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Earth-moving machinery — Laboratory evaluations of protective structures — Specifications for deflection-limiting volume

Engins de terrassement — Étude en laboratoire des structures de protection — Spécifications pour le volume limite de déformation

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 3164 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*.

This sixth edition cancels and replaces the fifth edition (ISO 3164:1995), which has been technically revised.

Earth-moving machinery — Laboratory evaluations of protective structures — Specifications for deflection-limiting volume

1 Scope

This International Standard specifies the deflection limiting volume (DLV) to be used when performing laboratory evaluations of structures which provide protection to operators of earth-moving machinery as defined in ISO 6165.

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 3411:2007, *Earth-moving machinery — Physical dimensions of operators and minimum operator space envelope*

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

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

3 Terms and definitions

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

3.1
deflection-limiting volume
DLV
approximation of a large seated operator as defined in ISO 3411

3.1.1
orthogonal DLV
DLV (3.1) that is an orthogonal approximation of an operator

Note 1 to entry: See Figure 1.

3.1.2
rounded DLV
orthogonal DLV (3.1.1) with corners rounded to approximate the curvature of the operator (e.g. head, shoulders)

Note 1 to entry: See Figure 2.

3.1.3
orthogonal top head plane
270 mm by 330 mm rectangular horizontal surface used with the *rounded DLV* (3.1.2) to replicate the top horizontal surface of the *orthogonal DLV* (3.1.1)

Note 1 to entry: See Figure 3.

Note 2 to entry: This top head plane is to be used with the rounded DLV when testing a FOPS (falling-object protective structure).

3.2
seat index point
SIP
point on the central vertical plane of the seat as determined by ISO 5353

3.3
locating axis
LA
horizontal axis for positioning the *DLV* (3.1) with respect to the *SIP* (3.2)

4 DLV dimensions, use and accuracy

4.1 **The** dimensions of the orthogonal DLV shall be as shown in Figure 1 and the dimensions of the rounded DLV as shown in Figure 2.

4.2 The dimension from the SIP to the rear boundary of the DLV assumes that the seat has 150 mm fore–aft adjustment. The 210 mm dimension shall be reduced from 210 mm to 135 mm if the seat does not have any fore–aft adjustment. If the fore–aft seat adjustment is less than 150 mm, the 210 mm dimension shall be reduced by one half of the difference between 150 mm and the actual fore–aft seat adjustment.

4.3 ROPS (roll-over protective structure) and TOPS (tip-over protective structure) testing shall use either the rounded or the orthogonal DLV. FOPS (falling-object protective structure) testing shall use the orthogonal DLV or the rounded DLV with an added orthogonal top head plane.

4.4 During lateral loading for TOPS and ROPS testing, it is permissible for the upper portion of the DLV to be rotated laterally about the SIP up to 15° (see Table 1). During longitudinal loading for TOPS and ROPS testing, it is permissible for the upper portion of the DLV to be rotated forwards about the LA up to 15°. See the examples given in Figure 4. The portion below the SIP of the DLV does not rotate. If there is interference with any machine component, rotation of the DLV shall be limited to the angle at which the interference occurs.

Table 1 — Summary of allowed DLV rotation during ROPS/TOPS testing

ROPS/TOPS loading direction	Degrees	DLV rotation direction
Lateral loading	15	Lateral
Longitudinal loading	15	Longitudinal

