



SLOVENSKI STANDARD SIST EN 13627:2001

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SIST EN 23449:2000

Earth-moving machinery - Falling-object protective structures - Laboratory tests and performance requirements (ISO 3449:1992 modified)

Earth-moving machinery - Falling-object protective structures - Laboratory tests and performance requirements (ISO 3449:1992 modified)

Erdbaumaschinen - Schutzaufbauten gegen herabfallende Gegenstände - Prüfungen und Anforderungen (ISO 3449:1992 modifiziert)

Engins de terrassement - Structures de protection contre les chutes d'objets - Essais de laboratoire et criteres de performance (ISO 3449:1992 modifiée)

Ta slovenski standard je istoveten z: EN 13627:2000

ICS:

53.100 Stroji za zemeljska dela Earth-moving machinery

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13627

October 2000

ICS 53.100

Supersedes EN 23449:1988

English version

Earth-moving machinery - Falling-object protective structures -
Laboratory tests and performance requirements (ISO 3449:1992
modified)

Engins de terrassement - Structures de protection contre
les chutes d'objets - Essais de laboratoire et critères de
performance (ISO 3449:1992 modifiée)

Erdbaumaschinen - Schutzaufbauten gegen herabfallende
Gegenstände - Prüfungen und Anforderungen (ISO
3449:1992 modifiziert)

This European Standard was approved by CEN on 30 September 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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 as an 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 2001, and conflicting national standards shall be withdrawn at the latest by April 2001.

This European Standard supersedes EN 23449:1988.

Annex A is normative.

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).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

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

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Endorsement notice

The text of the International Standard ISO 3449:1992 has been approved by CEN as a European Standard with agreed common modifications as given below :

- Scope is modified
- Normative references are updated
- Special requirements for the deflection-limiting volume (DLV) of skid-steer loaders with front access are deleted
- Alternative temperature requirement for minimum charpy V-notch impact strengths of structural members of FOPS is added
- Annex A is amended by requirements of annex B in order to include some further means of verification.

0 Introduction

This European Standard provides performance criteria for falling-object protective structures (FOPS). It recognizes that there are various classes and sizes of machines that operate in a variety of environmental conditions. Therefore, two levels of acceptance criteria are provided based upon end use. It is intended to assure operators of reasonable protection from falling objects of different sizes and masses under the conditions stated in 4.4.

1 Scope

1.1 This European Standard specifies

- a) the laboratory tests for measurement of structural characteristics, and
- b) the performance requirements in a representative test of a falling-object protective structure (FOPS).

1.2 The laboratory tests are a means of testing the characteristics of the structures used to protect the operator from localized impact penetration and, indirectly, of the load-carrying capacity of the supporting structure to resist impact loading.

1.3 This European Standard establishes a consistent, repeatable means of evaluating characteristics of FOPS under loading and prescribes performance requirements for these structures under such loading in a representative test.

NOTE: For the purposes of this European Standard, "representative test" means a test of a specimen whose material, dimensional, and processing requirements are typical of those FOPS currently being produced.

1.4 This European Standard applies to ride-in operator-controlled earth-moving machines as defined in EN ISO 6165:1999.

1.5 This European Standard does not apply to

- landfill compactors;
- excavators (see ISO 10262:1998);
- rollers;
- trenchers;
- pipelayers;
- part of machines where an additional seat is located for the operation of an additional attachment (e. g. attached backhoe).

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).

ISO 148:1983	Steel - Charpy impact test (V-notch)
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 (ISO 898-2:1980)
EN ISO 3164:1999	Earth-moving machinery - Laboratory evaluations of protective structures - Specifications for deflection-limiting volume (ISO 3164 : 1995)
EN 13510:2000	Earth-moving machinery – Roll-over protective structures - Laboratory tests and performance requirements (ISO 3471 : 1994, including Amendment 1 : 1997, modified)
EN ISO 6165:1999	Earth-moving machinery - Basic types – Vocabulary (ISO 6165 : 1997)
ISO 10262:1998	Earth-moving machinery – Hydraulic excavators – Laboratory tests and performance requirements for operator protective guards

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3 Terms and definitions

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

3.1 Falling-object protective structure (FOPS): A system of structural members arranged in such a way as to provide operators with reasonable protection from falling objects (for example, trees, rocks, small concrete blocks, hand tools).

3.2 Roll-over protective structure (ROPS): System of structural members whose primary purpose is to reduce the possibility of a seat-belted operator being crushed should the machine roll-over. Structural members include any subframe, bracket, mounting, socket, bolt, pin, suspension or flexible shock absorption used to secure the system to the machine frame, but exclude mounting provisions that are integral with the machine frame.

3.3 Deflection-limiting volume (DLV): Orthogonal approximation of a large, seated, male operator wearing normal clothing and a hard hat (see EN ISO 3164:1999, figure 1).

3.4 Acceptance levels

3.4.1 Level I: Resistance against impact loading for protection from falling of small objects, e. g. bricks, small concrete blocks and hand tools for machines involved such as highway maintenance, landscaping and other construction site services.

3.4.2 Level II: Resistance against impact loading for protection from falling of heavy objects, e. g. trees or rocks for machines involved in site clearing, overhead demolition and forestry.

4 General

The following points are stated to aid in understanding the underlying principles, intention and application of this European Standard.

4.1 The FOPS can be integrated in the cab of the operator.

4.2 This test procedure will not necessarily duplicate structural deformations due to a given actual impact of failing objects.

