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Stroji za zemeljska dela - Varnost - 12. del: Zahteve za bagre s kablom

Earth-moving machinery - Safety - Part 12: Requirements for cable excavators

Erdbaumaschinen - Sicherheit - Teil 12: Anforderungen für Seilbagger

Engins de terrassement - Sécurité - Partie 12: Prescriptions applicables aux pelles à câbles

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Stroji za zemeljska dela

Earth-moving machinery

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EUROPEAN STANDARD
NORME EUROPÉENNE
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March 2022

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Supersedes EN 474-12:2006+A1:2008

English Version

**Earth-moving machinery - Safety - Part 12: Requirements
for cable excavators**

Engins de terrassement - Sécurité - Partie 12 :
Prescriptions applicables aux pelles à câbles

Erdbaumaschinen - Sicherheit - Teil 12: Anforderungen
für Seilbagger

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 474-12:2022) 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of an identical text or by endorsement, at the latest by September 2022, and conflicting national standards shall be withdrawn at the latest by March 2024.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 474-12:2006+A1:2008.

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
- 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 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.

EN 474-12:2022 (E)

The main differences between this document and EN 474-12:2006+A1:2008 are as follows:

- a) normative references (Clause 2) (revised and updated);
- b) definitions (Clause 3) (revised and updated);
- c) list of significant hazards (Annex A) (revised and updated);
- d) requirements for operative protective structures (revised);
- e) free-fall requirements (revised);
- f) verification methods table (Clause 5) (added);
- g) stability requirements (revised and updated);
- h) requirements for swing brake (revised);
- i) illustrations (updated);
- j) Annex ZA (updated).

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.

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.

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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 at 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.

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EN 474-12:2022 (E)**1 Scope**

This document together with EN 474-1:2022 deals with all significant hazards, hazardous situations and events relevant to cable 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 cable 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.

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

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

- Laser;
- Lightning.

Drilling and foundation equipment (covered by EN 16228-1:2014+A1:2021 to EN 16228-7:2014+A1:2021) are not dealt with in this document.

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.

This document does not deal with demolition machinery.

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

2 Normative references

[SIST EN 474-12:2022](https://standards.iteh.ai/catalog/standards/sist/c79e6120-281b-4-81-0536-08b1b127-88/sist-en-474-12-2022)

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The following documents are referred to in the text in such a way that some 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 16228-1:2014+A1:2021, *Drilling and foundation equipment — Safety — Part 1: Common requirements*

EN 13000:2010+A1:2014, *Cranes — Mobile cranes*

EN 14502-2:2005+A1:2008, *Cranes — Equipment for the lifting of persons — Part 2: Elevating control stations*

EN 60204-32:2008, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:2008)*

EN ISO 2867:2011, *Earth-moving machinery — Access systems (ISO 2867:2011)*

EN ISO 6165:2012, *Earth-moving machinery — Basic types — Identification and terms and definitions (ISO 6165:2012)*

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)*

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

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*

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 1 Terminology for hydraulic excavators are specified in ISO 7135:2009.

NOTE 2 Terminology for cable excavators are specified in ISO 15219:2004 and illustrated in Annex C of this document.

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

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

3.1

cable excavator

excavator (see 4.4 of EN ISO 6165:2012), having a wire rope-operated upper structure primarily designed for excavating (e.g. with a dragline bucket, a front shovel or grab, a chisel), for compacting material (e.g. with a compaction plate), for demolition work (e.g. by hook or ball) and for material handling with special equipment and attachment

[SOURCE: EN ISO 6165:2012, 4.4.3, modified]

3.2

boom hoist system

system which consists of the boom and its adjustment mechanism

Note 1 to entry: Boom hoist system can consist of e.g. lower-, intermediate- and head-section, the A- frame system and the boom hoist winch system, hydraulic-mechanical adjustment mechanism.

3.3

lift system

parts of the machine used for earth-moving-, demolition-, compaction- and lifting operation (e.g. with hook assembly) application which consists of the main winch system

3.4

lifting and lowering operation

lifting and lowering of a load without disengaging the lifting drum and the lift drive system

EN 474-12:2022 (E)**3.5****free-fall**

intentional drop of a tool enabled by a complete or partially controlled disengagement of the lifting drum and the lift drive system

Note 1 to entry: The lifted tool is falling only by gravity.

3.5.1**free-fall operation**

setting up of the machine in which the free-fall function can be activated

3.5.1.1**automatic free-fall operation**

triggering and braking of free-fall is done by the control system without intervention of the operator

3.5.1.2**manual free-fall operation**

triggering and braking of free-fall is done by the operator

3.5.2**free-fall function**

function to enable free-fall

3.5.3**triggering of free-fall**

action (manual or automatic) that causes the starting of the free-fall

3.5.4**free-fall brake**

device to decelerate and hold a winch drum which is disconnected from its drive by a lifting winch disconnecting system

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3.5.5**lifting winch disconnecting system**

system to disengage the lift drive system from the lifting drum

Note 1 to entry: This system can also be used as free-fall brake.

3.6**dynamic compaction**

compacting ground by dynamic impact of a pounder weight

3.7**hoisting rope**

rope intended to lift the load in vertical direction

3.8**digging rope**

rope intended to be used for earth moving application to pull the tool, e.g. a dragline bucket

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3.9**closing rope**

rope intended to be used for opening and closing, e.g. a grab

Note 1 to entry: A closing rope can also be used to lift the load, mainly in vertical direction.

