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Earth-moving machinery — Tip-over protection structure (TOPS) for compact excavators — Laboratory tests and performance requirements

*Engins de terrassement — Structure de protection au basculement (TOPS)
pour mini-pelles — Essais de laboratoire et critères de performance*



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ISO 12117:1997(E)**Foreword**

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International Standard ISO 12117 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety requirements and human factors*.

Annex A forms an integral part of this International Standard. Annex B is for information only.

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Earth-moving machinery — Tip-over protection structure (TOPS) for compact excavators — Laboratory tests and performance requirements

1 Scope

This International 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 ISO 6165) with swing type boom, having an operating mass of 1 000 kg to 6 000 kg.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 148:1983, *Steel — Charpy impact test (V-notch)*.

ISO 898-1:1988, *Mechanical properties of fasteners — Part 1: Bolts, screws, and studs*.

ISO 898-2:1992, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread*.

ISO 3164:1995, *Earth-moving machinery — Laboratory evaluations of protective structures — Specifications for deflection-limiting volume*.

ISO 6165: —¹⁾, *Earth-moving machinery — Basic types — Vocabulary*.

ISO 6683:1981, *Earth-moving machinery — Seat belts and seat belt anchorages*.

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: —²⁾, *Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for falling-object guards*.

1) To be published. (Revision of ISO 6165:1987)

2) To be published.

3 Definitions

For the purposes of this International Standard, the following 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 (FOG): System of top guard and front guard for the protection of the excavator operator 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 seat belt system: Seat belt assembly with anchorages. [ISO 6683:1981, 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 ISO 3164:1995, figure 1.) [ISO 3164:1995, 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.

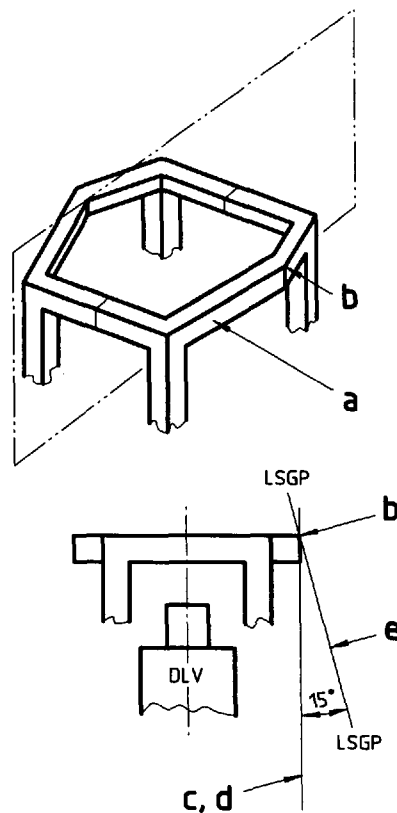
3.11 deflection of TOPS: Movement of the TOPS structure caused by the application of the load and measured at the load application point.

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.



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

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

4 Symbols

The following symbols are used in this International Standard.

