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Cranes — Access, guards and restraints —

Part 1: General

Appareils de levage à charge suspendue — Moyens d'accès, dispositifs de protection et de retenue —

Partie 1: Généralités

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Contents

1 Scope 1

2 Normative references 1

3 Terms and definitions 1

4 Access 3

4.1 General..... 3

4.2 Stairs 3

4.3 Rung ladders 4

4.4 Stepped ladders 6

4.5 Handrails and handholds 6

4.6 Gangways, landings and platforms 7

5 Guards and restraints..... 7

5.1 Guards for moving parts 7

5.2 Prevention of objects from falling..... 9

5.3 Electrical guarding..... 9

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11660-1 was prepared by Technical Committee ISO/TC 96, *Cranes*, Subcommittee SC 7, *Tower cranes*.

ISO 11660 consists of the following parts, under the general title *Cranes — Access, guards and restraints*:

- *Part 1: General*
- *Part 2: Mobile cranes*
- *Part 3: Tower cranes*
- *Part 4: Jib cranes*
- *Part 5: Overhead travelling cranes and portal bridge cranes*

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Cranes — Access, guards and restraints —

Part 1: General

1 Scope

This part of ISO 11660 establishes the general requirements for access to control stations and other areas of cranes, as defined in ISO 4306-1, during normal operation, maintenance, inspection, erection and dismantling. Guards and restraints are also dealt with in general, regarding the protection of persons on or near the crane as related to moving parts, falling objects or live parts.

The particular requirements relating to access, guards and restraints for the various types of cranes and lifting appliances are given in the other parts of ISO 11660.

In some cases, the particular requirements may not comply with the general requirements. Different dimensions are allowed provided an equivalent degree of protection is achieved.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 11660. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 11660 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 4306-1, *Cranes — Vocabulary — Part 1: General*.

IEC 60204-32, *Electrical equipment of industrial machines — Part 32: Requirements for hoisting machines*.

3 Terms and definitions

For the purposes of this part of ISO 11660, the terms and definitions given in ISO 4306-1 and the following apply.

3.1 ladder

access system or part of an access system, inclined from the horizontal at an angle greater than 50° but not more than 90°, consisting of a series of equally spaced steps that can accommodate one or both feet

3.1.1 rung ladder

ladder consisting of side rails and rungs which can accommodate both feet, used where the angle of inclination from the horizontal exceeds 75°

3.1.2**stepped ladder**

ladder consisting of side rails and steps which can accommodate both feet, used where the angle of inclination from the horizontal exceeds 65°

3.2**stair**

means of access used where the angle of inclination from the horizontal does not exceed 65°

3.3**ramp**

plane inclined at an angle of 20° or less from the horizontal, without steps

3.4**walkway**

part of an access system, with essentially horizontal flooring, that permits walking or crawling between locations on a crane

3.5**landing**

section of an essentially horizontal floor situated above and below a flight of stairs or access ladder

3.6**platform**

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

3.7**rung**

part of a ladder of any section but without sharp edges and which can be inscribed by a circle and on which one or both feet can be placed

See Figure 2.

3.8**step**

part of a ladder or stair with a flat horizontal surface on which both feet can be placed

See Figure 1.

3.9**going**

horizontal distance between the nose (outer edge) of a step and the vertical projection of the nose (outer edge) of the next step

See Figure 1.

3.10**handrail [handhold]**

device that may be grasped by the hand as an aid to body support and balance

3.10.1**handrail**

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

3.10.2**handhold**

device for single hand placement

3.11 toeboard

vertical plate which is placed around the perimeter of a platform to retain loose objects

4 Access

4.1 General

Access to control stations, machinery spaces and portions of the crane for which periodic inspection or maintenance is required shall be provided by means such as steps, stairs, ladders, gangways, landings and platforms complete with such handrails, handholds and other accessories as are necessary.

For cranes that are regularly erected and dismantled, means of access shall be provided as required for those operations. Their design shall permit performance of the work required.

For high cranes, it may be advantageous to have a powered means of access to the cabin.

