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**Safety of machinery — Permanent  
means of access to machinery —**

**Part 3:  
Stairs, stepladders and guard-rails**

*Sécurité des machines — Moyens d'accès permanents aux  
machines —*

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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](http://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](http://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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword — Supplementary information](#).

The committee responsible for this document is ISO/TC 199, *Safety of machinery*.

This second edition cancels and replaces the first edition (ISO 14122-3:2001) which has been technically revised. It also incorporates the Amendment ISO 14122-3:2001/Amd 1:2010.

ISO 14122 consists of the following parts, under the general title *Safety of machinery — Permanent means of access to machinery*:

- *Part 1: Choice of fixed means and general requirements of access*
- *Part 2: Working platforms and walkways*
- *Part 3: Stairs, stepladders and guard-rails*
- *Part 4: Fixed ladders*

An additional part, dealing with mobile machinery, is under preparation.

## Introduction

This International Standard is a type-B standard as stated in ISO 12100. It is relevant, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of this International Standard by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for peoples with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this International Standard.

In addition, this International Standard is intended for standardization bodies elaborating type-C standards. The requirements of this International Standard can be supplemented or modified by a type-C standard.

For machines which are covered by the scope of a type-C standard and which have been designed and built according to the requirements of that standard, the requirements of that type-C standard take precedence.

The purpose of this International Standard is to define the general requirements for safe access to machines. ISO 14122-1 gives guidance about the correct choice of access means when the necessary access to the machine is not possible directly from the ground level or from a floor or platform.

The dimensions specified are consistent with established ergonomic data given in ISO 15534-3.

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# Safety of machinery — Permanent means of access to machinery —

## Part 3: Stairs, stepladders and guard-rails

### 1 Scope

This part of ISO 14122 gives requirements for non-powered stairs, stepladders and guard-rails which are a part of a stationary machine, and to the non-powered adjustable parts (e.g. foldable, slidable) and movable parts of those fixed means of access.

NOTE 1 “Fixed” means of access are those mounted in such a manner (for example, by screws, nuts, welding) that they can only be removed by the use of tools.

This part of ISO 14122 specifies minimum requirements that also apply when the same means of access is required as the part of the building or civil construction (e.g. stairs, stepladders, guard-rails) where the machine is installed, on condition that the main function of that part of the construction is to provide a means of access to the machine.

NOTE 2 Where no local regulation or standards exists, this part of ISO 14122 may be used also for means of access which are outside the scope of the standard.

It is intended that this part of ISO 14122 be used with ISO 14122-1 to give the requirements for steps, stepladders and guard-rails.

The ISO 14122 series as a whole is applicable to both stationary and mobile machinery where fixed means of access are necessary. It is not applicable to powered means of access such as lifts, escalators, or other devices specially designed to lift persons between two levels.

This part of ISO 14122 is not applicable to machinery manufactured before the date of its publication.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 14122-1:2016, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access*

### 3 Terms and definitions

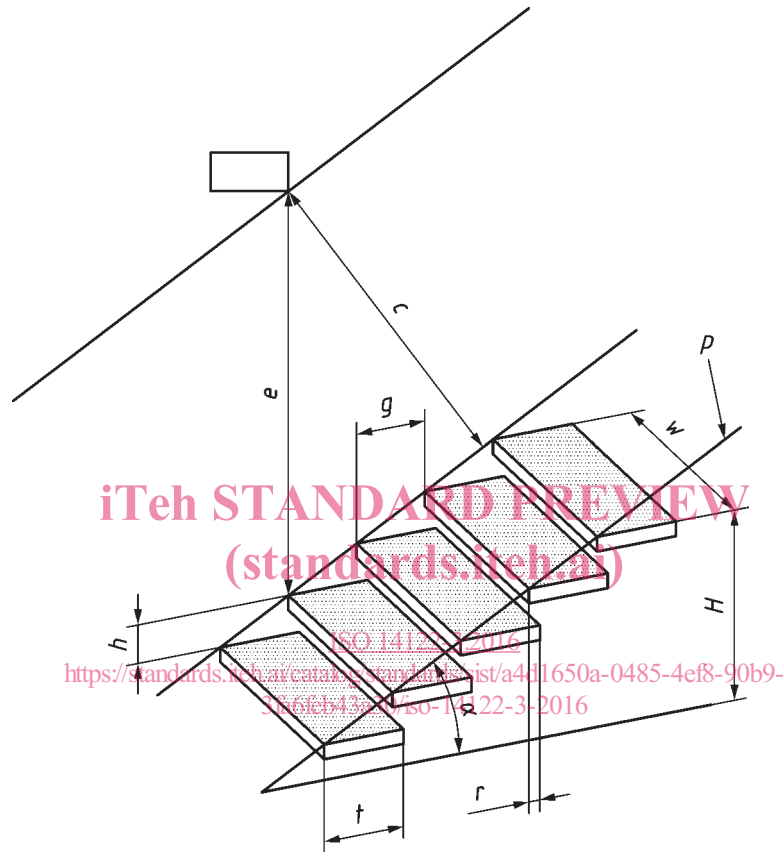
For the purposes of this document, the terms and definitions given in ISO 12100, ISO 14122-1 and the following apply.

