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Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO 14122-4:2016)

прийнято як національний стандарт
методом «підтвердження» за позначенням

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Безпечність машин. Постійні засоби доступу до машин.
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Safety of machinery - Permanent means of access to machinery - Part 4: Fixed ladders (ISO 14122-4:2016)

Sécurité des machines - Moyens d'accès permanents aux machines - Partie 4: Échelles fixes (ISO 14122-4:2016)

Sicherheit von Maschinen - Ortsfeste Zugänge zu maschinellen Anlagen - Teil 4: Ortsfeste Steigleiter (ISO 14122-4:2016)

This European Standard was approved by CEN on 29 April 2016.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 14122-4:2016 E

European foreword

This document (EN ISO 14122-4:2016) has been prepared by Technical Committee ISO/TC 199 “Safety of machinery” in collaboration with Technical Committee CEN/TC 114 “Safety of machinery” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2016, and conflicting national standards shall be withdrawn at the latest by December 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 14122-4:2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 14122-4:2016 has been approved by CEN as EN ISO 14122-4:2016 without any modification.

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of Directive 2006/42/EC machinery, and amending Directive 95/16/EC (recast) [2006 L157] aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/396 to provide one voluntary means of conforming to essential requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast) [2006 L157].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 2006/42/EC [2006 L157]

Essential Requirements of Directive 2006/42/EC	Clause(s) / subclause(s) of this EN	Remarks / Notes
1.5.15 "Risks of slipping, tripping or falling"	All	
1.6.2 "Access to operating position and service points"	All	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

IMPORTANT: Compliance with the requirements of EN ISO 14122-1 and a relevant access-specific part of EN ISO 14122 is necessary to achieve presumption of conformity.

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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 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).

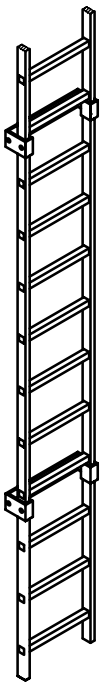


Figure 1 — Ladder with two stiles

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).

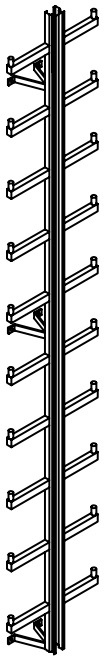


Figure 2 — Ladder with one stile

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.

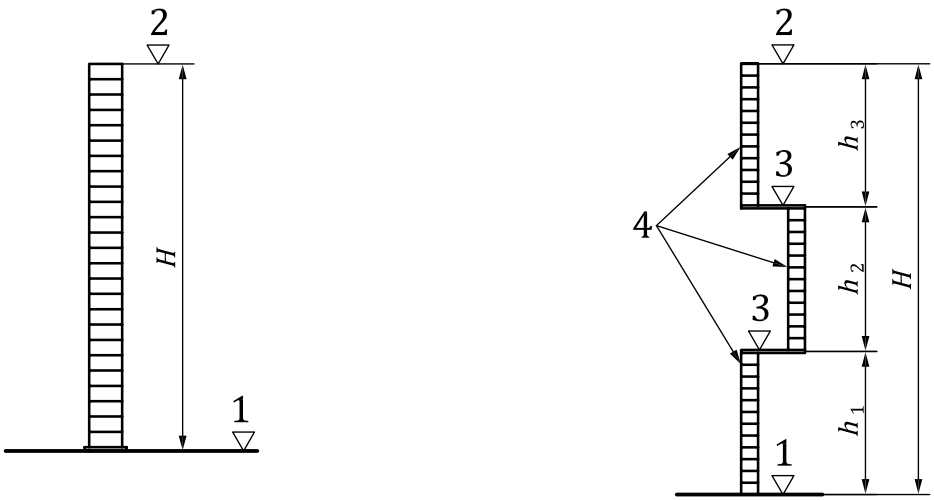
3.5
climbing height of ladder system
total height
H
vertical distance between the departure area on the ground and the *arrival area* (3.9) at the top of a *ladder system* (3.1)

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).



a) Single ladder flight **b) Staggered ladder flights**

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.

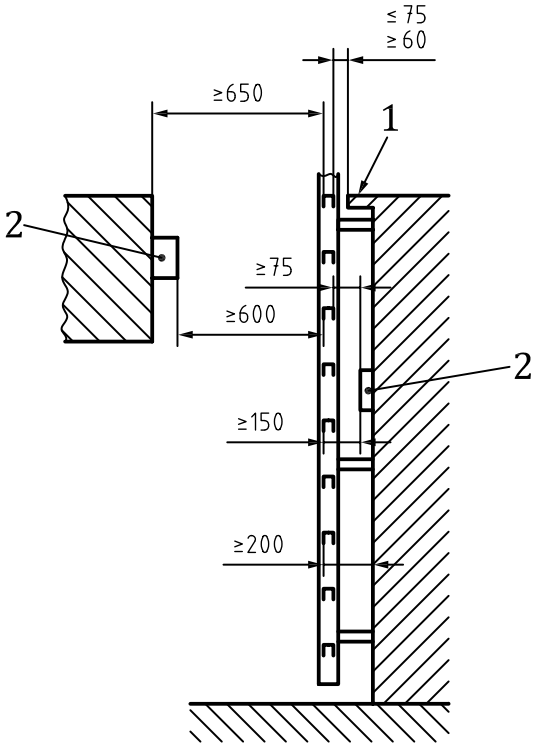
b) measured from behind of the rungs:

   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 ≥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 ≤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*, ≥24 000 mm

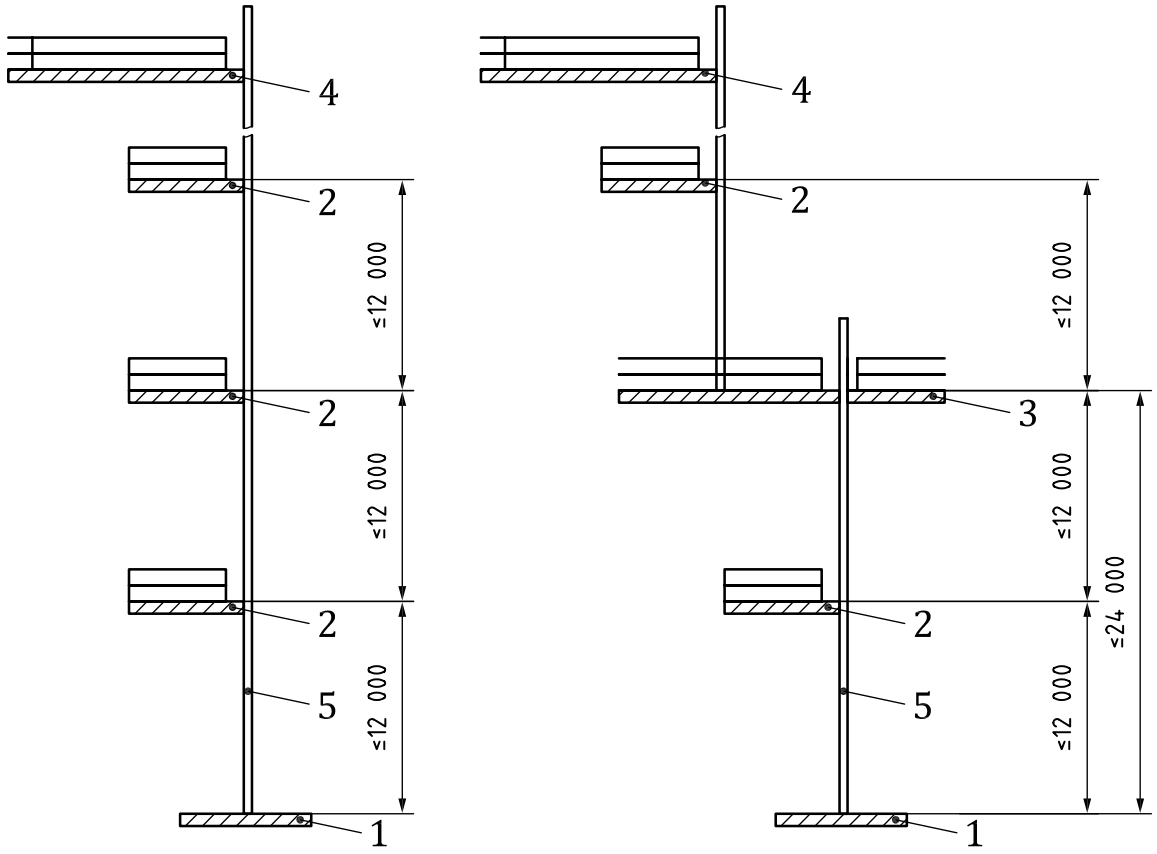
Ladders with single flights shall be equipped with rest platforms with distances ≤24 000 mm (see Figure 5). In between, an additional rest platform with distances ≤12 000 mm shall be fitted (see Figure 5). In case of insufficient space, moveable rest landings according to 5.6.4 may be fitted.

Ladders with staggered flights shall be equipped with intermediate platforms at intervals ≤24 000 mm (see Figure 19). In between, additional rest platforms at intervals ≤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 ≤12 000 mm shall be provided. When sufficient space cannot be made available, moveable rest landings according to 5.6.4 may be provided.

Dimensions in millimetres



Key

1 departure area
2 rest platform
3 intermediate platform
4 arrival area
5 fixed ladder system (schematic drawing)

Figure 5 — Arrangements of platforms and landings on ladders equipped with a fall arrester

5 Specific requirements of ladder systems

5.1 General requirements

The ladder system shall be designed so that the ladder itself and its attachment withstand reasonably foreseeable static and dynamic conditions. Criteria to be considered are, for example, the following:

— weight of the ladder system;

— maximum number of person staying in the ladder system;

— additional action occurring when the fall arrester will be activated.

If no other action/loads are relevant the, actions in 5.1.1 to 5.1.3 shall be applied.

5.1.1 Permanent action (dead load)

The mass of every component of the ladder shall be taken into account.

5.1.2 Variable action (rated load)

Loads F_1 = 1,5 kN and F_2 = 1,5 kN (see Figure 6) shall be used during the design of a ladder to represent a person.

The simulated load for the rungs F_1 (see Figure 6 a) and b) for a person shall be applied perpendicular to the rung at the most unfavourable position and equally distributed over a maximum length of 100 mm.

The simulated loads for the stile(s) F_2 shall be applied with a separation distance of 2 000 mm and parallel to the longitudinal axis of the ladder. The distance between the loads F_2 and the stile(s) shall be 300 mm [see Figure 6 c)].

For ladders with two stiles, the load F_2 shall be taken to be shared equally by both stiles [see Figure 6 c)].

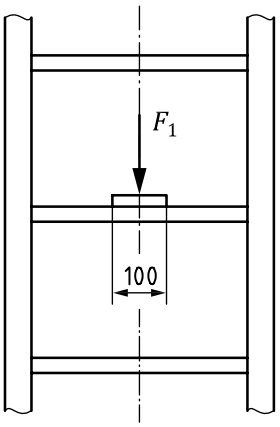
For platforms and landings as specified in 5.6, a concentrated load of 1,5 kN per person, applied at the most unfavourable position, shall be taken in to account.

