International Standard 2867

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Earth-moving machinery — Access systems

Engins de terrassement — Moyens d'accès

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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International Standard ISO 2867 was developed by Technical Committee ISO/TC 127, *Earth-moving machinery*, and was circulated to the member bodies in July 1979.

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It has been approved by the member bodies of the following countries :

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Belgium	Italy	Spain
Brazil	Japan	Sweden
Bulgaria	Korea, Rep. of	United Kingdom
Czechoslovakia	Philippines	USA
Egypt, Arab Rep. of	Poland	USSR

The member body of the following country expressed disapproval of the document on technical grounds :

France

This third edition cancels and replaces the second edition (i.e. ISO 2867-1976).

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Earth-moving machinery — Access systems

1 Scope

This International Standard specifies the criteria for steps, ladders, walkways, platforms, grab rails (handrails), grab handles, guardrails, and cab entrance and exit openings as they relate to aiding the operator and servicemen in performing their functions on the equipment.

It does not include criteria for the floor of the operating compartment or station.

2 Field of application

This International Standard is intended as a guide when designing access systems to the operating station and service points on all types of earth-moving machinery, primarily to aid in preventing accidents, and reducing injury to personnel getting on, off, or moving about on machines while servicing and preparing to operate them.

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3 References

ISO 2860, *Earth-moving machinery — Minimum access dimensions.* [1]

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

4 Definitions

For the purposes of this International Standard, the following definitions apply :

4.1 step : A device designed for foot placement.

4.2 ladder : A system consisting of a series of steps that are uniformly spaced and will accommodate either one foot or both feet.

4.3 walkway : A surface designed for personnel to move about on the machine.

4.4 platform : A surface on which personnel are required to perform a service function, or a machine function other than operating.

4.5 grab rail (handrail) and grab handle : Devices that may be grasped by the hand for body support.

4.5.1 grab rail (handrail) : A device designed specifically to permit movement of the hand to a different location without removing the hand from the device. (See figure 4.)

4.5.2 grab handle : A device designed specifically for single placement of a hand. (See figure 3.)

4.6 guardrail : A rail above the outside edge of a walkway or platform to protect a person from falling down. (see figure 6.)

4.7 entrance opening : The opening providing entry to the operating compartment.

5 General criteria

5.1 The design of these devices and the means of attachment should provide adequate strength for the purpose intended.

5.2 The designer should design for body dimensions for both the 95th percentile group and the 5th percentile groups. See ISO 3411.

5.3 The designs and attachment means should be such as to minimize the probability of the user being inadvertently restrained; for example, the catching or holding of a finger, hand, foot, or wearing apparel.

The design and placement of these devices should be such as to minimize protrusions that could increase injury in case of a fall.

5.4 Devices designed for hand contact should be free of roughness, such as sharp corners or protrusions.

5.5 These devices may be portable to provide convenient storage on the machine but, when in the use position, they should not move under load.

5.6 Steps, ladders, and grab rails to, on, and from platforms and walkways should be designed to permit the person using them to have three points of support on the system at all times (two hands and one foot, or two feet and one hand).

1) At present at the stage of draft. (Revision of ISO 2860-1973.)

6 Steps and ladders

6.1 The height of the first step from the ground to the machine should not exceed 700 mm when the machine is in the normal parked condition.

Based on principal human factors, the recommended height of the first step should be nor more than 400 mm.

6.2 Let X be the horizontal projection of the distance separating two successive steps of a ladder, and Y be its vertical projection. The recommended value of the sum $X + 2Y$ is 600 mm, and in no case should it exceed 800 mm. (See figure 2).

6.3 Where lateral movement is necessary from a top step of a ladder to a walkway or a platform, the distance should not exceed 300 mm.

6.4 It is preferred that all steps be wide enough to accommodate both feet. The recommended width for such design is 400 mm and in no case should it be less than 320 mm.

6.5 In those cases of steps where only one foot is used on a step, the recommended width is 200 mm and in no case should it be less than 160 mm. The use of such steps dictates that they be co-ordinated with properly positioned grab rails or grab handles to enforce the use of the proper foot.

6.6 The recommended dimension for toe clearance from the outside edge of the step is 200 mm, and in no case should it be less than 150 mm.

6.7 The recommended clearance height at the instep is 190 mm but in no case should it be less than 150 mm. (See figure 1.)

6.8 Wherever a foot may contact a moving part by protruding through the step, a shield should be provided between the step and the moving part.

6.9 The thread surface of a step should not be designed for use as a grab handle. The leading edge of steps should have no protrusions capable of snagging a finger, ring or clothing.

6.10 The design of steps should minimize the accumulation of debris. The tread surface should be of high slip resistance and should aid in the cleaning of mud and debris from the shoe sole.

