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Stroji za zemeljska dela - Varnost - 5. del: Zahteve za hidravlične bagre

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

Erdbaumaschinen - Sicherheit - Teil 5: Anforderungen für Hydraulikbagger

Engins de terrassement - Sécurité - Partie 5 Prescriptions applicables aux pelles hydrauliques

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Engins de terrassement - Sécurité - Partie 5 : Prescriptions applicables aux pelles hydrauliques Erdbaumaschinen - Sicherheit - Teil 5: Anforderungen für Hydraulikbagger

This European Standard was approved by CEN on 14 February 2022.

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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 CEN-CENELEC Management Centre has the same status as the official versions.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 474-5:2022) 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of an identical text or by endorsement, at the latest by September 2022, and conflicting national standards shall be withdrawn at the latest by March 2024.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 474-5:2006+A3:2013.

This document has been prepared under a standardization request 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 document.

For bibliographic references, see EN 474-1:2022.

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

- Part 1: General requirements (standards.iteh.ai)
- Part 2: Requirements for tractor-dozers
- Part 3: Requirements for loaders <u>SIST EN 474-5:2022</u> https://standards.iteh.ai/catalog/standards/sist/432fc91e-
- Part 4: Requirements for backhoe loaders 01b37/sist-en-474-5-2022
- Part 5: Requirements for hydraulic excavators
- Part 6: Requirements for dumpers
- Part 7: Requirements for 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
- Part 13: Requirements for rollers

This document is intended for use in combination with part 1 of the series.

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EN 474-5:2022 (E)

The main differences between this document and EN 474-5:2006+A3:2013 are as follows:

- a) normative references (Clause 2) (revised and updated);
- b) safety related functions of control systems (excluded);
- c) definitions (Clause 3) (revised and updated);
- d) list of significant hazards (revised and updated);
- e) requirements for operative protective structures (revised);
- f) ROPS requirements for hydraulic excavators (revised);
- g) visibility requirements (added);
- h) lifting operation requirements (revised);
- i) verification methods table (added) (Clause 5);
- j) rated lift capacity charts for lifting operation (updated);
- k) requirements for excavator swing brake (revised); NDARD
- l) illustrations (updated);
- m) requirements for quick couplers (added); (Standards.iteh.ai)
- n) list of significant hazards (Annex A) (updated);
- o) Annex ZA (updated). <u>SIST EN 474-5:2022</u> https://standards.iteh.ai/catalog/standards/sist/432fc91e-

Any feedback and questions on this document should be directed to the users national standards body. A complete listing of these bodies can be found on the CEN website.

PREVIEW

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

Introduction

This document is a type-C standard as stated in EN ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate in the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard. SIST EN 474-5:2022

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1 Scope

This document together with EN 474-1:2022 deals with all significant hazards, hazardous situations and events relevant to hydraulic excavators when used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer (see Annex A) associated with the whole lifetime of the machine as described in EN ISO 12100:2010, 5.4.

The requirements of this document are complementary to the common requirements formulated in EN 474-1:2022. This document does not repeat the requirements of EN 474-1:2022 but supplements or modifies the requirements for hydraulic excavators.

This document does not provide requirements for main electrical circuits and drives of machinery when the primary source of energy is an external electrical supply.

The following significant and relevant hazards are not covered in this document:

- Laser;
- Lightning.

This document does not provide performance requirements for safety related functions of control system(s).

This document does not deal with towing of trailers.

This document does not deal with demolition machinery.NDARD

This document also deals with lifting operation application, shove application, log application, grapple application, and magnetic plate application.

This document is not applicable to hydraulic excavators which are manufactured before the date of publication of this document by CEN.