For platforms, intermediate landings and moveable rest landings (one part) [see Figure 21 a)], concentrated loads are loads distributed over a load area of 200 mm × 200 mm.

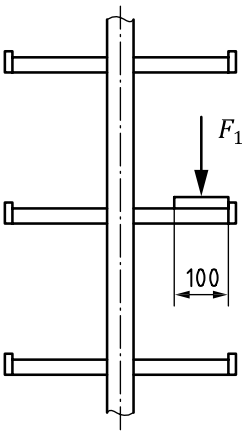
For moveable rest landings (two parts) [see Figure 21 b)], concentrated loads are loads distributed over two load areas, each of 100 mm × 100 mm.

Platforms shall be designed in accordance with ISO 14122-2 and ISO 14122-3.

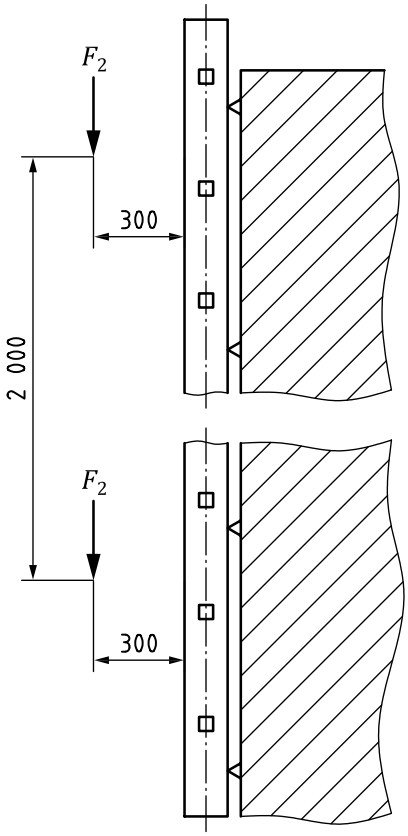
Dimensions in millimetres



a) Simulated loads on rungs for ladders with two stiles



b) Simulated loads on rungs for ladders with one stile



c) Simulated loads for stiles (schematic drawing)

Key

F_1 simulated load for rungs

F_2 simulated load for stiles

Figure 6 — Simulated loads on the ladder

5.1.3 Additional loading

5.1.3.1 General

Additional loading, e.g. caused by wind or snow, fall protection devices (see 5.1.3.2 and 5.1.3.3) shall be taken into account in stability calculations.

Loading on ladders, e.g. by impacts of trucks, is normally not considered.

5.1.3.2 Fall arrester

Calculations shall take into account the loading on the anchor line and the ladder when the fall protection device is activated by a falling person. In the absence of actual data, a minimum vertical force of 6 kN shall be assumed.

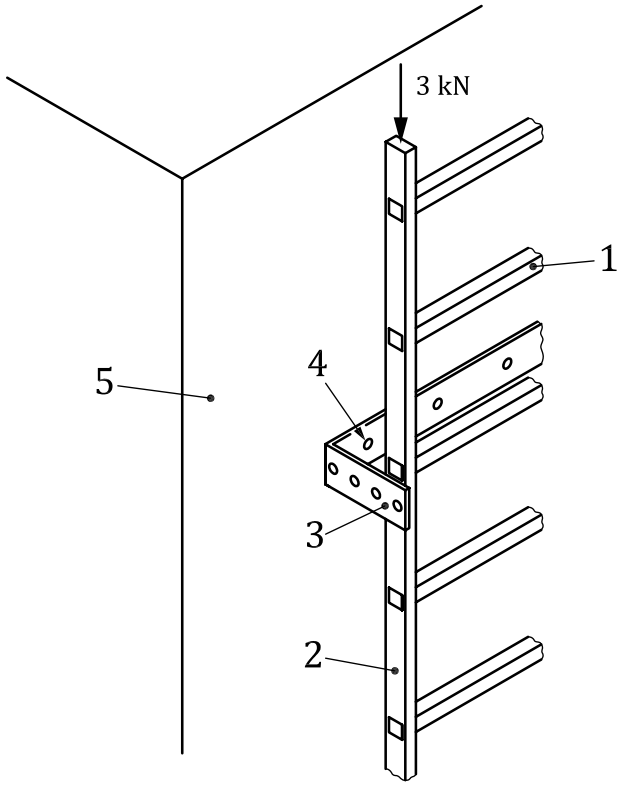
5.1.3.3 Safety cage

For the design of the safety cage, as a minimum the test procedure of 6.2.2 shall be applied.

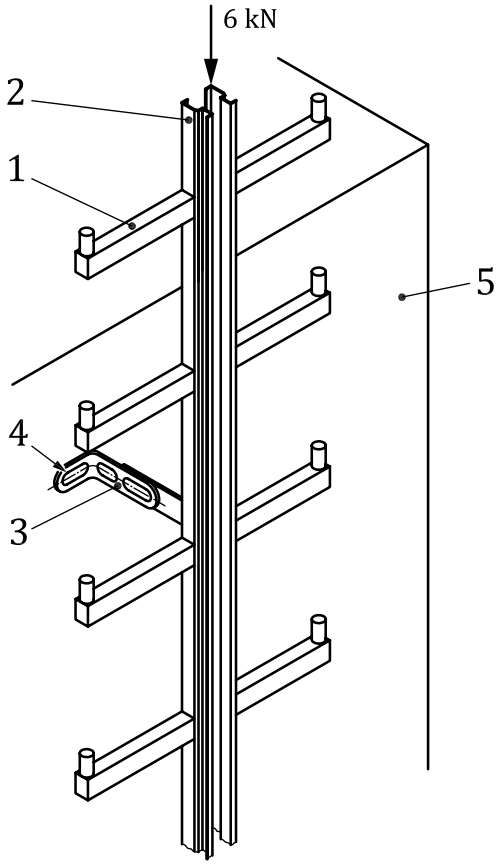
5.1.3.4 Ladder anchorage system

Calculations shall take into account a minimum load of ≥3 kN acting on each stile for ladders with two stiles, and a load of ≥6 kN acting on the single stile of ladders with one stile.

For calculation, it may be assumed that the load will be transmitted to fixed parts of surroundings (e.g. wall or enclosure of the machine) by four anchorage points



a) Ladder with two stiles



b) Ladder with one stile

Key

1 rung
2 stile
3 mounting
4 anchor point
5 fixed part (e.g. wall)

Figure 7 — Arrangements of anchor points and connections

5.1.4 Design

Ladders shall be designed to meet the same installation requirements as the machine, taking into account, where necessary, conditions such as harsh environment or vibrations.

All parts likely to be in contact with users shall be designed so that persons are not caught, hurt (e.g. caused by sharp corners, edges, welds with burrs) or hindered.

Opening or closing of moveable parts (gate) shall not cause hazards, e.g. accidental falling or shearing.

Fittings, hinges, anchor points, supports, and mounting points shall keep the assembly sufficiently rigid and stable to ensure the safety of users under normal conditions of use.

5.2 Ladder with two stiles

5.2.1 Strength

Ladder elements shall meet the verification requirement of stability by calculation in 6.1 or by test in 6.2.

5.2.2 Rungs

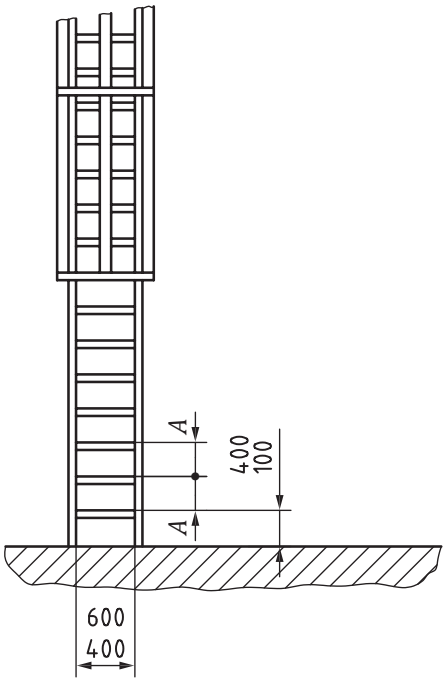
5.2.2.1 Strength

Rungs shall meet the verification requirement of stability by calculation in 6.1 or by test in 6.2.

5.2.2.2 Spacing

With the exception of the requirements for spacing between rungs at the departure area (see 5.4.2 and Figure 8), the spacing between successive rungs, *A*, shall be constant and shall be between 225 mm and 300 mm.

Dimension in millimetres



Key

A spacing

Figure 8 — Spacing and length of rungs

5.2.2.3 Length of rungs

The clear width between the two stiles shall be between 400 mm and 600 mm (see Figure 8). However, a clear width between 300 mm and 400 mm is permissible, in cases where the immediate environment makes it impossible to use 400 mm. Before a lower clear width is considered a check shall be carried out to see if it is possible to find a more favourable position for the ladder allowing a clear width of 400 mm or more.

When using a fall arrester the clear width between the stiles and the rigid anchorage line for a guided type fall arrester shall be at least 150 mm and the thickness of the anchorage line shall not be more than 80 mm (see Figure 9).

Dimension in millimetres

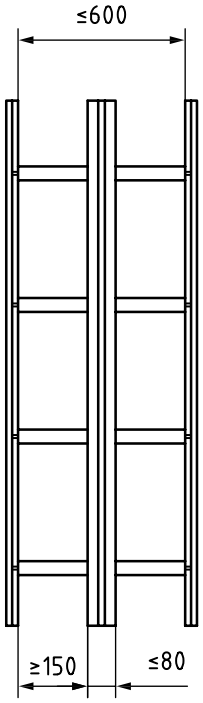


Figure 9 — Length of rungs on a ladder with two stiles and a rigid anchorage line for a fall arrester

5.2.2.4 Shape of rungs

The tread walking surface shall be flat and ≥20 mm [see Figure 10 a) to c)]. Therefore, circular rungs are not permitted. As an exception an inclined walking surface in accordance with Figure 10 d) is permitted.

The total perimeter of closed rungs, e.g. square, rectangular, polygonal, or inclined, shall be ≤140 mm.

Open rungs such as U-shaped rungs which cannot be fully gripped shall be designed such that injury to the hand from sharp edges is avoided.

For fixed ladders without fall protection devices, low climbing height and additionally an enhanced degree of pollution from the environment, slip resistant large rungs with for example two-row or multiple-row embossing perforation, can be used.

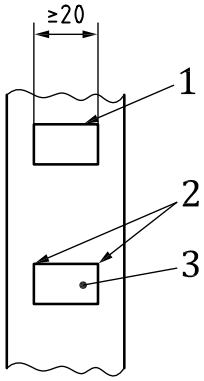
Special measures to prevent slipping may be necessary when the risk of slipping is increased due to environmental conditions (oil, ice, etc.). Where the accumulation of, for example, snow, ice, or dust is present, rungs with inclined profile according to Figure 10 d) may be used.