**3.1 stairs step ladders**

succession of horizontal levels — *steps* (3.1.11) and *landings* (3.1.5) — allowing passage on foot from one level to another

Note 1 to entry: Stairs/step ladders are composed of the elements shown in Figure 1 and defined in 3.1.1 to 3.1.16.

Note 2 to entry: For details on the *angle of pitch* (3.1.9) for stairs/step ladders, see ISO 14122-1:2016, 3.2 and 3.3.



**Key**

$H$ climbing height	$\alpha$ angle of pitch
$g$ going	$w$ width
$e$ head-height	$p$ pitch line
$h$ rise	$t$ depth of step
$r$ overlap	$c$ clearance

**Figure 1 — Parts of stairs**

**3.1.1 climbing height**

vertical distance between the reference level and the *landing* (3.1.5)

Note 1 to entry: See  $H$  in Figure 1.

**3.1.2 flight**

uninterrupted sequence of *steps* (3.1.11) between two *landings* (3.1.5)



### 3.1.3 going

horizontal distance between the step *nosing* (3.1.12) of two consecutive steps

Note 1 to entry: See  $g$  in [Figure 1](#).

### 3.1.4 head-height

minimum vertical distance, clear of all obstacles (such as beams, ducts, etc.) above the *pitch line* (3.1.8)

Note 1 to entry: See  $e$  in [Figure 1](#).

### 3.1.5 landing

horizontal resting area situated at the end of a *flight* (3.1.2)

### 3.1.6 walking line

theoretical line indicating the average path of the users

### 3.1.7 overlap

difference between the depth of the step and the *going* (3.1.3)

Note 1 to entry: See  $r$  in [Figure 1](#).

### 3.1.8 pitch line

notional line connecting the leading edge of the *nosing* (3.1.12) of successive *steps* (3.1.11) taken on the *walking line* (3.1.6) and which extends down to the landing at the bottom of the *flight* (3.1.2) from the nosing on the landing at the top of the *flight*

Note 1 to entry: See  $p$  in [Figure 1](#).

### 3.1.9 angle of pitch

<stair or step ladder> angle between the *pitch line* (3.1.8) and its projection on the horizontal level

Note 1 to entry: See  $\alpha$  in [Figure 1](#).

### 3.1.10 rise

height between two consecutive *steps* (3.1.11) measured from the tread surface of one to the tread surface of the next

Note 1 to entry: See  $h$  in [Figure 1](#).

### 3.1.11 step

horizontal surface on which one places the foot to go up or down the *stair/step ladder* (3.1)

### 3.1.12 nosing

top edge at the front of the *step* (3.1.11) or *landing* (3.1.5)

### 3.1.13 string

flanking framework element supporting the *steps* (3.1.11)

**3.1.14**

**width**

clear distance over the outside faces of the *step* (3.1.11)

Note 1 to entry: See *w* in [Figure 1](#).

**3.1.15**

**depth of step**

clear distance from the leading edge or the *nosing* (3.1.12) to the rear of the *step* (3.1.11)

Note 1 to entry: See *t* in [Figure 1](#).

**3.1.16**

**clearance**

absolute minimum clear distance between any obstacle and the *pitch line* (3.1.8), measured at an angle of 90° from the pitch line

