (FPCP)
2 seat index point (SIP)
3 plane parallel to the tractor median plane

Figure 1 — Determination of eye position

Dimensions in millimetres



a) Semi-circle of vision to the front according to 5.1



b) Semi-circle of vision to the front according to 5.3

Key

1 sector of vision to the front

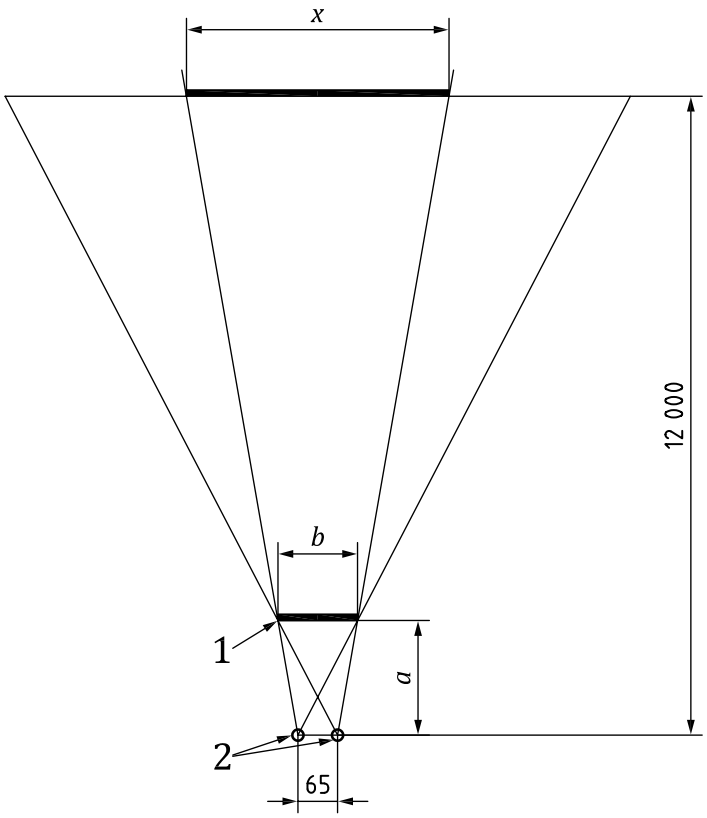
2 reference point

3 masking effect

[a] 5 500 mm when the maximum design speed is ≤ 25 km/h; 4 500 mm when the maximum design speed is > 25 km/h

Figure 2 — Semi-circle of vision to the front

Dimensions in millimetres



Key

1 obstruction
2 eyes
a distance between obstruction and the eyes
b width of obstruction
x masking effect (see 5.2.2)

Figure 3 — Mathematical determination of masking effects

Bibliography

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

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