The surface of the rung shall have a slip resistant walking surface which causes no injuries, to hands. Until an International Standard on enhanced slip resistance is available, see ISO 14122-2:2016, Annex A.

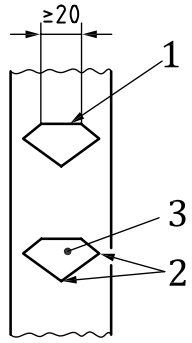
5.2.2.5 Position of rungs

Rungs shall be positioned so that their tread walking surface is perpendicular to axis of the stile (see Figure 10).

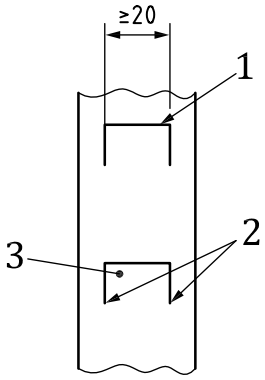
Dimension in millimetres



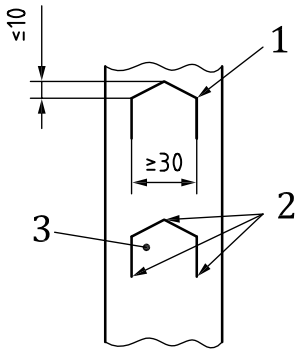
a) Design of rectangular rungs — recommended mounting



b) Design of polygonal rungs — mounting for special use only



c) Design of U-shaped profile rungs— recommended mounting



d) Design of rungs with inclined profile

Key

1 tread walking surface

2 no sharp edges

3 rung

Figure 10 — Examples of position and shape of rungs

5.2.3 Connection of ladder and guard-rail

If the distance between ladder and guard-rail is >120 mm, then the guard-rail shall be fitted connecting with the ladder in the range of the handrails and kneerails. For further information, see ISO 14122-3:2016, 7.1.

5.3 Ladder with one stile

5.3.1 Strength

The ladder shall meet the tests in 6.3 (torsion test).

5.3.2 Rungs

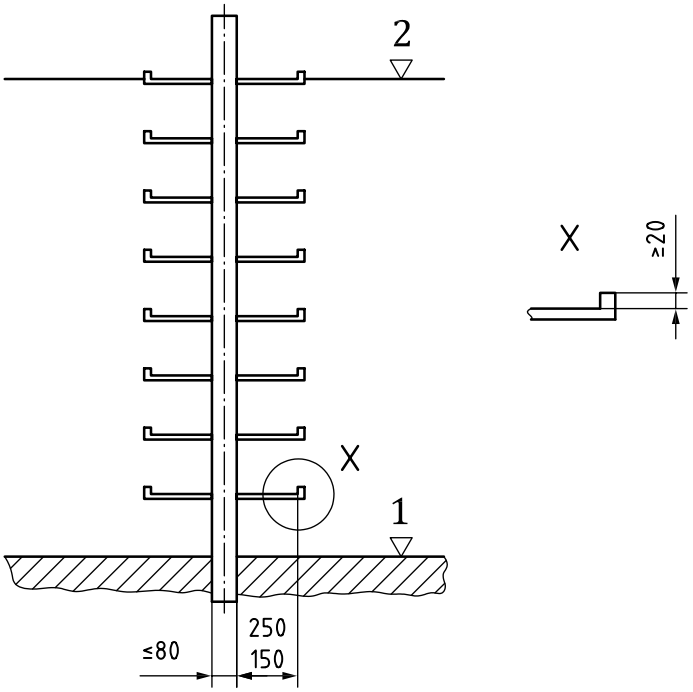
5.3.2.1 Strength

Rungs shall meet the verification requirement of stability by calculation in 5.1 or by test in 6.3.

5.3.2.2 Spacing

The spacing shall be in accordance with 5.2.2.2. The rung at one side of the stile shall be on the same level as the respective rung at the opposite side of the stile (see Figure 11).

Dimension in millimetres



Key

1 departure area
2 arrival area

Figure 11 — Dimensions and design of a ladder with one stile and a rigid anchorage line

5.3.2.3 Cross-section, tread, and position of rungs

The requirements of 5.2.2.4 and 5.2.2.5 shall be applied.

5.3.2.4 Length of rungs

The clear width between the stile and the protective device against slipping-off shall be ≥150 mm and ≤250 mm and the width of the stile shall be ≤80 mm (see Figure 11).

The ends of the rungs shall be fitted with protective devices against slipping-off laterally from the rungs. These protective devices against slipping-off shall have a height of ≥20 mm (see detail X of Figure 11).

5.4 Departure and arrival areas

5.4.1 General requirements

If it is required to take measures to prevent unauthorized people and/or persons not fully equipped with a fall arrester and non-trained persons to gain access to machinery, an "anti-climb" device as specified in Annex A shall be applied when such equipment is fitted on the ladder. In this case, a written warning or audible signal is not alone an adequate a device for access control.

Measures to prevent persons falling from a height shall be provided, e.g. guard-rails, over a length of at least 1 500 mm, at the following:

— on both the left and the right sides of the vertical axis of the ladder;

— over the entire length of the edge, if the length on both sides is less than 1 500 mm (entire length of the edge less than 3 000 mm);

— on both sides of adjacent walkways.

These measures to prevent persons falling from height are independent from any fall protection device on the ladder.

When a fall arrester is applied, connecting or disconnecting with this device shall only be possible from a safe area/position.

Departure and arrival areas as well as intermediate platforms shall meet the relevant requirements of ISO 14122-2 and ISO 14122-3.

5.4.2 Departure area (entrance)

If the walking surface of the departure area has been raised by more than 500 mm above the surroundings, or the departure area is close to areas which are not able to take a load, e.g. area made of glass or synthetic material, the departure area shall have guard-rails or equivalent means that are able to protect persons against falling from a height.

The spacing between departure area and lowest rung shall be ≥100 mm and ≤400 mm (see Figure 8).

5.4.3 Arrival area (exit)

At the arrival area a platform according ISO 14122-2 and ISO 14122-3 shall be provided.

If a structure of the machine or part of the building is considered as an arrival area it shall meet the requirements of ISO 14122-2 and ISO 14122-3.

The top of the upper rung/step shall be positioned at the same level as the walking surface of the arrival area (see Figure 12 and Figure 14).

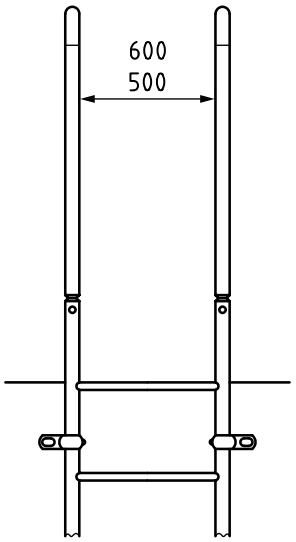
5.4.4 Access opening

5.4.4.1 Front or side exit

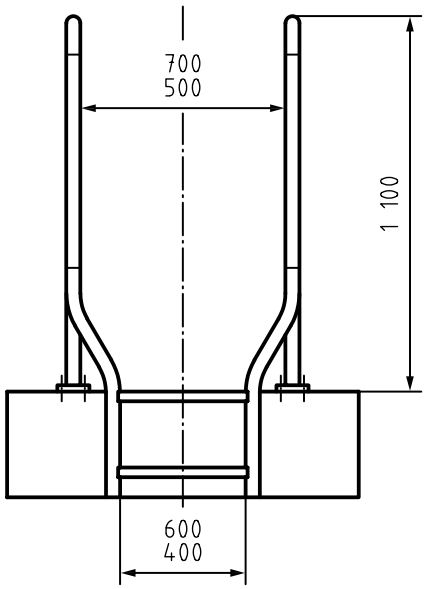
Ladders may have a front exit [see Figure 12 a) and b)] or side exit [see Figure 12 c)] to the arrival area.

The width of the access opening shall be ≥500 mm and ≤700 mm [see Figure 12 a) and b)].

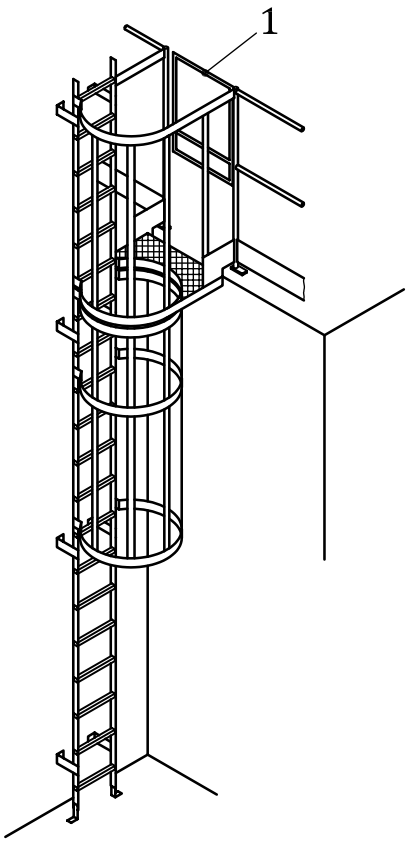
Dimensions in millimetres



a) Example for linearly stiles



b) Example for cranked stiles



c) Example for side exit

Key

1 self-closing gate

NOTE For better explanation, required protection device(s) such as a safety cage and self-closing gate are not pictured.

Figure 12 — Schematic examples of front and side exit

5.4.4.2 Self-closing gates

To prevent falling through the access opening at arrival area from an access platform the opening shall be provided with a self-closing gate.

Self-closing gates shall meet the requirements of ISO 14122-3:2016, 7.4.1.

5.4.5 Trap doors

When it is necessary, a platform may have an opening to permit access to (and exit from) a ladder below the platform, which shall be closed by a trapdoor (see Figure 13).

The trap door shall be designed as follows:

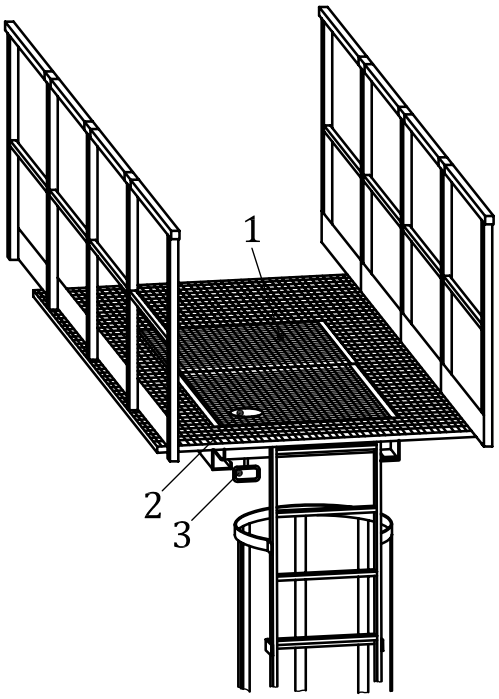
a) the opening shall be at least equal to the required size of the ladder cage;

b) the trap door shall not open downwards, and shall move upwards or horizontally;

c) it shall be opened non-powered and intentionally, and the operating force shall not exceed the force limits for machinery operation (see EN 1005-2:2003+Amd1:2008 and EN 1005-3:2002+Amd1:2008);

d) the trap door shall allow the safe passage of the operator while in the open position;

e) it shall be self-closing (e.g. spring-applied) after safe passage.



