
International Standard



4254/1

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

**Tractors and machinery for agriculture and forestry —
Technical means for ensuring safety —
Part 1: General**

Tracteurs et matériels agricoles et forestiers — Dispositifs techniques permettant d'assurer la sécurité — Partie 1: Généralités

First edition — 1985-12-15

UDC 631.3-78

Ref. No. ISO 4254/1-1985 (E)

Descriptors: agricultural machinery, tractors, safety devices, accident prevention, operating stations, ergonomics, specifications.

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.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4254/1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Tractors and machinery for agriculture and forestry — Technical means for ensuring safety — Part 1: General

0 Introduction

This part of ISO 4254 provides guidelines regarding the prevention of accidents arising from the use of tractors and machinery for agriculture and forestry.

It gives general guidelines to be met when designing tractors and machines.

It is intended that other parts will be developed which will widen or limit these general guidelines for individual machinery types.

1 Scope

This part of ISO 4254 specifies technical means of improving the degree of personal safety of operators and others involved in the course of normal running, maintenance and use, intended to be carried out by the user of the machinery.

2 Field of application

This part of ISO 4254 applies to the design of tractors and machinery for agriculture and forestry. Subsequent parts may have wider or more limited fields of application for individual machinery types.

3 References

ISO 500, *Agricultural tractors — Power take-off and drawbar — Specification.*

ISO 3600, *Tractors and machinery for agriculture and forestry — Operator manuals and technical publications — Presentation.*

ISO 3767, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays —*

Part 1: Common symbols.

Part 2: Symbols for agricultural tractors and machinery.

*Part 3: Symbols for powered lawn and garden equipment.*¹⁾

*Part 4: Symbols for forestry machinery.*¹⁾

ISO/TR 3778, *Agricultural tractors — Maximum actuating forces required to operate controls.*

ISO 3789, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Location and method of operator controls —*

Part 1: Common controls.

Part 2: Controls for agricultural tractors and machinery.

Part 3: Controls for powered lawn and garden equipment.

ISO 3864, *Safety colours and safety signs.*

ISO 5673, *Agricultural tractors — Power take-off drive shafts for machines and implements.*

ISO 5674, *Tractors and machinery for agriculture and forestry — Guards for power take-off drive shafts — Test methods.*

ISO 5692, *Agricultural vehicles — Mechanical connections on towed vehicles — Hitch-rings — Specifications.*

ISO 6489/1, *Agricultural vehicles — Mechanical connections on towing vehicles — Part 1: Hook type — Dimensions.*

4 Principles in providing safety

Tractors and machinery for agriculture and forestry shall be designed and constructed in such a way that they do not cause danger when properly used.

Operating and maintaining the machine should be carried out in accordance with the manufacturer's instructions. These requirements shall primarily be met by the design of the machine. If this is not possible, the machine shall be equipped with special means for ensuring safety, for example guards or safe location of the dangerous parts. Functional components that need to be exposed for correct operation shall be shielded to the maximum extent permitted by the intended function of the components. Additionally, in such circumstances, warning of the hazard shall be indicated on the machine (see clause 9).

1) At present at the stage of draft.

5 Moving parts treated as dangerous

In general all moving parts shall be treated as dangerous; particular attention is drawn to the following:

- all shafts (including joints, shaft ends and crank shafts), pulleys, flywheels, gearing (including friction roller mechanisms), cables, sprockets, belts, chains, clutches, couplings and all blades or wings of fans;
- the run-on point of any belt, chain or cable;
- keyways, keys and grease nipples, etc. that protrude from moving parts;
- all points where the danger of pinching or shearing is possible;
- ground wheels or tracks adjacent to the operator's position (standing platform, seat, footrest) and passenger seat (where provided).

6 Guard types

There are three types of guards designed to prevent contact by a person or clothing with moving parts. They may be classified as:

- a) shields or covers;
- b) casing;
- c) enclosures;

and are characterized as follows.

6.1 Shield or cover (see figure 1)



Figure 1 — Shield and cover

Protective devices designed and fitted so that alone or with other parts of the machine, they prevent the dangerous part being reached from the side or sides covered.

6.2 Casing (see figure 2)

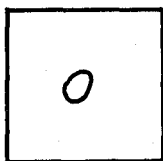


Figure 2 — Casing

Protective device designed and fitted so that, alone or with other parts of the machine, it prevents contact with the dangerous part from all sides.

