SLOVENSKI STANDARD
SIST EN 13531:2002+A1:2008

01-december-2008

Stroji za zemeljska dela - Konstrukcija za zaģ ito pred prevrnitvijo (TOPS) za majhne bagre - Laboratorijski preskusi in zahtevane lastnosti (ISO 12117:1997, spremenjen)

Earth-moving machinery - Tip-over protection structure (TOPS) for compact excavators - Laboratory tests and performance requirements (ISO 12117:1997 modified)

Erdbaumaschinen - Umsturzvorrichtung (TOPS) für Kompaktbagger - Prüfungen und Anforderungen (ISO 12117:1997, modifiziert)

Engins de terrassement - Structures de protection au basculement (TOPS) pour mini-pelles - Essais de laboratoires et exigences de performance (ISO 12117:1997 modifiée)

Ta slovenski standard je istoveten z: **EN 13531:2001+A1:2008**

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53.100	Stroji za zemeljska dela	Earth-moving machinery

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Earth-moving machinery - Tip-over protection structure (TOPS) for compact excavators - Laboratory tests and performance requirements (ISO 12117:1997 modified)

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

The text of the International Standard from Technical Committee ISO/TC 127 "Earth-moving machinery" of the International Organization for Standardization (ISO) has been taken over with modifications as a European Standard by Technical Committee CEN/TC 151 "Construction equipment and building material machines - Safety", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-08-14.

This document supersedes EN 13531:2001.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] ⟨A1⟩.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

[A1] For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. ⟨A1⟩

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of the International Standard ISO 12117:1997 has been approved by CEN as a European Standard with agreed common modifications as given below.

The informative clause 6.1.4 and the informative Annex B of ISO 12117:1997 dealing with a longitudinal loading test of TOPS have not been taken over in the European Standard.

Introduction

This European Standard is a type C-standard as stated in [A1] EN ISO 12100 [/A1].

1 Scope

This European Standard establishes a consistent and reproducible means of evaluating the load-carrying characteristics of tip-over protective structures (TOPS) under static loading, and prescribes performance requirements of a representative specimen under such loading.

It applies to TOPS of compact excavators (as defined in EN ISO 6165) with swing type boom, having an operating mass (see 3.14) of 1 000 kg to 6 000 kg.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by Amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

[A1] *deleted text* [/A1]

EN ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws, and studs (ISO 898-1:1999)*

EN 20898-2:1993, *Mechanical properties of fasteners – Part 2: Nuts with specified proof load values – Coarse thread (ISO 898-2:1992)*

ISO 148, *Steel – Charpy impact test (V-notch)*

EN ISO 3164:1999, *Earth-moving machinery – Laboratory evaluations of protective structures – Specifications for deflection-limiting volume*

EN ISO 6683:1999, *Earth-moving machinery - Seat belts and seat belt anchorages*

[A1] EN ISO 12100-1:2003, *Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles (ISO 12100-2:2003)* [/A1]

ISO 7135:1993, *Earth-moving machinery – Hydraulic excavators – Terminology and commercial specifications*

ISO 9248:1992, *Earth-moving machinery – Units for dimensions, performance and capacities, and their measurement accuracies*

ISO 10262:1998, *Earth-moving machinery – Hydraulic excavators – Laboratory tests and performance requirements for falling-object guards*

3 Terms and definitions

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

3.1
tip-over protective structure (TOPS)
system of structural members whose primary purpose is to reduce the possibility of an operator, held by a seat belt system (3.5), being crushed should a machine tip-over

NOTE Structural members include any subframe, bracket, mounting, socket, bolt, pin, suspension, flexible shock absorber used to secure the system to the swing frame, but excludes mounting provisions that are integral with the swing frame.

3.1.1
cabin type TOPS
TOPS for machines with a cabin

3.1.2
canopy type TOPS
TOPS for machines having an open canopy

NOTE Both of these types of TOPS are designed to be integrated with the main members of the TOPS for the evaluation test, whether they are separated from the load carrying members or not.