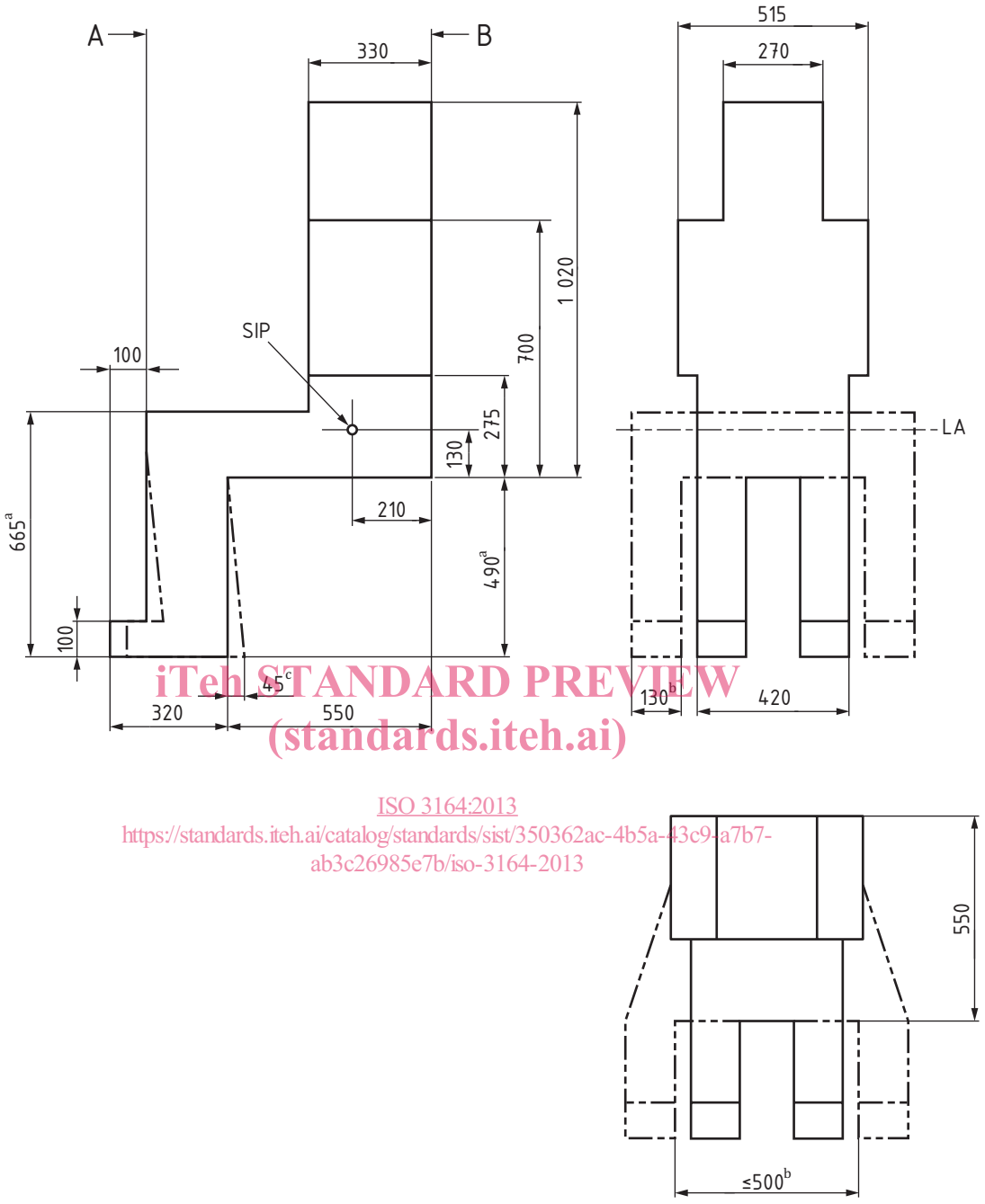
The rounded DLV better represents the shape of the operator's head when the DLV is rotated in the longitudinal and lateral directions.

4.5 All linear dimensions of the DLV shown in Figures 1 and 2 shall have a tolerance of ±5 mm. The accuracy of locating the DLV with respect to the SIP shall be ±13 mm, horizontally and vertically. The accuracy of the rotation shall be ±1°.