2 Normative references

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https://standards.iteh.ai/catalog/standards/sist/432fc91e-

The following documents are perfected to fin-the text9in such a way that some 2 or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 474-1:2022, Earth-moving machinery — Safety — Part 1: General requirements

EN 13531:2001+A1:2008, Earth-moving machinery — Tip-over protection structure (TOPS) for compact excavators — Laboratory tests and performance requirements (ISO 12117:1997 modified)

EN ISO 3471:2008, Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements (ISO 3471:2008)

EN ISO 5353:1998, Earth-moving machinery and tractors and machinery for agriculture and forestry — Seat index point (ISO 5353:1995)

EN ISO 6683:2008, Earth-moving machinery — Seat belts and seat belt anchorages — Performance requirements and tests (ISO 6683:2005)

EN ISO 7096:2020, Earth-moving machinery — Laboratory evaluation of operator seat vibration (ISO 7096:2020)

EN ISO 12100:2010, Safety of machinery— General principles for design — Risk assessment and risk reduction (ISO 12100:2010)

EN ISO 16001:2017, Earth-moving machinery — Object detection systems and visibility aids — Performance requirements and tests (ISO 16001:2017)

ISO 5006:2017, Earth-moving machinery — Operator's field of view — Test method and performance criteria

ISO 6016:2008, Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components

ISO 7451:2007, Earth-moving machinery — Volumetric ratings for hoe-type and grab-type buckets of hydraulic excavators and backhoe loaders

ISO 7546:1983, Earth-moving machinery — Loader and front loading excavator buckets — Volumetric ratings

ISO 10262:1998, Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for operator protective guards

ISO 10262:1998/Cor 1:2009, Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for operator protective guards — Technical Corrigendum 1

ISO 10567:2007, Earth-moving machinery — Hydraulic excavators — Lift capacity

ISO 12117-2:2008, Earth-moving machinery — Laboratory tests and performance requirements for protective structures of excavators — Part 2: Roll-over protective structures (ROPS) for excavators of over 6 t

ISO 12117-2:2008/Cor 1:2010, Earth-moving machinery — Laboratory tests and performance requirements for protective structures of excavators — Part 2: Roll-over protective structures (ROPS) for excavators of over 6 t — Technical Corrigendum 174-5:2022

 $\label{eq:https://standards.iteh.ai/catalog/standards/sist/432fc91e-ISO 12117-2:2008/AMD 1:2016, Earth-moving machinery_t-eiLaboratory tests and performance requirements for protective structures of excavators — Part 2: Roll-over protective structures (ROPS) for excavators of over 6 t – Amendment 1$

ISO 13031:2016, Earth-moving machinery — Quick couplers — Safety

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 474-1:2022, EN ISO 12100:2010 and the following apply.

NOTE Terminology for hydraulic excavators are specified in ISO 7135:2009 and illustrated in Annex D of this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <u>https://www.electropedia.org/</u>
- ISO Online browsing platform: available at <u>https://www.iso.org/obp</u>

3.1

hydraulic excavator

self-propelled machine on crawler, wheels or legs, having an upper structure normally capable of 360° swing with mounted equipment, primarily designed for excavating with bucket, without moving the undercarriage during the work cycle

Note 1 to entry: An excavator work cycle normally comprises excavating, elevating, swinging and discharging material (see EN ISO 6165:2012). Hydraulic excavators can also be used for material handling/transportation.

3.1.1

minimal swing radius excavator (MSRX)

excavator for operation in confined space having an upper structure with a short swing radius (equipment and attachment swing within 120 % of the width of the undercarriage)

3.1.2

compact excavator

excavator and minimal swing radius excavator with an operating mass (see ISO 6016:2008) of less than or equal to 6 000 kg

3.2

walking excavator

excavator with three or more supporting legs which may be articulated, telescopic or both and which can be fitted with wheels

3.3

PREVIEW

operator protective guards

system of a top guard and/or a front guard for the operator station of excavators

[SOURCE: ISO 10262:1998, 3.1 MOD]

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3.3.1 https://standards.iteh.ai/catalog/standards/sist/432fc91efront guard 995b-4cfa-9fe2-9c6258901b37/sist-en-474-5-2022 device intended to provide object protection to the front of the operator station of excavators

[SOURCE: ISO 10262:1998, 3.2]

3.3.2

top guard

device intended to provide falling object protection to the top of the operator station of excavators

[SOURCE: ISO 10262:1998, 3.3]

3.3.3

cab riser

any spacer that increases the height of the seat index point (SIP), as defined in ISO 5353, greater than 250 mm relative to normal configuration

[SOURCE: ISO 12117-2:2008+A1:2016, 3.5]

4 Safety requirements and/or protective/risk reduction measures

4.1 General

4.1.1 Context

Hydraulic excavators shall comply with the safety requirements and/or protective/risk reduction measures of this clause. In addition, the machines shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.

