INTERNATIONAL STANDARD

ISO 13854

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Safety of machinery — Minimum gaps to avoid crushing of parts of the human body

Sécurité des machines — Écartements minimaux pour prévenir les risques d'écrasement de parties du corps humain

Reference number
ISO 13854:1996(E)

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.

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 13854 was prepared by the European Committee for Standardization (CEN) (as EN 349:1993) and was adopted, under a special "fast-track procedure", by Technical Committee ISO/TC 199, *Safety of machinery*, in parallel with its approval by the ISO member bodies.

Annex A of this International Standard is for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

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Introduction

According to ISO/TR 12100-1, in general machinery is said to be safe if it can perform its function, be transported, installed, adjusted, maintained, dismantled and disposed of under the conditions of its intended use without causing injury or damaging health.

One method of avoiding the hazard of crushing of parts of the human body is to make use of the minimum gaps specified in this International Standard.

In specifying minimum gaps, a number of aspects have to be taken into consideration, such as:

— accessibility of the crushing zones;

— anthropometric data, taking into account ethnic groups likely to be found in the countries concerned;

— technical and practical aspects.

If these aspects were further developed, the current state of the art, reflected in this International Standard, could be improved.

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Safety of machinery — Minimum gaps to avoid crushing of parts of the human body

1 Scope

The object of this International Standard is to enable the user (e.g. standard makers, designers of machinery) to avoid hazards from crushing zones. It specifies minimum gaps relative to parts of the human body and is applicable when adequate safety can be achieved by this method.

This International Standard is applicable to risks from crushing hazards only and is not applicable to other possible hazards (e.g. impact, shearing, drawing-in).

NOTE — For impact, shearing or drawing-in hazards, for example, additional or other measures need to be taken.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/TR 12100-1:1992, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic Terminology, methodology.*

ISO/TR 12100-2:1992, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications.*

ISO 13852:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO/TR 12100-1 and ISO 13852 and the following definition apply.

3.1 crushing zone: Zone in which the human body or parts of the human body are exposed to a crushing hazard. This hazard will be generated if

— two movable parts are moving towards one another, or

— one movable part is moving towards a fixed part.

NOTE — See also annex A.

4 Minimum gaps

4.1 Methodology for the use of this International Standard

The method of using this International Standard shall form part of the iterative safety strategy outlined in clause 5 "Strategy for selecting safety measures" of ISO/TR 12100-1:1992.

The user of this International Standard shall:

a) identify the crushing hazards;

b) assess the risks from these hazards in accordance with ISO/TR 12100-1, paying particular attention to the following:

— where it is foreseeable that the risk from a crushing hazard involves different parts of the body, the minimum gap given in table 1 relating to the largest of these parts shall be applied [see also d)],

— the unpredictable behaviour of children and their body dimensions if children are included in the population at risk,

— whether parts of the body could enter the crushing zone in a configuration other than those indicated in table 1,

— whether thick or bulky clothing (e.g. protective clothing for extreme temperatures) or tools have to be taken into account,

— whether machinery will be used by persons wearing thick-soled footwear (e.g. clogs) which will increase the effective dimension of the foot;

c) select from table 1 the appropriate minimum gap relating to the body part at risk (see also annex A);

d) if adequate safety cannot be achieved by the minimum gaps selected from table 1, other or additional measures and/or means shall be used (see e.g. ISO/TR 12100-1, ISO/TR 12100-2 and ISO 13852).

If the minimum gap for the largest expected body part cannot be achieved, the following example gives one particular means of restricting access to smaller body parts.

EXAMPLE

Access of larger body parts to the crushing zone can be prevented by the use of protective structures having a restricted opening, as indicated in figure 1.

The possibility of access to a crushing zone for a particular part of the body is dependant on the following:

— the gap a between the fixed and moving part or between two moving parts;

— the depth b of the crushing zone;

— the dimensions c of the opening in the protective structure and its distance d from the crushing zone.

NOTE — The dimensions for openings in relation to safety distances can be found in ISO 13852.

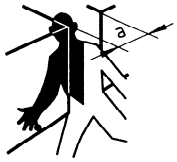
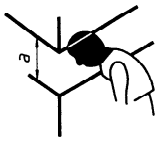
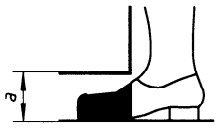
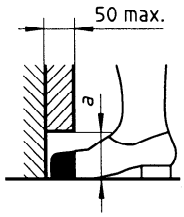
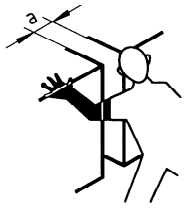
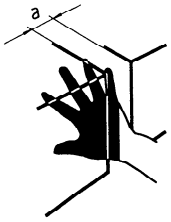
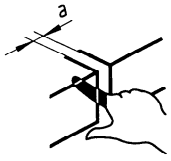
For certain applications there may be justifiable reasons to deviate from the minimum gaps in table 1. Standards dealing with these applications indicate how adequate safety can be reached.

