

---

---

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

*Engins de terrassement — Sécurité —*

*Partie 12: Exigences applicables aux pelles à câble*

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 20474-12:2017](https://standards.iteh.ai/catalog/standards/sist/56d272ee-e591-4c65-afd5-6951574ce2e4/iso-20474-12-2017)

<https://standards.iteh.ai/catalog/standards/sist/56d272ee-e591-4c65-afd5-6951574ce2e4/iso-20474-12-2017>



**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

ISO 20474-12:2017  
<https://standards.iteh.ai/catalog/standards/sist/56d272ee-e591-4c65-afd5-6951574ce2e4/iso-20474-12-2017>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>2</b>
<b>4 Safety requirements and protective measures</b> .....	<b>3</b>
4.1 General.....	3
4.2 Operator's station.....	3
4.2.1 General.....	3
4.2.2 Roll-over protective structures (ROPS).....	3
4.2.3 Operator's protective guard.....	3
4.3 Operator's controls and indicators.....	3
4.3.1 Controls for driving and steering.....	3
4.3.2 Warning indicator.....	3
4.4 Steering.....	3
4.5 Swing brakes.....	4
4.6 Lift system.....	4
4.6.1 Force-controlled operation (lifting, lowering).....	4
4.6.2 Free-fall operation.....	4
4.6.3 Switchover.....	4
4.6.4 Boom.....	4
4.6.5 Ropes.....	4
4.6.6 Rope drum, rope pulley.....	5
4.7 Limiting devices.....	5
4.7.1 Load moment limiting device.....	5
4.7.2 Lift limiting switch.....	5
4.7.3 Limit switch for the boom hoist system.....	5
4.8 Calculation of the lift capacity.....	5
4.8.1 Calculation method.....	5
4.8.2 Rated load table for object-handling application.....	6
4.9 Safety-related parts of the control system.....	6
4.10 Stability.....	6
4.10.1 General.....	6
4.10.2 Stability in different applications.....	6
4.10.3 Dragline bucket.....	7
4.10.4 Grab and front shovel.....	7
4.10.5 Object-handling applications.....	7
4.11 Cable excavator with electrical power source.....	7
<b>5 Verification of safety requirements and protective measures</b> .....	<b>7</b>
<b>6 Information for use</b> .....	<b>7</b>
<b>Annex A (normative) Requirements for cable excavator swing brakes</b> .....	<b>9</b>
<b>Annex B (informative) Illustrations</b> .....	<b>12</b>
<b>Bibliography</b> .....	<b>15</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html) (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*.

This second edition cancels and replaces the first edition (ISO 20474-12:2008), which has been technically revised with the following changes:

- normative references have been updated;
- references to national and regional provisions in the withdrawn ISO/TS 20474-14 have been deleted;
- new safety requirements and protective measures have been added, including requirements for the operator's protective guard.

It is intended to be used in conjunction with ISO 20474-1.

A list of all parts in the ISO 20474 series, published under the general title, *Earth-moving machinery — Safety*, can be found on the ISO website.

## Introduction

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

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 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.

ISO 20474 provides acceptable safety requirements for earth-moving machinery. This standard does not necessarily provide requirements to meet all national and regional regulatory provisions, e.g. Japan does not allow object handling with earth-moving machinery.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 20474-12:2017](https://standards.iteh.ai/catalog/standards/sist/56d272ee-e591-4c65-afd5-6951574ce2e4/iso-20474-12-2017)

<https://standards.iteh.ai/catalog/standards/sist/56d272ee-e591-4c65-afd5-6951574ce2e4/iso-20474-12-2017>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 20474-12:2017](https://standards.iteh.ai/catalog/standards/sist/56d272ee-e591-4c65-afd5-6951574ce2e4/iso-20474-12-2017)

<https://standards.iteh.ai/catalog/standards/sist/56d272ee-e591-4c65-afd5-6951574ce2e4/iso-20474-12-2017>

# Earth-moving machinery — Safety —

## Part 12: Requirements for cable excavators

### 1 Scope

This document gives the safety requirements specific to cable excavators as defined in ISO 6165. It is intended to be used in conjunction with ISO 20474-1, which specifies general safety requirements common to two or more earth-moving machine families. The specific requirements given in this document take precedence over the general requirements of ISO 20474-1.

