
**Earth-moving machinery — Access
systems**

Engins de terrassement — Moyens d'accès

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	1
4 General requirements for access systems	4
5 Walking and standing surface criteria.....	5
6 Step requirements	5
7 Ladders	8
8 Stairs and stairways	8
9 Handrails and handholds	8
10 Platforms, passageways, walkways, guardrails and foot barriers	10
11 Enclosure openings.....	12
Bibliography	16

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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 2867 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety requirements and human factors*.

This sixth edition cancels and replaces the fifth edition (ISO 2867:1994), which has been technically revised.

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Introduction

The structure of safety standards in the field of machinery is as follows.

- a) Type-A standards (basis standards) give basic concepts, principle for design and general aspects that can be applied to machinery.
- b) Type-B standards (generic safety standards) dealing with one or more safety aspect(s) or one or more type(s) of safeguards that can be used across a wide range of machinery:
 - type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);
 - type-B2 standards on safeguards (e.g. two-hands controls, interlocking devices, pressure sensitive devices, guards).
- c) Type-C standards (machinery safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This International Standard is a type-C standard, as stated in ISO 12100-1.

When provisions of this type-C standard are different from those which are stated in type-A or type-B standards, the provisions of this type-C standard take precedence over the provisions of the other standards for machines that have been designed and built according to the provisions of this type-C standard.

NOTE ISO 14122 is a series of type-B standards that provides general requirements for access to stationary and mobile machines and that can be used as a general reference for the design of access systems for earth-moving machines.

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Earth-moving machinery — Access systems

1 Scope

This International Standard specifies criteria for access systems (steps, ladders, walkways, platforms, grab rails/handrails, grab handles, guardrails and enclosure entrance and exit openings) as they relate to aiding the operator, maintenance personnel and service personnel in performing their functions on earth-moving machinery. It is applicable to systems giving access to the operator platform and to routine maintenance points on earth-moving machinery, as defined in ISO 6165, parked in accordance with the manufacturer's instructions.

NOTE This document is based on the 5th to 95th percentile operator dimensions, as defined in ISO 3411.

This International Standard deals with the following significant hazards, hazardous situations and events: slip, trip and fall of persons, and unhealthy postures or excessive effort.

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 3411:1995, *Earth-moving machinery — Human physical dimensions of operators and minimum operator space envelope*

ISO 6165:2001, *Earth-moving machinery — Basic types — Vocabulary*

ISO 12508:1994, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

access system

system provided on a machine for entrance to and exit from an operator, inspection or routine maintenance platform from and to the ground

3.1.1

primary access system

access system normally used for ingress and egress

3.1.2

alternative exit path

access route from the operator platform used during anticipated emergency situations, when the primary access system cannot be used

3.2

basic dimension

dimensional value that takes into account ergonomics criteria based on comfort

NOTE Acceptable values are within the specified range (from minimum to maximum).

3.3

enclosure opening

opening leading to or from an access system, large enough for a person to pass through

3.3.1

primary opening

opening normally used for access

3.3.2

alternative opening

opening for use during emergencies when the primary opening is not usable

3.3.3

service opening

opening for use during maintenance, service or inspection

3.4

guardrail

device along the open sides of walkways or platforms to protect a person from falling

3.5

handrail and handhold

parts of an access system that may be grasped by the hand as an aid to body support and balance

3.5.1

handrail

device that permits hand movement to a different location without removing the hand from the device

3.5.2

handhold

device for single hand placement

3.6

slip-resistant surface

access system surface having qualities that improve the grip of footwear

3.7 Ladders

3.7.1

inclined ladder

ladder with angle of inclination from the horizontal greater than 50°, but not more than 75°

3.7.2

vertical ladder

ladder with angle of inclination from the horizontal greater than 75°, but not more than 90°

3.7.3

ladder fall-limiting device

any device that minimizes the risk of fall from a ladder system

EXAMPLE Ladder cage.

3.8**stairway**

access system, or part of an access system, inclined from the horizontal at an angle greater than 20° but not more than 50°, consisting of three or more steps

3.9**step**

device for placement of one or both feet, either as part of a ladder or stairway, or installed (placed) individually

3.9.1**flexible step**

step that is mounted with a material which moves when it contacts an obstacle and returns to the original location (acts to minimize damage to the step)

3.10**riser height**

height between two consecutive steps, measured from the tread surface of one step to the tread surface of the next step

3.11**tread depth**

distance from the leading edge to the back of the step

3.12**stride distance**

horizontal distance from the leading edge of one step to the leading edge of the next step

3.13**walkway**

part of an access system that permits walking or moving between locations on the machine

3.13.1**boom walkway**

walkway used mainly on long booms inclined at an angle of up to 20° from the horizontal

3.13.2**passageway**

walkway with confining barriers on both sides for erect walking

3.14**platform**

horizontal surface for the support of persons engaged in operation, routine maintenance or inspection work

3.14.1**operator platform**

area from which an operator controls the travel and work functions of the machine

3.14.2**rest platform**

platform used between parts of a ladder system on which a person may rest while standing