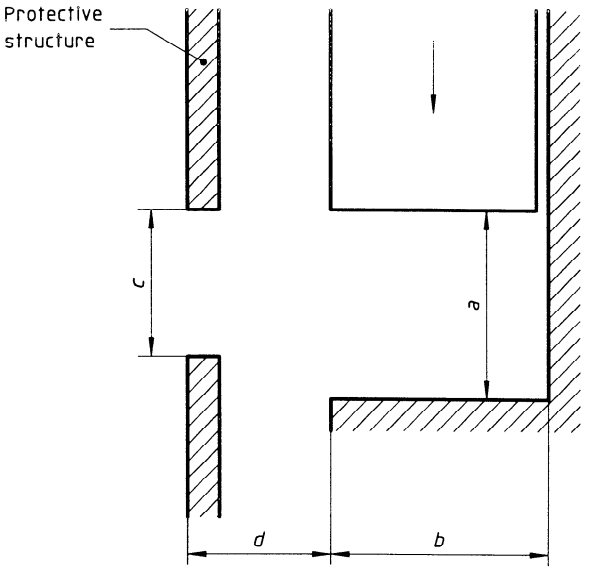
4.2 Values

Table 1 gives values for minimum gaps to avoid crushing of parts of the human body. For the selection of the appropriate minimum gap, see 4.1.

Table 1

Dimensions in millimetres

Part of body	Minimum gap, *a*	Illustration
Body	500	
Head (least favourable position)	300	
Leg	180	
Foot	120	
Toes	50	
Arm	120	
Hand Wrist Fist	100	
Finger	25	



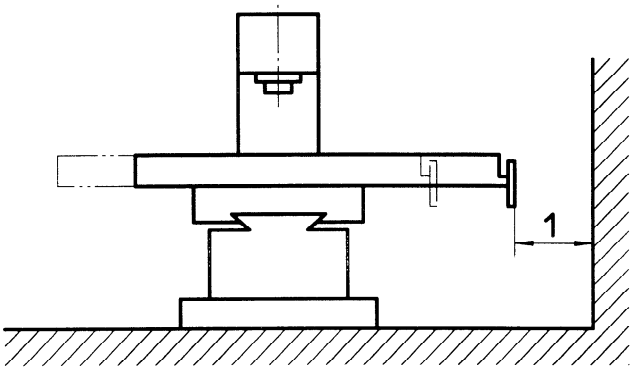
NOTE — For an explanation of the symbols, see the example in 4.1.

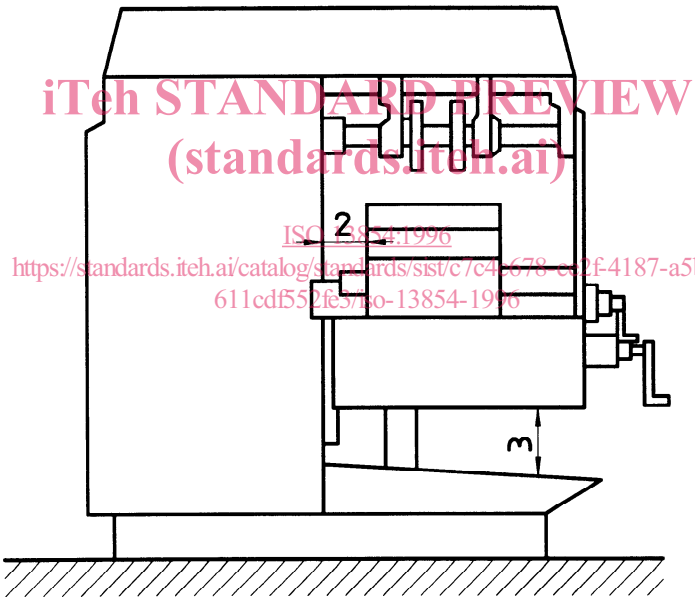
Figure 1

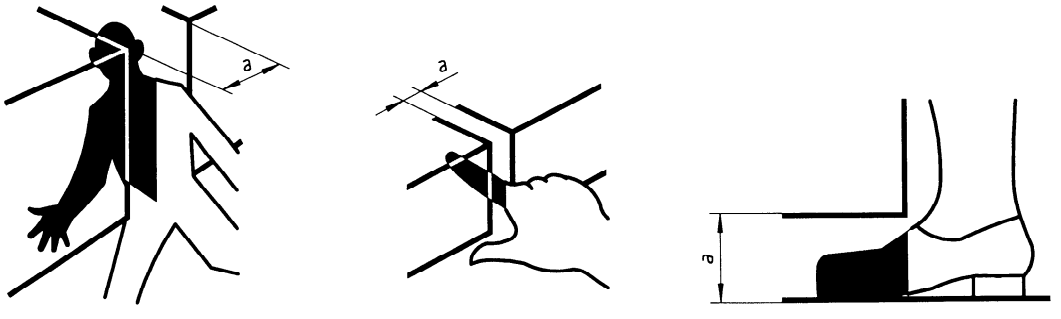
Annex A
(informative)

Illustration of crushing zones

The indicated crushing zones and the parts of the human body considered in figure A.1 are examples only. For the application of risk assessment, see 4.1.







1 2 3

NOTE — a is the minimum gap.

Figure A.1