This document deals with all significant hazards, hazardous situations and events relevant to the earth-moving machinery within its scope (see ISO 20474-1:2017, Annex A) when used as intended or under conditions of misuse reasonably foreseeable by the manufacturer. It specifies the appropriate technical measures for eliminating or reducing risks arising from relevant hazards, hazardous situations or events during commissioning, operation and maintenance.

It is applicable only to the machine itself if the cable excavator is intended for use in combination with other equipment or attachments such as drill rigs and those for pile driving or extracting and moving (e.g. rail-track, walking legs, pontoon, ship equipment or stationary undercarriages). It does not deal with the specific hazards relevant to such additional equipment or attachments.

This document is not applicable to machines manufactured before the date of its publication.

### 2 Normative references

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.

ISO 4310, *Cranes — Test code and procedures*

ISO 5010, *Earth-moving machinery — Rubber-tyred machines — Steering requirements*

ISO 6165, *Earth-moving machinery — Basic types — Identification and terms and definitions*

ISO 6014, *Earth-moving machinery — Determination of ground speed*

ISO 7546, *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 15219, *Earth-moving machinery — Cable excavators — Terminology and commercial specifications*

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

ISO 20474-1:2017, *Earth-moving machinery — Safety — Part 1: General requirements*

EN 791:1995, *Drill rigs — Safety*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20474-1, ISO 15219, and the following, apply.

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

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

#### 3.1

##### **cable excavator**

excavator having a wire-rope-operated upper structure designed primarily for excavation with a dragline bucket, front shovel or grab, used for compacting material with a compaction plate, for demolition work by hook or ball, and for material handling with special *equipment* (3.3) and *attachments* (3.2)

Note 1 to entry: See [Annex B](#) for illustrations.

Note 2 to entry: For the definition of *excavator*, see ISO 6165 or ISO 20474-5.

[SOURCE: ISO 6165:2012, 4.4.3, modified — By adding Notes 1 and 2.]

#### 3.2

##### **boom hoist system**

boom system comprising lower, intermediate and head sections, and A-frame and boom hoist winch systems

#### 3.3

##### **lift system**

main winch system used for earth-moving, demolition, compaction and object-handling (e.g. with hook assembly) applications

#### 3.4

##### **swing**

rotation of the upper structure of an excavator in relation to a fixed reference frame on the ground

#### 3.5

##### **working swing revolution speed**

turntable-swing speed, reached in a 180° revolution of the upper structure, with maximum rotation command input starting from a still position

Note 1 to entry: It is expressed in revolutions per minute (r/min).

#### 3.6

##### **deceleration swing angle**

angle measured in degrees of swing while the swing motion is decelerated from working swing revolution speed to a complete stop

#### 3.7

##### **swing torque**

torque which propels the upper structure relative to the undercarriage

Note 1 to entry: It is expressed in Newton metres (N · m).

#### 3.8

##### **swing service brake**

device or system used to decelerate the rotation of the upper structure and to bring it to a stop at any position

EXAMPLE Frictional brake, electrically operated brake, hydrostatically or other hydraulically operated brake.

Note 1 to entry: See [Annex A](#).



**3.9****swing parking brake**

device or system used to hold the stopped upper structure in any stationary position (e.g. transport position)

Note 1 to entry: See [Annex A](#).

**4 Safety requirements and protective measures****4.1 General**

Cable excavators shall comply with the safety requirements and protective measures of ISO 20474-1, in as far as those are not modified by the specific requirements of this clause.

**4.2 Operator's station****4.2.1 General**

ISO 20474-1:2017, 4.3 shall apply, with the additions and modifications given in [4.2.2](#) and [4.2.3](#) below.

**4.2.2 Roll-over protective structures (ROPS)**

ISO 20474-1:2017, 4.3.3, does not apply to cable excavators.

**4.2.3 Operator's protective guard**

Cable excavators shall be designed such that an operator's protective structure (top and front guard) can be fitted.

A protective structure (top and front guard) shall be offered by the manufacturer and selected by the user according to the existing risk of the application. The protective structures shall be in accordance with ISO 10262:1998, 7.

**4.3 Operator's controls and indicators****4.3.1 Controls for driving and steering**

ISO 20474-1:2017, 4.5.1 and 4.6.1, shall apply, except that the movements of the controls for driving and steering do not need to correspond to the intended direction of movement if the upper structure is not in the normal driving direction.