Key

1 trap door (foldable) slidable
2 release mechanism
3 grip

Figure 13 — Example of a trap door

5.5 Fall protection device

5.5.1 Safety cage

5.5.1.1 Strength

The strength verification of a safety cage shall be made by tests.

5.5.1.2 Dimensions and requirements

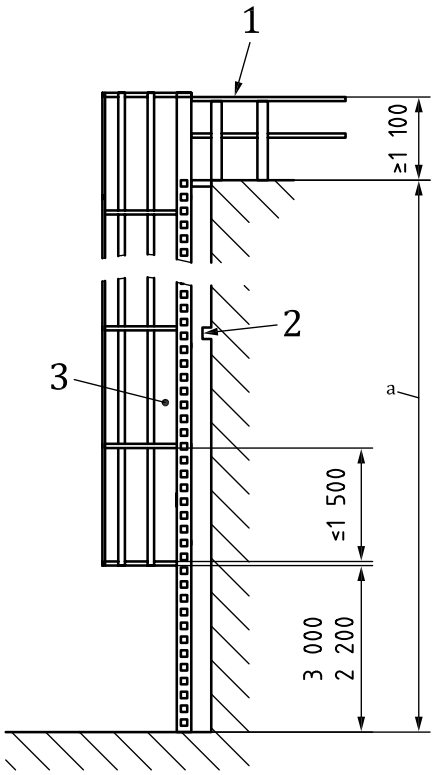
When a safety cage is arranged with horizontal hoops associated with uprights the distance between two hoops shall ≤1 500 mm (see Figure 14) and the distance between two uprights on the cage shall ≤300 mm (see Figure 15). The hoops shall be placed at right angles to the uprights on the cage. The uprights shall be fixed to the inside of the hoop and be equally spaced.

The spacing of safety cage components shall be designed so that the empty spaces are in any case ≤0,40 m^2.

The clear distances within the hoop of the safety cage shall be ≥650 mm and ≤800 mm (see Figure 15).

This applies equally to non-circular as well as circular safety cages. The distance from the rung to the safety cage shall be ≥650 mm and ≤800 mm(see Figure 15).

Dimensions in millimetres



Key

1 guard rail of the arrival area
2 obstacle
3 to suit maximum open area
a Climbing height of ladder system (total height) *H*, or height of ladder flight *h*.

Figure 14 — Dimension of a safety cage and its arrangement

The clearance within the stiles at the arrival area, measured along the transverse axis of the ladder rungs between the inside face of the stiles shall be ≥500 mm and ≤700 mm [(see Figure 12 a) and b)].

Below the cage on the chosen access side, the safety cage shall not have elements likely to obstruct the access to the area situated in front of the ladder. At the arrival area, the safety cage shall be extended up to the height of the guard-rail of the arrival area (see Figure 19).

The lowest part of safety cage, e.g. the lowest hoop, shall be at a height of ≥2 200 mm and ≤3 000 mm above the departure area (see Figure 14).

Dimensions in millimetres

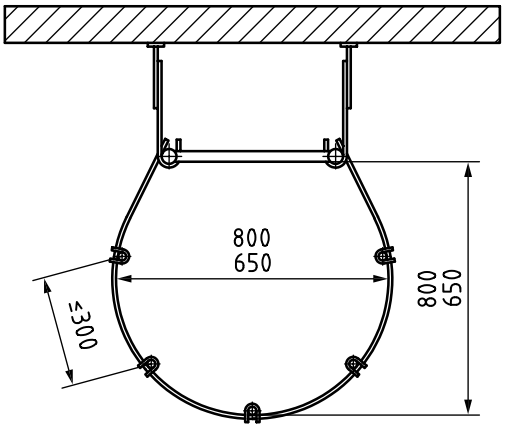


Figure 15 — Clear distances within the safety cage

If the horizontal distance from a fixed ladder, equipped with a safety cage, to the guard-rail of an elevated departure area is ≤1 500 mm, the gaps inside the guardrail shall be closed in the area left and right of the axis of the safety cage of 1 500 mm, e.g. by imperforate panels or meshed structures (see Figures 16 and 17).

If the vertical distance between handrail and safety cage is ≥700 mm, measures such as

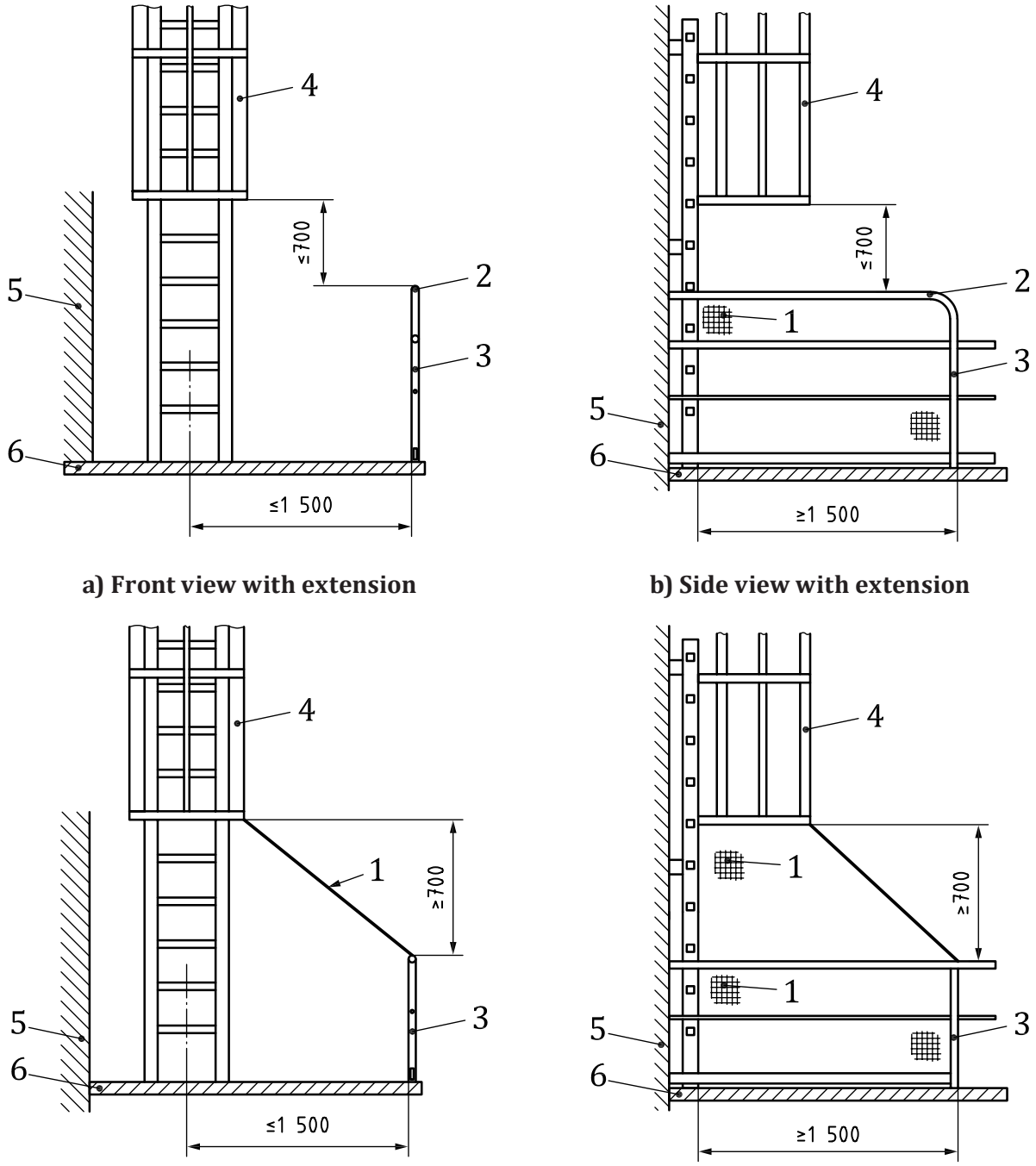
— extension(s) of the guardrail [see Figure 16 a) and b) and Figure 17 a) and b)], and

— closing the gap(s) by use of a meshed structure, [see Figure 16 c) and d) and Figure 17 c) and d)] shall be applied.

If meshed structures are applied, the mesh size shall be ≤100 mm × 100 mm.

Where ladders are located perpendicular to the guard rails at a distance less than 1 500, the guard rail shall be modified according the requirements above on a length of 1 500 mm (see Figure 16 b) and d)].