3.15**foot barrier**

device to prevent a person's foot from slipping off the edge of a platform or walkway

3.16**ramp**

plane inclined at an angle of 20° or less from the horizontal

3.17

cleat

device added to a walkway or ramp surface to improve traction

3.18

three-point support

feature of an access system that enables a person to use simultaneously two hands and one foot or two feet and one hand while ascending, descending or moving about on the machine

3.19

two-point support

feature of an access system that enables a person to use simultaneously two feet or one hand and one foot while ascending, descending or moving about on the machine

4 General requirements for access systems

4.1 Primary access systems

4.1.1 Correct use of the access system for hand and foot placement shall be self evident without special training.

4.1.2 Protruding devices of the access system that could create a hazard by catching or holding body appendages or wearing apparel shall be minimized.

4.1.3 Protrusions that could create a trip hazard to the user or increase the severity of injury in case of a fall shall be minimized.

4.1.4 User contact with potential hazards such as extreme differences in heat or cold, electrical hazards, moving parts and sharp corners shall be minimized. [ISO 2867:2006](https://standards.iteh.ai/catalog/standards/sist/eab5dbc7-59e2-44f0-9a02-6b66115a571a/iso-2867-2006)

4.1.5 All surfaces of the access system used for walking, stepping or crawling (including any device or structural component thereof used as part of an access system) shall be slip-resistant.

4.1.6 Proper placement of components of the access system shall permit and encourage a person to use three-point support while ascending, descending or moving about the access system, when more than 1 m above the ground. Two-point support is acceptable for stairs, stairways, ramps, walkways and platforms. Three-point support should be used for all ladder systems. Track shoe and track pad surfaces are accepted as access steps if three-point support is provided.

4.1.7 If the operator or a service person needs to carry items to the operator station or to a routine maintenance point, a system such as one of the following examples shall be provided (and instructions provided if not obvious):

- a) stairway or ramp to provide access so that only two-point support is needed and one hand can be available for carrying items;
- b) platforms or surfaces every 2 m where items can be temporarily placed so that three-point support can be maintained when moving on the access system;
- c) system to move items to the operator station or routine maintenance point so that three-point support can be used on the access system at all times.

4.2 Moveable primary access systems

Primary access system devices may be moveable for convenient storage on the machine but shall be capable of being positively secured when in use or in the stored position. Machines equipped with a power-actuated access system shall have a secondary means of egress in case of power failure (see 4.3).

4.3 Alternative exit path

An alternative exit path shall be provided on a different location of the machine than the primary access path from the operator platform. If the alternative exit path is not obvious, it shall be identified. The alternative exit path is intended for emergency situations (e.g. machine tip-over) and therefore does not need to meet the primary access requirements, according to 4.1.

5 Walking and standing surface criteria

5.1 The walking and standing surfaces of access systems shall not be permanently deformed with the following perpendicular forces applied.

- a) A force of 2 000 N concentrated through a 125 mm diameter disc applied at any location on the surface.
- b) A force of 4 500 N uniformly distributed per square metre of surface area, with a proportional load permitted to be used if the surface area is less than 1 m².

The forces specified in a) and b) shall be applied consecutively, but not simultaneously.

Enclosure roofs such as cab and canopy roofs used for support of personnel during inspection need only meet the requirement of a).

5.2 Openings in walkways and platform surfaces shall not permit the passage of a spherical object of diameter 40 mm or larger. The opening in walkway and platform surfaces shall not permit the passage of a spherical object of diameter 20 mm or larger above an area where persons will be walking, standing or working. Surfaces without openings shall be used when necessary to prevent the passage of material that could result in personal injury to a person above or below the surface. For boom walkways and other similar areas that are used only for inspection or routine maintenance, the standing or stepping surface openings may be increased to twice the aforementioned values.

5.3 Handrails, handholds and guardrails shall be capable of withstanding a minimum force of 1 000 N applied at any point from any direction without visible permanent deformation. Flexible devices shall not deflect under the applied test load more than 80 mm from their normal undeflected position.

6 Step requirements

6.1 Steps shall conform to the dimensions given in Figure 1 and Table 1. All steps should be wide enough to accommodate both feet, reference dimension *C* for ladders and single or multiple steps. For steps that are susceptible to damage during machine operation, steps that accommodate one foot are permitted.

6.2 Where lateral body movement is necessary from the top or bottom step of a ladder to the next stepping surface, the distance between the step and the nearest edge of the bearing surface shall be within a spherical radius $R \leq 300$ mm. See Figure 1.

6.3 The following general considerations apply.

- a) Where the possibility exists that a foot could protrude through the step and contact a moving part, a shield shall be provided between the step and the moving part.
- b) Step design shall minimize the risk of the foot slipping laterally off the step.
- c) The step tread surface shall not be intended for use as a handhold.
- d) Step design shall minimize accumulation of debris and aid in the cleaning of mud and debris from the shoe sole.
- e) Step design shall provide the user with natural foot placement, or the steps shall be clearly visible to the user.