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Earth-moving machinery — Safety —

Part 5: Requirements for hydraulic excavators

Engins de terrassement — Sécurité —

Partie 5: Exigences applicables aux pelles hydrauliques

Reference number
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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 20474-5 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]

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.

Earth-moving machinery — Safety —

Part 5:
Requirements for hydraulic excavators

1 Scope

This part of ISO 20474 gives the safety requirements specific to hydraulic 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 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.

2 Normative references

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 3449:2005, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements*

ISO 3471, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements*

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 6683, *Earth-moving machinery — Seat belts and seat belt anchorages — Performance requirements and tests*

ISO 7135, *Earth-moving machinery — Hydraulic excavators — Terminology and commercial specifications*

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 8084, *Machinery for forestry — Operator protective structures — Laboratory tests and performance requirements*

ISO 10262, *Earth-moving machinery — Hydraulic excavators — Laboratory tests and performance requirements for operator protective guards*

ISO 10567:2007, *Earth-moving machinery — Hydraulic excavators — Lift capacity*

ISO 12117, *Earth-moving machinery — Tip-over protection structure (TOPS) for compact excavators — Laboratory tests and performance requirements*

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 ISO 7135, and the following, apply.

3.1
hydraulic excavator
self-propelled machine on crawlers, wheels or legs, having an upper structure normally capable of a 360° swing with mounted equipment, primarily designed for excavating with bucket, without moving the undercarriage during the work cycle

NOTE 1 An excavator work cycle normally comprises excavating, elevating, swinging and discharging of material (see ISO 6165).

NOTE 2 Hydraulic excavators may also be used for material handling/transportation.

3.1.1
minimal swing radius excavator
MSRX
excavator for operation in confined space having an upper structure with a short swing radius (equipment and attachment swing within 120 % of the width of the undercarriage)

3.1.2
compact excavator
excavator and **minimal swing radius excavator** (3.1.1) with an operating mass in accordance with ISO 6016 of less than or equal to 6 000 kg

3.2
walking excavator
excavator with three or more supporting legs which may be articulated, telescopic or both and which can be fitted with wheels

NOTE For information on regional provisions, see ISO/TS 20474-14.

4 Safety requirements and/or protective measures

4.1 General

Hydraulic excavators 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 Access

ISO 20474-1:2008, 4.2, shall apply.

4.3 Operator's station

4.3.1 Minimum space envelope

ISO 20474-1:2008, 4.3.1.2, shall apply.

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

4.3.2 Operator's protection

4.3.2.1 Operator's protective guard

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

4.3.2.2 Roll over protective structures (ROPS) and tip-over protective structures (TOPS)

ISO 20474-1:2008, 4.3.3, shall apply only to walking excavators (see 4.8.3).

Compact excavators having an operating mass greater than 1 000 kg shall be fitted with a TOPS according to ISO 12117.

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

4.3.2.3 Protection for log application

The excavator shall be equipped with a front protection and, if a relevant hazard exists, with a top protection, according to ISO 10262 and ISO 8084, as applicable.

4.3.3 Operator's seat

4.3.3.1 Seat adjustment for compact excavators

ISO 20474-1:2008, 4.4.1.3, shall apply only to excavators with an operating mass according to ISO 6016 of less than 3 000 kg.

4.3.3.2 Vibration

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

4.3.4 Rear window

ISO 20474-1:2008, 4.3.2.9, shall apply except that the rear window of the excavator does not need to be equipped with window wipers, washers and defrosters.

4.4 Controls for driving and steering

ISO 20474-1:2008, 4.5.1 d) and 4.6.1, shall apply with the following addition: 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.

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

4.5 Swing brakes

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

4.6 Stability and safety devices

4.6.1 General

ISO 20474-1:2008, 4.11, shall apply with the additions given in 4.6.2 to 4.6.4.

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.

In order to provide sufficient stability, the rated operating load in intended operations shall be determined as specified in 4.6.2 and 4.6.4.

4.6.2 Bucket and shovel applications

The capacity of an excavator used in a bucket or shovel application shall be either

a) the rated tipping load in accordance with ISO 10567 in the most unfavourable position, or

b) the hydraulic capacity in accordance with ISO 10567,

whichever is the lesser of the two.

The volumetric rating of the bucket or shovel shall be determined in accordance with ISO 7451 or ISO 7546.

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

4.6.3 Log applications

4.6.3.1 Stationary

The rated lift capacity in a stationary log application shall be determined by either

— the rated tipping load in accordance with ISO 10567, with a log in the most unfavourable position, or

— the hydraulic lift capacity in accordance with ISO 10567,

whichever is the lesser of the two.