4.1.2 Specific relation to EN 474-1

Hydraulic excavators shall comply with the requirements of EN 474-1:2022, as far as not modified or replaced by the requirements of this part.

There are general requirements specified in EN 474-1:2022 that are not applicable because the risk assessment has shown that for hydraulic excavators the corresponding hazard does not exist. For hydraulic excavators 4.4.2.2, 4.14.2.3 and 4.22.5 in EN 474-1:2022, are not applicable.

4.2 Operator's station

4.2.1 Minimum space

EN 474-1:2022, 4.3.1.2 shall apply with the following modification:

On excavators with retractable front window, the cab height above SIP according to EN ISO 5353:1998 shall not be less than 920 mm measured with the window retracted into the cab.

4.2.2 Roll over and tip over protective structures (ROPS and TOPS) (standards.iten.al)

4.2.2.1 General

EN 474-1:2022, 4.3.3 does not apply for hydraulic excavators except for walking excavators, see 4.10.3. https://standards.iteh.ai/catalog/standards/sist/432fc91e-EN 474-1:2022, Annex B, B.7 does not apply for hydraulic excavators with moveable cabs, see 4.2.2.4.

4.2.2.2 Compact excavators

Compact excavators with an operating mass greater than 1 t and less than or equal to 6 t according to ISO 6016:2008 shall be equipped with a tip-over protective structure (TOPS).

TOPS shall meet the requirements of EN 13531:2001+A1:2008.

4.2.2.3 Hydraulic excavators with no cab riser or with fixed cab riser below 500 mm

Hydraulic excavators with no cab riser or with fixed cab riser up to 500 mm and with an operating mass greater than 6 t and less than or equal to 50 t according to ISO 6016:2008 shall be equipped with ROPS.

ROPS shall meet the requirements of ISO 12117-2:2008 and its ISO 12117-2:2008/Cor 1:2010 and its ISO 12117-2:2008/Amd. 1:2016.

4.2.2.4 Hydraulic excavators with fixed cab riser above 500 mm or with movable operator's station

— Hydraulic excavators with fixed cab riser above 500 mm or with movable operator's station and with an operating mass greater than 6 t and less than or equal to 50 t according to ISO 6016:2008 shall be equipped with TOPS. For evaluation of the performance of the TOPS, ISO 12117-2:2008 and ISO 12117-2:2008/Cor 1:2010 and ISO 12117-2:2008/AMD 1:2016 shall be used in respect of lateral loading only and with the following lateral load energy: Lateral load energy Us (J) = $6500 \times (M/10000)^{1,25}$.

— Hydraulic excavators with fixed cab riser above 500 mm or with movable operator's station and with an operating mass greater than 6 t and less than or equal to 50 t according to ISO 6016:2008 intended to be used where risk of rolling over exists (e.g. steep slope), shall be equipped with a roll over protective structure (ROPS). ROPS shall meet the requirements of ISO 12117-2:2008 and ISO 12117-2:2008/Cor 1:2010 and ISO 12117-2:2008/AMD 1:2016.

For hydraulic excavators with a movable operator's station as described in EN 474-1:2022, Annex B, the ROPS and TOPS tests shall be performed with the operator station in the hydraulic excavator's travel position. The operator station mounted to the moving linkage components shall be attached to the upper swing frame. The boom and any boom lift cylinders shall be attached to the upper swing frame as applicable based on potential contact with them during the test. The test load(s) shall be applied to the operator's station structure as specified in ISO 12117-2:2008 and ISO 12117-2:2008/Cor 1:2010 and ISO 12117-2:2008/AMD 1:2016.

The test includes the whole lifting configuration (e.g. cab riser frame and mounted cab).