6.3 Enclosure

Protective device which by means of a rail, fence, frame or the like ensures the safety distance necessary so that the dangerous part cannot be reached inadvertently.

7 Guard construction

Guards shall be sufficiently strong. Unless it is clearly inappropriate, they shall, without cracking, tearing or permanently deflecting, withstand a perpendicular static load of 1 200 N.

Parts designed as platforms and steps which are also guards shall comply with appropriate strength requirements for platforms and steps.

Where a guard is in such a position that it may occasionally be used as a step it shall withstand a load of 1 200 N.

Guards shall be rigidly fixed, have no sharp edges, be weather-resistant and retain their strength under extremes of temperature, taking into account the intended use.

Guards shall be designed in such a way that operating and servicing the machine can be readily carried out.

Guards shall normally be permanently attached to the machine; they may be openable, in which case they should remain attached to the machine in some way, for example by means of a hinge, slide, linkage or other suitable means, and should be provided with a convenient means to keep them closed. "Permanent attachment" includes the use of threaded fasteners, split pins, or other means that can be dismantled with common hand tools.

In some circumstances it is necessary for guards which can be opened to be designed so that the movement of dangerous parts is automatically stopped when the guard is opened or the design prevents the guard being opened until all movement of the dangerous parts has ceased. This can be achieved for example by designing the guard securing device(s) so that the part will stop before the guard is opened. A suitable warning notice shall be fitted to all such guards and to any opening in them without such securing devices.

Guards may be formed of a welded or rigid mesh or grille. The size of the opening permitted depends on the distance between the guard and the moving part as given in clause 8. The design of the guard shall be such that it is not possible to distort the mesh or the grille during proper use in such a way that the opening size and distance relationship exceeds the limits given in clause 8.

8 Safety distance

There may be circumstances where the requirements of clause 4 can be met by ensuring a safety distance, as described in 6.3, from the dangerous part.

It is possible to circumvent the protection provided by a safety distance (as specified in 8.1) by the misuse of steps, ladders, boxes or chairs, etc., but the general principle of a safety distance, in compliance with clause 4, is acceptable provided the following criteria are met so that the dangerous parts are out of reach.

8.1 Safety distance from dangerous part

The safety distance is based on measurements from the location which a person can occupy to operate, maintain or inspect the dangerous part.

8.1.1 Upward reach

The safety distance for upward reach is 2 500 mm for persons standing upright.

8.1.2 Reach below barriers

No safety distance is specified where it is possible to reach below a safety barrier, unless the aperture is small enough to be considered only in relation to finger, hand or arm access in which case the requirements of 8.1.6 apply.

8.1.3 Reach over barriers

Barriers the height of which is less than 1 000 mm above the location which a person can occupy shall not be acceptable.

The safety distance for sideward or downward reach over barriers of 1 000 mm or greater height depends on

- a) the distance from the ground level to the dangerous part;
- b) the height of the guard;
- c) the horizontal distance between the dangerous part and the guard.

When designing a barrier, the dimensions in table 1 shall be met (see figure 3).

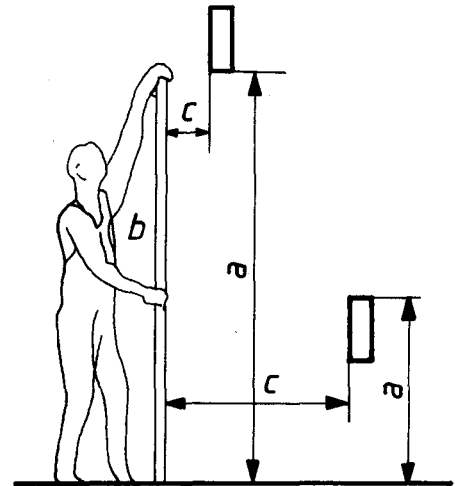


Figure 3 — Principles for determining the distance required from a guard to the dangerous part