4.3 This test procedure is generally destructive of the FOPS assembly, as permanent deformation will occur to the structure.

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4.4 Although FOPS meeting the acceptance levels of 3.4 do not give crush protection under all circumstances in which the machine could be struck from above, it is expected that penetration protection will be ensured under at least the following conditions.

- level I: A round object dropped from a height sufficient to develop an energy of 1365 J;
- level II: A blunt object (see figure 1) dropped from a height sufficient to develop an energy of 11600 J.

Drop height of a standard object is defined as a function of its mass (see figure 3).

4.5 The material temperature requirement of 6.3 is intended to be a base-line of measurement for testing, to ensure that the FOPS will have meaningful resistance to brittle fracture; it does not necessarily relate to operating conditions.

4.6 Because, in an actual situation involving a falling object, loading will be dynamic (possibly impact), the use of conventional "safety factors" based on static force loading should be treated with caution. The "safety factor" of a FOPS is related more to energy absorption capability and details of weld design and welding procedure than it is to static force resistance.

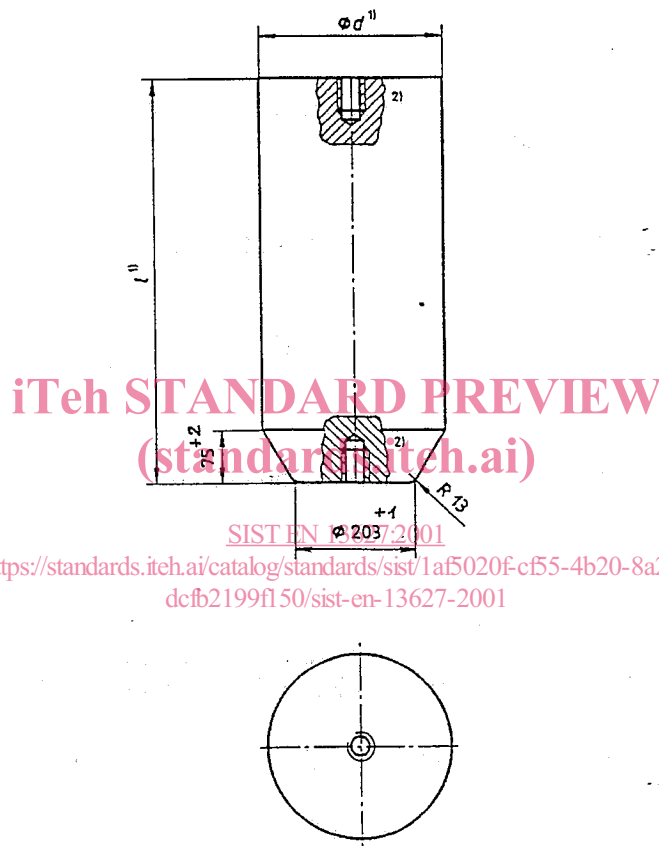
5 Laboratory tests

5.1 Apparatus

5.1.1 Solid steel or ductile iron or other sphere, having a mass of 45 kg (level I), with the sphere diameter not exceeding 250 mm or a standard laboratory drop test object, made of steel as shown in figure 1 (level II).

For level II an optional drop test object is a sphere or ball with a maximum diameter of 400 mm and with the capability of developing an energy of 11600 J.

Dimensions in millimetres



- 1) Dimensions d and l are optional, depending on the mass of the test object required to match the height of drop that will provide the energy specified in 4.4.

For example, for a drop test object mass of 227 kg

$$d = 255 \text{ mm to } 260 \text{ mm}$$

$$l = 583 \text{ mm to } 585 \text{ mm}$$

To determine the drop height, see figure 3.

- 2) May be drilled and tapped for a lifting eye.

Figure 1: Standard laboratory drop test object

- 5.1.2** Means of raising the standard test object to the required height.
- 5.1.3** Means of releasing the standard test object so that it drops without restraint.
- 5.1.4** The test surface of the apparatus shall be of such firmness that it is not penetrated during the drop test.
- 5.1.5** Means of determining whether the FOPS enters the deflection-limiting volume during the drop test. This may be either of the following:
- a DLV, placed upright, made of a material which will indicate any penetration by the FOPS; grease may be put on the lower surface of the FOPS cover to indicate such penetration;
 - a dynamic instrumentation system of sufficient frequency response to indicate the relevant deflection with respect to the DLV.

5.2 DLV requirements

The DLV and its location shall be in accordance with EN ISO 3164. The DLV shall be fixed firmly to the same part of the machine as the operator's seat, and shall remain there during the entire formal test period.

5.3 Test conditions

5.3.1 Measurement accuracy

The measurement accuracy of the deflection of the FOPS shall be $\pm 5\%$ of the maximum deflection measured.

5.3.2 Machine or test bed condition

5.3.2.1 The FOPS to be evaluated shall be attached to the machine structure as it would be in actual machine use. A complete machine is not required; however, the portion on which the FOPS is mounted shall be identical to the actual structure, and the vertical stiffness of a test bed shall be not less than that of an actual machine as described in 5.3.2.2,

5.3.2.2 If the FOPS is mounted on a machine, the following stipulations apply:

- there are no limitations on customary attachments and/or payload;
- all ground-engaging tools shall be in the normal carry position;
- all suspension systems, including pneumatic tyres, shall be set at operating levels. Variable suspensions shall be in the "maximum stiffness" range;
- all cab elements, such as windows, normally removable panels or non-structural fittings, shall be removed so that they do not contribute to the strength of the FOPS.