INTERNATIONAL STANDARD

**ISO 20474-4**

Second edition
2017-07

# Earth-moving machinery — Safety —

## Part 4: Requirements for backhoe loaders

*Engins de terrassement — Sécurité —*

*Partie 4: Exigences applicables aux chargeuses-pelleteuses*



Reference number
ISO 20474-4:2017(E)



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

# 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).

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).

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



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 20474-4:2008), 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.

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.

# Earth-moving machinery — Safety —

# Part 4: Requirements for backhoe loaders

## 1 Scope

This document gives the safety requirements specific to wheeled and crawler backhoe loaders 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.

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 2330, *Fork-lift trucks — Fork arms — Technical characteristics and testing*

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

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

ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls*

ISO 7096:2000, *Earth-moving machinery — Laboratory evaluation of operator seat vibration*

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

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

ISO 8643, *Earth-moving machinery — Hydraulic excavator and backhoe loader boom-lowering control device — Requirements and tests*

ISO 9248, *Earth-moving machinery — Units for dimensions, performance and capacities, and their measurement accuracies*

ISO 14397-1:2007, *Earth-moving machinery — Loaders and backhoe loaders — Part 1: Calculation of rated operating capacity and test method for verifying calculated tipping load*

ISO 14397-2, *Earth-moving machinery — Loaders and backhoe loaders — Part 2: Test method for measuring breakout forces and lift capacity to maximum lift height*

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

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20474-1, ISO 6165 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**
**backhoe loader**
self-propelled crawler or wheeled machine having a main frame designed to carry both front-mounted equipment and rear-mounted backhoe equipment (normally with outriggers or stabilizers)

Note 1 to entry: When used in the backhoe mode, the machine is stationary and normally digs below ground level.

Note 2 to entry: When used in the loader mode (bucket use), the machine loads through forward motion.

Note 3 to entry: A backhoe work cycle normally comprises excavating, elevating, swinging and discharging of material. A loader work cycle normally comprises filling, elevating, transporting and discharging of material.

[SOURCE: ISO 6165:2012, 4.3]

**3.2**
**compact backhoe loader**
*backhoe loader* (3.1) with an operating mass in accordance with ISO 6016 of 4 500 kg or less, designed to work in limited spaces with the associated needs for greater manoeuvrability



**3.3**
**hydraulic lift capacity**
maximum mass that can be lifted in any arm position with the fork in horizontal position limited by the hydraulic circuit working pressure as defined in ISO 14397-2



**3.4**
**anchorage point**
vertical point below the lifting device where the load force is applied or transposed

**3.5**
**hydraulic holding circuit pressure load**
maximum static pressure in a specific circuit, limited by a relief valve at a flow no greater than 10 % of rated circuit flow

**3.6**
**tipping load**
static load at the balance point

**3.7**
**hydraulic lift capacity**
maximum load that can be lifted at the bucket hinge pin with any hydraulic circuit activated, limited by the working circuit hydraulic pressure

**3.8**
**lift point radius**
horizontal distance between the bucket hinge pin and the swing pivot centre

**3.9**
**balance point**
point at which the moment acting to overturn the machine with a specific load and lift point radius is equal to the moment of the machine available to resist overturning

**3.10**
**overturning moment**
moment when the balance point is reached

**3.11**
**test force**
force applied to the load cell either by the test weight or by applying hydraulic means

# 4 Safety requirements and protective measures

## 4.1 General

Backhoe loaders 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 Minimum space envelope

On backhoe loaders with a retractable rear window, the cab height above the SIP (seat index point) shall not be less than 920 mm, measured with the window retracted into the cab.

### 4.2.2 Operator's controls



ISO 20474-1:2017, 4.5 applies with the following additions.



— On backhoe loaders equipped with outriggers, an acoustic and visual warning device shall warn the operator when the travel control is engaged and the outriggers are not in the transport position as defined by the manufacturer. An acoustic and visual warning device shall warn the operator that the transmission is engaged when the operator's seat is not facing in the direction of the controls used to propel, e.g. braking, steering. The operator shall be able to determine if the outriggers are in the transport position as defined by the manufacturer prior to engaging the travel control.

— If the backhoe loader is provided with an alternative operator position with alternative travel controls, there shall also be control devices for braking and steering at this alternative position, which meet the performance requirements for the primary functions.

### 4.2.3 Operator's seat

ISO 20474-1:2017, 4.4.1, shall apply; in addition, the seat shall be in accordance with ISO 7096:2000, input spectral class EM 5, and EM 8 for compact backhoe loaders.

## 4.3 Warning devices

ISO 20474-1:2017, 4.9, first indent, applies with the addition that the sound level shall also be greater than or equal to 93 dB(A) at 7 m distance from backhoe swing centre to the rear. The operator shall be able to activate the warning device also from the backhoe operation position.