Table 1 — Downward and sideward safety distance
Dimensions in millimetres

a	b ¹⁾							
	2 400	2 200	2 000	1 800	1 600	1 400	1 200	1 000
	c							
2 400	—	100	100	100	100	100	100	100
2 200	—	250	350	400	500	500	600	600
2 000	—	—	350	500	600	700	900	1 100
1 800	—	—	—	600	900	900	1 000	1 100
1 600	—	—	—	500	900	900	1 000	1 300
1 400	—	—	—	100	800	900	1 000	1 300
1 200	—	—	—	—	500	900	1 000	1 400
1 000	—	—	—	—	300	900	1 000	1 400
800	—	—	—	—	—	600	900	1 300
600	—	—	—	—	—	—	500	1 200
400	—	—	—	—	—	—	300	1 200
200	—	—	—	—	—	—	200	1 100

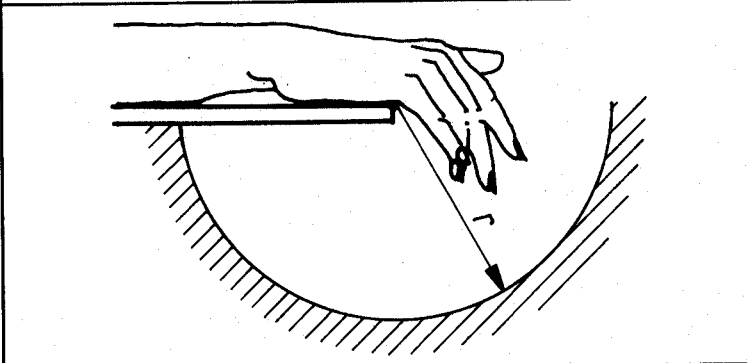
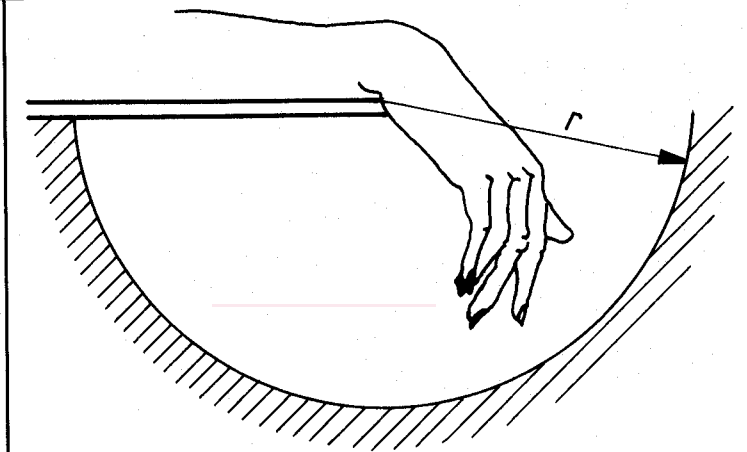
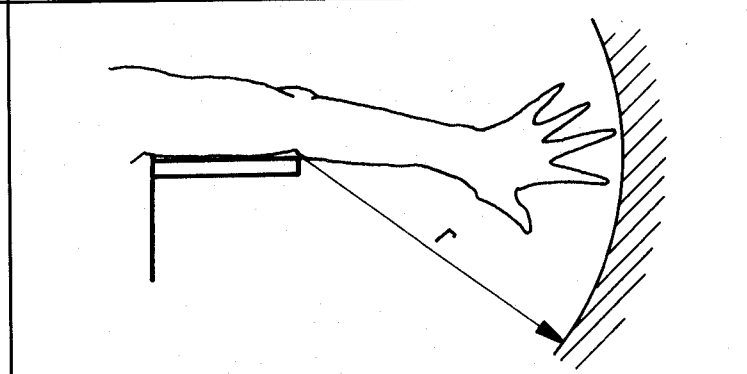
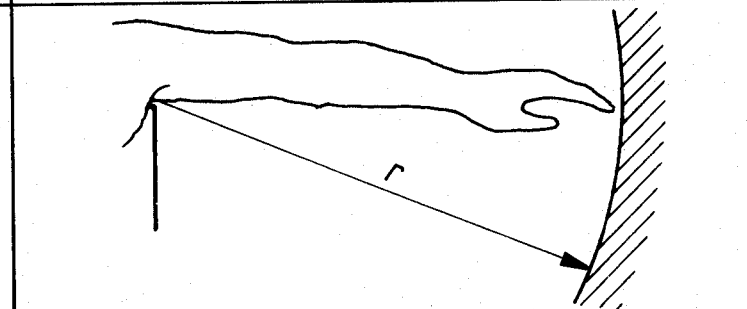
1) Values of b < 1 000 mm do not increase the reach. Moreover, the danger arises of falling towards the danger source.