Dimensions in millimetres



a) Front view with extension

b) Side view with extension

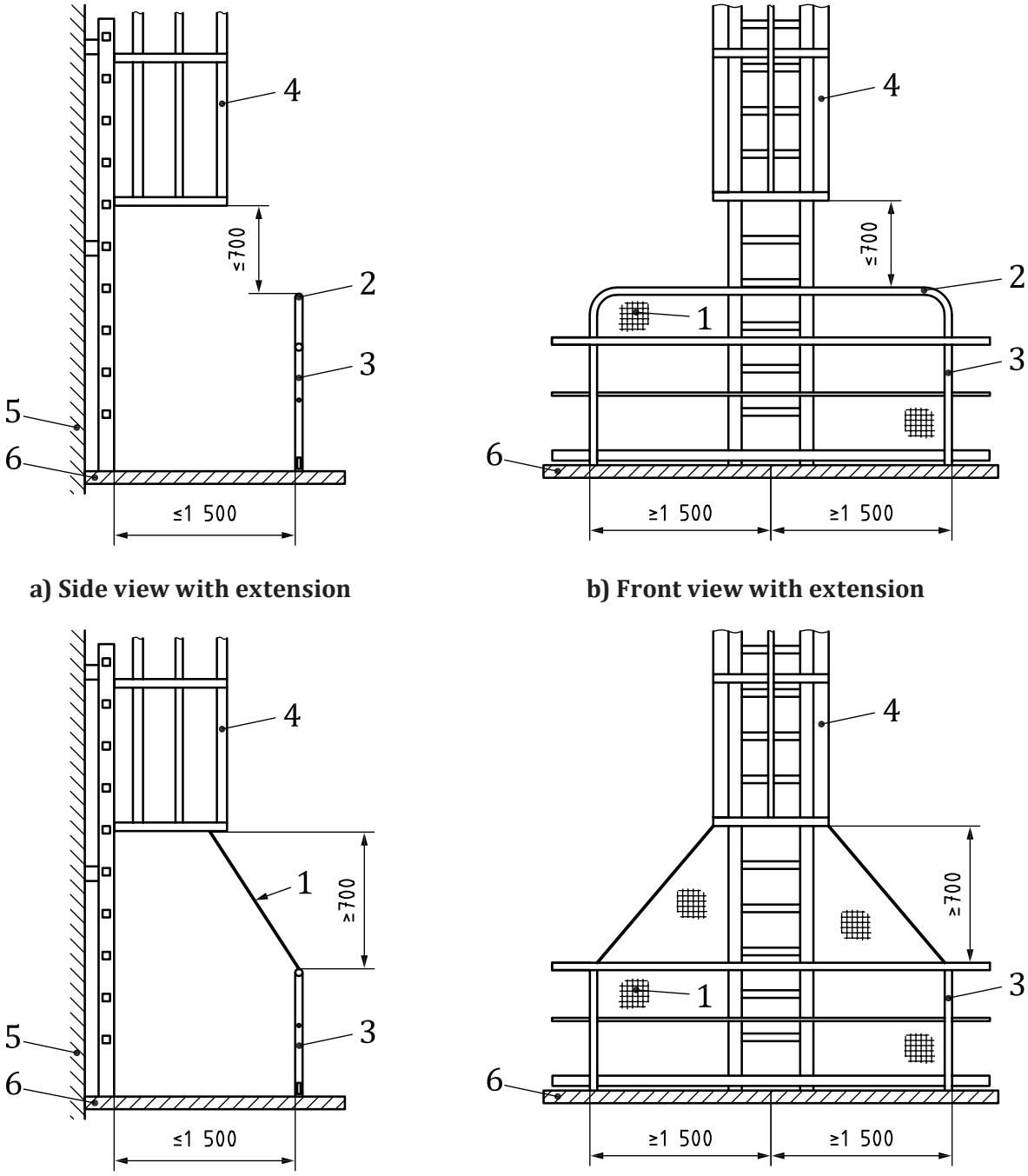
c) Front view with meshed structure

d) Side view with meshed structure

Key

1 meshed structure
2 extension of the guardrail
3 guard-rail
4 ladder with safety cage
5 building
6 platform

Figure 16 — Measures completing the protective function of guard-rails at departure area (lateral fall from height) — schematic sketch



Key

1 meshed structure
2 extension of the guardrail
3 guard-rail
4 ladder with safety cage
5 building
6 platform

Figure 17 — Measures completing the protective function of guard-rails at departure area (backwards fall from height) — Schematic sketch

5.5.2 Fall arrester

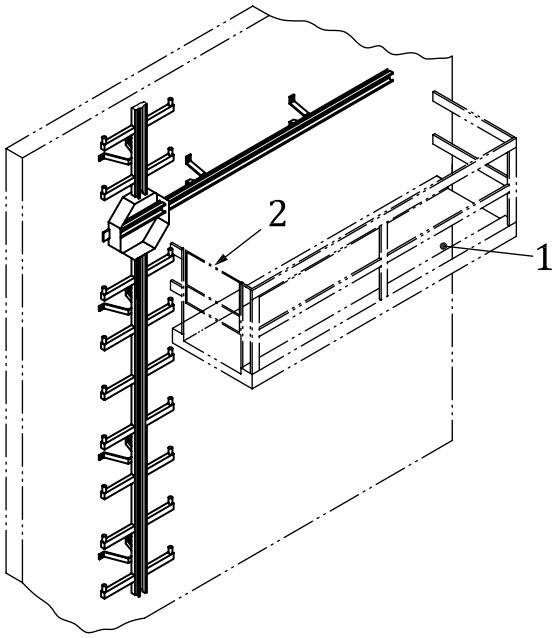
5.5.2.1 Requirements

The fall arrester shall comply with EN 353-1.

When choosing a system, rigid anchor line made of rail should be preferred.

5.5.2.2 Arrangement for getting on and off ladders with a guided-type fall arrester

The fall arrester and its surroundings shall be designed so that the user has to connect or disconnect in a safe position, e.g. by providing a continuous line according to EN 795 (see Figure 18), or a trapped door according to 5.4.5 leading to a fully guarded platform equipped with a self-closing gate according to ISO 14122-3:2016, 7.4.



Key

1 rest platform
2 self-closing gate

Figure 18 — Example of an extension of rigid anchorage line

5.6 Platforms and landings

5.6.1 Access platforms

Access platforms and their protective structures shall meet the requirements of ISO 14122-2.

Guard-rails as protective devices against the risk of falling from a height at departure and arrival areas as well as at intermediate platforms shall meet the relevant requirements for guard-rails according to ISO 14122-3.

5.6.2 Intermediate and rest platforms

5.6.2.1 Intermediate platforms

Intermediate platforms shall meet the requirements of ISO 14122-2.

When required, guard-rails as protective devices against the risk of falling from a height at departure and arrival areas as well as at intermediate platforms shall meet the relevant requirements for guard-rails according to ISO 14122-3.

When the intermediate platform is installed between two ladder flights the length (clear distance between the two consecutive flights) of the intermediate platform shall be ≥700 mm. (see Figure 19).

5.6.2.2 Rest platforms

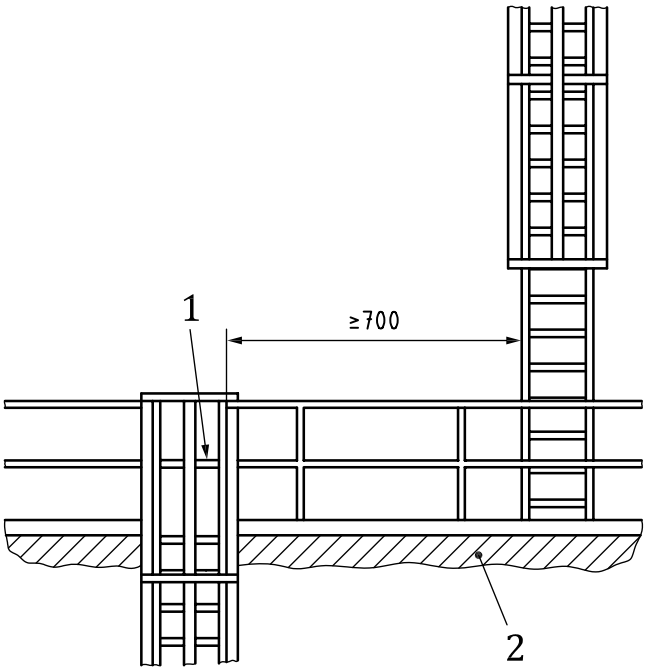
Rest platforms (see Figure 18) shall meet the requirements of ISO 14122-2 except that

— the length shall be ≥700 mm,

— the width shall be ≥500 mm.

When required, guard-rails as protective devices against the risk of falling from a height at departure and arrival areas as well as at intermediate platforms shall meet the relevant requirements for guard-rails according to ISO 14122-3.

Dimensions in millimetres



Key

1 gate

2 intermediate platform

Figure 19 — Intermediate platform

5.6.3 Intermediate landings

The intermediate landing shall be designed so that the projection of the enclosed area of the safety cage onto the horizontal landing is maximized. The accumulation of, for example, water, snow, ice or dust, shall be avoided. Gap(s) between the intermediate landing and adjacent structures shall be less than 50 mm. Toe-plates or baseboards are not required. The clear distance of the consecutive safety cage shall not be reduced [see Figure 20 b)].

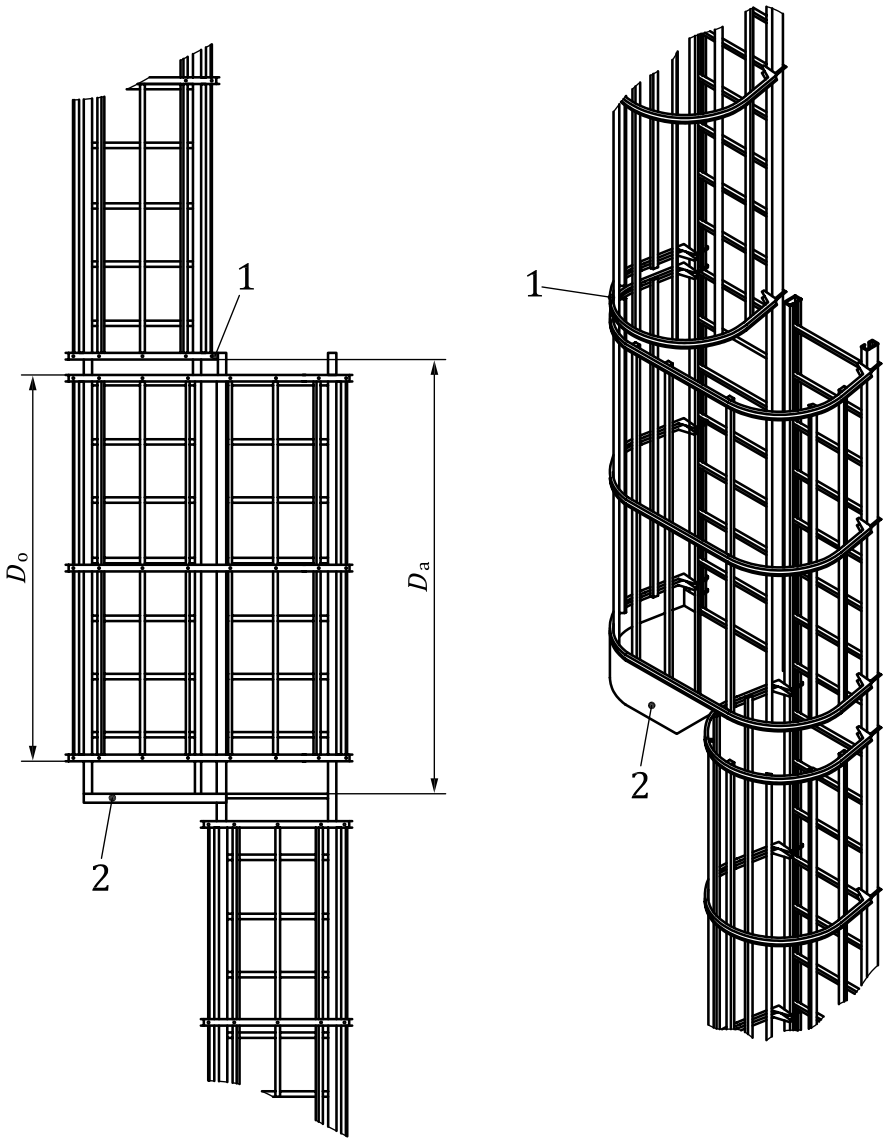
The vertical overlap [see Figure 20 a)] of two consecutive flights shall be at least 1 500 mm. The safety cage of the upper flight shall start/begin at least at 2 200 mm but not more than 3 000 mm above the intermediate landing level.

To ensure a safe hand grip between two consecutive stiles of the ladder flights either a gap ≥75 and ≤100 mm between the stiles shall be foreseen, or a handrail (see ISO 14122-3) shall be fitted.

