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

**Part 4:
Fixed ladders**

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

Partie 4: Échelles fixes

Sample Document

get full document from standards.iteh.ai



Reference number
ISO 14122-4:2016(E)

© ISO 2016

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Selection and design of ladder systems	6
4.1 General	6
4.1.1 Design and construction	6
4.1.2 Choice depending on available space	6
4.1.3 Spacing between the ladder and any permanent obstruction	6
4.2 Choice of a type fall protection device	7
4.2.1 Necessity of a fall protection device	7
4.2.2 Types of fall protection devices	7
4.2.3 Guidance for a risk assessment	8
4.3 Height of ladder flights and fall protection device	8
4.3.1 Limits of space	8
4.3.2 Ladder systems >3 000 mm and ≤10 000 mm total height, H	8
4.3.3 Ladder systems >10 000 mm total height, H	9
4.4 Platforms and landings	9
4.4.1 Installation of platforms at arrival and departure areas	9
4.4.2 Arrangement of platforms and landings for ladders with a total height, H >10 000 mm	9
5 Specific requirements of ladder systems	10
5.1 General requirements	10
5.1.1 Permanent action (dead load)	10
5.1.2 Variable action (rated load)	11
5.1.3 Additional loading	13
5.1.4 Design	14
5.2 Ladder with two stiles	14
5.2.1 Strength	14
5.2.2 Rungs	14
5.2.3 Connection of ladder and guard-rail	17
5.3 Ladder with one stile	17
5.3.1 Strength	17
5.3.2 Rungs	18
5.4 Departure and arrival areas	19
5.4.1 General requirements	19
5.4.2 Departure area (entrance)	19
5.4.3 Arrival area (exit)	19
5.4.4 Access opening	19
5.4.5 Trap doors	21
5.5 Fall protection device	22
5.5.1 Safety cage	22
5.5.2 Fall arrester	26
5.6 Platforms and landings	26
5.6.1 Access platforms	26
5.6.2 Intermediate and rest platforms	26
5.6.3 Intermediate landings	27
5.6.4 Moveable rest landings	29
5.7 Requirements on moveable parts of fixed ladders	30
6 Verification of safety requirements	30
6.1 General	30

6.1.1	General requirements.....	30
6.1.2	Verification of stability by calculation.....	31
6.1.3	Verification of stability by testing.....	31
6.2	Tests of fixed ladders with two stiles.....	31
6.2.1	Strength and bending of a ladder element.....	31
6.2.2	Test for safety cage.....	32
6.3	Test of ladders with one stile.....	33
6.3.1	Test of ladder elements.....	33
6.4	Test of extensions of guard-rails.....	35
7	Information for use for fixed ladders	36
7.1	Instruction handbook.....	36
7.1.1	General.....	36
7.1.2	Ladder systems with fall arrester	36
7.2	Marking of ladder systems with fall arrester.....	37
Annex A (normative) Requirements for the design of anti-climb devices		38
Annex B (informative) Summary of main dimensions of a fixed ladder equipped with a safety cage		42
Annex C (informative) Significant technical changes between this part of ISO 14122 and the previous edition		44
Bibliography		47

Sample Document

get full document from standards.iteh.ai

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 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 14122-4:2004), which has been technically revised. It also incorporates the Amendment ISO 14122-4:2004/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.

This International Standard is of relevance, 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 the 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.

Safety of machinery — Permanent means of access to machinery —

Part 4: Fixed ladders

1 Scope

This part of ISO 14122 gives requirements for fixed ladders which are a part of a stationary machine, and to the non-powered adjustable parts (e.g. foldable, slidable) and movable parts of fixed ladder systems.

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. fixed ladders) 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 fixed ladder systems.

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*

ISO 14122-2:2016, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

ISO 14122-3:2016, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

EN 353-1:2014, *Personal protective equipment against falls from a height — Part 1: Guided type fall arresters including a rigid anchor line*

EN 795, *Personal fall protection equipment — Anchor devices*

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

fixed ladder system

ladder system

fixed ladder

installation of at least one *ladder flight* (3.4), *fall protection* (3.7), where appropriate, as well as landing(s) and/or platform(s)

Note 1 to entry: In the following text, the abbreviation “ladder” and “ladder flight” is used for fixed ladders and fixed ladder flights, respectively.

3.2

ladder with two stiles

ladder, according to ISO 14122-1:2016, 3.1, which is stationary and where the rungs are arranged between and attached to the stiles

Note 1 to entry: The stiles carry the load (see [Figure 1](#)).

