
Earth-moving machinery — Safety —
Part 15:
Requirements for compact tool
carriers

Engins de terrassement — Sécurité —

Partie 15: Exigences applicables aux porte-outils compacts

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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.

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 of 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*.

A list of all parts in the ISO 20474 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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 in accordance with 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.

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Earth-moving machinery — Safety —

Part 15: Requirements for compact tool carriers

1 Scope

This document gives the safety requirements specific to compact tool carriers. 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 2867, *Earth-moving machinery — Access systems*

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 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 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
compact tool carrier**

self-propelled direct-control crawler or wheeled machine having a base machine mass of less than 2 000 kg, having either a pedestrian operating position or a standing *operator platform* (3.6) at the rear of the machine and either front-mounted *interchangeable equipment* (3.2) or lift arms with a quick coupler capable of coupling to interchangeable, front-mounted attachments

[SOURCE: ISO 6165:2012, 4.13, modified — The mass has been increased and changed to “base machine” and the term “attachment bracket” has been updated to “quick coupler”.]

**3.2
interchangeable equipment**

equipment that an operator can change using the *equipment attaching bracket* (3.5) to change the function of the machine

EXAMPLE Loader arm frame, dumper body.

**3.3
load carrying attachment**

attachment that during its normal use would contain or support a payload

EXAMPLE Bucket, fork, sweeper bucket, grapple fork, concrete mixer.

**3.4
non-load carrying attachment**

attachment that during its normal use would not contain or support a payload

EXAMPLE Auger, blade, trencher, mower, breaker, tiller, snow blower, soil conditioner.

**3.5
equipment attaching bracket**

device mounted on the *compact tool carrier* (3.1) to facilitate the quick interchange of equipment from the base machine

**3.6
operator platform**

surface provided for a ride-on, standing operator to operate the *compact tool carrier* (3.1)

**3.7
ground-supported operator platform**

operator platform (3.6) that pivots about a connection on the base machine and is supported with one or more trail wheels or skid surfaces that follows the contour of the ground

**3.8
powered attachment**

attachment that requires power (e.g. hydraulic) from the *compact tool carrier* (3.1) to operate

4 Safety requirements and protective measures

4.1 General

Compact tool carriers 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 Compact tool carriers with operator platform

ISO 20474-1:2017, 4.2, is replaced by the following.

- a) An operator platform, if provided, shall have
 - a durable, slip-resistance surface,
 - a maximum height of 400 mm above the ground reference plane,
 - a surface area of at least 1 355 cm² and shall be capable of containing a circle with a minimum diameter of 360 mm or minimum dimensions of 430 mm in width by 315 mm in depth. The operator platform does not need to be continuous in its width, provided the standing area for each foot has a minimum dimension of 160 mm in width.
- b) Compact tool carriers with an operator platform shall have a handhold in accordance with ISO 2867 to facilitate ingress and egress from the platform.
- c) A ground-supported or folding operator platform shall automatically lock in the operating position when the operator platform is lowered, or upward rotation of the operator platform shall be limited to provide clearance for the operator between structural components of the base machine and the pivoting platform. Both small and large operator human physical dimensions in accordance with ISO 3411 shall be considered.

If the compact tool carrier with a pedestrian operator position has a provision to add an operator platform, the platform shall be designed to meet the requirements of [4.2](#).

4.3 Operator's station

ISO 20474-1:2017, 4.3.1, shall apply with the exception that compact tool carriers shall not be equipped with a cab or with provisions for fitting a cab.

ISO 20474-1:2017, 4.3.2 to 4.3.6, do not apply.

4.4 Operator's controls and indicators

ISO 20474-1:2017, 4.5, shall apply except for ISO 20474-1:2017, 4.5.9, and with the following additions.

- a) A suitable device (e.g. handhold) providing a means of support for the operator during machine travel shall be provided. This device may also be used as the handhold in [4.2](#). If the compact tool carrier is equipped with an operator platform, the device shall not restrict or impede the operator's access to and from the platform. The device and the control for travel shall be located so the operator's hand is within the width of the upper structure of the compact tool carrier when the operator grasps the control or device.
- b) Controls of the compact tool carrier shall be designed to provide the operator a means of support while operating the travel and work functions.
- c) Compact tool carriers intended to operate powered attachments shall comply with the following, if applicable.
 - 1) A means shall be provided to automatically remove power to the attachment when the operator leaves the compact tool carrier's operator position. Controls that return to their neutral position when the operator releases the control (hold-to-run control) meet this requirement. Except for hold-to-run controls, reactivation of the attachment shall only be possible by two or more separate and distinct actions by the operator.
 - 2) A means may be provided to allow operation of a powered attachment with the operator not in the compact tool carrier's operator position. Such means shall require an intentional action

by the operator prior to leaving the compact tool carrier's operator position when the compact tool carrier is stationary.

d) ISO 20474-1:2017, 4.5.10, shall also apply to compact tool carriers with an operator platform.

