BRITISH STANDARD

BS EN
811 : 1997

Implementation of

Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs

The European Standard EN 811: 1996 has the status of a British Standard

ICS 13.110

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee MCE/3, Safeguarding of machinery, upon which the following bodies were represented:

Advanced Manufacturing Technology Research Institute
Agricultural Engineers Association
British Cable Makers Confederation
British Compressed Air Society
British Robot Association
British Rubber Manufacturers Association Ltd.
British Textile Machinery Association
Consumer Policy Committee of BSI
Health and Safety Executive
Loss Prevention Council
Machine Tool Technologies Association
Machinery Safety Equipment Manufacturers Association
PICON
Society of Laundry Engineers and Allied Trades Limited
Trades Union Congress

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National foreword

This British Standard has been prepared by Technical Committee MCE/3, and is the English language version of EN 811 : 1996, published by the European Committee for Standardizaton (CEN).

This British Standard is published under the direction of the Engineering Sector Board whose Technical Committee MCE/3 has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developements and promulgate them in the UK.

NOTE. International and European Standards, as well as overseas standards, are available from Customer Services, BSI, 389 Chiswick High Road, London W4 4AL.

Cross-references

Publication referred to	Corresponding British Standard
EN 292-1 : 1991	BS EN 292-1 : 1991 *Safety of machinery — Basic concepts, general principles for design* — Part 1: *Basic terminology, methodology*
EN 294 : 1992	BS EN 294 : 1992 *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*
EN 1050	BS EN 1050: *Safety of machinery — Risk assessment*

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 8, an inside back cover and a back cover.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 811

October 1996

ICS 13.110

Descriptors: Safety of machinery, dangerous machines, accident prevention, hazards, human body, lower limbs, dangerous areas, distance, dimensions

English version

Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs

Sécurité des machines — Distances de sécurité pour empêcher l'atteinte des zones dangereuses par les membres inférieurs

Sicherheit von Maschinen — Sicherheitsabtände gegen das Erreichen von Gefahrstellen mit den unteren Gliedmaßen

This European Standard was approved by CEN on 1996-08-31. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 811 : 1996 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 114, Safety of machinery, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 1997, and conflicting national standards shall be withdrawn at the latest by April 1997.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

This European Standard is a Type-B1 standard in accordance with EN 414.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

Contents

Introduction

In accordance with EN 292-1, in general, machinery is said to be safe if it is possible that the machinery can perform its function to be transported, installed, adjusted, maintained, dismantled and disposed of under the conditions of its intended use without causing injury or damaging human health.

One method of eliminating or reducing risks caused by machinery is to make use of safety distances preventing danger zones from being reached.

Sometimes reasonably foreseeable reaching situations can occur, e.g. while persons

– try to use a foot to clean out discharge and/or feed openings or

– operate pedestrian controlled machinery

This standard specifies safety distances only for the lower limbs. Safety distances for the upper limbs are covered by EN 294.

In specifying safety distances to prevent access (see clause **4**) and distances to impede free access (see clause **5**) a number of aspects have to taken into consideration, such as:

– reaching situations of the lower limbs occurring when machinery is being used;

– anthropometric data taking into account ethnic groups likely to be found in European countries;

– bio-mechanical facts, such as compression and stretching of parts of the human body and limits of joint rotation;

– technical and practical aspects.

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

1 Scope

This European Standard establishes values for safety distances to prevent access and distances to impede free access by the lower limbs of persons of 14 years of age and above. The values are based on practical experience which has been found to be adequate for this group of persons.

The distances apply when adequate safety can be achieved by distance alone and when access by the upper limbs is not foreseeable according to the risk assessment.

NOTE. These distances will not provide sufficient protection against certain hazards, for example radiation and emission of substances. For such hazards additional or other measures can be necessary.

The safety distances to prevent access relate to openings and protect those persons trying to reach danger zones under the conditions specified for the different reaching situations. Sometimes a reasonably foreseeable approach to danger zones can occur while persons try to use a foot to clean out discharge and/or feed openings or operate pedestrian controlled machinery.

The distances to impede free access relate to the height up to the protective structure and reduce risk to persons by limiting the free movement of the lower limbs.

If persons below 14 years of age are to be taken into account it is not relevant to establish values other than those for upper limbs. Then the safety distances to prevent danger zones being reached by the upper limbs derived from table 5 of EN 294 : 1992 will apply.