4.6.3.2 Moving

The rated lift capacity in a moving (driving with load) log application shall be determined by either

— the rated tipping load as 60 % of the tipping load in accordance with ISO 10567, with a log in the most unfavourable position, or

— the hydraulic lift capacity as defined in ISO 10567:2007, 3.11,

whichever is the lesser of the two.

4.6.4 Object-handling applications

4.6.4.1 General

The capacity of excavators is determined in accordance with 4.6.4.2 and 4.6.4.3.

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

4.6.4.2 Rated lift capacity in object handling

The rated lift capacity in object handling shall be defined by its rated lift capacity according to ISO 10567.

4.6.4.3 Rated lift capacity table in object handling

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

4.6.4.4 Load safety devices

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

4.6.4.5 Other applications

The rated lift capacity of derivated machinery shall be determined by the manufacturer according to the load specification given in 4.6.4.2 and 4.6.4.3, whereby the comparable hazard has to be considered for the special application.

4.7 Parking brake for compact crawler excavators

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

4.8 Specific requirements for walking excavators

4.8.1 Operator's station

4.8.1.1 Steering system

ISO 20474-1:2008, 4.6.1, is not applicable.

4.8.1.2 Visibility

ISO 20474-1:2008, 4.8.1, is not applicable.

The ground contacting part of each leg in all possible positions shall be visible from the operator's station in order to ensure that the operator can place the legs on firm ground.

4.8.1.3 Egress

In case of failure of the energy source, or with the engine stopped, it shall be possible for the operator to leave the machine safely.

EXAMPLE By lowering the operator's station, or by steps or stairs.

4.8.2 Wheel brake system

ISO 20474-1:2008, 4.7, is not applicable to walking excavators having a maximum of two wheels.

4.8.3 Operator's protection

4.8.3.1 Roll-over protective structures (ROPS)

Walking excavators shall be fitted with ROPS in accordance with ISO 3471 for backhoe loaders of equivalent mass.

4.8.3.2 Restraint systems

All walking excavators fitted with a cab shall be equipped with an operator restraint system in accordance with ISO 6683.

4.8.3.3 Falling-object protective structure (FOPS)

Walking excavators shall be designed so that a FOPS in accordance with ISO 3449:2005, level II, can be fitted (see also ISO 20474-1:2008, 4.3.4).

4.8.3.4 Legs, hydraulic circuit

All leg cylinders shall be fitted with lock valves to prevent the machine from becoming unstable in the case of a hydraulic system failure.

4.8.4 Stability

4.8.4.1 Conditions

The stability shall be determined under the following conditions:

a) on a level and firm supporting test surface;

b) with stabilizer and wheels (at maximum spread position) extended as specified by the manufacturer;

c) with the lower side of the undercarriage at a levelled position of approximately 350 mm above the test surface;

d) with tipping lines as shown in Figure 1;

e) at maximum reach with/without telescopic arm to the front/rear, as shown in Figure 2, and to the side as shown in Figure 3.

