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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
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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 voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 199, *Safety of machinery*.

This second edition cancels and replaces the first edition (ISO 13854:1996), of which it constitutes a minor revision.

Introduction

The structure of safety standards in the field of machinery is as follows.

a) Type-A standards (basis standards) give basic concepts, principles for design and general aspects that can be applied to machinery.

b) Type-B standards (generic safety standards) deal with one or more safety aspect(s), or one or more type(s) of safeguards that can be used across a wide range of machinery.

   — type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);

   — type-B2 standards on safeguards (e.g. two-hand controls, interlocking devices, pressure-sensitive devices, guards).

c) Type-C standards (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines.

ISO 13854 is a type-B-1 standard as stated in ISO 12100.

This document 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 document by the abovementioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people 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 abovementioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

In addition, this document is intended for standardization bodies elaborating type-C standards.

The requirements of this document 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.

According to ISO 12100, 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 of this document.

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, and

— technical and practical aspects.

If these aspects are further developed, the current state of the art, reflected in this document, can be improved.

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

1 Scope

This document enables 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 document 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, drawing-in hazards, additional or other measures are to be taken.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100, ISO 13857 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
crushing zone
zone in which the human body or parts of the human body are exposed to a crushing hazard

Note 1 to entry: This hazard will be generated if

— two movable parts are moving towards one another, or

— one movable part is moving towards a fixed part.

See also Annex A.

4 Minimum gaps

4.1 Methodology for the use of this document

The method of using this document shall form part of the iterative safety strategy outlined in ISO 12100:2010, Clause 4.

The user of this document shall

a) identify the crushing hazards,

b) assess the risks from these hazards in accordance with ISO 12100, 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 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 can 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), and

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 12100 and ISO 13857).

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.

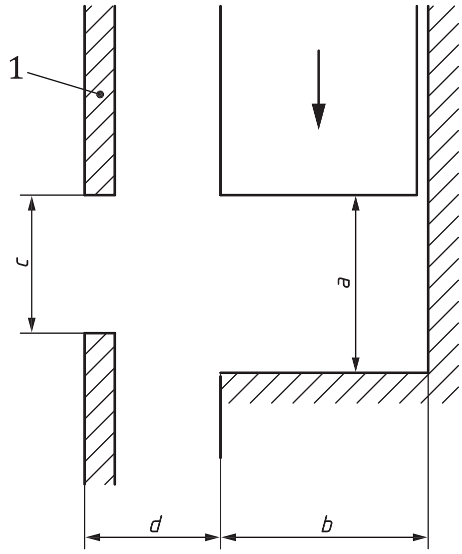
The possibility of access to a crushing zone for a particular part of the body is dependent on the following:

— 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 13857.



Key

1 protective structure

Figure 1 — Use of protective structures having a restricted opening

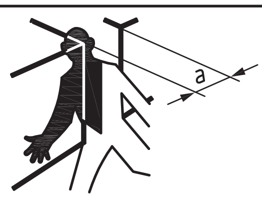
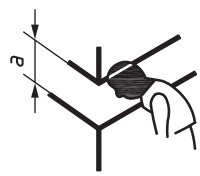
For certain applications, there may be justifiable reasons to deviate from the minimum gaps in Table 1. Standards dealing with these applications shall indicate how adequate safety can be reached.

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	
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