6.11 Pivoting mounted steps should be avoided whenever possible. Where ground clearances dictate, the first step from the ground may be so mounted. However, only one step in a series may be so mounted.

6.12 The recommended headroom clearance above all ladders and steps is 2 010 mm.

7 Grab rails (handrails) and grab handles

7.1 Grab rails appropriately spaced to provide continuous support to a moving man should be placed within convenient reach.

7.2 The preferred cross-section of a grab rail and grab handle is circular. However, a square or rectangular cross-section with round corners is permissible but it should be free from sharp edges.

7.3 For circular cross-section grab rails and grab handles the maximum diameter should be 38 mm. The minimum diameter should be 16 mm. The recommended dimension is 25 mm. For square or rectangular cross-sections, these dimensions apply across flats (axially between parallel surfaces).

7.4 Grab handles should have an accessible minimum length between the bend radii of the support legs of 150 mm. The recommended length is 250 mm to all surfaces. (See figure 3.)

7.5 The minimum hand clearance of all grab rails and grab handles should be 75 mm to all surfaces. (See figure 3.)

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7.6 Grab rails and successive grab handles should be placed parallel to the path of motion of the user. Grab handles may be vertical or horizontal but should be parallel and consistent within a given system.

7.7 Any grab or grab handles on which the hand surface extends beyond the support should have a change of shap at the end of the hand surface to help prevent the hand from slipping off the end.

7.8 Grab rails or grab handles for access purposes should begin at a maximum heigth of 1 600 mm above the ground, the platform or walkway where the steps start when the machine is in a normal parked position. It is recommended that the grab rail continue to at least 900 mm above the final step. The maximum height should be given not only above the ground but also above the platform and walkway where the steps start.

7.9 The vertical grab rails or grab handle should be espaced no more than 200 mm to the side of the nearest edge of the step surface. The recommended spacing between parallel grab rail is 400 mm. The maximum spacing between parallel grab rails is 600 mm.

7.10 On inclined ladders, where hip clearance is a factor, the recommended spacing between parallel grab rails is 600 mm.

7.11 The recommended grab rail height vertically above any step or inclined ladder is 900 mm. (See figure 4.)

7.12 When grab or grab rails are placed in parallel along walkways, they should be located 850 mm to 1 400 mm above the walkways. (See figure 5.)

7.13 In a ladder system, the use of grab rails at the sides of the ladder is preferred to grab handles. Where grab handles are used, the spacing should correspond to the step spacing.

7.14 Control levers and pedals should be so designed that they are not used unconsciously as grab handles or grab rails.

8 Guardrails

8.1 It is recommended that a rigid guardrail be placed along the edge of walkways and platforms.

8.2 The recommended guardrail height is between 1 000 mm and 1 100 mm above the walkway or platform. A second rail should be spaced midway between the walkway and the top rail. (See figure 6.)

8.3 Where an opening in the guardrail has been provided, other than at the end of a guardrail, to provide access to a ladder or step, a safety bar or equivalent should be provided across the opening.

9 Walkways and platforms

9.1 Tread surfaces of all walkways and platforms should have high slip resistance or self-cleaning properties where practical.

9.2 Walkways and platforms with guardrails should have a minimum width of 300 mm without any protrusions above the walkways or platform.

Walkways with handrails on adjacent structures and which are used only for servicing and maintenance of the stationary machine should have a minimum width of 230 mm and preferably 300 mm.

9.3 The edge of a walkway or platform adjacent to a step or ladder should have no protrusions capable of snagging a finger, ring, or clothing.

9.4 The floors of walkways and platforms should be equipped on the sides, where the handrail is placed, with a protective board (toe guard) having a minimum height of 50 mm. (See figure 6.)

10 Cab entrance and exit opening

10.1 The recommended entrance opening width is 680 mm. The minimum opening width measured from the platform is 300 mm up to a height of 770 mm and 450 mm above the 770 mm up to a height of 1 550 mm. From the 1 550 mm height to a height of 1 800 mm the opening may be tapered such that the width is 350 mm at the 1 800 mm height. (See figure 7.

10.2 The recommended door height of sit-down type cabs is 1 300 mm or more from the floor. The recommended height of doors in stand-up cabs is 1 800 mm or more from the floor.

10.3 An alternative exit for emergency purposes should be provided in a cab surface different from the entrance door wall. The exit dimensions shall comply with the requirements given in 10.1 and 10.2 or in ISO 2860. A window or hatch, which can be readily opened, can be used as an alternative exit for emergency purposes.

10.4 The door should be accessible directly from the access steps or from a walkway or platform.

10.5 The external door handle should be located from 500 to 1 500 mm above the place on which the man must stand to open the door. The recommended height is 900 mm. On machines where the door is opened from the ground, the door handle height should not be more than 1 700 mm.