4.2 Stairs

4.2.1 Stairs shall be provided with a handrail on both sides at a vertical height of 1 m to 1,1 m above the edge of each step, together with an intermediate rail located at half the handrail height.

If the stairs are near a continuous surface, it is acceptable to have only one handrail, on the open side.

4.2.2 The steps of the stairs shall be of the nonskid type and the outer edge (nose) shall be free from sharp edges.

4.2.3 Step construction shall minimize accumulation of debris and aid in the cleaning of mud and debris from the shoe sole where appropriate.

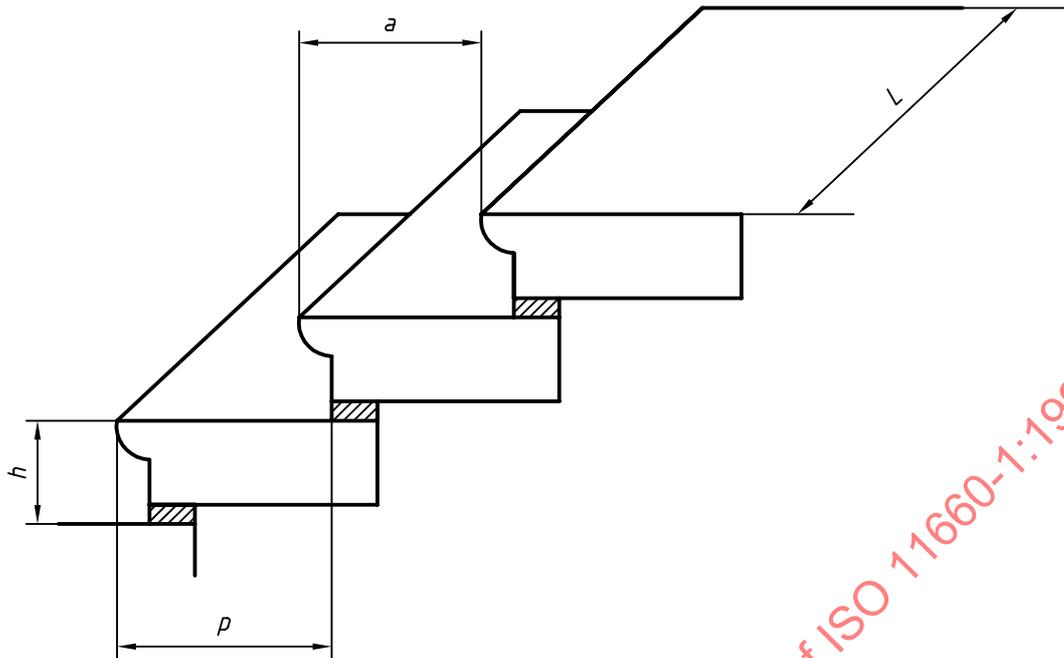
4.2.4 Steps shall be regularly spaced. Step construction shall provide natural foot placement while descending or the step shall be clearly visible while descending.

4.2.5 Steps shall conform with the dimensions given in Table 1. See Figure 1.

Table 1 — Dimensions of steps

Dimensions in millimetres

	cf. Figure 1	Minimum	Maximum
Riser	h	180	—
Tread width	p	240	400
Going	a	—	270
Clear width	L	320	—

**Key**

- h* Riser
- p* Tread width
- a* Going
- L* Clear width

Figure 1 — Dimensions of steps

Furthermore the following formula shall be observed:

$$2h + a = 630 \text{ mm}$$

All steps on the same stair flight shall have the same values of *a*, *h* and *p*.

4.2.6 The steps shall withstand without permanent deformation:

- a) a force of 2000 N applied through a 125 mm diameter disc at any location on the surface, and
- b) a uniformly distributed force of $4500 \text{ N} \cdot \text{m}^{-2}$.