3.2
falling object guard
system of top guard and front guard for the protection of the excavator operator's station (See ISO 10262)

3.3
swing frame
main chassis or main load bearing structural member(s) of the revolving upper frame of the mini-excavator upon which the TOPS is directly mounted

3.4
swing-type boom
boom pivoted horizontally at the boom base (See ISO 7135:1993, figure 18)

3.5
restrain system
seat belt assembly with anchorages (EN ISO 6683:1999, definition 4.3)

3.6
bedplate
substantially rigid part of the test fixtures to which the machine frame is attached for the purpose of the test

3.7
deflection-limiting volume (DLV)
orthogonal approximation of a large, seated, male operator wearing normal clothing and a protective helmet (See EN ISO 3164:1999, figure 1) [EN ISO 3164:1999, definition 3.1]

3.8
representative specimen
TOPS, mounting hardware and machine frame (complete or partial) for test purposes that is within the manufacturer's specifications

3.9
load distribution device
device used to prevent localized penetration of the TOPS members at the load application point

3.10
load application point
point on the TOPS structure where the test load is applied to the TOPS structure

3.11
deflection of TOPS
movement of the TOPS structure caused by the application of the load and measured at the load application point

3.12
simulated ground plane (SGP)
flat surface on which a machine, after tipping over, is assumed to come to rest

3.13
lateral simulated ground plane (LSGP)
for a machine coming to rest on its side, the plane 15° away from the DLV about the horizontal axis within the plane established in the vertical plane passing through the outermost point (see Figure 1). This establishes the LSGP. The LSGP is established on an unloaded TOPS and moves with the member to which load is applied while maintaining its 15° angle with respect to the vertical

3.14
operating mass
mass of the base machine, with equipment and attachments as specified by the manufacturer, operator (75 kg), full fuel tank, and all fluid systems at the levels specified by the manufacturer.

NOTE Soil, mud, rocks, branches, debris, etc. that commonly adhere to or lie on machines in use are not considered as part of the mass of any machine. Material dug, carried or handled in any manner is not considered part of the machine mass in determining test requirements.

4 Symbols

The following symbols are used in this European Standard.

4.1 *U*: Energy, expressed in joules (J), absorbed by the structure, related to the machine mass (*m*).

4.2 *F*: Force, expressed in newtons (N).

4.3 *m*: Manufacturer's maximum recommended machine mass, expressed in kilograms (kg). The manufacturer's maximum recommended machine mass includes attachments in operating condition with all reservoirs full to capacity, tools and TOPS.

4.4 *L*: Length of the TOPS, expressed in millimetres, defined as below.

a) For a one- or two-post TOPS with a falling object (top and front) guard for the operator's station and/or cantilevered load-carrying structural members, the length, *L*, is that portion of the cantilevered load-carrying members which covers at least the vertical projection of the length of the DLV of the operator. It is measured at the top of the TOPS, from the extreme face of the TOPS post(s) to the far end of the cantilevered load-carrying members (see Figure 2).

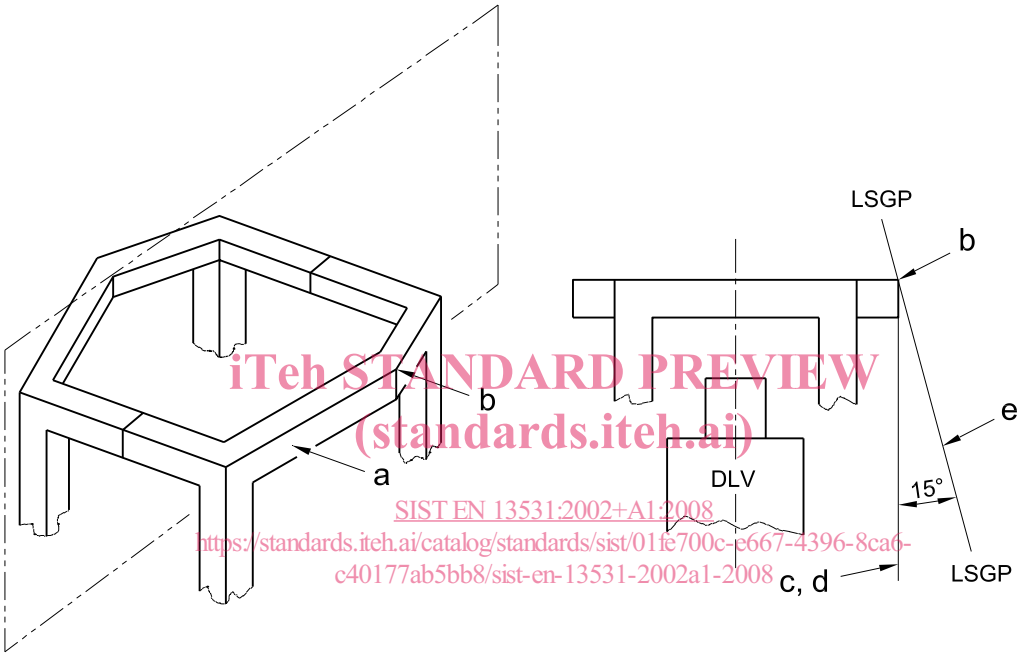
b) For all other TOPS, the length, *L*, is the greatest total longitudinal distance between the outsides of the front and rear posts (see Figure 3).