8.1.4 Round reach

Table 2 shows the extent of reach around barriers which can be attained, taking into account the aperture and the distance from other obstructions. Dangerous components shall be beyond these limits if they are not independently guarded.

Table 2 — Extent of reach

Dimensions in millimetres

Limb		Illustration	Safety distance, <i>r</i>
From	To		
Finger base	Finger tip		$r > 120$
Wrist	Finger tip		$r > 230$
Elbow	Finger tip		$r > 550$
Shoulder	Finger tip		$r > 850$

8.1.5 Inside reach through guards

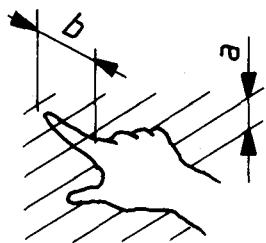
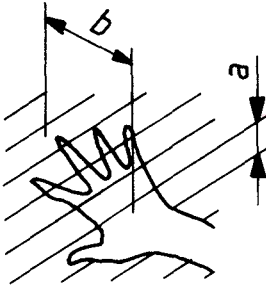
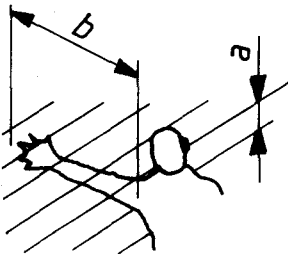
The safety distances depend on the shape of the openings.

8.1.6 Openings

The openings shall not exceed the size appropriate to the distance of the guard from the moving part (see table 3).

Table 3a) – Reach dimensions through rectangle or slot

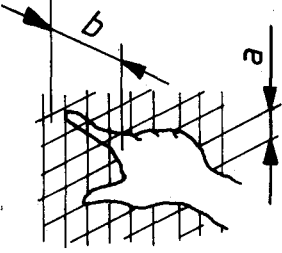
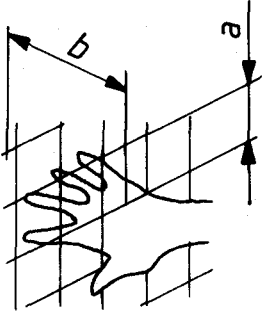
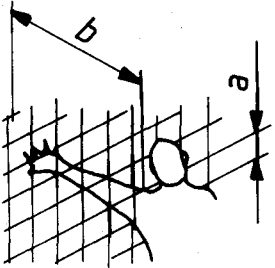
Dimensions in millimetres

Limb	Illustration	Width of aperture (rectangle or slot), a	Safety distance to danger source, b
Finger tip		$4 < a < 8$	$b > 15$
Finger		$8 < a < 20$	$b > 120$
Hand		$20 < a < 30$	$b > 200$
Arm		$30 < a < 135^{1)}$	$b > 850$

1) When the width is greater than 135 mm, part of the body can also pass through the aperture. In this case, safety distances as specified in 8.2 shall be observed.

Table 3b) — Reach dimensions through mesh or grille

Dimensions in millimetres

Limb	Illustration	Width of aperture (diameter or lateral length), a	Safety distance to danger source, b
Finger tip		$4 < a < 8$	$b > 15$
Finger		$8 < a < 25$	$b > 120$
Hand		$25 < a < 40$	$b > 200$
Arm		$40 < a < 250$	$b > 850$

8.1.6.1 Polygonal openings

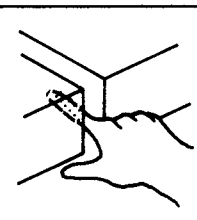
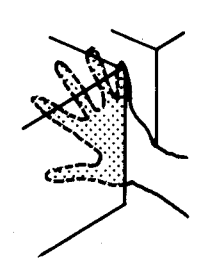
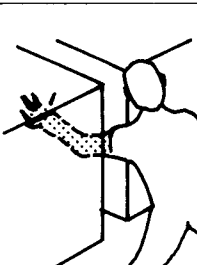
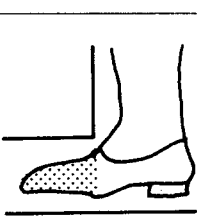
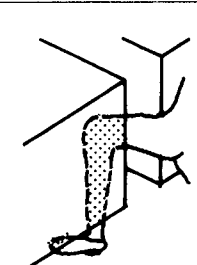
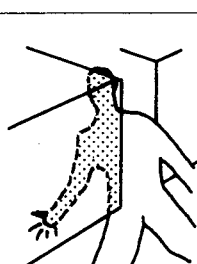
Polygonal openings, where the diameter of the largest circle that can be inscribed is not less than half the distance between the two apexes that are the furthest apart, shall meet the same requirements as for round openings. The diameter of the inscribed circle shall be regarded as the size of the opening. All other polygonal openings shall be regarded as slots.