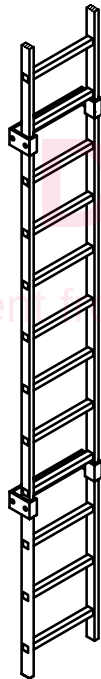


Figure 1 — Ladder with two stiles

3.3

ladder with one stile

ladder, according to ISO 14122-1:2016, 3.1, which is stationary and where the rungs are attached to both sides of the stile

Note 1 to entry: The stile carries the load alone (see [Figure 2](#)).

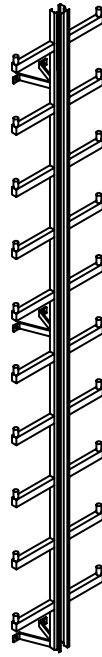


Figure 2 — Ladder with one stile

3.4 ladder flight

continuous part of the *fixed ladder* (3.1)

- between the *departure area* (3.8) and *arrival area* (3.9), in the case of ladders without platforms, or
- between the *departure area* (3.8) or *arrival area* (3.9) and the nearest platform, or
- sequentially between landings or *rest platforms* (3.12)

Note 1 to entry: See [Figures 3a](#) and [3b](#).

3.5 climbing height of ladder system total height

H

vertical distance between the departure area on the ground and the *arrival area* (3.9) at the top of a *ladder system* (3.1)

Note 1 to entry: See [Figure 3 a](#)).

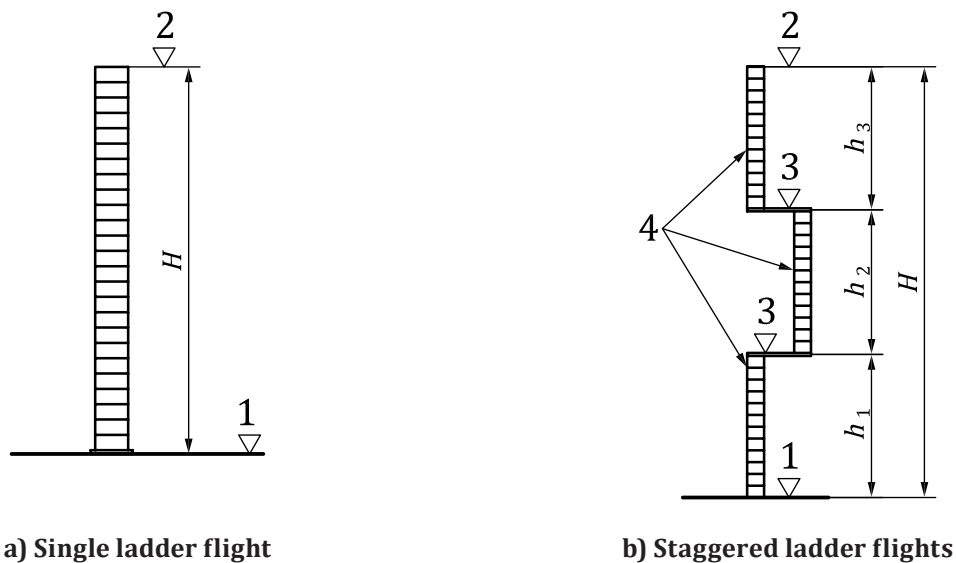
Note 2 to entry: In case of staggered *ladder flights* (3.4), the vertical distance between *departure area* (3.8) of the first flight and the arrival area at the top of the last flight.

3.6 height of ladder flight

h

vertical distance of each staggered *ladder flight* (3.4)

Note 1 to entry: See [Figure 3 b](#)).



Key

- 1 departure area
- 2 arrival area
- H climbing height of ladder system (total height)
- 3 intermediate platform or intermediate landing
- 4 ladder flight
- h height of ladder flight

Figure 3 — Height of flights and location of intermediate platforms/landings

3.7

fall protection

technical measure to prevent or to minimize the risk of people falling from ladders

3.7.1

safety cage

cage-shaped protective device, permanently fixed to the ladder, to minimize the risk of persons falling from ladders

Note 1 to entry: See [Figure 14](#), [Figure 15](#), [Figure 20 a\)](#) and [Figure B.1](#).

3.7.2

guided type fall arrester on rigid anchorage line

fall arrester

protective equipment permanently fixed to the ladder and used in combination with personal protective equipment

Note 1 to entry: See also definition in EN 353-1 and EN 363.

3.8

departure area

entrance

bottom level of the surroundings or of the *intermediate platform* ([3.11](#)) from which a person starts to climb the ladder or *ladder system* ([3.1](#))

Note 1 to entry: See [Figure 3 a\)](#) and [Figure 3 b\)](#).