4.5 Brake systems

ISO 20474-1:2017, 4.7, shall apply.

If the compact tool carrier has a removable or folding operator platform which allows the machine to be used as a pedestrian-operated compact tool carrier, the machine shall meet the brake system requirements for a ride-on machine.

4.6 Visibility

ISO 20474-1:2017, 4.8.1, does not apply except that compact tool carriers shall be designed so that the operator has sufficient visibility from the operator's station in relation to the travel and work areas of the machine necessary for its intended use.

4.7 Warning devices and safety signs

ISO 20474-1:2017, 4.9, shall apply except that an audible warning device (horn) is not required.

4.8 Stability

4.8.1 General requirements

ISO 20474-1:2017, 4.11, shall apply with the additions given in [4.8.2](#) to [4.8.5](#) below and the following.

The mass of the operator (75 kg) shall be used during the tipping limit and capacity rating tests if the mass of the operator is supported only by the machine.

4.8.2 Tipping limit

4.8.2.1 General

The compact tool carrier including combinations of interchangeable equipment and attachments shall be designed and tested in accordance with the tipping limits specified in [4.8.2.2](#) and [4.8.2.3](#) according to the intended use of the machine foreseen by the manufacturer as described in the operator's manuals.

4.8.2.2 Compact tool carrier without attachment

The tipping limit shall be 15° or greater when tested per the tipping limit test in [Annex A](#). The machine shall be positioned on the tilt table with the rear of the compact tool carrier down slope, the equipment at the maximum lift height and quick coupler, if provided, rolled back.

4.8.2.3 Compact tool carrier and interchangeable equipment/attachment combinations

4.8.2.3.1 Each combination of compact tool carrier with load carrying equipment or attachment that is intended to be loaded or unloaded at the maximum lift height of the equipment (e.g. bucket, forks) should meet the following criteria.

a) The lateral, forward and rearward tipping limits shall be 15° or greater when tested in accordance with the tipping limit test in [Annex A](#). The machine shall be positioned on the tilt table with the equipment or attachment loaded to the equipment or attachment's maximum capacity, as determined by the manufacturer, while positioned to maintain the load at the maximum lift height of the equipment.

- b) The forward tipping limit shall be 15° or greater when tested in accordance with the tipping limit test in [Annex A](#). The machine shall be positioned on the tilt table with the equipment or attachment loaded to the equipment or attachment's maximum capacity, as determined by the manufacturer, while positioned to maintain the load at maximum reach.

4.8.2.3.2 The combination of compact tool carrier with non-load carrying equipment or attachment having a manufacturer's recommended working position at or below maximum reach (e.g. tiller, trencher) shall meet the following criteria.

The lateral and forward tipping limits shall be 15° or greater when tested in accordance with the tipping limit test in [Annex A](#). The machine shall be positioned on the tilt table with the equipment or attachment in the least stable position at maximum reach.

4.8.2.3.3 Each combination of compact tool carrier with equipment or attachment that normally are operated at or below maximum reach but may be raised above maximum reach but less than the maximum lift height of the equipment for short periods of operation (e.g., auger, sod roller, tree spade) shall meet the following criteria.

The lateral, forward and rearward tipping limits shall be 15° or greater when tested in accordance with the tipping limit test in [Annex A](#). The machine shall be positioned on the tilt table with the equipment or attachment positioned in the least stable position and fully loaded, if required, at the manufacturer's recommended maximum working height.

4.8.2.3.4 Each combination of compact tool carrier with equipment or attachment that can only be operated while the compact tool carrier is stationary and the equipment (e.g., lift arms) are down (e.g., backhoe attachment) shall meet the following criteria.

The lateral, forward and rearward tipping limits shall be 15° or greater when tested in accordance with the tipping limit test in [Annex A](#). The machine shall be positioned on the tilt table with the equipment or attachment in the travel position, as specified by the manufacturer.

4.8.3 Bucket application

The rated operating capacity shall be determined in accordance with ISO 14397-1.