8.2 Pinching points

A pinching point is considered dangerous for the parts of the body illustrated in table 4 if the appropriate minimum separation distance is not maintained. The design of the machine shall ensure that the next bigger part of the body cannot pass through.

Table 4 — Minimum separation distances for pinching points

Dimensions in millimetres

Limb	Illustration	Minimum separation distance required
Finger		25
Hand Wrist Fist		100
Arm		120
Foot		120
Leg		180
Body		500

9 Provision of information

9.1 Operating manuals

Where safety precautions are necessary during operation and servicing of agricultural machines, appropriate instructions shall be provided with the machine (see ISO 3600).

9.2 Warning notices

Durable warning notices shall be affixed to the machine where parts present danger to the operator. Also included are circumstances where the inadvertent lowering of parts of equipment can cause danger. Particular danger or safety warnings shall be indicated on the notice. Symbols, layout and colours to be used for safety signs should preferably be in accordance with ISO 3864.

Existing national or other regulations may require specific symbols, sizes, layout or colour. The warning notice shall be either pictorial or text in a language acceptable to the user or, if appropriate, the national regulating authority concerned.

10 Working stability

Machines and trailers that may create a danger to the user through tilting, as a result of the centre of gravity moving (for example when emptying or filling), shall be provided with means of preventing such danger.

Hydraulically raised components that need to be held in a raised position to allow servicing or adjustment shall be provided with an independent and reliable means of retaining them in the required position.

11 Operator's workplace

11.1 Handholds and steps

Any machine on which the presence of a driver or operator is necessary, including any place to which access is required for service or maintenance, shall be fitted with handles or handholds and steps so the person has a safe, convenient means of mounting and dismounting.

Both handholds and steps may be parts of the machine if they are suitably designed and placed. Steps shall be designed in relation to the general construction in order to ensure protection from moving parts. If moving parts, for example tyre sections, form restrictions or trapping areas with the steps, a suitable means of protection shall be provided. Steps shall have a non-slip surface and a vertical retainer at both sides.

The dimensions for steps will normally be found in the parts of this International Standard relating to specific machines. Where there is no specific provision, the steps shall comply with the dimensions in figure 4.

Where access is provided by a series of steps which are designed to be used alternately each by one foot, then the minimum width and height specified do not apply.

11.2 Operating positions

Means shall be provided to prevent the operator from falling from his workplace. Any platform on which the operator is required to stand during the operation of the machine shall be level and shall have a non-slip surface and, if appropriate, provision for drainage.

The platform shall be provided with a foot-guard (toe-board) on all sides, which shall be fitted around the edge of the platform, or not more than 50 mm outside it, and shall extend not less than 75 mm above the platform, and with a guard rail which shall be not less than 1 000 mm and not more than 1 100 mm above the platform. There shall also be an intermediate rail so that the vertical distance between any two rails does not exceed 500 mm.

However, it is not necessary to provide a foot-guard or fixed guard rails for the platform:

- a) when the machine itself affords protection at least equal to that which the foot-guard and guard rail would provide if these were fitted;

- b) where it is necessary to permit the access of persons or movement of material; a rail or chain shall be provided across the access when the machine is operating.