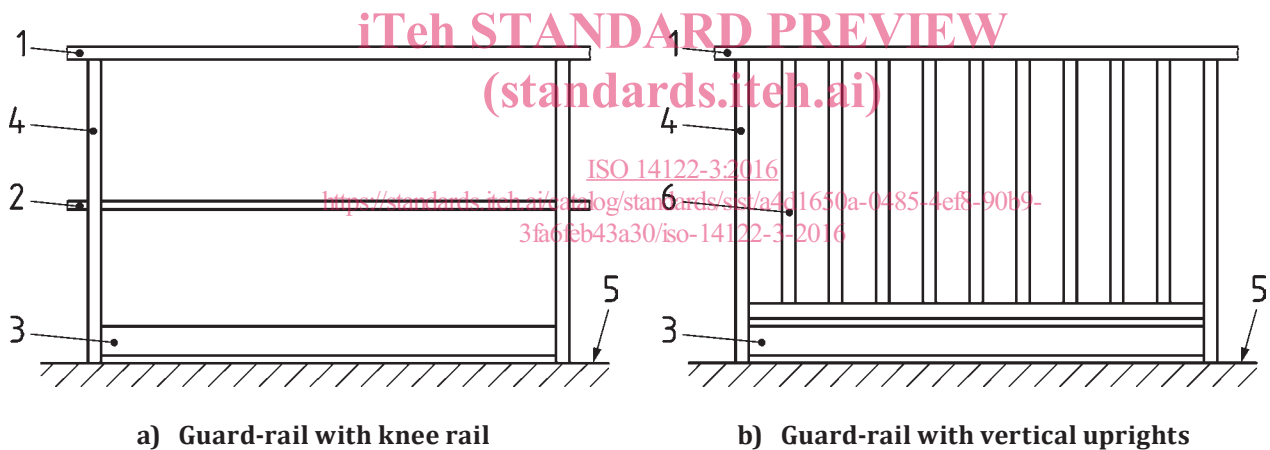
Note 1 to entry: See *c* in [Figure 1](#).

**3.2**

**guard-rail**

device for protection against accidental fall sideways with which *stairs/step ladders* (3.1) or *landings* (3.1.5), platforms and walkways may be equipped

Note 1 to entry: Typical parts of a guard-rail are shown in [Figure 2](#) and defined in 3.2.1 to 3.2.5.



**Key**

- |             |                     |
|-------------|---------------------|
| 1 handrail  | 4 stanchion         |
| 2 knee rail | 5 walking level     |
| 3 toe-plate | 6 vertical uprights |

**Figure 2 — Examples of the parts of a typical structure of a guard-rail**

**3.2.1**

**handrail**

rigid top element designed to be grasped by the hand for body support which can be used individually or as the upper part of a *guard-rail* (3.2)

Note 1 to entry: See 1 in [Figure 2](#).



### 3.2.7

#### transfer zone

area defined by the loading zone and the space needed for the movement of the *mezzanine gate* (3.2.6)

## 4 General requirements

### 4.1 Construction and materials

Stairs, step ladders and guard-rails — including fittings, hinges, anchorage points, supports and mountings — shall be designed and constructed and the materials selected so that they withstand the foreseeable conditions of use (see ISO 14122-1:2016, Clause 5). In particular, at least the following details shall be taken into account:

- a) dimensions of stairs, stepladders and guard-rails shall be in accordance with available anthropomorphic data (see also ISO 15534-1 and ISO 15534-3);
- b) guard-rails shall be designed and constructed to prevent objects falling;
- b) for hazards generated by falling objects through openings on steps, see ISO 14122-2:2016, 4.2.4.5.1.

Opening or closing of moving parts (gates), of adjustable parts (e.g. foldable, slidable) and of movable parts shall not cause further hazards (for example by shearing or by falling) to users and other persons in the vicinity.

### 4.2 Design and construction for the structure and the steps

4.2.1 The structure and the steps shall be designed to satisfactorily resist the foreseeable imposed loads.

The unfactored loads applicable used for the structure of the stair or stepladder in the industrial field can vary. For each application the expected unfactored loads shall be defined. As a minimum the following assumptions for unfactored loads shall be applied in calculations to be considered, but higher values can be necessary. Higher values shall be applied when higher loading is foreseeable:

- for low density pedestrian traffic without load, 1,5 kN/m<sup>2</sup>;
- for low density pedestrian traffic with load or for high density pedestrian traffic, 5 kN/m<sup>2</sup>;

4.2.2 Steps shall resist the following minimum unfactored loadings:

- if the clear width  $w < 1\,200$  mm then 1,5 kN shall be distributed over an area of 100 mm × 100 mm, where one boundary is the leading edge of the nosing applied at the middle of the stair width;
- if the clear width  $w \geq 1\,200$  mm then respectively two loads of each 1,5 kN shall be distributed simultaneously over each of the 100 mm × 100 mm, areas applied at the most unfavourable points spaced at intervals of 600 mm where one boundary is the leading edge of the nosing.

The deflection between the structure supporting the steps and the steps under an unfactored load shall not exceed 1/300<sup>th</sup> of the span of the step or 6 mm, whichever is the lower.

## 5 Specific requirements applicable to stairs

5.1 Going,  $g$ , and rise,  $h$ , shall meet [Formula \(1\)](#):

$$600 \leq g + 2h \leq 660 \text{ (dimensions in millimetres)} \quad (1)$$

5.2 The going (distance  $t$  minus  $r$ , see [Figure 4](#)) shall be between 210 mm and 310 mm.