4.5 *W*: Width of the TOPS, expressed in millimetres, defined as below.

a) For a one- or two-post TOPS with a falling object (top and front) guard for the operator's station and/or cantilevered load-carrying structural members, the width, *W*, is that portion of the cantilevered load-carrying members which covers at least the vertical projection of the width of the DLV. It is measured at the top of the TOPS, members from the extreme face of the TOPS left and right post to the far end of the cantilevered load-carrying members (see Figure 2).

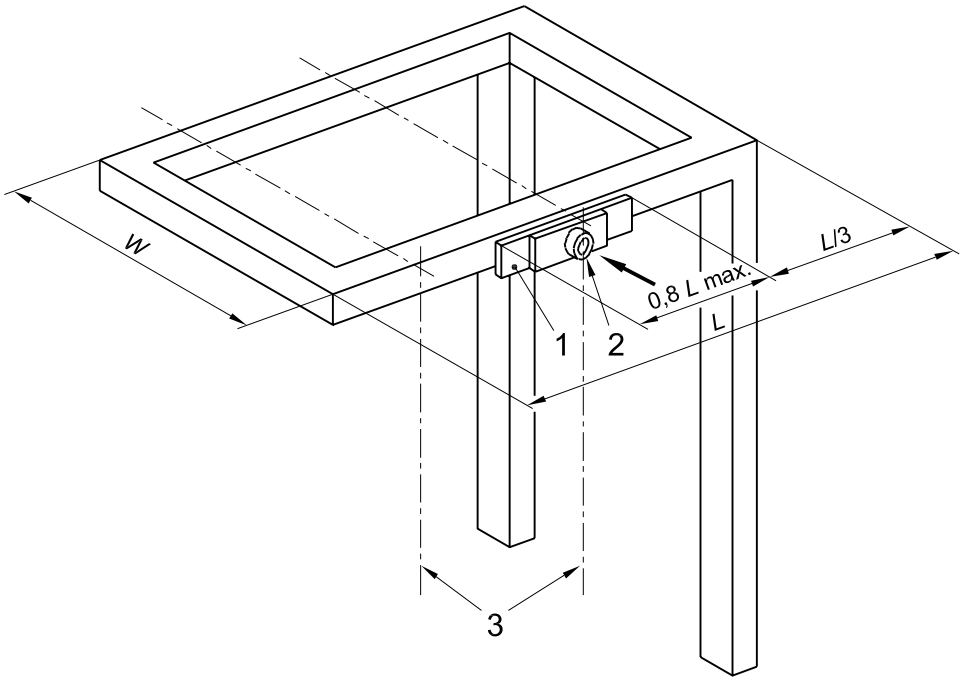
b) For all other TOPS, the width, *W*, is the greatest total width between the outsides of the left and right TOPS posts (see Figure 3).

4.6 Δ: Deformation of the TOPS, expressed in millimetres.



Key
a upper TOPS member to which the lateral load is applied
b outermost point from the end view of member a
c vertical line through point b
d vertical plane parallel to the machine longitudinal centreline through line c
e lateral simulated ground plane (LSGP)

Figure 1 — Determination of lateral simulated ground plane (LSGP)