## 4.4 Stability

### 4.4.1 General

ISO 20474-1:2017, 4.11, shall apply, with the additions given in 4.4.2 and 4.4.3 below.

NOTE All rated capacities as defined hereafter are based on tests, calculations, or both, of machines on a level and firm supporting surface.

The mass of the load, its density and the location of its centre of gravity, as well as the mass of the attachment and the quick coupler, if fitted, shall be included in the determination of the rated operating load and the size/capacity of the attachment.

In order to provide sufficient stability, the rated operating load in intended operations shall be determined as specified in 4.4.2 and 4.4.3.

### 4.4.2 Loader portion

#### 4.4.2.1 General

The rated capacities of the backhoe loader used in loader applications shall be determined as follows, with the backhoe in its transport position as specified by the manufacturer.

The loader portion of the backhoe loader does not require a boom-lowering control device as defined in ISO 8643.

#### 4.4.2.2 Bucket application

The rated operating capacity shall be determined according to ISO 14397-1.

The volumetric rating of bucket shall be determined according to ISO 7546.

NOTE The mass, volumetric rating of bucket and density of the material are taken into account when the bucket capacity is selected for a specific application.



#### 4.4.2.3 Fork application



##### 4.4.2.3.1 General

The rated operating capacity is based on the use of forks and shall be determined by the criteria specified in 4.4.2.3.2 and 4.4.2.3.3.

##### 4.4.2.3.2 Stability assessments

The tipping load shall be determined according to ISO 14397-1 and ISO 14397-2, with the fork in a horizontal position. The rated load, as a percentage of tipping load, shall not exceed the applicable value as specified in Table 1.

**Table 1 — Stability factors in fork application**

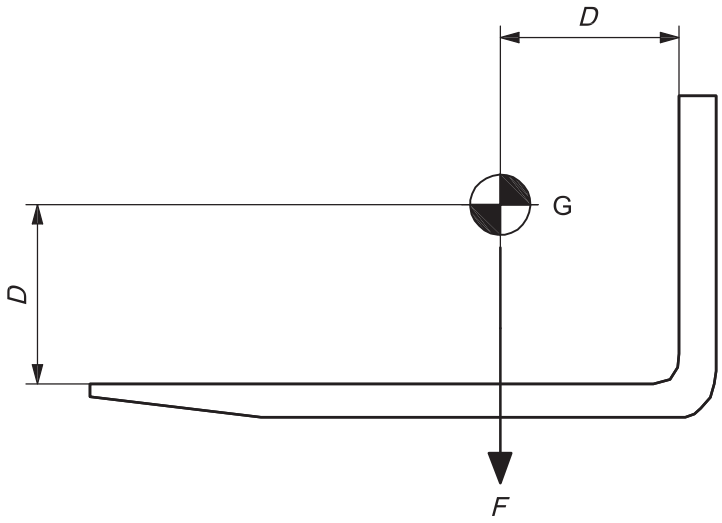
| Rated load capacity as a percentage of tipping load for loader portion | |
|---|---|
| **Ground condition** | **Percentage of tipping force** |
| Rough terrain | 60 |
| Firm and level ground | 80 |

Stability factors used to determine the rated operating load of the crawler backhoe loader shall not exceed 35 % of the tipping load.

##### 4.4.2.3.3 Fork load centre of gravity

Fork arms shall meet the performance requirements stated in ISO 2330.

The load centre of gravity distance, *D*, is determined as a point on the longitudinal centreline of the machine at half the distance from the most rearward point of the load opening to the tip of the fork (see Figure 1).




**Key**

*D* distance, mm

*F* load, N

G centre of gravity

**Figure 1 — Load centre of gravity with fork arms**



#### 4.4.2.4 Log-handling application

##### 4.4.2.4.1 General



The rated operating capacity is based on a log grapple application and shall be determined according to ISO 14397-1 (except for stability factor stated in ISO 14397-1:2007, 5.1 with the log grapple fitted. The rated load as percentage of tipping load shall not exceed the applicable value specified in Table 2.

**Table 2 — Stability factors in log handling**

| Ground condition | Rated operating load capacity as percentage of tipping load | |
|---|---|---|
| | Wheeled backhoe loaders | Crawler backhoe loaders |
| Rough terrain | 75 | 50 |
| Firm and level ground | 85 | 60 |

#### 4.4.2.5 Object-handling application

The rated operating capacity is based on use of a lifting accessory or accessories and the attachment and shall be determined according to ISO 14397-1.

#### 4.4.2.6 Other applications

The rated load of derivative machinery shall be determined by the manufacturer according to the load specification given in 4.4.2.2 to 4.4.2.5, considering the comparable hazard.