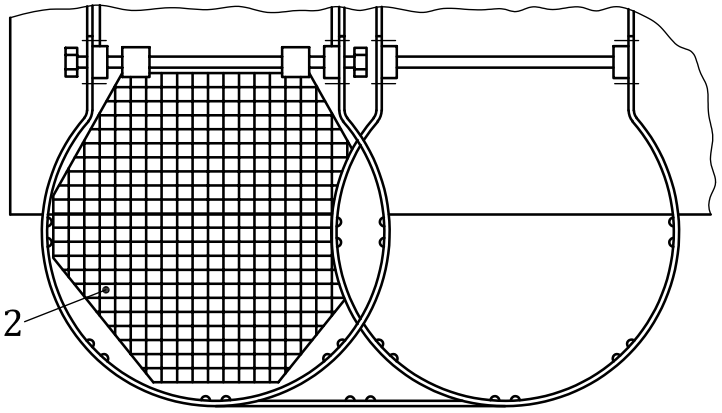
The distance, D_a, from intermediate platform level to the first hoop 1 shall not exceed 2 500 mm [see Figure 20 a)].

The overlap of the safety cages, D_o, shall be ≥2 000.

Dimensions in millimetres



a) Safety cages of two consecutive flights



b) Safety cages of two consecutive flights (plan view)

Key

D_a distance from intermediate platform level to the first hoop

D_o overlap

1 first hoop

2 intermediate platform level

Figure 20 — Design of safety cages of two consecutive flights

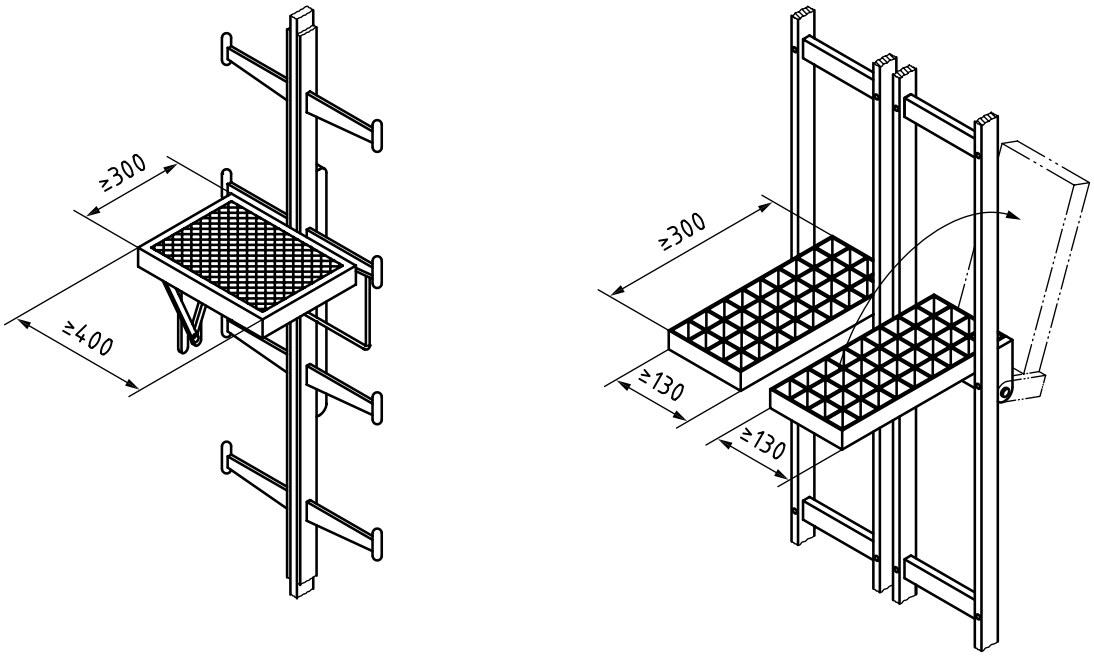
5.6.4 Moveable rest landings

When they are designed as

a) one part, they shall be ≥400 mm wide and ≥300 mm long [see Figure 21 a)];

b) two parts, they shall be ≥130 mm wide and ≥300 mm long [see Figure 21 b)].

Dimensions in millimetres



a) Example of moveable rest landing (one part)

b) Example of moveable rest landing (two parts)

Figure 21 — Examples of moveable rest landings

5.7 Requirements on moveable parts of fixed ladders

In addition to the basic requirements, the following requirements for foldable, slidable, height-adjustable or hinged parts apply:

— it shall be secured to the fixed means of access in its working position;

— it shall be locked in the intended positions when in use and in the stored position, e.g. by gravity, spring force or locking mechanism;

— it shall be designed that there is no risk of crushing;

— the manual operating force needed to adjust the height shall not exceed recommended force limits for machinery operation (see EN 1005-2:2003+Amd1:2008 and EN 1005-3:2002+Amd1:2008).

NOTE A section of a fixed access system can be adjustable for convenient storage on the machine.

6 Verification of safety requirements

6.1 General

6.1.1 General requirements

Safety requirements and/or measures shall be assessed by

— measurement,

— visual inspection,

— calculation and/or load test.

The methods and the results shall be documented (e.g. protocol).

For verification of safety requirements it is assumed that

— a safety cage is applied commonly in combination with ladders with two stiles, and

— a fall arrester is applied commonly in combination with ladders with one or two stiles.

6.1.2 Verification of stability by calculation

For calculation the loads shall be applied at the most unfavourable point.

For partial factors for actions specific material standards shall be applied.

6.1.3 Verification of stability by testing

A material factor of 1,75 for aluminium and steel has been already considered in the test loads.

The load duration shall be ≥1 min.

Measuring of the residual deflection shall be carried out no less than one minute after removing the test load.

6.2 Tests of fixed ladders with two stiles

6.2.1 Strength and bending of a ladder element

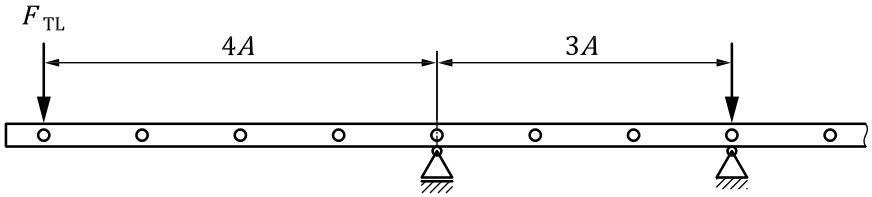
6.2.1.1 Test on stiles

For verification of required stability, the bending test of the stiles of the ladder element may be carried out by a simulated system in Figure 22.

The test is carried out without a preload in accordance with Figure 22 on at least eight rungs.

The test load (F_{TL}) shall be 700 N.

A residual deflection of the stiles related to the length of the loaded part of the ladder (4× spacing of the rung) shall be not more than 0,3 %.



Key

F_{TL} test load

A spacing of rungs

Figure 22 — Ladder with two stiles — Bending test

6.2.1.2 Test for rungs

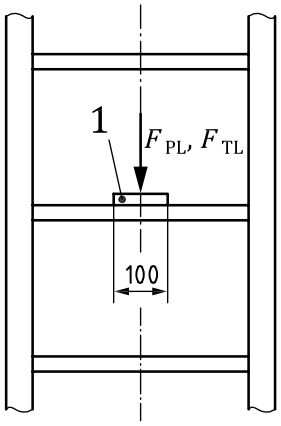
A centred preload (F_{PL}) of 200 N is applied for verification of adequate strength.

The position of the rung after removing the preload is taken into account as a reference position for test load F_{TL} of 2 600 N (see Figure 23) carried out in similar way.

The loads are perpendicular and may, in accordance with Figure 23, be considered as equally distributed on a length of 100 mm. The underlayment shall be rigid and shall have no sharp edges.

A residual deflection of the rungs related to the length of the rung shall be not more than 0,3 %.

Dimensions in millimetres



Key

1 underlayment

F_{PL} preload

F_{TL} test load

Figure 23 — Ladder with two stiles — Test of rungs

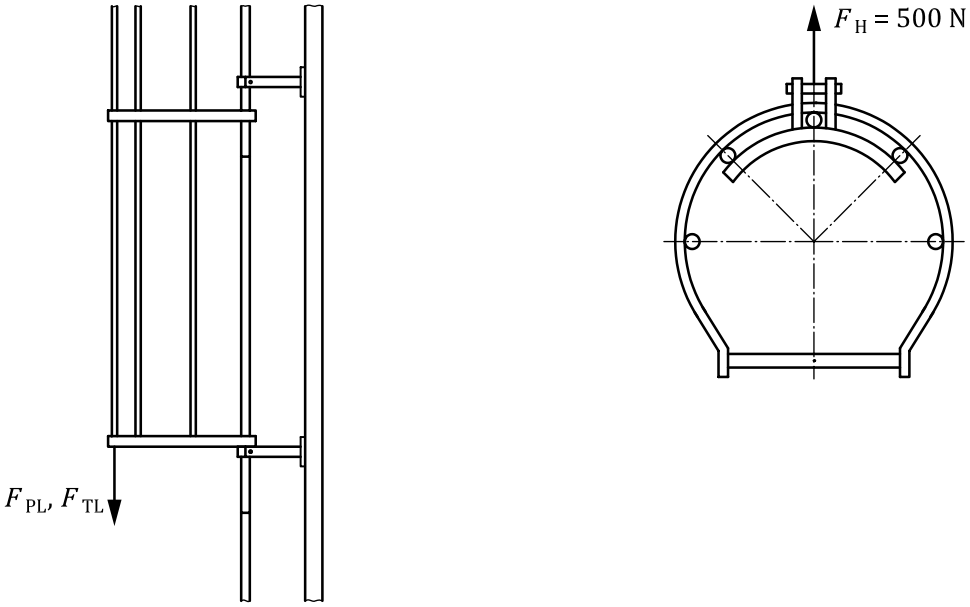
6.2.2 Test for safety cage

The test is carried out on a safety cage section with three hoops and five uprights which are fitted to the ladder element.

The test shall be carried out in accordance with Figure 24.

A preload (F_{PL}) of 200 N is applied perpendicular at the most unfavourable point of the lower hoop. The position of the hoop after removing the preload is taken into account as a reference position for the test to be carried out with a test load (F_{TL}) of 1 000 N.

The permissible permanent deflection measured at the point of application of the load shall be no more than 50 mm.



a) Test of hoops **b) Test of uprights**

Key

F_{PL} preload

F_{TL} vertical test load

F_H horizontal test load

Figure 24 — Test of safety cage

For uprights, a load (F_H) of 500 N shall be horizontally applied at the most unfavourable point between two consecutive hoops. F_H may be distributed over three uprights.

The permissible permanent deflection measured at the point of application of the load is 10 mm maximum.

The test is carried out under the same conditions as those likely to exist at the place where it could be used.

