



BSI Standards Publication

**Safety of machinery – Safety distances
to prevent hazard zones being reached
by upper and lower limbs**

National foreword

This British Standard is the UK implementation of EN ISO 13857:2019. It is identical to ISO 13857:2019. It supersedes BS EN ISO 13857:2008, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/3, Safeguarding of machinery.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2019
Published by BSI Standards Limited 2019

ISBN 978 0 580 97941 5

ICS 13.110

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2019.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

EUROPEAN STANDARD

EN ISO 13857

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2019

ICS 13.110

Supersedes EN ISO 13857:2008

English Version

Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)

Sécurité des machines - Distances de sécurité empêchant les membres supérieurs et inférieurs d'atteindre les zones dangereuses (ISO 13857:2019)

Sicherheit von Maschinen - Sicherheitsabstände gegen das Erreichen von Gefährdungsbereichen mit den oberen und unteren Gliedmaßen (ISO 13857:2019)

This European Standard was approved by CEN on 6 October 2019.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN ISO 13857:2019) has been prepared by Technical Committee ISO/TC 199 "Safety of machinery" in collaboration with 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 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 13857:2008.

This document 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 the relationship with EU Directive(s) see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 13857:2019 has been approved by CEN as EN ISO 13857:2019 without any modification.

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Safety distances to prevent reach or access by upper and lower limbs	2
4.1 General.....	2
4.1.1 Assumptions.....	2
4.1.2 Risk assessment.....	2
4.2 Safety distances to prevent access by upper limbs.....	3
4.2.1 Reaching upwards.....	3
4.2.2 Reaching over protective structures.....	4
4.2.3 Reaching around.....	6
4.2.4 Reaching through openings.....	8
4.2.5 Effect of additional protective structures on safety distances.....	10
4.3 Safety distances to prevent access by lower limbs.....	11
4.4 Consideration of whole body access.....	13
Annex A (informative) Use of Tables 1 and 2 with intermediate values	14
Annex B (informative) Distances to impede free access by lower limbs	18
Bibliography	20

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 of 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 www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This second edition cancels and replaces the first edition (ISO 13857:2008) which has been technically revised. The main change compared to the previous edition is that the document has been made more readable and more in line with ISO 12100:2010.

Introduction

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

- a) **type-A standards** (basic safety standards) giving basic concepts, principles for design, and general aspects that can be applied to all machinery;
- b) **type-B standards** (generic safety standards) dealing with one safety aspect or one or more type(s) of safeguard 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** (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This document is a type-B1 standard as stated in ISO 12100:2010.

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 organisations, market surveillance etc.);

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned 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 above-mentioned 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.

One method of eliminating or reducing risks caused by machinery is to make use of safety distances preventing hazard zones from being reached by the upper and lower limbs.

In specifying safety distances, a number of aspects need to be taken into consideration, such as:

- reach situations occurring when machinery is being used;
- reliable surveys of anthropometric data, taking into account population groups likely to be found in the countries concerned;
- biomechanical factors, such as compression and stretching of parts of the body and limits of joint rotation;
- technical and practical aspects; and

- additional measures for particular groups of persons (e.g. persons with special needs), which can be required due to a deviation from the specified body dimensions.

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

1 Scope

This document establishes values for safety distances in both industrial and non-industrial environments to prevent machinery hazard zones being reached. The safety distances are appropriate for protective structures. It also gives information about distances to impede free access by the lower limbs (see [Annex B](#)).

This document covers people of 14 years and older (the 5th percentile stature of 14-year-olds is approximately 1 400 mm). In addition, for upper limbs only, it provides information for children older than 3 years (5th percentile stature of 3-year-olds is approximately 900 mm) where reaching through openings needs to be addressed.

NOTE 1 It is not practical to specify safety distances for all persons. Therefore, the values presented are intended to cover the 95th percentile of the population.

Data for preventing lower limb access for children is not considered.

The distances apply when sufficient risk reduction can be achieved by distance alone. Because safety distances depend on size, some people of extreme dimensions will still be able to reach hazard zones even when the requirements of this document are met.

Compliance with the requirements in this document will prevent access to the hazard zone. Nevertheless the user of this document is advised that it does not provide the required risk reduction for every hazard (e.g. hazards related to machine emissions such as ionizing radiation, heat sources, noise, dust).

The clauses covering lower limbs apply on their own only when access by the upper limbs to the same hazard zone is not foreseeable according to the risk assessment.

The safety distances are intended to protect those persons trying to reach hazard zones under the conditions specified (see [4.1.1](#)).

NOTE 2 This document is not intended to provide measures against reaching a hazard zone by climbing over (see ISO 14120:2015, 5.18).

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>