4.3 Rung ladders

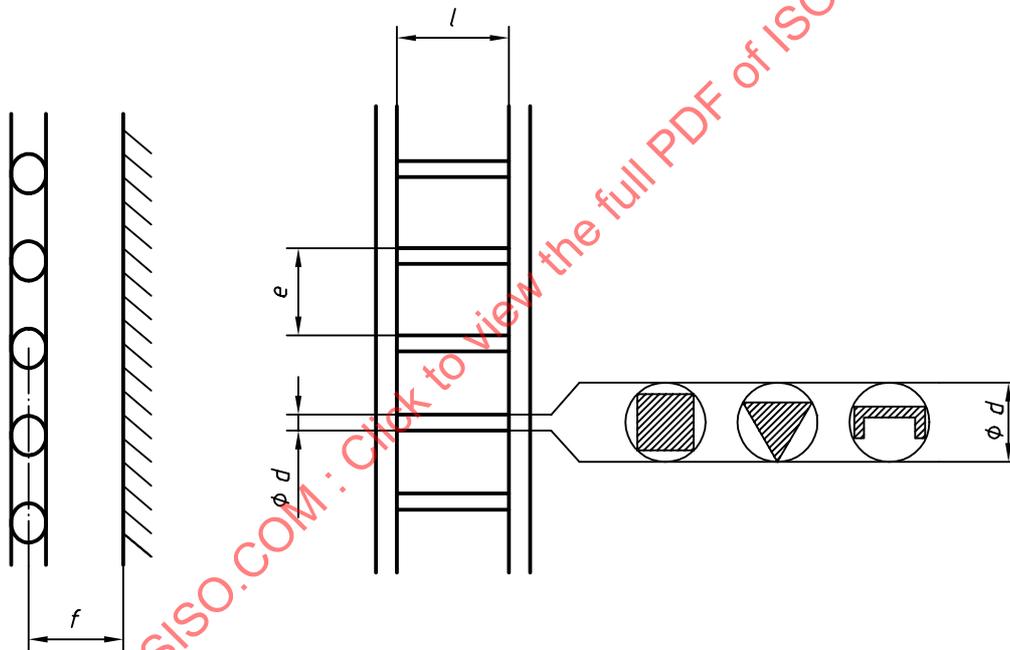
4.3.1 The uprights shall permit a firm grasp and shall be free from sharp edges.

4.3.2 Ladders shall conform with the dimensions given in Table 2. See Figure 2.

Table 2 — Dimensions of rung ladders

Dimensions in millimetres

	cf. Figure 2	Minimum	Maximum
Width between side rails	l	300	500
Rung spacing pitch (measured from the top of a rung to the top of the next rung)	e	230	300
Free space behind rungs (toe clearance, measured from the centreline of the rung)	f	150	—
Diameter surrounding the shape of the rungs	d	16	40

**Key**

- l Width between side rails
- e Rung spacing pitch (measured from the top of a rung to the top of the next rung)
- f Free space behind rungs (toe clearance, measured from the centreline of the rung)
- d Diameter surrounding the shape of the rungs

Figure 2 — Dimensions of rung ladders

4.3.3 The rungs shall support at their centre a force of 1200 N distributed over 0,1 m without permanent deformation.

4.3.4 Normally side rails are continuous but where side rails are required to be discontinuous, the maximum gap between them shall not be more than 40 mm.

4.3.5 Ladders which permit access to a height of more than 5 m shall be fitted with hoop guards from a point 2,50 m above their departure platform. The hoop guards shall have the following characteristics:

- hoop diameter between 0,6 m and 0,8 m;
- maximum distance between hoops:
 - 1) 0,9 m with 3 vertical bars;
 - 2) 1,5 m with 5 vertical bars.

When the mounting platform is situated more than 5 m above ground level and the hoop guard of the vertical tunnel projects even partially beyond the platform, the lowest hoop should be joined to the bond rail of the platform by at least two vertical bars.

4.3.6 The hoops shall be connected by three or five longitudinal bars spaced equally around the hoop; in all cases, a bar shall be fixed in a position diametrically opposite to the vertical axis of the ladder.