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

4.8.4 Fork application

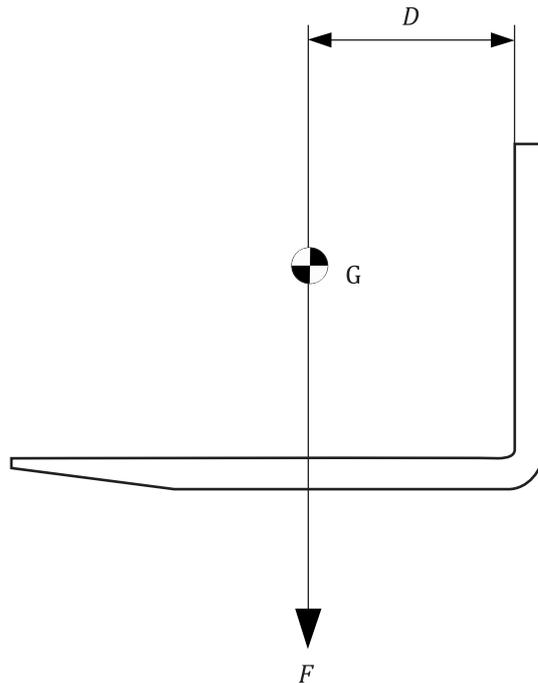
4.8.4.1 General

The rated operating capacity is based on the use of forks and shall be determined in accordance with ISO 14397-1. The stability factor, k , shall be determined using the criteria for a crawler loader or a wheeled loader with skid steering as appropriate for the compact tool carrier under test.

4.8.4.2 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 (see [Figure 1](#)).



- Key**
- D distance in millimetres
 - F load in Newton
 - G centre of gravity

Figure 1 — Load centre distance with fork arms

4.8.5 Other applications

The rated load or rated capacity of other integrated equipment (derivative machinery) shall be determined by the manufacturer using the appropriate capacity rating method or verification method for that type of equipment.

EXAMPLE The rating for a compact tool carrier with dumper body is to be determined in accordance with ISO 6483.

4.9 Object handling

ISO 20474-1:2017, 4.12, shall apply to compact tool carriers intended to be fitted with a lifting device designed and constructed for object handling.

4.10 Protective measures and devices

ISO 20474-1:2017, 4.14, shall apply with the following addition.

The machine structure around the operator's station of the compact tool carrier may be considered to be part of the barrier guard for determining safety distances as provided in ISO 3457.

4.11 Electrical and electronic systems

ISO 20474-1:2017, 4.16, shall apply except for ISO 20474-1:2017, 4.16.8.

4.12 Fire protection

ISO 20474-1:2017, 4.19, shall apply except for ISO 20474-1:2017, 4.19.2.

4.13 Interchangeable equipment and attachments

4.13.1 General

ISO 20474-1:2017, 4.20, shall apply with the following additions.

Normal operation and maintenance of the interchangeable equipment and attachment shall be evaluated to determine if any additional safety features are necessary as part of the process of approving the use of interchangeable equipment or attachment on a compact tool carrier.

In addition to the tipping limit requirements of 4.8.2, technical standards related to the interchangeable equipment or attachment should be applied, where applicable, as part of the process of approving the use of interchangeable equipment or attachment on a compact tool carrier.

4.13.2 Coupling of interchangeable equipment

The equipment attaching bracket for interchangeable equipment, if provided, shall have an engagement system and a locking system meeting the following requirements.

- a) The engagement system shall retain the equipment under all normal operating conditions.
- b) It shall be possible to verify the engaged position of the equipment attaching bracket from the operator's position or from the location where the engagement control is operated.
- c) A locking system shall be provided as a means to prevent inadvertent release of the engagement system.

4.13.3 Powered attachment with seated operator position

Powered attachments with a seated operator position (e.g. backhoe attachment) which is intended to be used only when the compact tool carrier is stationary, shall be designed so that the travel control system of the compact tool carrier is disabled or guarded by location during operation of the attachment. Locating the seat operating position so that the travel controls of the compact tool carrier is outside the zones of reach as provided in ISO 6682 satisfies the requirement of being guarded by location.

4.14 Maintenance

ISO 20474-1:2017, 4.21, shall apply with the following exception.

A lockable storage box on the machine for tools and accessories is not required.

4.15 Speed limit for non-riding machines

The maximum travel speed of compact tool carriers with a pedestrian operator position shall be in accordance with ISO 20474-1:2017, 4.24, except that the reverse speed shall be limited to 4,0 km/h.

5 Information for use

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

- a) The manufacturer shall provide instructions for the proper use of the quick coupler and the equipment attaching bracket for interchangeable equipment, if provided.

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

- 1) bucket application in accordance with [4.8.3](#);
- 2) fork application in accordance with [4.8.4](#);
- 3) ratings for interchangeable equipment, if provided.

NOTE Ratings for interchangeable equipment can be provided with the interchangeable equipment if not included with the compact tool carrier.

c) Appropriate instructions and warnings for proper operation regarding lift height and slope limitations shall be provided with the equipment or attachment for those equipment or attachments tested per [4.8.2.3.3](#), [4.8.2.3.4](#) and any equipment or attachment that does not meet the requirements of [4.8.2.3.1](#) or [4.8.2.3.2](#).

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