10.6 The internal door handle should be located from 500 to 850 mm from the floor for the seated man and from 800 to 1 000 mm from the floor for the standing man.

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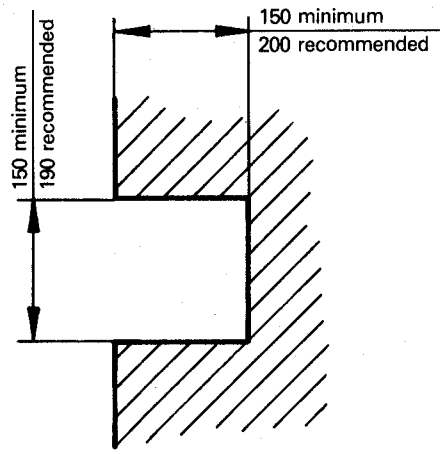

Figure 1 — Step

Dimensions in millimetres

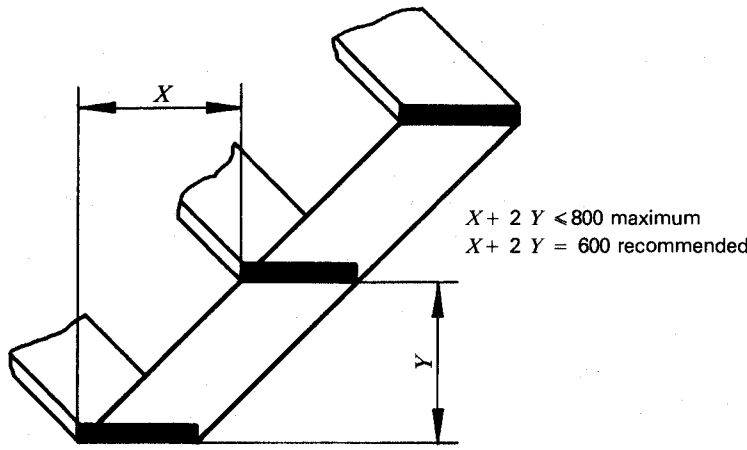

Figure 2 — Ladder

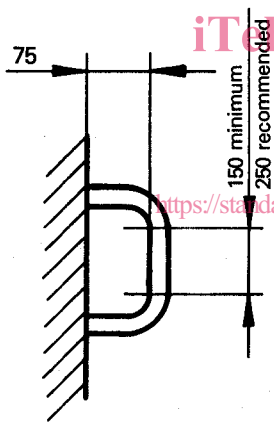

Figure 3 — Grab handle

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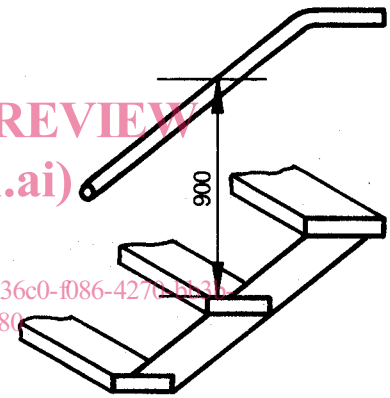