4.3.7 The strength of the hoop guards supported by the longitudinal bars shall permit the application, at any point on a hoop, of a vertical force of 1000 N distributed over 0,1 m; no permanent deformation is permitted.

4.3.8 A hoop guard is not required when the ladder is located inside a structure and if the structural members provide an equivalent protection.

It is considered that equivalent protection is provided when the position of the structural members is such that a sphere of 0,6 m diameter cannot pass between them.

4.3.9 Ladders shall be provided with rest landings for at least every 10 m of vertical climb.

4.3.10 Whenever possible, flights of ladders shall be positively separated from one another.

4.3.11 Emergency ladders shall comply with requirements of 4.3.1 to 4.3.3.

4.4 Stepped ladders

4.4.1 Stepped ladders shall have handrails or handholds as specified in 4.5.

4.4.2 The steps shall comply with 4.2.2 to 4.2.6.

4.5 Handrails and handholds

4.5.1 Handrails and handholds shall comply with the dimensions given in Table 3 and illustrated in Figure 3.

4.5.2 Handrails shall be appropriately spaced and within convenient reach to provide continuous support to a moving person in accordance with Table 3.

4.5.3 The preferred cross-section of a handrail or handhold is circular. A square or rectangular cross-section with rounded corners is permissible.

4.5.4 Handrails and successive handholds shall be placed parallel to the path of motion of the user. Handholds may be oriented vertically or horizontally but shall be consistent within a given system.

4.5.5 Any handrail or handhold on which the handgrasp surface extends beyond the support shall have a change of shape at the end of the handgrasp surface to alert the user that he has reached the end.

4.5.6 The use of handrails on a ladder system is preferred to handholds. Where handholds are used, the spacing shall correspond to the rung or step spacing.

Table 3 — Dimensions of handrails and handholds

Dimensions in millimetres

Dimension	cf. Figure 3	Minimum	Maximum
Width — diameter or across flats			
1) Ladder, step or walkway		16	38
2) Stairway and ramp handrails	<i>A</i>	16	80
Length between bend radii for support legs of handholds	<i>B</i>	150	—
Hand clearance to mounting surface	<i>C</i>	75	—
Distance above standing surface	<i>D</i>	900	1600
Vertical continuation distance of handrail above, platform, stairway or ramp	<i>E</i>	850	1100
Offset distance of handrail or handhold from edge of step	<i>F</i>	—	200
Width between parallel handrails			
1) Ladder		—	600
2) Stairway and ramp	<i>G</i>	460	—
Height of handrail above the floor	<i>H</i>	850	1400

4.6 Gangways, landings and platforms

4.6.1 The floor of gangways, landings and platforms shall be constructed of noncombustible (fire-resistant) material with a skid-resistant surface and shall not retain liquid.

4.6.2 The slots or holes in sheet metal, grating or all other materials which form a noncontinuous surface for the floor of gangways, landings and platforms situated at more than 2 m above the ground, shall have dimensions so that a sphere of 30 mm diameter cannot pass through them.

4.6.3 The gangways, landings and platforms for access to the control stations and to the equipment of the crane which need inspection and regular maintenance and are situated at more than 2 m above the ground shall be equipped with side protections conforming with the dimensions given in Table 4, or with any other means of ensuring at least equivalent protection.

4.6.4 Gangways, landings and platforms shall conform with the dimensions given in Table 4.

4.6.5 Every surface on which personnel may stand shall withstand without permanent deformation:

- a force of 2000 N applied through a 125 mm diameter disc at any location on the surface, and
- a uniformly distributed force of 4500 N · m⁻².

5 Guards and restraints

5.1 Guards for moving parts

Moving parts, such as drives, projecting axle ends, wheels, belt drives, chains, couplings, gearing, rail wheels and pulleys, which might constitute a hazard during normal operation, maintenance or adjustment shall be guarded. These guards may be removed or put out-of-service temporarily if necessary for maintenance or adjustment.

The guards shall support without permanent deformation the weight of a person of 90 kg mass unless the guard is located in an area where it is forbidden to stand or to circulate during crane operation or maintenance.