6.3 Test of ladders with one stile

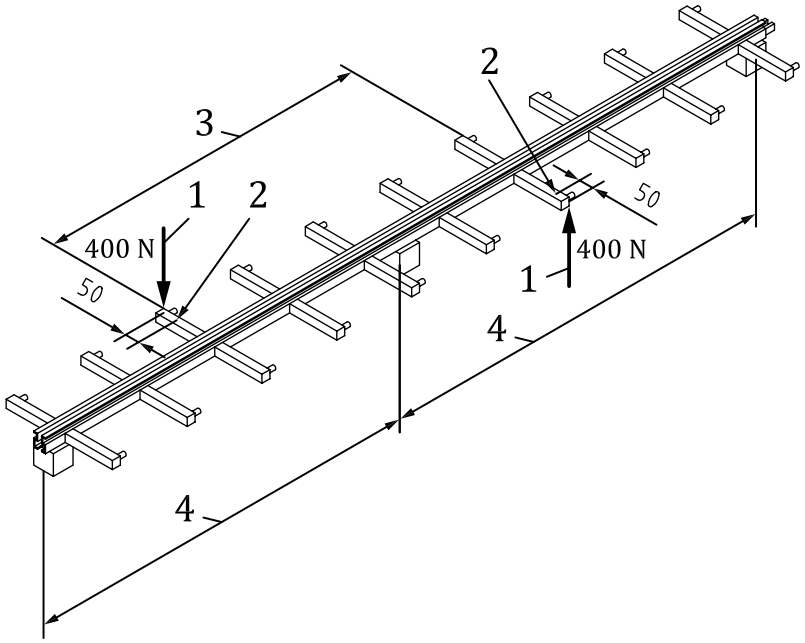
6.3.1 Test of ladder elements

6.3.1.1 Torsion test of ladder elements

The stability of the stile may be verified by a torsion test using an adequate section of a ladder in accordance with Figure 25.

The minimum length of the test specimen is the distance between two consecutive anchor points.

Dimensions in millimetres



Key

1 line of application
2 measuring point
3 distance between four set of rungs
4 distance between two consecutive anchor points

Figure 25 — Ladder with one stile — Torsion test

The ladder shall be mounted at the anchor points on the ground and be loaded by a couple created by two forces each of 400 N and separated by a distance equal to the spacing between 5 rungs, as indicated in Figure 25.

The distance between the test loads corresponds to the distance between four sets of rungs of the ladder.

The direction of test loads is perpendicular to the face of the ladder and shall be applied at the end of the rungs close to devices against slipping off and to the combination of rungs considered as the most unfavourable.

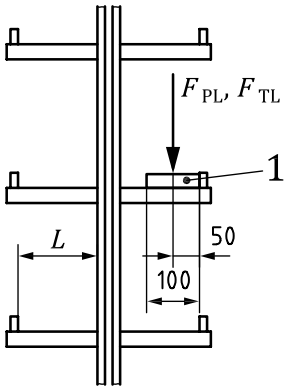
The deflection of the ladder shall not exceed 20 mm under the application of the test loads.

Deflections shall be measured is at a distance of 50 mm from the lateral protective device provided at the end of the rung to prevent slipping-off; the direction of measuring to be in line with the application of the test load.

6.3.1.2 Test of rungs

Stability shall be verified by testing in accordance with Figure 26.

Dimensions in millimetres



Key

1 underlayment

F_{PL} preload

F_{TL} test load

L length of tread

Figure 26 — Ladder with one stile — test of rungs

A preload (F_{PL}) of 200 N shall be applied perpendicular to the top of the rung. The position of the rung after removing the preload is the reference position for the test load F_{TL}.

The direction of the preload and of test load F_{TL} of 2,6 kN is perpendicular to the top of the rungs when the ladder is in the position when in use.

The preload and test load may be considered equally distributed on a length of 100 mm when an underlayment is positioned up against the lateral devices provided at the end of the rungs to prevent slipping. The underlayment shall be rigid and shall have no sharp edges.

After removing the test load, the residual deflection of the rungs, relative to the position after removing the preload, shall be not more than 0,3 % of the length, L, of the rung.

The position of measurement of deflections is at a distance of 50 mm from the lateral protective device provided at the end of the rung to prevent slipping-off; the direction of measuring shall be in line with the application of the test load.

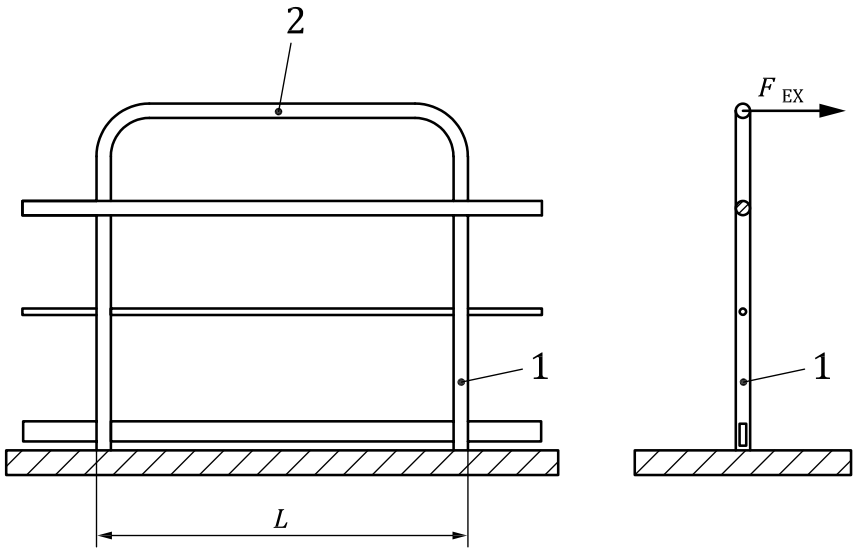
6.4 Test of extensions of guard-rails

For verification of required stability, a load (F_{EX}) shall be applied horizontally at the most unfavourable position along the length of the upper part of the guard-rail extension, see Figure 27.

$$F_{EX} = 300 \text{ N/m} \times L \times \gamma$$

where γ is the material factor for steel and aluminium ($\gamma = 1{,}75$).

After removing the load, the function of the extension shall not be impaired and no cracks or permanent deflection shall be identifiable by inspection.



Key

1 underlayment
2 extension
F_{EX} preload
F_{TL} test load
L length of extension

Figure 27 — Test of extensions of guard-rails

7 Information for use for fixed ladders

7.1 Instruction handbook

7.1.1 General

In addition to the general requirements provided in ISO 14122-1, information shall be given about the following in the instruction handbook supplied with the machine:

— fall arrester, including the method of fixing and the assembly of the fall arrester;

— use of anti-climb device(s);

— use of gloves when climbing the ladder.

7.1.2 Ladder systems with fall arrester

The relevant provisions of ISO 12100 as well as of EN 353-1 shall be presented in the instruction handbook supplied with the machine.

The following minimum information shall be provided when the ladder system includes a fall arrester:

— advice that a ladder with fall arrester shall be used only by well-trained users;

— advice on the risk of falling while using an incompatible self-locking guided type fall arrester and incompatible lanyard with the rigid anchor line;

— advice on how to use the harness, as provided by the manufacturer, with the guide lock;

— advice on how to instruct the authorized person(s) in the safe operation of ladders with fall arrester;

— advice on how movable parts shall be locked in the intended positions when in use and in the stored position.

7.2 Marking of ladder systems with fall arrester

At least the following shall be permanently marked at points of entry and exit to the ladder system:

— the manufacturer;

— the year of manufacture;

— the date of commissioning;

— a reference on standard for fall protection;

— a reference on standard of full body harness;

— the type of guided type fall arrester;

— the type of fall protection device;

— the notice: “Use of Personal Protective Equipment is mandatory”.

The marking is only required to be applied to those points of entry and exit which are reachable via the respective ladders.

A marking, for example, by an embossed coating is considered permanent. The information of the marking should be mentioned in the operating instructions for ladders with fall arrester.

Annex A
(normative)

Requirements for the design of anti-climb devices

A.1 General

Anti-climb devices shall be fixed at the ladder and designed as follows:

— it shall not increase the risk of falling;

— the clear width of the ladder and the cage with the anti-climb devices complies with 4.1.2 and 5.5.1.2;

— in order not to impair the movements of the operator when going inside or outside the ladder, the clear width of the ladder and the cage with the anti-climb devices shall comply with 4.1.2 and 5.5.1.2;

— operators climbing the ladder shall not be trapped;

— they shall allow the safe passage of the operator while in the access position (this means “open”, if door systems are fitted);

— the combination of an anti-climb device and the ladder shall not compromise the integrity of the ladder, e.g. stability;

— they shall be safe, operable and access to the ladder shall be by a key alternative device from the departure area;

— they shall be operable either with one hand or one foot when standing in the ladder;

— they shall return to a position preventing access (this means “closed and locked”, if door systems are fitted) by self-closing (e.g. spring applied) and self-locking (be locked) after safe passage.

NOTE 1 The anti-climb-device is generally fitted at the departure area, but an anti-climb device at the arrival area is not excluded.

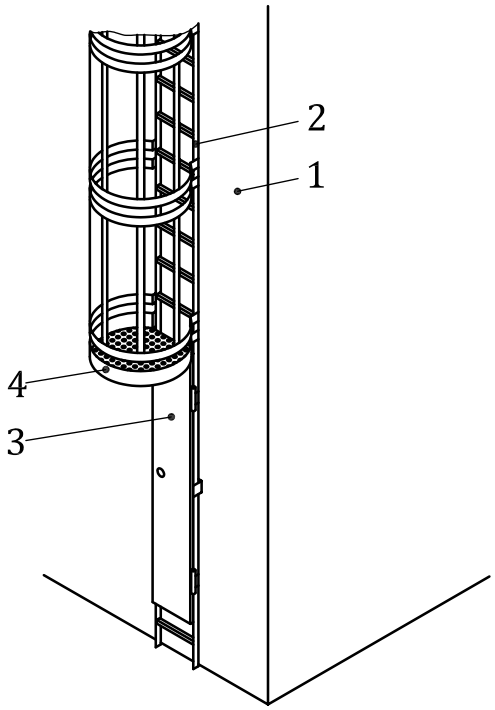
NOTE 2 For security application, national regulation might be applicable.

NOTE 3 An anti-climb device is considered also to be a guard, see ISO 14120.

A.2 Door systems fitted as anti-climb devices

A.2.1 General

For door systems, see Figure A.1.



Key

1 fixed part (wall)
2 ladder
3 anti-climb device
4 trap door hatch cover

Figure A.1 — Example of an anti-climb device on fixed ladders with safety cage

A.2.2 Dimensions

The height of the door shall be at least 1 800 mm.

For ladders equipped with a safety cage, the free distance between the upper part of the door and the cage shall be between 10 mm to 50 mm and the anti-climb device shall be fitted with an additional horizontal hatch cover that can prevent access to the cage (see Figure A.1).

On a ladder fitted with a fall arrester, the upper part of the anti-climb device shall be located in a height of ≥3 000 mm in order to avoid misuse. The locking control system shall be between 600 mm and 1 800 mm, measured from finished floor level.

