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Earth-moving machinery — Safety —

Part 3: Requirements for loaders

Engins de terrassement — Sécurité —

Partie 3: Exigences applicables aux chargeuses

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Contents

Page

Foreword

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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).

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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 20474-3:2008), 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— references to national and regional provisions in the withdrawn ISO/TS 20474-14 have been deleted;

— stability requirements 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 3:
Requirements for loaders

1 Scope

This document gives the safety requirements specific to 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 5353, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

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 7131, *Earth-moving machinery — Loaders — Terminology and commercial specifications*

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

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 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 ISO 7131, 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
loader
self-propelled crawler or wheeled machine having front-mounted equipment primarily designed for loading operation (bucket use), which loads or excavates through forward motion of the machine

Note 1 to entry: A loader work cycle normally comprises filling, elevating, transporting and discharging material.

Note 2 to entry: Derivative machinery: loaders can also be used for derivative applications (see ISO 20474-1:2017, 3.1.2).

Note 3 to entry: See Annex A for examples of different types of loader.

3.2
compact loader
loader (3.1) having an operating mass as defined in ISO 6016 of 4 500 kg or less for wheeled loaders and 6 000 kg or less for crawler loaders, designed to work in areas with limited space, with the associated need for greater manoeuvrability

[SOURCE: ISO 6165:2012, 4.2.3]

3.3
skid steer loader
loader (3.1) normally having an operator station between or to the side of the attachment-supporting structure and steered by using variation of speed, and/or direction of rotation between traction drives on the opposite sides of a machine having fixed axles on wheels or tracks

[SOURCE: ISO 6165:2012, 4.2.2]

3.4
swing loader
loader (3.1) having a swing-type lift arm which can rotate to the left and the right of the straight position

Note 1 to entry: A swing loader work cycle is similar to a loader cycle, but additional work can be done with the equipment offset from the longitudinal axis of the machine.

[SOURCE: ISO 6165:2012, 4.2.1]

4 Safety requirements and protective measures

4.1 General

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 Rear windows

The rear window of loaders, except for compact loaders, shall be fitted with a motorised wiper and washer.

4.3 Protection

4.3.1 Operator's controls and indicators

ISO 20474-1:2017, 4.5, shall apply, with the following addition for compact loaders with front access.

Controls for lifting and lowering the loader linkage, machine movement and hydraulically controlled attachments (e.g. multi-purpose bucket) shall be either automatically mechanically secured (e.g. by a safety bar) or automatically deactivated when the operator leaves/enters the operator's compartment.

4.3.2 Guarding for loaders

Loaders shall be fitted with side protection that prevents the operator from reaching the trapping parts between the lift arms and fixed parts of the machine when the operator is seated in the operator's position.

NOTE Tempered glass alone does not fulfil the requirements of a protective device where a risk of crushing, shearing and cutting exists according to ISO 13857.

Front protection shall be provided for the operator's lower limbs if the lift arm equipment or attachment passes within 1,5 m forward of the SIP as defined in ISO 5353. The front protective structure shall have a minimum height of 200 mm from the floor plate.

4.4 Stability

4.4.1 General requirements

ISO 20474-1:2017, 4.11 shall apply with the additions given in 4.4.2 to 4.4.7, 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 capacity and the size or capacity of the attachment.

Loaders do not need boom lowering control device as defined in ISO 8643.

In order to provide a sufficient stability the rated operating capacity in intended operations shall be determined as specified in 4.4.2 to 4.4.7.

4.4.2 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 have to be taken into account when the bucket capacity is selected for a specific application.

4.4.3 Fork application

4.4.3.1 General

The rated operating capacity is based on the use of forks and shall be determined according to ISO 14397-1 (except for the stability factor stated in ISO 14397-1:2007, 5.1)and with the fork in a horizontal position. The rated load as a percentage of tipping load shall not exceed the applicable value specified in Table 1.

Table 1 — Stability factors in fork application

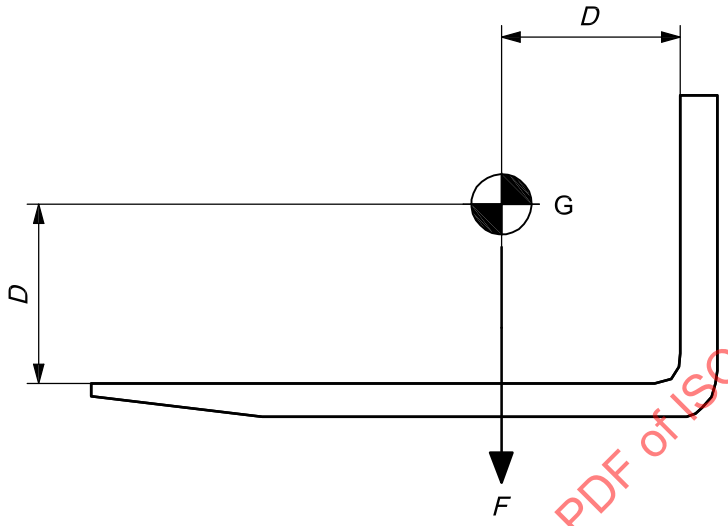
Rated load as a percentage of tipping load	
Ground condition	**Wheel loader**
Rough terrain	60
Firm and level ground	80

Stability factors to determine rated load of wheel loaders with skid steering shall not exceed 50 % and crawler loaders, or skid steer track loaders, shall not exceed 35 % of the tipping load.

4.4.3.2 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, as shown in Figure 1.



