



SLOVENSKI STANDARD
SIST EN 474-5:2000

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Earth-moving machinery - Safety - Part 5: Requirements for hydraulic excavators

Earth-moving machinery - Safety - Part 5: Requirements for hydraulic excavators

Erdbaumaschinen - Sicherheit - Teil 5: Anforderungen für Hydraulikbagger

Engins de terrassement - Sécurité - Partie 5: Exigences applicables aux pelles hydrauliques

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Exigences applicables aux pelles hydrauliques

Erdbaumaschinen - Sicherheit - Teil 5:
Anforderungen für Hydraulikbagger

This European Standard was approved by CEN on 1996-01-06. 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.

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FOREWORD

This European Standard has been prepared 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of an identical text or by endorsement, at the latest by December 1996, and conflicting national standards shall be withdrawn at the latest by December 1996.

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).

The Annex A is normative and contains "List of additional hazards", Annex B is informative and contains "Rated object handling capacity tables" and Annex C is informative and contains "Illustrations".

EN 474 "Earth-moving machinery - Safety" comprises the following parts:

Part 1	General requirements
Part 2	Requirements for tractor-dozers
Part 3	Requirements for loaders
Part 4	Requirements for backhoe loaders
Part 5	Requirements for hydraulic excavators
Part 6	Requirements for dumpers
Part 7	Requirements for tractor-scrapers
Part 8	Requirements for graders
Part 9	Requirements for pipelayers
Part 10	Requirements for trenchers
Part 11	Requirements for earth- and landfill compactors
Part 12	Requirements for cable excavators.

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

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0 Introduction

This European Standard is a Type C-standard in the structure of A-/B-/C-standards as defined in EN 292-1:1991.

The machinery concerned and the extent to which hazards are covered is indicated in the scope of this standard.

1 Scope

This standard specifies additional requirements to and/or exceptions from EN 474-1:1994 "Earth-moving machinery - Safety - Part 1: General requirements".

This standard applies to wheel and crawler excavators as defined in ISO/DIS 6165:1994, and gives additional requirements for attachments and for derivated machinery.

This standard applies also for compact excavators as defined in 3.2.1 and figure C.2 and walking excavators as defined in 3.2.2 and figure C.5.

This standard deals with the significant hazards pertinent to hydraulic excavators when they are used as intended and under the conditions foreseen by the manufacturer (see Annex A of this standard and Annex C of EN 474-1:1994).

Bucket wheel excavators are not covered in this standard.

2 Normative references

This European Standard incorporates by dated or undated references, 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.

EN 292-1:1991	Safety of machinery - Basic concepts - General principles for design - Part 1: Basic terminology, methodology
EN 292-2:1991	Safety of machinery - Basic concepts - General principles for design - Part 2: Technical principles and specifications
EN 474-1:1994	Earth-moving machinery - Safety - Part 1: General requirements
ENV 1070:1993	Safety of machinery - Terminology
EN 23411:1988	Earth-moving machinery - Human physical dimensions of operators and minimum operator space envelope
EN 25353:1988	Earth-moving machinery and tractors and machinery for agriculture and forestry - Seat index point
EN 60204-1:1992	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 2867:1994	Earth-moving machinery - Access systems