3.9**arrival area****exit**

top level of the surroundings or of the *intermediate platform* (3.11) to which, the person steps after the ascent or the descent downwards starts

Note 1 to entry: See [Figure 3 a\)](#) and [Figure 3 b\)](#).

Note 2 to entry: In a ladder system with staggered flights, the *arrival area* (3.9) can also be a *departure area* (3.8) for subsequent ascent.

3.10**intermediate landing**

horizontal structure between two consecutive *ladder flights* (3.4), used with ladders having staggered flights, which is designed to change the ladder flights or for resting

Note 1 to entry: See [Figure 20](#).

3.11**intermediate platform**

horizontal structure between two consecutive *ladder flights* (3.4) which is designed to allow more than one person at the same time to change or to rest in the ladder system

Note 1 to entry: See [Figure 19](#).

3.12**rest platform**

horizontal structure on a single *ladder flight* (3.4) which is designed to allow more than one person at same time to rest in the ladder system

Note 1 to entry: See [Figure 18](#).

3.13**moveable rest landing**

area equipped with the required protective means designed to incite that the user of the *ladder system* (3.1) can rest but cannot interchange

Note 1 to entry: See [Figure 21 a\)](#) and [Figure 21 b\)](#).

3.14**access platform**

horizontal structure at the *departure area* (3.8) or *arrival area* (3.9) used by a person for access to a *ladder system* (3.1)

3.15**trap door**

hatch, intended to be opened temporarily to provide access through a platform or other horizontal structure

Note 1 to entry: See [Figure 13](#).

3.16**non-trained user**

person without experience how to use the fall arrester

3.17**well-trained user**

person with instruction and experience in how to use the fall arrester

EXAMPLE Installer of wind turbine generator systems.

4 Selection and design of ladder systems

4.1 General

4.1.1 Design and construction

Ladder systems are designed with staggered flights or single flight (see [4.3.2](#) and [4.3.3](#)).

The ladder(s) should be designed with two stiles. In exceptional cases (e.g. insufficient space for installation a ladder with two stiles or where a fall arrester is required, because of an altering inclination of the ladder system), ladder(s) with one stile may be foreseen.

4.1.2 Choice depending on available space

Minimum space can be achieved by using single flights (see [4.3.3](#) for height restrictions for a single flight).

Medium space is required when using consecutive staggered flights with landings (see [Figure 20](#)).

Maximum space is required when staggered flights and intermediate platforms are applied (see [Figure 19](#)).

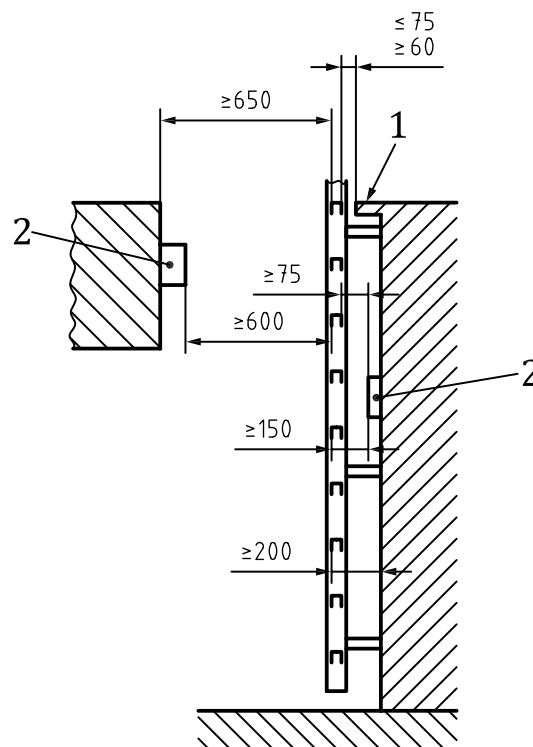
4.1.3 Spacing between the ladder and any permanent obstruction

The space between the ladder and any permanent obstruction or obstacles shall be (see [Figure 4](#))

- a) measured from the front of the rungs:
 - 1) in front of the ladder:
 - at least 650 mm or, where obstacles such as pipes or trays cross, 600 mm;
 - 2) behind the ladder:
 - at least 200 mm or, where obstacles such as pipes or trays cross, 150 mm.
- b) measured from behind of the rungs:
 - 1) behind the ladder:
 - at least 75 mm, except the upper rung, which shall be between 60 mm and 75 mm.

If the stiles are designed to be used as a handrail the space around the stiles shall be at least 75 mm, except at the level at the arrival area.

Dimensions in millimetres

**Key**

- 1 arrival area
- 2 obstacles such as pipes or trays

Figure 4 — Space dimensions with permanent obstacles

4.2 Choice of a type fall protection device

4.2.1 Necessity of a fall protection device

In case of an overall falling height $\geq 3\,000$ mm, the ladder shall be fitted with a fall protection device.