Key

1 load distributor

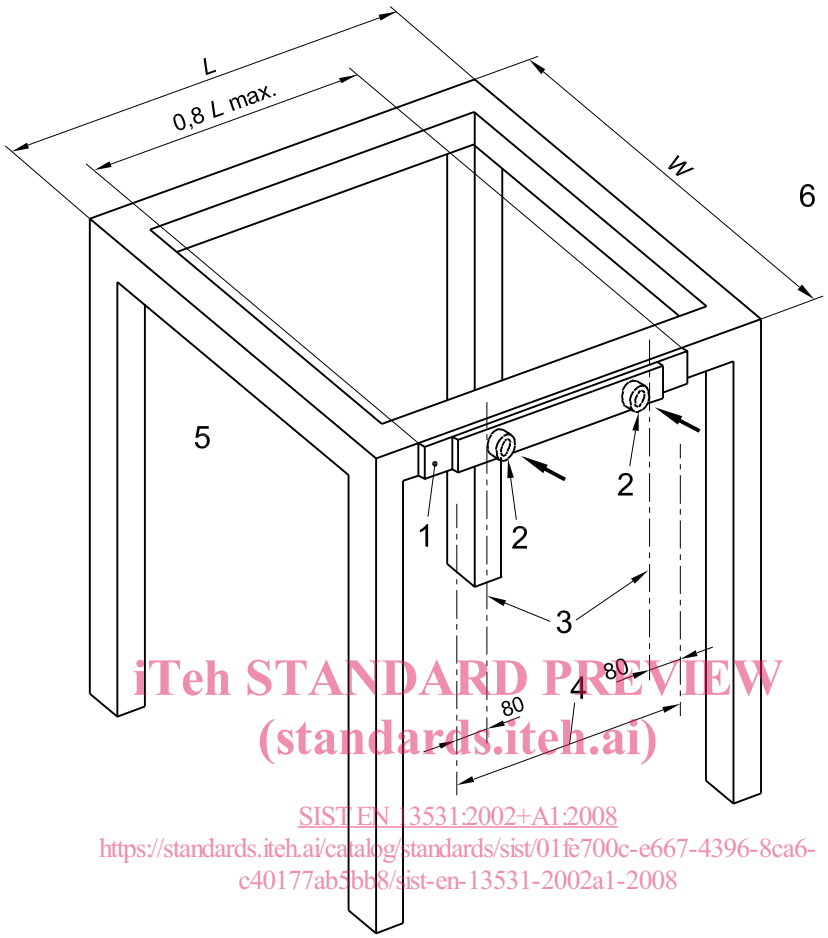
2 socket

3 boundary planes of the DLV

NOTE Load distributor and socket are used to prevent local penetration and to hold the end of the load-generating device.

Figure 2 — Two-post TOPS lateral load application point

Dimensions in millimetres



Key

1 load distributor

2 socket

3 boundary planes of the DLV

4 load zone

5 back

6 front

NOTE 1 Load distributor and socket are used to prevent local penetration and to hold the end of the load-generating device.

NOTE 2 Typical but not mandatory layout.

Figure 3 — Four-post TOPS lateral load application point

5 Test method and facilities

5.1 General

The requirement for TOPS is energy absorption in the lateral direction. There are limitations on deflections under the lateral loading. The energy requirements and limitations on deflection (DLV) under lateral loading are intended to assure that the TOPS will not significantly deform while retaining significant capability to withstand impact in the tip.

The evaluation procedure will not necessarily duplicate structural deformations due to a given actual tip-over. However, it is expected that crush protection for a seat-belted operator will be assured under at least the following conditions:

— a flat hard soil surface;

— 90° of tip-over about the swing frame longitudinal axis without losing contact with the surface.

5.2 Instrumentation

Systems used to measure mass, force and deflection shall be capable of meeting the requirements of ISO 9248:1992.

5.3 Test facilities

Fixtures shall be adequate to secure the TOPS/swing frame assembly to a bedplate and to apply the required lateral load as determined by the formulae given in Table 1.

5.4 TOPS/swing frame assembly and attachment to bedplate

5.4.1 The TOPS shall be attached to the swing frame as it would be on an operating machine (see Figure 4). A complete swing frame is not required for the evaluation. However, the swing frame and mounted TOPS test specimen shall represent the structural configuration of an operating installation. All normally detachable windows, panels, doors, and other non-structural elements shall be removed so that they do not contribute to, nor detract from, the structural evaluation.

5.4.2 The TOPS/swing frame assembly shall be secured to the bedplate so that the members connecting the assembly and bedplate experience minimal deflection during testing. The TOPS/swing frame assembly shall not receive any support from the bedplate, other than that due to the initial attachment.

5.4.3 The test shall be conducted with any machine/ground suspension elements blocked externally so that they do not contribute to the load-deflection behaviour of the test specimen. Suspension elements used to attach the TOPS to the machine frame and acting as a load path shall be in place and functioning at the start of the test.