A.2.3 Testing

A.2.3.1 General

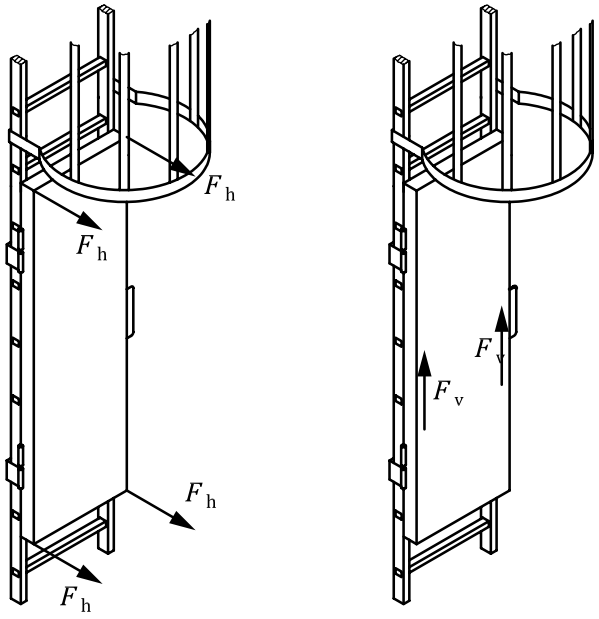
Test shall be made with the door in the closed and locked position. After removing the loads there shall be no visible permanent deflection which could lead to a lack of functionality. A function test shall be carried out.

A.2.3.2 Static test

The following loads shall be applied in two different tests:

— a load (F_h) of 1 500 N shall be applied horizontally, in accordance with Figure A.2, at each angle of the door during 1 min;

— a load (F_V) of 4 500 N shall be applied vertically, in accordance with Figure A.2, at the two lower angles.



Key

F_h horizontal load

F_v vertical load

Figure A.2 — Static test

A.2.3.3 Dynamic test of the hatch cover

A bag (soft body) according to Figure A.3 with a weight of 50 kg shall be dropped on the horizontal hatch cover from 2 000 mm above the hatch cover.

Dimensions in millimetres

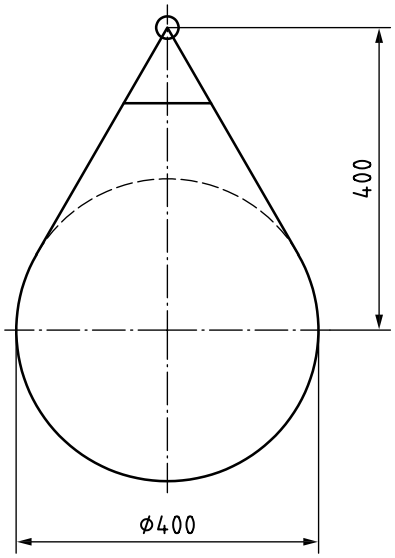


Figure A.3 — Test bag

A.2.4 Information for use for anti-climb device

In addition to the general requirements (see ISO 14122-1:2016, Clause 7) information for unlocking access doors shall be permanently marked and visible on the door or at the side of the door.

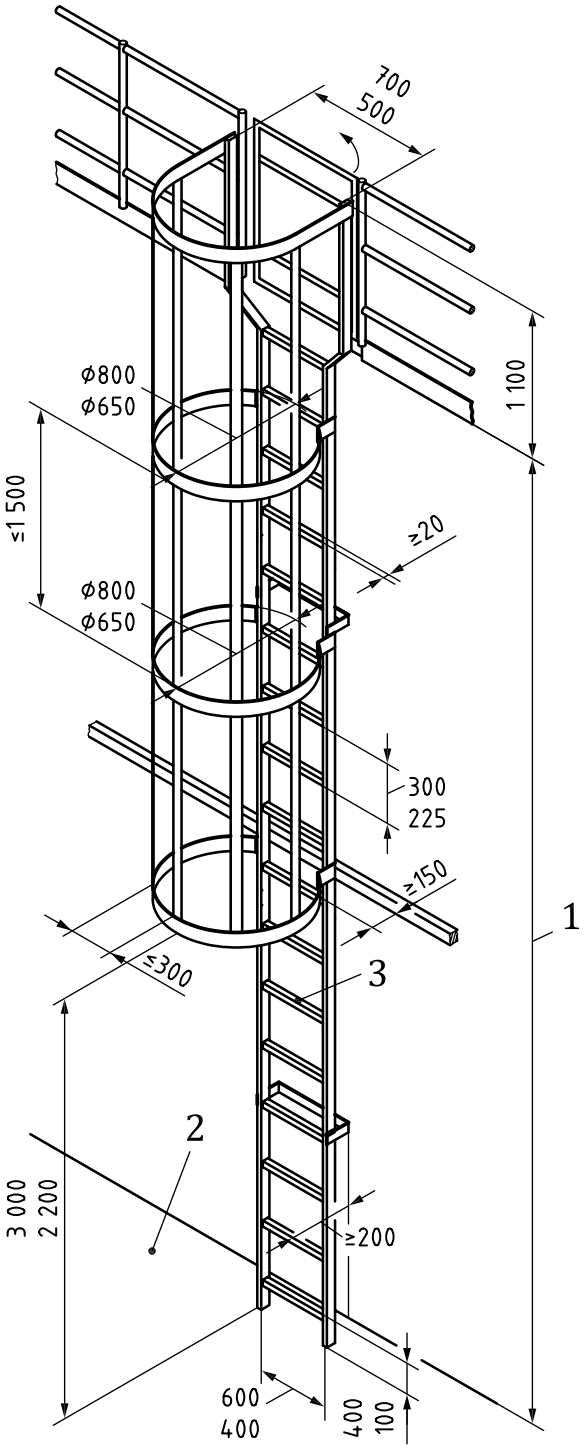
Annex B
(informative)

Summary of main dimensions of a fixed ladder equipped with a safety cage

See Figure B.1.

NOTE For requirements, provisions, and details, see the relevant clauses in this part of ISO 14122.

Dimensions in millimetres



Key

1 overall falling height ≥3 000
2 departure area
3 total perimeter of closed rungs ≤140

Figure B.1 — Main dimensions on a fixed ladder equipped with a safety cage

Annex C
(informative)

Significant technical changes between this part of ISO 14122 and the previous edition

See Table C.1.

Table C.1 — Technical changes

ISO 14122–4	ISO 14122–4:2004 ISO 14122–4:2004/Amd1:2010
Modified: This part is limited only to "*stationary machinery*", is applicable on "*non-powered adjustable parts*"	1 Scope
Updated	2 Normative references
3.1, new "*fixed ladder system*"	—
3.2, figure added	3.1
3.3, figure added	3.2
3.4, figure added	3.3
3.5, modified	3.4
3.6	3.5
3.7	3.6
3.7.1, modified	3.6.1
3.7.2	3.6.2
3.8	3.8
3.9	3.7
3.10, new "*intermediate landing*"	—
3.11, modified	3.9
3.12, modified	3.10
3.13, modified	3.10
3.14	3.11
3.15	3.12
3.16, new "*non-trained user*"	—
3.17 new "*well-trained user*"	—
4, new "*Selection and design of ladder systems*"	—
4.1	4.1
4.1.1, new "*Construction*",	4.1 3rd paragraph, general aspects are transferred to Part 1
4.1.2, new "*Choice depending on available space*"	—
4.1.3, new "*Spacing between the ladder and any permanent obstruction*"	4.2, Figure 5 and 4.4.4
4.2, modified "*Choice of a type fall protection device*"	4.3
4.2.1, modified "*Necessity of a fall protection device*"	4.3.1
4.2.2, new "*Types of a fall protection device*"	—
NOTE This list includes the significant technical changes but is not an exhaustive list of all modifications from the previous version.	

Table C.1 *(continued)*

ISO 14122–4	ISO 14122–4:2004 ISO 14122–4:2004/Amd1:2010
4.2.3, modified "*Guidance for a risk assessment* "	4.3.2
4.3, new "*Height of ladder flights and fall protection device*"	—
4.3.1, new "*Limits of space* "	—
4.3.2, new "*Ladder systems >3 000 mm and ≤10 000 mm total height H*"	—
4.3.3, new "*Ladder systems >10 000 mm total height H*"	—
4.4, new "*Platform and landings*"	—
4.4.1, new "*Installation of platforms on arrival –and departure areas*"	—
4.4.2, new " *Arrangement of platforms and landings with total height H > 10 000 mm*"	4.7.5.1
5, modified "*Specific requirements of ladder systems*"	4
5.1, modified, providing a calculation method	4.1
5.1.1 new "*Permanent action (dead load)*"	—
5.1.2, new "*Variable action (rated load)*"	—
5.1.3, new "*Additional loading*"	Sections of 4.2.2.2
5.1.4, new "*Design*"	Sections of 4.1
5.2, new "*Ladder with two stiles*"	4.4
5.2.1, new "*Strength*"	4.2
5.2.2, modified "*Rungs*"	4.2
5.2.2.2, modified	4.4.1.1 and 4.4.1.2
5.2.2.3, modified	4.4.2.2
5.2.2.4, modified, e.g. round rungs excluded	4.4.2.4, 4.4.2.3
5.2.2.5, modified	4.4.1, Figure 6
5.2.3, new "*Connection of ladder and guard rail*"	—
5.3, new "*Ladder with one stile*"	4.2, 4.4. and Figure 5
5.4, new "Departure and arrival areas	—
5.4.1, new "*General requirements*"	4.7
5.4.2, modified "*Departure area (entrance)*"	4.7.1
5.4.3, modified "*Arrival area (exit)*"	4.7.2
5.4.4, modified	4.7.3, excluding 4.7.3.3
5.4.5, modified "*Trap doors*"	4.7.3.3
5.5, new "*Fall protection device*"	4.3
5.5.1, modified and Figure 4d deleted	4.5, 4.7.1.2, 4.7.2.2, Figures 4a, 4c, 8
5.5.2, modified	4.6 and 4.7.4.3
5.6, modified	4.7.5 and Figure 4b
5.7, new "*Requirements on moveable parts of fixed ladders*"	—
6, modified	5
NOTE This list includes the significant technical changes but is not an exhaustive list of all modifications from the previous version.	

Table C.1 *(continued)*

ISO 14122–4	ISO 14122–4:2004 ISO 14122–4:2004/Amd1:2010
7, modified "*Information for use for fixed ladders* "	6
New: Annex A "*Requirements on the design of anti-climb devices*"	—
New: Annex B " *Summary of the main dimensions on a fixed ladder equipped with a safety cage*"	—
NOTE This list includes the significant technical changes but is not an exhaustive list of all modifications from the previous version.	

Bibliography

[1] EN 131-2, *Ladders — Part 2: Requirements, testing, marking*

[2] EN 364, *Personal fall protection equipment — Personal fall protection systems*

[3] ISO 2867, *Earth-moving machinery — Access systems*

[4] ISO 4254-1, *Agricultural machinery — Safety — Part 1: General requirements*

[5] ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

[6] ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

[7] ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

[8] ISO 15534-1, *Ergonomic design for the safety of machinery — Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery*

[9] ISO 15534-2, *Ergonomic design for the safety of machinery — Part 2: Principles for determining the dimensions required for access openings*

[10] ISO 15534-3, *Ergonomic design for the safety of machinery — Part 3: Anthropometric data*

[11] EN 1005-2:2003+Amd1:2008, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

[12] EN 1005-3:2002+Amd1:2008, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*