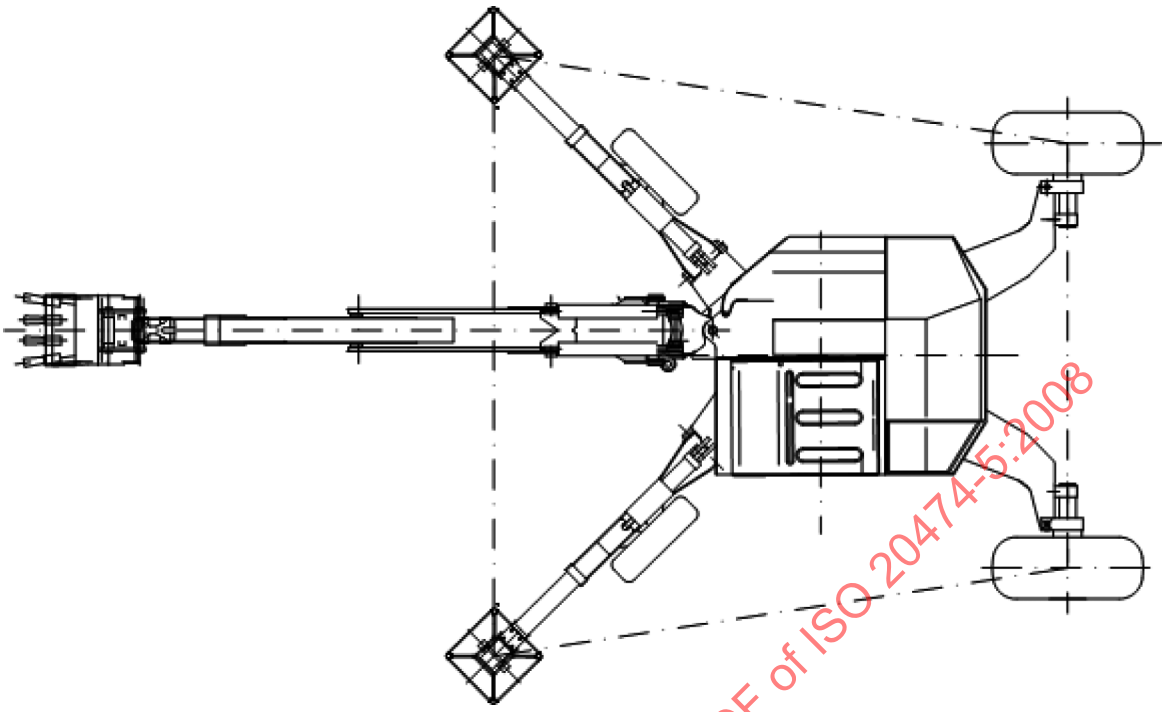
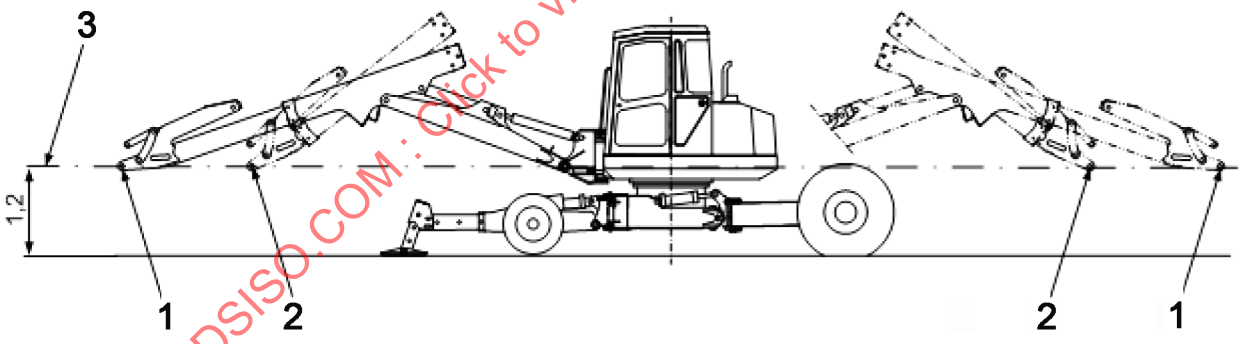


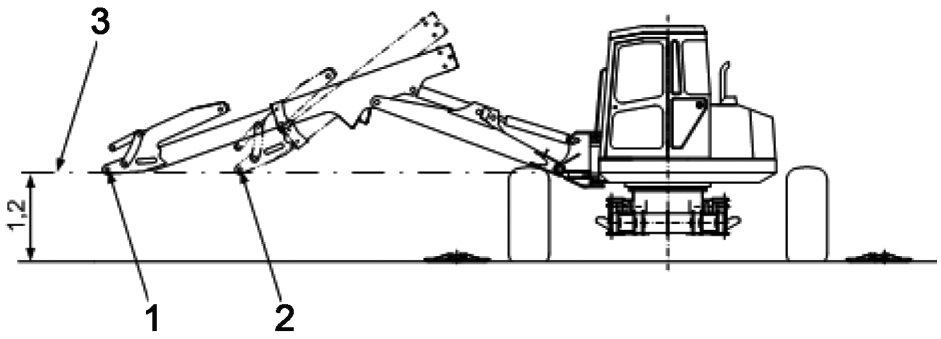
Figure 1 — Tipping lines of walking excavators



Key

1 fully extended
2 fully retracted
3 measuring line (measurements in metres)

Figure 2 — Measurement of rated tipping load to front/rear



Key

1 fully extended
2 fully retracted
3 measuring line (measurements in metres

Figure 3 — Measurement of rated tipping load to the side

4.8.4.2 Bucket applications

The bucket volume of walking excavators in bucket applications shall be determined by either

a) the rated tipping load according to ISO 10567, in the most unfavourable position, or

b) the hydraulic capacity as specified in ISO 10567,

whichever is the lesser of the two.

The volumetric rating of the bucket shall be determined in accordance with ISO 7451.

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

4.8.4.3 Object-handling applications

4.8.4.3.1 Rated lift capacity in object handling

The rated lift capacity in object handling shall be determined in accordance with ISO 10567.