For certain applications there are justifiable reasons to deviate from these distances. Standards dealing with these applications should indicate how adequate safety can be achieved.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-1	*Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*
EN 294 : 1992	*Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*
EN 1050	*Safety of machinery — Risk assessment*

3 Definitions

For the purposes of this standard the definitions given in EN 292-1 and EN 294 apply.

4 Safety distances to prevent access

4.1 General

4.1.1 *Assumptions*

The safety distances have been derived by making the following assumptions:

– The protective structures and any openings in them retain their shape and position. Otherwise further consideration shall be given to achieve adequate safety.

– Safety distances are measured from the surface restricting the body or the relevant part of the body.

4.1.2 *Risk assessment*

Determination of the required safety distance for reaching danger zones shall depend on a risk assessment (see EN 292-1 and prEN 1050).

This European Standard shall be used if the risk assessment justifies that there is only a risk to the lower limbs. Where there is a risk to both upper and lower limbs, then for a given opening the largest safety distance given in table 1 of this standard or in table 4 of EN 294 : 1992 shall be used.

4.2 Reaching through openings for the lower limbs

The safety distances *sr* given in table 1 apply to persons reaching through openings in an attempt to reach a danger zone.

4.2.1 *Regular openings*

The dimension *e* of openings corresponds to the side of a square opening, the diameter of a round opening and the narrowest dimension of a slot opening.

Slot openings > 180 mm and square or round openings > 240 mm will allow access for the whole body.

The values given in table 1 are independent of whether clothing or footwear is being worn.

Table 1

Dimensions in mm

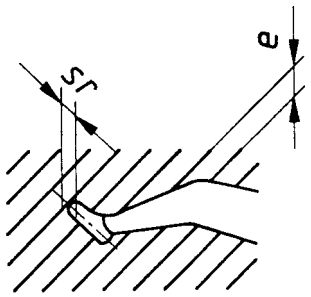
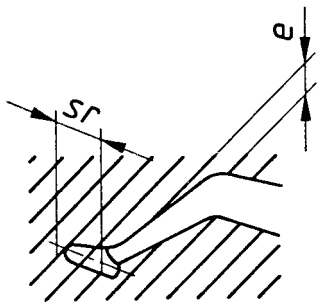
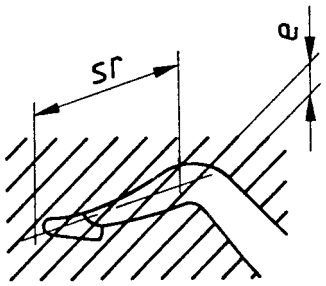
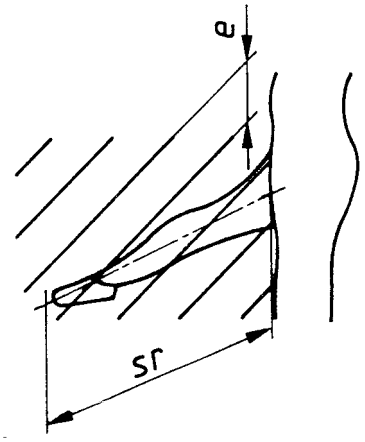
Part of lower limb	Illustration	Opening	Safety distance *sr*	
			Slot	Square or round
Toe tip		$e \leq 5$	0	0
Toe		$5 < e \leq 15$	≥ 10	0
		$15 < e \leq 35$	≥ 80[1)]	≥ 25
Foot		$35 < e \leq 60$	≥ 180	≥ 80
		$60 < e \leq 80$	≥ 650[2)]	≥ 180

Table 1. *(concluded)*

Dimensions in millimetres

Leg up to knee		$80 < e \leq 95$	≥ 1100[3)]	≥ 650[2)]
Leg up to crotch		$95 < e \leq 180$	≥ 1100[3)]	≥ 1100[3)]
		$180 < e \leq 240$	not admissible	≥ 100[3)]

[1)] If the length of the slot opening is ≤ 75 mm the distance can be reduced to ≥ 50 mm.
[2)] The value corresponds to 'Leg up to knee'.
[3)] The value corresponds to 'Leg up to crotch'.

4.2.2 *Irregular openings*

In case of irregular openings the following steps shall be carried out:

a) Determine first:

– the diameter of the smallest round opening and

– the side of the smallest square opening and

– the width of the narrowest slot opening

into which the irregular opening can be completely inserted (see hached area in figure 1).

b) Select the corresponding three safety distances in accordance with table 1.

c) The shortest safety distance of the three values selected in b) can be used.