4.2.2 Types of fall protection devices

The main alternatives for protection of the users of fixed ladders against falling from a height are the following:

a) Safety cage

The cage is a means which is always present and the actual level of safety is independent of the operator's actions, therefore it is the preferred choice.

b) Guided type fall arrester on rigid anchorage line (fall arrester)

A fall arrester is only effective if the user chooses to use it. If a harness with an incompatible sliding system is used with a guided type fall arrester, there will be a risk of falling.

A combination of both safety cage and fall arrester, shall not be applied.

4.2.3 Guidance for a risk assessment

For the selection of a suitable type of fall protection device, a risk assessment in accordance with ISO 12100 shall be made for each particular application and especially when drafting type C- standards. The relevant aspects to be taken into account are, for example, the following:

- a) access conditions, such as
 - 1) range limits, and
 - 2) design limits;
- b) total climbing height for a fixed ladder;
- c) quantum of risk of falling from height and expected severity of injuries;
- d) human aspects, such as
 - 1) fatigue,
 - 2) stress, and
 - 3) experience, ability and training;
- e) rescue aspects;
- f) environmental aspects, such as
 - 1) wind, and
 - 2) extreme temperatures;
- g) frequency of use:
 - 1) occasional, or
 - 2) common;
- h) handling of
 - 1) tools, and
 - 2) spare parts.

4.3 Height of ladder flights and fall protection device

4.3.1 Limits of space

Surrounding structures, e.g. walls, parts of machines, can provide protection equivalent to a safety cage when they provide a containment area with dimensions similar to those given for a safety cage in [5.5.1.2](#).

4.3.2 Ladder systems >3 000 mm and ≤10 000 mm total height, H

These shall be designed as follows:

- staggered flights with a maximum height of the flight, h , of 6 000 mm, equipped with a safety cage;
- a single flight, equipped with a safety cage;
- a single flight, equipped with a guided type fall arrester on a rigid anchorage line (fall arrester).

Where it is not possible to use a cage, individual protective equipment, e.g. a fall arrester, shall be provided.

NOTE Fall arresters are intended to be used only by well-trained persons (see [Clause 7](#)).

4.3.3 Ladder systems >10 000 mm total height, H

They shall be designed as follows:

- staggered flights with a maximum height of the flight, h , of not more than 6 000 mm equipped either with a safety cage;
- staggered flights equipped with a fall arrester;
- a single flight be equipped with a fall arrester.

For non-trained users, only staggered flights equipped with a safety cage shall be provided.

Where it is not possible to use a cage, individual protective equipment shall be provided.

NOTE The fall arrester is intended to be used only by well-trained persons (see [Clause 7](#)).

4.4 Platforms and landings

4.4.1 Installation of platforms at arrival and departure areas

If the present areas on site at the departure area and arrival area are not built horizontally, solidly and even, platforms or other means shall be applied to achieve this requirement.

4.4.2 Arrangement of platforms and landings for ladders with a total height, $H > 10\,000$ mm

4.4.2.1 General

Where it is intended that more than one person will use the ladder system at the same time, depending on the type of the fall protection device, intermediate platforms or rest platforms shall be provided (see [4.4.2.2](#) to [4.4.2.4](#)).

4.4.2.2 Ladders equipped with a safety cage

Intermediate platforms or landings with a distance $\leq 6\,000$ mm shall be applied at the change of ladder systems with staggered flights (see [Figure 3b](#)).

4.4.2.3 Ladders equipped with a fall arrester and a total height, $H, \geq 24\,000$ mm

Ladders with single flights shall be equipped with rest platforms with distances $\leq 24\,000$ mm (see [Figure 5](#)). In between, an additional rest platform with distances $\leq 12\,000$ mm shall be fitted (see [Figure 5](#)). In case of insufficient space, moveable rest landings according to [5.6.4](#) may be fitted.

Ladders with staggered flights shall be equipped with intermediate platforms at intervals $\leq 24\,000$ mm (see [Figure 19](#)). In between, additional rest platforms at intervals $\leq 12\,000$ mm shall be provided (see [Figure 5](#)). In case of insufficient space, moveable rest landings according to [5.6.4](#) may be fitted.

4.4.2.4 Ladders equipped with a fall arrester and a total height, $H, < 24\,000$ mm

Rest platforms (see [Figure 18](#)) at intervals $\leq 12\,000$ mm shall be provided. When sufficient space cannot be made available, moveable rest landings according to [5.6.4](#) may be provided.