4.8.4.3.2 Rated lift capacity table in object handling

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

4.8.4.3.3 Load safety devices

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

4.8.5 Retrieval and towing

ISO 20474-1:2008, 4.15, shall apply, except for ISO 20474-1:2008, 4.15.2 and 4.15.5.

5 Verification of safety requirements and/or protective measures

ISO 20474-1:2008, Clause 5, shall apply.

6 Information for use

ISO 20474-1:2008, Clause 6, shall apply, with the following additions to the operator's manual (6.2):

a) a description of the excavator configuration required for object handling;

b) the parking procedure for compact crawler excavators;

c) a description of excavator stability in different applications;

d) safety instructions for selection and use of additional protective guards (see 4.3.2);

e) a prescription of special precautions for walking excavators;

f) an instruction that compact excavators ($\leqslant$ 1 500 kg) not fitted with a protective guard shall not be used for applications where the risk of falling objects is given;

g) special instructions for log applications (reduced travelling speed, avoidance of abrupt brake- or steering-action, central fixing of the trunk, transport position during movement, etc.);

h) an instruction of the necessity for a front guard and a top guard in log applications;

i) instructions for the functioning, use and deactivation of the load safety devices, if fitted.

Annex A
(informative)

Illustrations

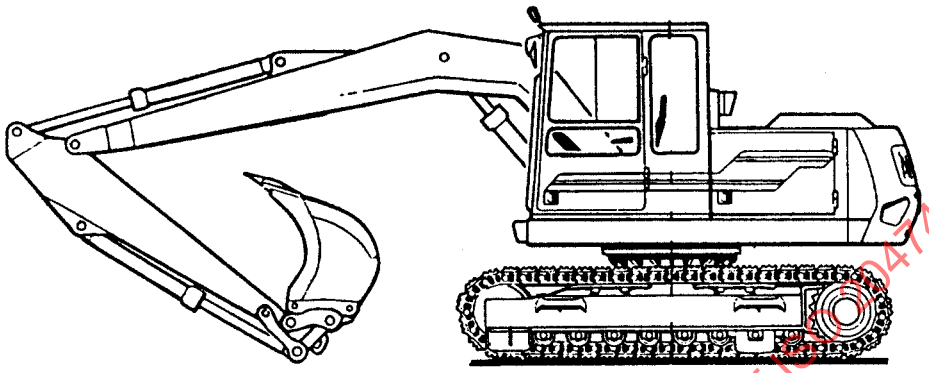


Figure A.1 — Crawler excavator

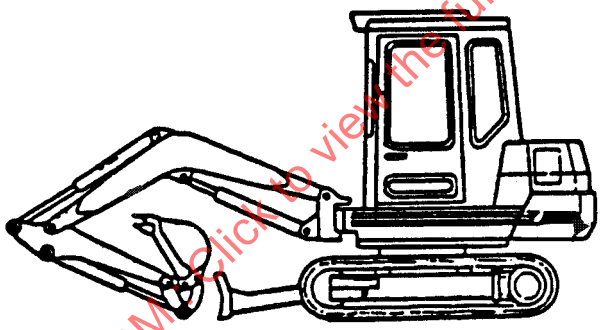


Figure A.2 — Compact crawler excavator

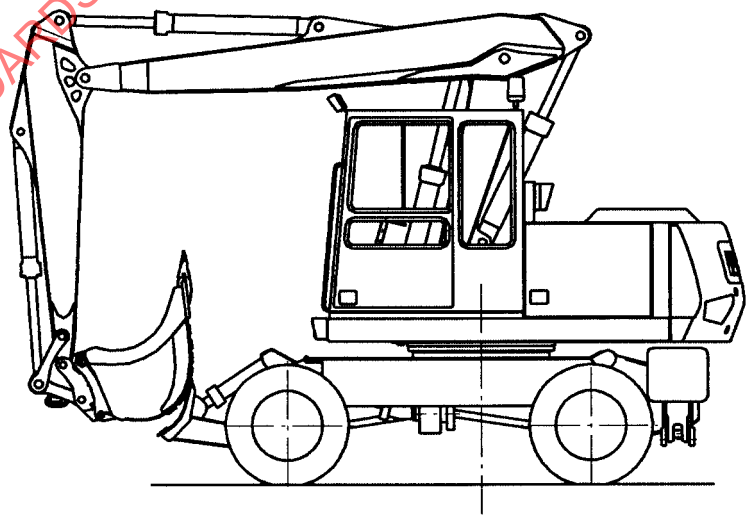


Figure A.3 — Wheeled excavator