Key

D distance, mm (see Table 3)
F load, N
G centre of gravity

Figure 1 — Load centre of gravity with fork arms

4.4.4 Log handling application

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

Rated load as a percentage of tipping load		
Ground condition	**wheel loaders**	**crawler loaders**
Rough terrain	75	50
Firm and level ground	85	60

4.4.5 Single heavy object (non-palletized, single heavy object) application

4.4.5.1 General

The rated operating capacity is based on the use of a single heavy object handling device (for a non-palletized load), and shall be determined according to ISO 14397-1:2007, Annex A.

4.4.5.2 Handling attachment

The centre of gravity distance, *D*, of the attachment is as shown in Figure 1.

For indicating the rated operating load for a single heavy object handling attachment, a transversal square cross-section of the load should be considered.

The specifications in Table 3 should preferably be selected.

Table 3 — Load centre distance

Load, F N	**Distance,** D mm
$F \leq 100\,000$	600
$100\,000 < F \leq 200\,000$	900
$F > 200\,000$	1 200

4.4.6 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.

4.4.7 Other applications

The rated load of derivative machinery shall be determined by the manufacturer according to the load specification given in 4.4.2 to 4.4.6, considering the comparable hazard.

5 Information for use

ISO 20474-1:2017, 6.2 shall apply with the following additions.

The manufacturer shall provide information on the rated operating capacity as well as the corresponding operating conditions:

— bucket application according to 4.4.2;

— fork application according to 4.4.3;

— log handling application according to 4.4.4;

— single heavy object application according to 4.4.5;

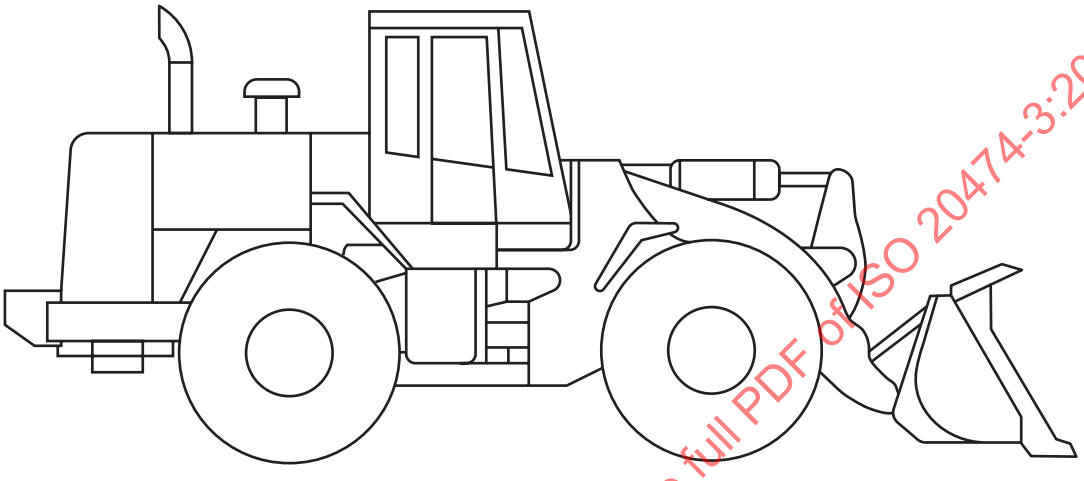
— object handling application according to 4.4.6;

— other applications according to 4.4.7.

Annex A
(informative)

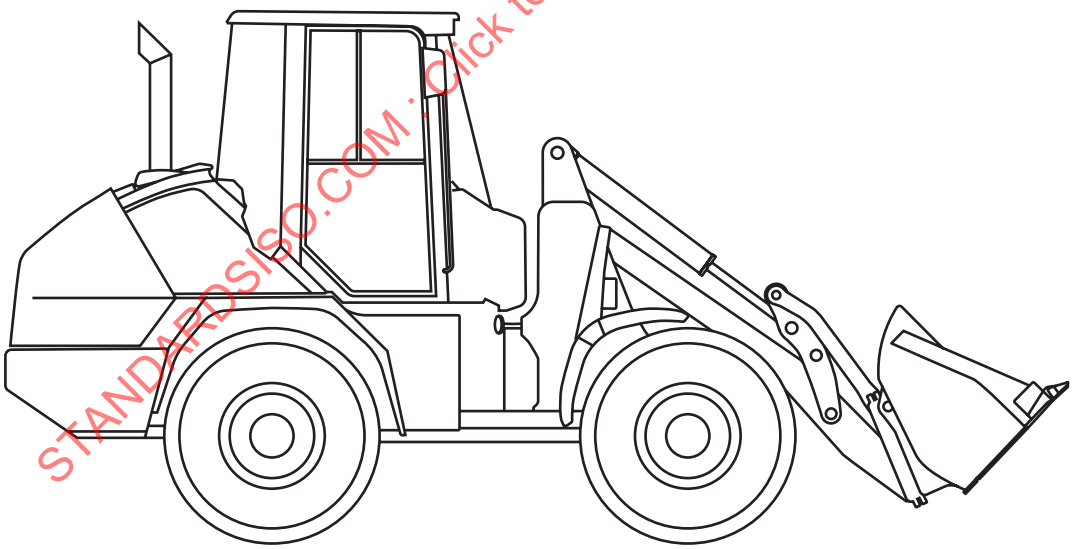
Illustrations

See Figures A.1 to A.6.



NOTE Wheeled loader with an operating mass greater than 4 500 kg.

Figure A.1 — Wheeled loader



NOTE Wheeled loader with an operating mass of 4 500 kg or less, designed to work in areas with limited space, with the associated need for greater manoeuvrability.

Figure A.2 — Compact wheeled loader