5 Location of DLV

5.1 The DLV shall be located using the SIP, as defined in ISO 5353, as the reference point (see Figures 1 and 2).

Dimensions in millimetres

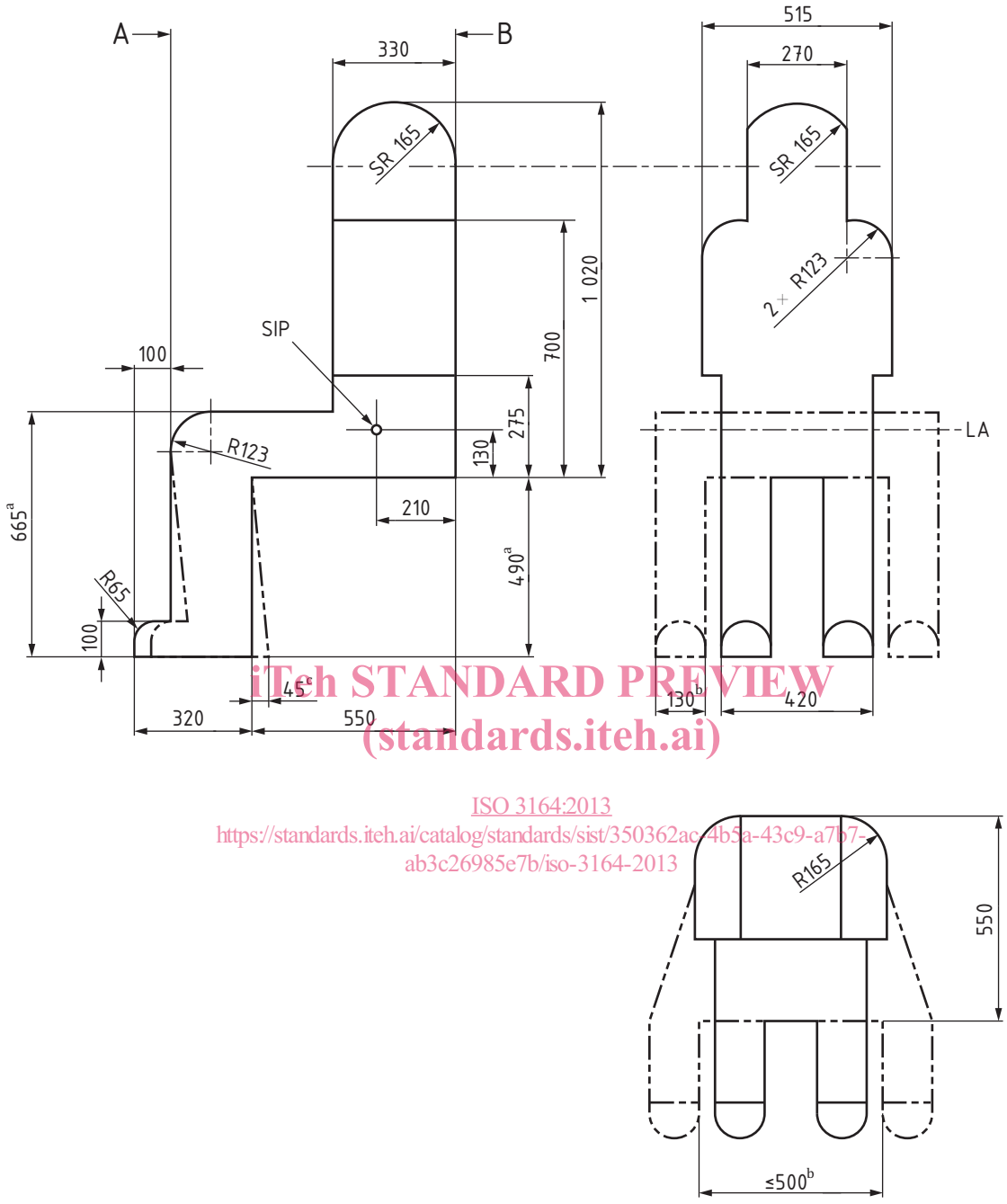


Key

A front boundary plane
B rear boundary plane
LA locating axis
SIP seat index point
a May be reduced to avoid interference with floor plates.
b Machine parts or controls can require additional separation of the feet and legs of the DLV.
c Feet may move 45 mm rearwards.

Figure 1 — Orthogonal DLV dimensions

Dimensions in millimetres



Key

A front boundary plane
B rear boundary plane
LA locating axis
SIP seat index point
a May be reduced to avoid interference with floor plates.
b Machine parts or controls can require additional separation of the feet and legs of the DLV.
c Feet may move 45 mm rearwards.

Figure 2 — Rounded DLV dimensions

5.2 For machines which have multiple seat locations and therefore multiple SIPs (see ISO 5353:1995, 5.3.3), the SIP used by the operator to move the machine in the travel mode shall be used.

5.3 The DLV shall be positioned so that the locating axis (LA) shown in Figure 1 passes through the SIP location as determined in 5.2. The DLV shall be centred transversely in the seat location with its principal axes horizontal and vertical (axes X′ and Z′ as defined in ISO 5353:1995, Figure 2).

5.4 The location of the LA of the DLV shall remain coincidental with the SIP even though that line can move during any or all of the laboratory loadings.

NOTE Machine controls and their components normally positioned in the DLV are not considered to violate the DLV.

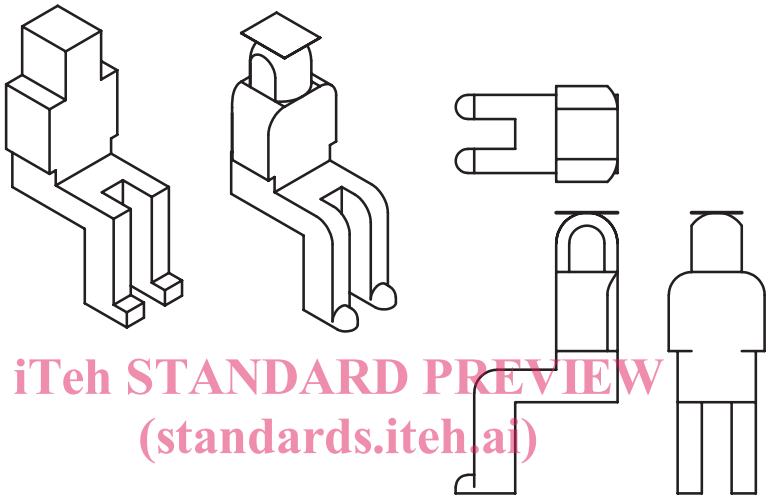
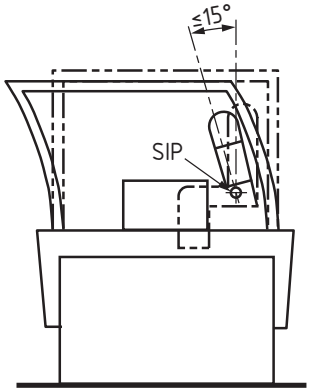


Figure 3 — Perspective and orthogonal top head plane for use with rounded DLV for FOPS testing



a) Lateral load on roller with sideways-mounted seat