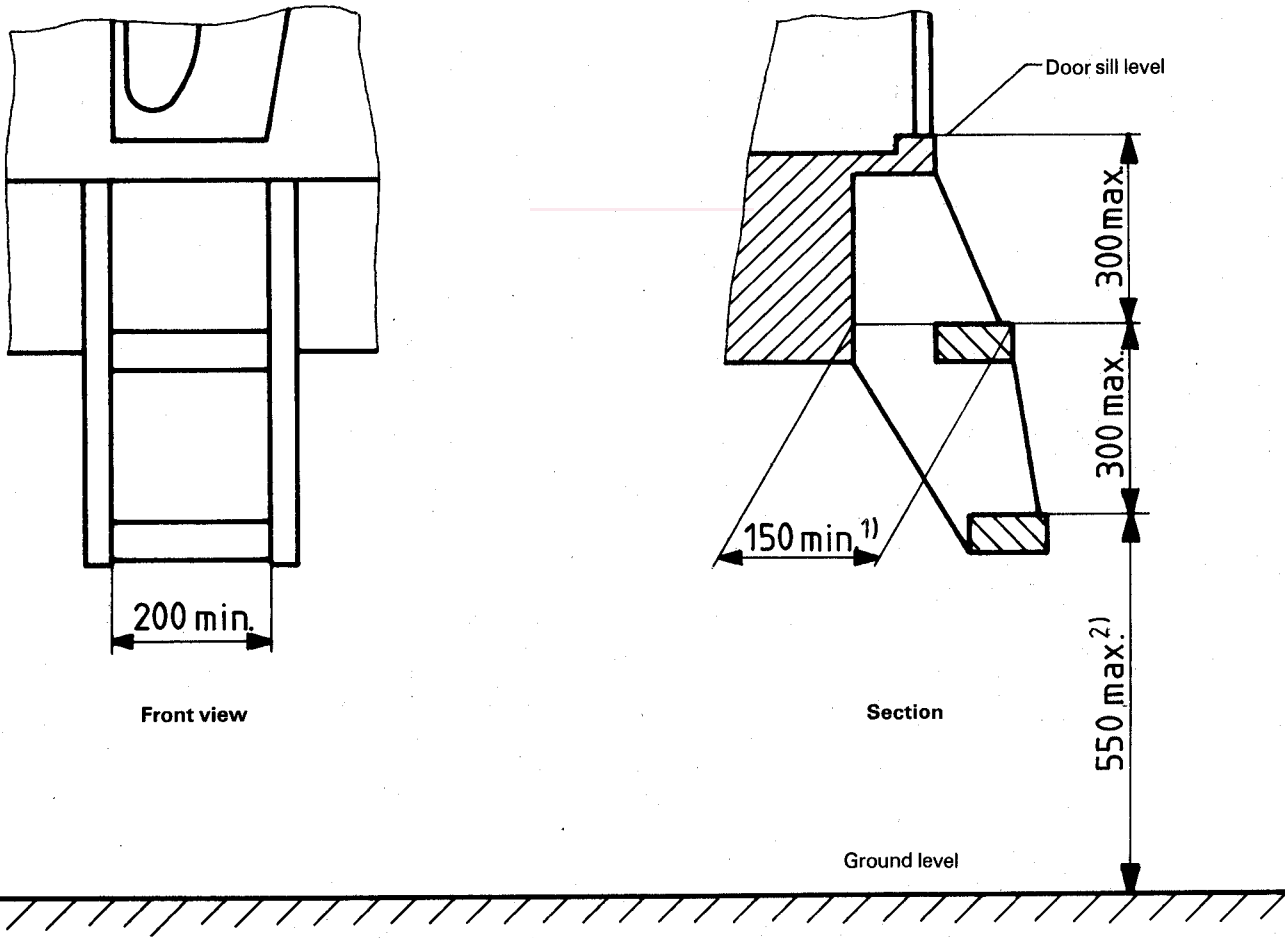
11.3 Seats

On a machine on which the operator is required to sit, a seat shall be provided which will adequately support him in all working and operating modes and prevent him from slipping off the seat. Adequate and comfortable support and protection for the feet shall be provided.

11.4 Operating control

The operating controls, such as steering wheels or levers, gear levers, cranks, pedals, and switches, shall be arranged and fitted in such a way as to allow safe and easy control and manipulation by an operator in the normal operating position. Pedals and controls shall be positioned so that they do not obstruct access. The function of the controls shall be marked on or near the control in accordance with ISO 3767 and ISO 3789, and shall meet the requirements of ISO/TR 3778 where appropriate.

Dimensions in millimetres



1) Minimum clearance and not size of tread surface.
 2) The dimensions shall be obtained also with the largest tyres (normally inflated).

Figure 4 – Limiting dimensions of steps