Figure 4 — Handrail

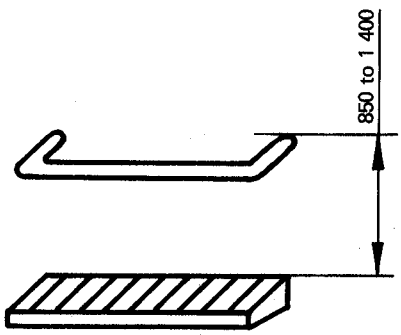


Figure 5 — Grab rail above walkway

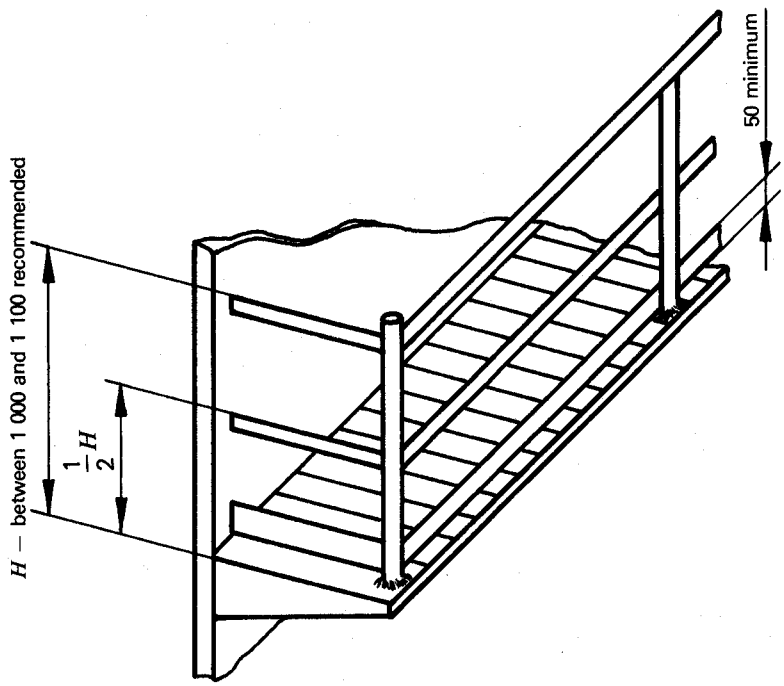
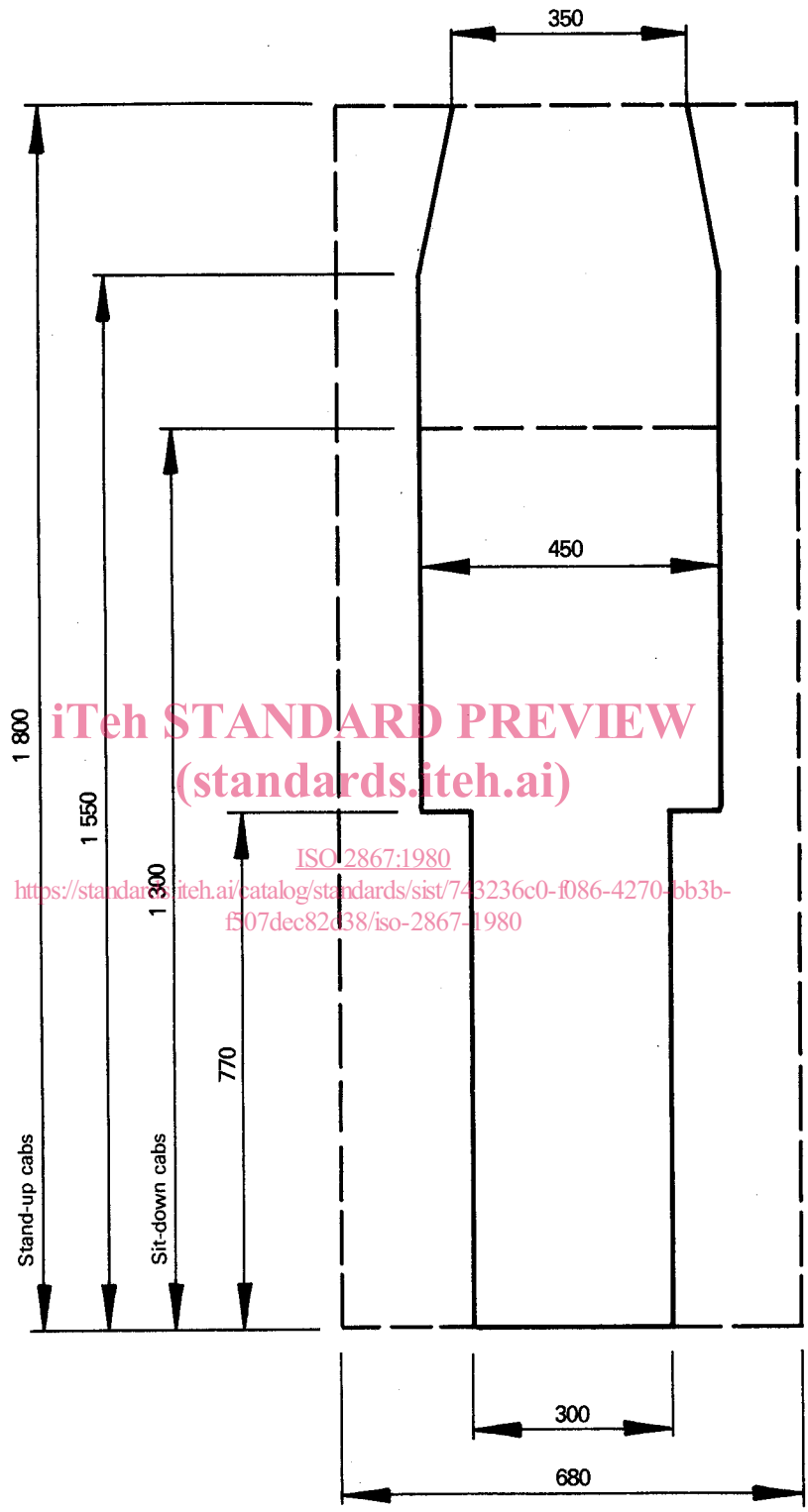


Figure 6 — Guardrail

Dimensions in millimetres



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— — — — Recommended access opening

——— Minimum access opening

NOTE — The 350 and 300 dimensions do not need to be symmetrical to the 450 dimension. The lower vertical dimension of 770 can be tapered.

Figure 7 — Access opening

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