
**Earth-moving machinery — Safety —
Part 4:
Requirements for backhoe loaders**

Engins de terrassement — Sécurité —

Partie 4: Exigences applicables aux chargeuses-pelleteuses

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 20474-4 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*.

ISO 20474 consists of the following parts, under the general title *Earth-moving machinery — Safety*:

- *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*
- *Part 14: Information on national and regional provisions [Technical Specification]*

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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 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.

Provisions that are applicable for Australia, the EU, Japan or the USA, and which are mandatory for compliance with specific governmental laws, directives or regulations in force in the particular country or region, are given in ISO/TS 20474-14.

NOTE Other countries or regions may also have regional requirements.

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Earth-moving machinery — Safety —

Part 4: Requirements for backhoe loaders

1 Scope

This part of ISO 20474 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 earth-moving machine families, and with ISO/TS 20474-14, which gives information on provisions that are mandatory in particular countries or regions. The specific requirements given in this part of ISO 20474 take precedence over the general requirements of ISO 20474-1.

This part of ISO 20474 deals with all significant hazards, hazardous situations and events relevant to the earth-moving machinery within its Scope when used as intended or under conditions of misuse reasonably foreseeable by the manufacturer (see also ISO/TS 20474-14). It specifies the appropriate technical measures for eliminating or reducing risks arising from significant hazards, hazardous situations or events during commissioning, operation and maintenance. It is not applicable to machines manufactured before the date of its publication.

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2 Normative references

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The following referenced documents are indispensable for the application 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 6165:2006, *Earth-moving machinery — Basic types — Identification and terms and definitions*

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

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

ISO 14397-1, *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 20474-1:2008, *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, and the following, apply.

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 When used in the backhoe mode, the machine is stationary and normally digs below ground level.

NOTE 2 When used in the loader mode (bucket use), the machine loads through forward motion.

NOTE 3 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.

[ISO 6165:2006, definition 4.3]

3.2 compact backhoe loader
backhoe loader with an operating mass in accordance with ISO 6016 of 4 500 kg or less, designed to work in confined 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

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4 Safety requirements and/or protective measures

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4.1 General

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

4.2 Protection

4.2.1 Roll-over protective structures (ROPS)

ISO 20474-1:2008, 4.3.3 shall apply.

For mandatory national and/or regional provisions, see ISO/TS 20474-14.

4.2.2 Falling object protective structures (FOPS)

For mandatory national and/or regional provisions, see ISO/TS 20474-14.

4.3 Operator's station

4.3.1 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.

4.3.2 Operator's controls

For mandatory national and/or regional provisions, see ISO/TS 20474-14.

4.3.3 Operator's seat

ISO 20474-1:2008, 4.4.1, shall apply; in addition, the seat shall be in accordance with ISO 7096:2000, input spectral class EM5.

For mandatory national and/or regional provisions, see ISO/TS 20474-14.

4.4 Warning devices

For mandatory national and/or regional provisions, see ISO/TS 20474-14.

4.5 Stability

4.5.1 General

ISO 20474-1:2008, 4.11, shall apply, with the additions given in 4.5.2 and 4.5.3.

NOTE All rated capacities as defined hereafter are based on tests and/or calculations 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 attachment bracket, if fitted, shall be included in the determination of the rated operating load and the size/capacity of the attachment.

The burst pressure of hydraulic hoses shall be four times the operating pressure.

In order to provide sufficient stability, the rated operating load in intended operations shall be determined as specified in 4.5.2 and 4.5.3.

4.5.2 Loader portion

4.5.2.1 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.

4.5.2.2 Bucket application

The rated operating load shall be determined as follows:

- tipping load and rated operating load in accordance with ISO 14397-1;
- volumetric rating of the bucket in accordance with ISO 7546.

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

4.5.2.3 Fork application

4.5.2.3.1 General

The rated operating capacity is based on the use of forks and shall be determined by the criteria specified in 4.5.2.3.2 to 4.5.2.3.5.

4.5.2.3.2 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.

4.5.2.3.3 Hydraulic lift capacity

It shall be possible to control the rated load in all positions foreseen by the manufacturer, considering all relevant hydraulic circuits involved.

4.5.2.3.4 Rated operating load

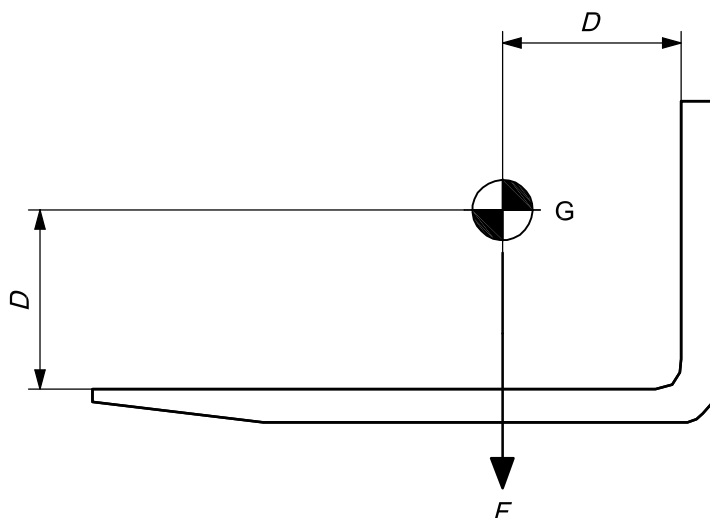
The rated operating load shall be determined by either

- the rated load according to 4.5.2.3.2, or
- the hydraulic lift capacity as specified in 4.5.2.3.3,

whichever is the lesser of the two.

4.5.2.3.5 Fork size

The fork arm size shall be selected and the load centre of gravity distance, *D* (see Figure 1), determined in accordance with Table 2.



Key

D distance, mm (see Table 2)

F load, N

G centre of gravity

Figure 1 — Load centre distance

Table 2 — Load centre distance

Load, <i>F</i> N	Distance, <i>D</i> mm
$F \leq 10\,000$	400
$10\,000 < F \leq 50\,000$	500
$50\,000 < F \leq 100\,000$	600

Forks shall be in accordance with ISO 2330.

4.5.2.4 Log-handling application

4.5.2.4.1 General

The rated operating load of a backhoe loader in log-handling applications shall be determined using the criteria given in 4.5.2.4.2 and 4.5.2.4.3.

4.5.2.4.2 Stability assessments

The tipping load shall be determined according to ISO 14397-1, with the log grapple fitted. The rated load, as a percentage of tipping load, shall not exceed the applicable value as specified in Table 3.

Table 3 — 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