**4.3.2 Warning indicator**

ISO 20474-1:2017, 4.5.1, shall apply. Additionally, warning indicators shall be provided at the operator station or other relevant location to indicate the activation of the free-fall operations (see [4.6.2](#)) and to indicate the deactivation of the load moment limiting devices (see [4.7.1](#)) during dragline bucket, grab and front shovel application.

**4.4 Steering**

ISO 20474-1:2017, 4.6, shall apply, with the following exceptions.

ISO 20474-1:2017, 4.6.2, shall apply only for rubber-tyred cable excavators with a travel speed of more than 30 km/h, measured according to ISO 6014.

For rubber-tyred machines with a travel speed  $\leq$  30 km/h, ISO 5010 shall apply, except for the requirements for emergency steering.

#### 4.5 Swing brakes

Cable excavators shall be equipped with swing service and swing parking brake systems, which shall meet the requirements given in [Annex A](#).

#### 4.6 Lift system

##### 4.6.1 Force-controlled operation (lifting, lowering)

The lift system of cable excavators shall be fitted with a brake that actuates immediately after the release of lever or pedal controls.

The brake system shall automatically actuate in case of a loss of energy or force-controlled lowering. There shall be no effect on the stability of the excavator during this operation.

The brake system shall be capable of holding the rated load as specified in [4.8](#).

##### 4.6.2 Free-fall operation

The lift system of a cable excavator shall be fitted with a brake that actuates immediately after

- corresponding activation of the pedal control, or
- release of a hand-operated lever control.

The brake shall be so designed that a dynamic load and a progressive actuation is possible. The rope guide shall be so designed that an uncontrolled run-up or run-off of the rope is avoided.

##### 4.6.3 Switchover

There shall be no load lowering in case of a switchover from force controlled to free-fall operation.

##### 4.6.4 Boom

The boom of a cable excavator shall be secured against repulsing in the case of a sudden release of the load.

The boom shall be equipped with a limit switch to avoid backward overload.

The connection (bolts) of the boom-pieces shall be so designed that mounting and disassembling can be carried out without the need for a person to remain under the boom.

##### 4.6.5 Ropes

The ropes of cable excavators shall have safety factors in accordance with [Table 1](#).

**Table 1 — Safety factors of ropes**

Attachments Dragline Grab Hook	Group 1					
	Lift or closing ropes	Digging ropes	Boom-holding ropes			
			Operating with load connected		Lifting boom without load	
Safety factor <sup>a</sup>			Active ropes	Static ropes	Active ropes	Static ropes
	3,55	3,0	3,55	3,0	3,05	3,0

<sup>a</sup> The factors are the relation between the minimum breaking force of the rope and the maximum static load of the cable excavator when used as intended.

#### 4.6.6 Rope drum, rope pulley

##### 4.6.6.1 General

The rope drum and rope pulley shall be built and designed so that damage to the rope and run-off or trip-out of the rope guide is avoided.

##### 4.6.6.2 Rope drum

The ratio between the rope drum diameter and rope diameter shall be 1:20 at a minimum.

##### 4.6.6.3 Rope pulley

The ratio between the rope pulley diameter and rope diameter shall be 1:22 at a minimum, measured at the thread of the groove. Exceptions to this are permitted for fair leads of drag ropes, rope guidance pulleys and auxiliary ropes, such as grab guidance rope, digging guidance rope, ballast guidance rope of fair leads.

##### 4.6.6.4 Flanged wheel projection

The beaded edge of the winch drums shall be at least 1,5 times the rope diameter.

#### 4.7 Limiting devices

##### 4.7.1 Load moment limiting device

The lift system and boom hoist system of cable excavators in object-handling applications shall have a load moment limiting device to avoid overload. The load moment limiting device shall be adjusted to the rated load as defined in 4.9 with a tolerance of +10%. Operations that reduce the load moment shall be possible after the functioning of the load moment limiting device.

##### 4.7.2 Lift limiting switch

Cable excavators in object-handling applications shall be equipped with a limiting switch for lifting movement. It shall be possible to lower the boom after activation of the lift-limiting switch.

##### 4.7.3 Limit switch for the boom hoist system

The boom hoist system of a cable excavator shall be equipped with a limiting switch to avoid a backward overload of the boom. Boom lowering shall be possible after actuation of this limiting switch.

#### 4.8 Calculation of the lift capacity

##### 4.8.1 Calculation method

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

- flat surface;
- hard surface (depth of penetration = 0);
- tipping line in accordance with EN 791:1995, 5.5;
- load test according to ISO 4310.