ISO 3164:1992	Earth-moving machinery - Laboratory evaluations of roll-over and falling object protective structures - Specifications for deflection-limiting volume
ISO 3449:1992	Earth-moving machinery - Falling Object Protective Structures - Laboratory tests and performance requirements
ISO 3471:1994	Earth-moving machinery - Roll-over Protective Structures - Laboratory test and performance requirements
ISO 4250-2:1991	Narrow and wide base off-road tyres and rims - Part 2: Loads and inflation pressures
ISO/DIS 4250-3:1993	Earth-mover tyres and rims - Part 3: Rims
ISO 5006-1:1991	Earth-moving machinery - Operator's field of view - Part 1: Test method
ISO 6014:1986	Earth-moving machinery - Determination of ground speed
ISO 6016:1982	Earth-moving machinery - Methods of measuring the masses of whole machines, their equipment and components
ISO/DIS 6165:1994	Earth-moving machinery - Basic types - Vocabulary
ISO 6393:1985	Acoustics - Measurement of airborne noise emitted by earth-moving machinery - Method for determining compliance with limits for exterior noise - Stationary test condition
ISO 6682:1986	Earth-moving machinery - Zones of comfort and reach for controls
ISO 7096:1994	Earth-moving machinery - Laboratory evaluation of operator seat vibration
ISO 7135:1993	Earth-moving machinery - Hydraulic excavators - Terminology and commercial specifications
ISO/DIS 7451:1994	Earth-moving machinery - Volumetric ratings for hydraulic excavator buckets and backhoe loader buckets
ISO 7546:1983	Earth-moving machinery - Loader and front loading excavator buckets - Volumetric ratings
ISO 8643:1988	Earth-moving machinery - Hydraulic excavator and backhoe-loader boom lowering control device - Requirements and tests
ISO 9244:1995	Earth-moving machinery - General principles for safety signs and hazard pictorials
ISO/DIS 9249:1995	Earth-moving machinery - Engine test code - Net power
ISO 10263-2:1994	Earth-moving machinery - Operator enclosure environment - Part 2: Air filter test
ISO 10263-4:1994	Earth-moving machinery - Operator enclosure environment - Part 4: Operator enclosure ventilation, heating and/or air-conditioning test method
ISO 10567:1992	Earth-moving machinery - Hydraulic excavators - Lift capacity

ISO 10968:1995	Earth-moving machinery - Operator's controls
ISO/DIS 12117:1984	Earth-moving machinery - Tip-over protection structure (TOPS) for compact excavators - Laboratory tests and performance requirements
ISO 12509:1995	Earth-moving machinery - Lighting, signalling and marking lights, and reflex-reflector devices

3 Definitions

For the purposes of this standard the definitions stated in ENV 1070:1993 apply.

Additional definitions specifically needed for this standard are added below.

3.1 Common definitions

Terminology and commercial specifications for hydraulic excavators are specified in ISO 7135:1993 and illustrated in Annex C of this standard.

Definitions used in EN and ISO standards referred to in this standard are also valid for this standard.

3.2 Additional definitions

3.2.1 Excavator: self-propelled machine on crawler, wheels or legs, having an upper structure normally capable of 360° swing with a mounted supporting excavator linkage, primarily designed for excavating with hoe or shovel attachment, without moving the undercarriage.

NOTE: A work cycle comprises excavating, elevating, swinging and discharging material.

3.2.2 Compact excavator: excavator with an operating mass (see ISO 6016:1982) $\leq 6\,000$ kg.

3.2.3 Walking excavator: excavator having three or more supporting legs. The legs can be articulated and/or telescopic, and may be fitted with wheels.

3.2.4 Attachment bracket: device to facilitate quick interchange of attachments.

3.2.5 Attachment: removable device (working tool) mounted either directly to the linkage or on an attachment bracket to fulfil the primary function of the machine or for a specific use.

EXAMPLE: bucket, log grapple, blade, ripper.

3.2.6 Tip-over protective structure (TOPS): a system of structure members whose primary purpose is to reduce the possibility of a seat-belted operator being crushed should the machine tip-over. Structural members include any subframe, bracket, mounting, socket, bolt, pin, suspension or flexible shock absorber used to secure the system to the upper structure, but exclude mounting provisions that are integral with the upper structure.

4 Safety requirements

4.1 General

4.1.1 Access

EN 474-1:1994, clause 4.1 applies with the following exceptions:

- dimension code G, in ISO 2867:1994, figure 2, can be > 600 mm when the hand rails/hand holds are in the door opening;
- dimension B, in ISO 2867:1994, figure 1, can be 500 mm in the step above the track;
- an access step integrated in the track frame can be retracted to up to 30 mm from the outer edge of the track shoe.