4.1 U : Energy, expressed in joules, absorbed by the structure, related to the machine mass.

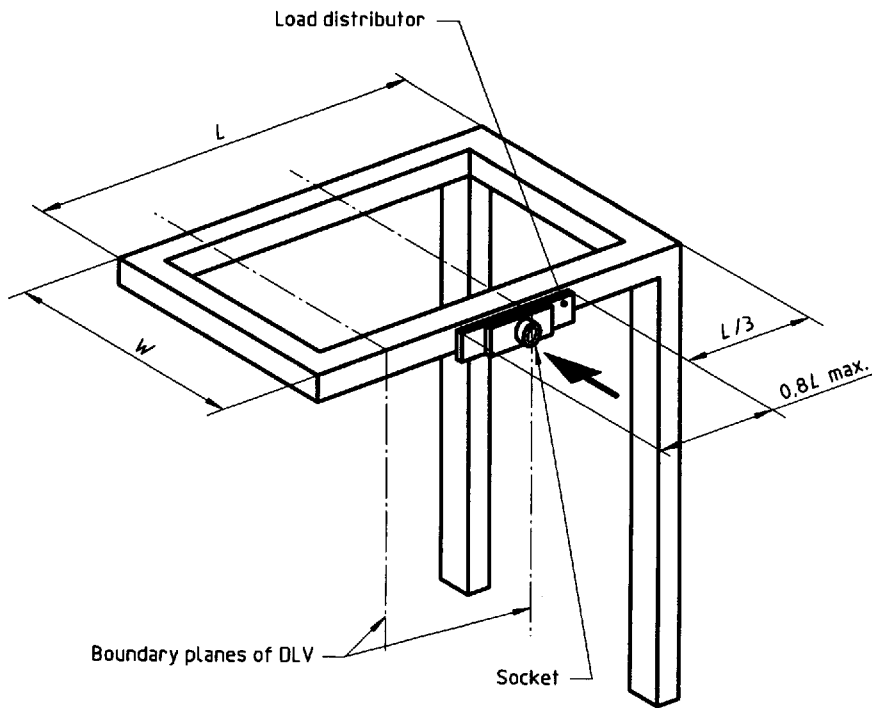
4.2 F : Force, expressed in newtons.

4.3 m : Manufacturer's maximum recommended mass, expressed in kilograms.

The manufacturer's maximum recommended 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.

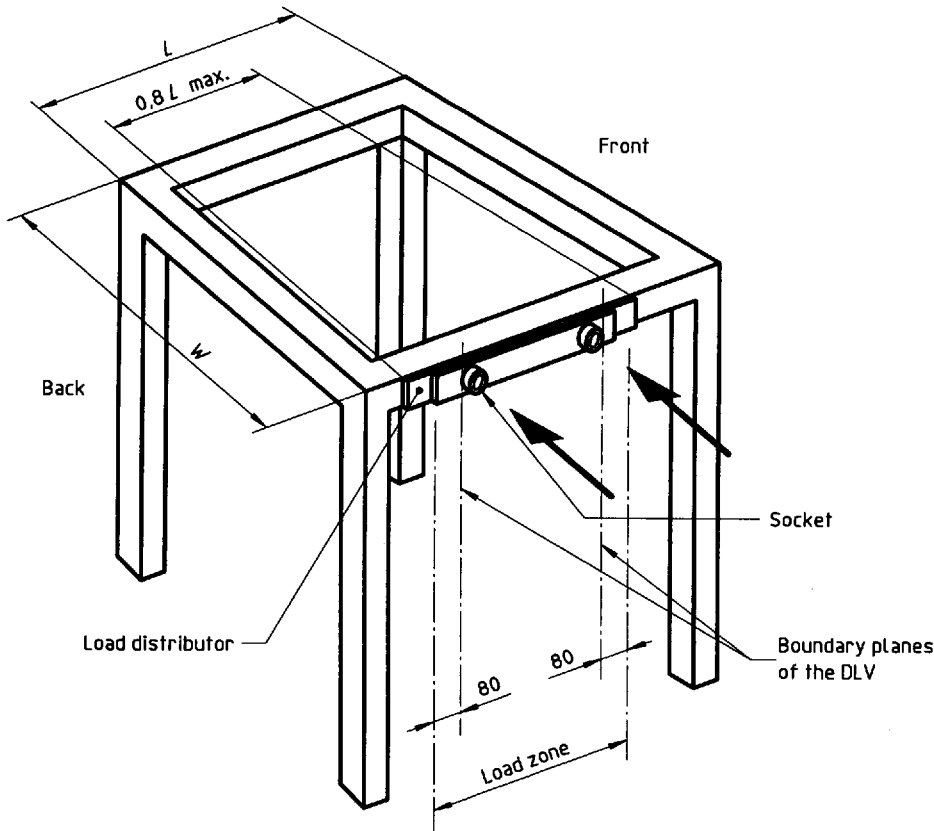
- a) For a one- or two-post TOPS with a FOG and/or cantilevered load-carrying structural members, the length, L , is that portion of the cantilevered load-carrying members which covers the vertical projection of the length of the DLV of the operator. It is measured at the top of the TOPS, from the extreme 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).



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



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

Figure 3 — Four-post TOPS lateral load application point