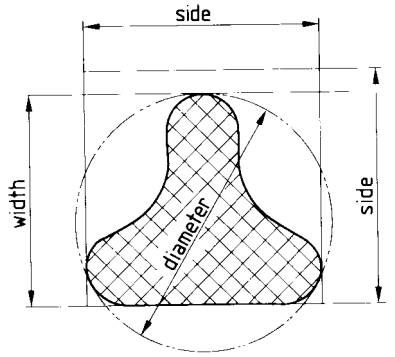


Figure 1.

5 Distances to impede free access

A protective structure can be used to restrict the free movement of the lower limbs under protective structures. When this method has to be used, distances are given in annex A in relation to the height up to the protective structure.

NOTE 1. This method gives limited protection and in many cases other methods will be more appropriate.

NOTE 2. Additional precautions can be required to restrict access of the upper limbs and/or to prevent access of the whole body to the danger zone.

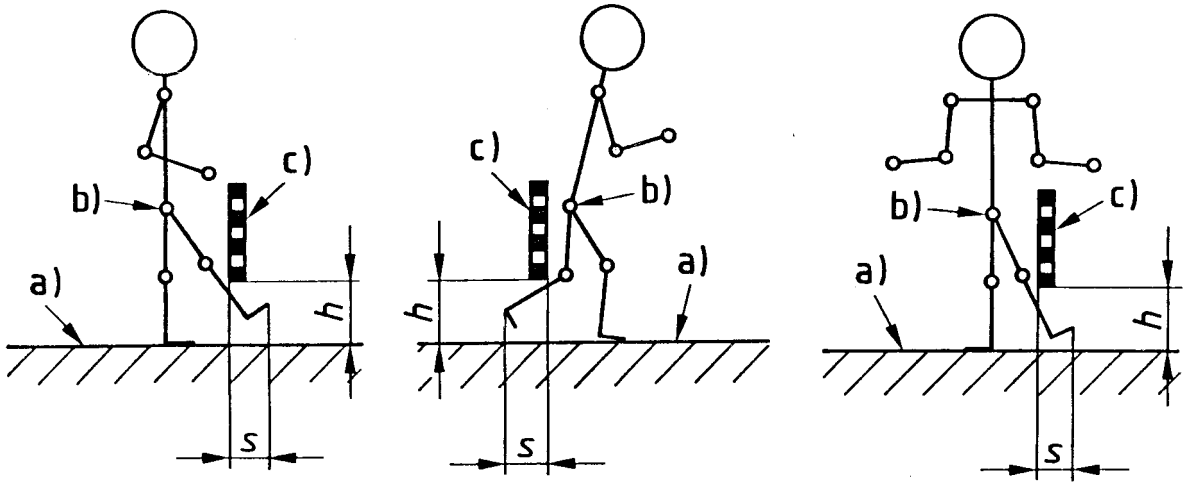
Annex A (informative)

Impeding free movement under protective structures

Table A.1 gives distances *s* for particular cases where access of the lower limbs is impeded with the person remaining in a standing position (see figure A.1) without any additional support.

Where there is a risk of slipping or misuse, applying the values given in table A.1 can be inappropriate.

There should be no interpolation between the values in this table. If the height *h* up to the protective structure is between two values then the distance for the higher value of *h* should be used.



Case 1 Case 2 Case 3

a) Reference plane

b) Hip joint

c) Protective structure

Figure A.1

Table A. 1

Dimensions in mm

Height up to protective structure *h*	**Distance** *s*		
	Case 1	**Case 2**	**Case 3**
$h \leq 200$	≥ 340	≥ 665	≥ 290
$200 < h \leq 400$	≥ 550	≥ 765	≥ 615
$400 < h \leq 600$	≥ 850	≥ 950	≥ 800
$600 < h \leq 800$	≥ 950	≥ 950	≥ 900
$800 < h \leq 1000$	≥ 1125	≥ 1195	≥ 1015

Annex ZA (informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU directives

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU directives:

Council Directive of 14 June 1989 on the approximation of the laws of the Member States relating to machinery (89/392/EEC)

Council Directive of 20 June 1991 amending Directive 89/392/EEC on the approximation of the laws of the Member States relating to machinery (91/368/EEC)

Council Directive of 14 June 1993 amending Directive 89/392/EEC on the approximation of the laws of the Member States relating to machinery (93/44/EEC)

WARNING. Other requirements and other EU directives might be applicable to the products falling within the scope of this standard.

The clauses of this standard are likely to support requirements of the three directives mentioned above.

Compliance with this standard provides one means of conforming with the specific essential requirements of the directives concerned and associated EFTA regulations.

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