4.1.2 Operator's station

EN 474-1:1994, clause 4.2 applies with the following provisions:

- machines with an operating mass $> 1\,500$ kg (see ISO 6016:1982) shall be designed and built so that a cab can be fitted (see EN 474-1:1994, clause 4.2.1);

4.1.2.1 Minimum space envelope

EN 474-1:1994, clause 4.2.2.5 applies with the addition that for an excavator, except compact excavators with an operating mass (see ISO 6016:1982) $< 1\,500$ kg, with retractable front window, the cab height shall not be less than 920 mm measured with the window retracted into the cab.

For machines with an operating mass (see ISO 6016:1982) $\leq 1\,500$ kg (see EN 474-1:1994, clause 4.2.1) the minimum space envelope width (dimension 920 mm, EN 23411:1988, figure 5) can be reduced to 650 mm at elbow height.

4.1.2.2 Heating and ventilation system

If a heating and ventilation system according to EN 474-1:1994, clause 4.2.2.6 is required the system shall:

- either comply with ISO 10263-4:1994
- or have the capacity of increasing the temperature of the air inside the cab and maintain a temperature of $+ 18^{\circ}\text{C}$ at prevailing ambient temperature. The minimum capacity of the heating system shall have a T of 25°C measured at -10°C ambient temperature.

Measurement of the system capacity shall be made at three points. The three points shall be located in a vertical plane through the SIP and parallel to the longitudinal axis of the machine as follows (see figure 1):

- at the filament position centre-point as defined in ISO 5006-1:1991;
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- at the SIP as defined in EN 25353:1988;
- 100 mm above floor plate and 600 mm in front of the SIP.

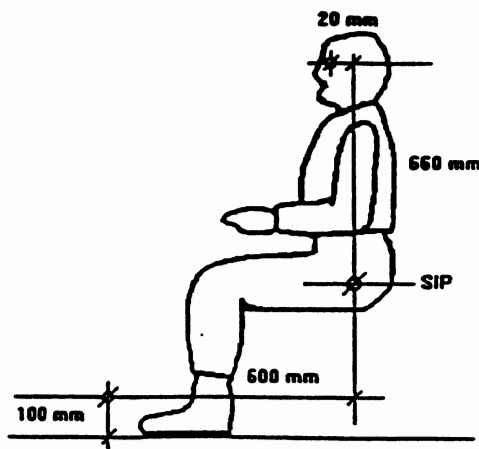


Figure 1: Location of measuring points

Alternatively the heating capacity can be determined by calculation.

The ventilation system shall be capable of providing the cab with filtered fresh air at the minimum of 43 m³/h. The filter should be tested according to ISO 10263-2:1994.

NOTE: The filter element selection depends on the operating environment conditions.

4.1.3 Operator's protection

Excavators shall be designed so that an operator's protective structure can be fitted. A protective structure shall be offered by the manufacturer and selected by the user according to the existing risk of the application. The following protective structures shall be considered:

4.1.3.1 Falling object protective structures (FOPS)

Excavators shall be designed so that an operator's station can receive a FOPS according to ISO 3449:1992.

Two acceptance levels are defined:

- level I for excavators having a operating mass $\leq 6\ 000$ kg;
- level II for excavators having a operating mass $> 6\ 000$ kg.

4.1.3.2 Front guard

Excavators shall be equipped with a front guard if the application requires. A FOPS (see 4.1.3.1) extension forward from the SIP of 750 mm for compact excavators and 1 000 mm for other excavators are considered as front guards.

4.1.3.3 Tip over protective structures (TOPS)

Compact excavators fitted with a cab shall be fitted with a tip over protective structure according to ISO/DIS 12117:1994. The TOPS shall be tested in the lateral direction and the energy requirements shall be determined by the manufacturer.

The limitations on the deflection are absolute, no part of the TOPS shall enter the DLV (see ISO 3164:1992) at any time during the lateral loading phase of the test.

During the test it is permissible for the upper portion of the DLV to be rotated up to 15 degrees laterally as shown in figure 2, when the minimum energy requirement is met. The portion below the LA line of the DLV can be disregarded. The TOPS shall not break away from the upper structure due to failure of the TOPS or upper structure.

Charpy V-notch impact strength test of structure members of the TOPS may be performed at - 20°C.