4 Safety requirements and/or protective/risk reduction measures**4.1 General****4.1.1 Context**

Cable 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

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

4.2 Access

EN 474-1:2022, 4.2.1 shall apply with the following addition:

Access systems shall be provided to ensure access to the positions for assembly/dismantling of elements assembled on the site; particularly boom sections, shrouds, ropes and shall comply with EN ISO 2867:2011.

4.3 Operator's station**4.3.1 General**

EN 474-1:2022, 4.3 shall apply with the following modifications in 4.3.2 to 4.3.3.

4.3.2 Roll-over protective structures (ROPS)

EN 474-1:2022, 4.3.3 does not apply for cable excavators.

4.3.3 Operator's protective guard

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

Cable excavators shall be designed so that operator's protective structures can be fitted.

For cable excavators, intended for dynamic compaction operation, protective structures shall be provided by the manufacturer. The protective structures shall provide performance of level II in accordance with 8.1b (top guard) and 8.2b (front guard) of ISO 10262:1998+Cor. 1:2009.

Rope shovels and draglines equipped with boom and dipper handle are not required to provide a front guard.

4.3.4 Moveable operator station

EN 474-1:2022, 4.3.5 does not apply.

Moveable operation station shall be in accordance with EN 14502-2:2005+A1:2008.

4.4 Seat

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

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The seat shall meet the requirements of EN ISO 7096:2020, the input spectral class shall meet the class EM 6 for the test excitation vibrations.

4.5 Operator's controls and indicators**4.5.1 General**

EN 474-1:2022, 4.5.1 shall apply with the following addition to 4.5.1 d):

The movements of the controls for driving and steering (see 4.6) do not need to correspond to the intended direction of movement if the upper structure is not in the normal driving direction.

4.5.2 Operating mode

Cable excavators intended for use in different modes shall be fitted with a lockable operating mode selector for at least:

- a) excavator operation mode (see 4.9);

NOTE 1 Excavator operation mode can include e.g. excavating, compaction, demolition.

- b) lifting operation mode (see 4.10).

The activation of the selected operation mode shall be optically indicated at the operator's station(s).

NOTE 2 A remote control is also considered as an operator's station.

The selection of an operation mode shall not initiate any machine movement.

4.5.3 Controls on stabilizers

Control devices (except remote controls) for extending/retracting the stabilizers (e.g. outriggers, retractable crawlers) shall be in a position or provided with means where the movements of the stabilizers can clearly be seen by the operator and from where crushing of the operator is not possible.

If the horizontal movement of the stabilizers is controlled from a fixed control on the ground level, it shall only be possible to affect that movement on the side where the controls are situated.

4.6 Steering system

EN 474-1:2022, 4.6 shall apply with the following modification:

EN 474-1:2022, 4.6.1 does not apply for cable excavators.

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 (see 4.5.1).

4.7 Swing brakes

Cable excavators shall be equipped with swing service and swing parking brake systems which shall meet the performance and test requirements as defined in Annex B.

4.8 Stability**4.8.1 General**

The level of the cable excavator shall be indicated so that it is clearly visible to the operator in the operator's station (e.g. inclinometer in the cab).

Cable excavators with outriggers shall be fitted with a level indicating device (e.g. inclinometer) in every control station where the levelling movements can be controlled.

The accuracy of the level indicating device (e.g. inclinometer) shall be better or equal to $\pm 0,1^\circ$.

EN 474-1:2022, 4.11 applies with the following addition:

The calculation of the lift capacity of cable excavators shall be made on the basis of the following criteria:

- the machine is standing on flat and firm surface;
- if the machine is intended to be used on inclined surfaces, the slope has to be considered in the calculation;
- the tipping lines shall be taken from ISO 10567:2007, 4.1.3 and 4.1.4. For track type undercarriages the tipping line in travelling direction is given either by the line connecting the centreline of the support idlers/sprockets or the line connecting the centreline of the first and last support rollers, depending on the slope of the chain (according to EN 16228-1:2014+A1:2021, 5.2.3.3.2, Figure 1);

A table of the rated lift capacity shall be available at the operator's station (see Clause 6).

4.8.2 Calculation of tipping load

The tipping load of a cable excavator P_{tip} shall be calculated as follows:

$$P_{tip} = \left(\frac{9,81 \times m \times X}{R} \right) [N]$$

where

- m is the mass of the cable excavator including the mass of the equipment (e.g. boom, jib) [kg];
- X is the horizontal distance of the centre of gravity of m to the smallest tipping line according to EN 16228-1:2014+A1:2021, 5.2.3.3 [m];
- R is the horizontal distance from the application point of P to the smallest tipping line according to EN 16228-1:2014+A1:2021, 5.2.3.3 [m].

The rear tipping load of a cable excavator $P_{tip, rear}$ shall be calculated as follows:

$$P_{tip, rear} = \left(\frac{9,81 \times m \times X_1}{R_1} \right) [N]$$

where

- m is the mass of the cable excavator including the mass of the equipment (e.g. boom, jib) [kg];
- X_1 is the horizontal distance of the centre of gravity of m to the smallest rear tipping line according to EN 16228-1:2014+A1:2021, 5.2.3.3 [m];
- R_1 is the horizontal distance from the application point of P to the smallest rear tipping line according to EN 16228-1:2014+A1:2021, 5.2.3.3 [m].

4.8.3 Stability in different applications

4.8.3.1 General

The mass of the intended load and the location of its centre of gravity as well as the mass of the attachment shall be included in the determination of the rated operating load and the capacity of the attachment.