4.2.3 Operator protective guards

EN 474 1:2022, 4.3.4 shall be replaced by the following:

Operator protective guards shall comply with ISO 10262:1998 and ISO 10262:1998/Cor 1:2009.

For hydraulic excavators with an operating mass less than or equal to 1 500 kg operator protective guards are not required.

For hydraulic excavators with an operating mass greater than 1500 kg fixing points for the operator protective guards shall be provided.

For hydraulic excavators with an operating mass greater than 1 500 kg and equal or less than 6 000 kg according to ISO 6016:2008, the operator protective guards shall meet the requirements of ISO 10262:1998 and ISO 10262:1998/Cor 1:2009, Eevel 14-5:2022

For hydraulic excavators with an operating mass greater than 6 000 kg according to ISO 6016:2008, the operator protective guards shall meet the requirements of ISO 10262:1998 and ISO 10262:1998/Cor 1:2009, Level II.

Hydraulic excavators used in log application shall be equipped with a front guard according to ISO 10262:1998 and ISO 10262:1998/Cor 1:2009.

4.2.4 Defrosting system

EN 474-1:2022, 4.3.2.1.4 shall apply with the following addition:

The defrosting system shall be capable of also defrosting the boom side window to meet the visibility requirements of EN 474-1:2022, 4.8.1.

4.3 Seat

4.3.1 Adjustment

For compact excavators, EN 474-1:2022, 4.4.1.3 shall apply with the following addition:

For compact excavators with an operating mass \leq 3 000 kg, the vertical adjustment of minimum 60 mm is not required.

4.3.2 Vibration

EN 474-1:2022, 4.4.1.4 shall apply with the following modifications:

For excavators greater than 6 000 kg the seat shall comply with spectral class EM 6 of EN ISO 7096:2020.

NOTE This clause makes reference to EN ISO 7096:2020 even though that standard gives no performance requirement for excavator seats.

4.3.3 Restraint system

EN 474-1:2022, 4.4.1.5 shall apply with the following modification:

Machines fitted with ROPS or TOPS shall have an operator restraint system that meets the requirements specified in EN ISO 6683:2008.

4.4 Steering system

EN 474-1:2022, 4.6.1 shall apply with the following addition:

The movements of the controls for steering do not need to correspond to the intended direction of movement if the upper structure is not in the normal driving direction.

4.5 Brake systems

4.5.1 Brake systems for travelling

EN 474-1:2022, 4.7 shall apply with the following modification:

For crawler excavators less than or equal to 3 000 kg, the working tool (e.g. bucket) or a special attachment (e.g. dozer blade) can substitute the parking brake to immobilise the machine.

4.5.2 Brake systems for swinging **PREVIEW**

Hydraulic excavators shall be equipped with swing brakes and swing locks.

Swing brakes shall comply with the requirements as defined in Annex C.

For hydraulic excavators with an operating mass less than 1 000 kg swing parking brake is not required.

Swing lock is not required/if the swing parking blake complies with C.3.1.4 and C.4.2. 4.6 Operator's field of view

F

4.6.1 Position of display devices

EN 474-1:2022, 4.8.1 shall apply with the modifications to ISO 5006:2017 as indicated in 4.6.1, 4.6.2 and 4.6.3.

NOTE ISO 5006:2017 covers both travel mode and operating mode for excavators (see ISO 5006:2017, 8.3.3.3).

ISO 5006:2017, 7.2 shall be replaced by the following:

The devices (e.g. CCTV display, mirror) used by the operator to view the area being monitored shall be placed such that they are in the 180° arc centred in front of the operator.

If visibility of the portion on the rectangular boundary (RB) as defined below, is masked by the linkage movement as defined in ISO 5006:2017, 8.3.3.3, one additional mirror may be installed in the 180°-270° arc centred in front of the operator to provide visibility to this portion of the RB. Such a mirror shall neither be used for the assessment of visibility on any other portion of the RB or the visibility test circle, nor for the assessment of visibility in the travel position.

The centre of the mirror shall be used as the reference for mirror location. The mirror locations shall be noted in the test report.