SLOVENSKI STANDARD
SIST-TP CEN/TR 13387-3:2023

01-december-2023

Nadomešča:
SIST-TP CEN/TR 13387-3:2018

Izdelki za otroke - Smernice o splošni varnosti - 3. del: Nevarnosti zaradi mehanskih lastnosti

Child care articles - General safety guidelines - Part 3: Mechanical hazards

Artikel für Säuglinge und Kleinkinder - Sicherheitsleitfaden - Teil 3: Mechanische Gefährdungen

Articles de puériculture - Conseils relatifs à la sécurité - Partie 3 : Dangers mécaniques

Ta slovenski standard je istoveten z: **CEN/TR 13387-3:2023**

ICS:

97.190	Otroška oprema	Equipment for children

SIST-TP CEN/TR 13387-3:2023 **en**

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER REPORT

CEN/TR 13387-3

March 2023

ICS 97.190

Supersedes CEN/TR 13387-3:2018

English Version

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This Technical Report was approved by CEN on 2 January 2023. It has been drawn up by the Technical Committee CEN/TC 252.

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European foreword

This document (CEN/TR 13387-3:2023) has been prepared by Technical Committee CEN/TC 252 “Child care articles”, the secretariat of which is held by AFNOR.

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 CEN/TR 13387-3:2018.

This new edition of this Technical Report is a hazard-based Technical Report. The main changes compared to the previous edition are listed below:

— Mechanical hazards — Safety philosophy: addition of a new paragraph on new technologies;

— Hazard due to small components: Reworded;

— Footholds: Reworded.

The CEN/TR 13387 series, with the general title *Child care articles - General safety guidelines*, comprises the following five parts:

— *Part 1: Safety philosophy and safety assessment*;

— *Part 2: Chemical hazards*;

— *Part 3: Mechanical hazards*;

— *Part 4: Thermal hazards*;

— *Part 5: Product information*.

CEN/TR 13387-3 is intended to be used in conjunction with CEN/TR 13387-1.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

1 Scope

This document provides guidance information on mechanical hazards that should be taken into consideration when developing safety standards for child care articles. In addition, these guidelines can assist those with a general professional interest in child safety.

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 4593, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
mechanical hazards
physical factors which may give rise to injury due to the mechanical properties of products/product parts

3.2
reach envelopes
age related physical data on the reach limits of the limbs of children in different postures

Note 1 to entry: See 5.2.

3.3
ageing
change of properties of the material due to exposure to environmental factors such as temperature, humidity, UV radiation, cleaning agents, etc.

3.4
mechanical wear
change of mechanical properties due to fatigue or repeated operation of devices, mechanisms and other parts of the product

4 Mechanical hazards — Safety philosophy

This clause addresses the most widely known mechanical hazards and is intended to provide guidance when drafting standards for child care articles.

Anthropometric data and information on the abilities of children related to risks are given in CEN/TR 13387-1:2018, Annex A. When using these data for setting requirements, adequate safety margins should be considered. These data refer to static and not dynamic anthropometric data, therefore care should be taken if using these data for anything other than static situations when drafting standards.

When drafting standards, conditions of use should be considered, bearing in mind the behaviour of children. Also, it is to be considered whether the child is attended or unattended when using the product and also the child's access to hazardous features.

For each mechanical hazard a rationale is given, explaining the potential hazard to the child. Requirements, test equipment and test methods are also given. Where appropriate, these can be used when drafting standards.

New technologies, e.g. fingerprint or face recognition or others, could be used for opening and closing a mechanical device or for operating a product.

When developing technical standards for child care articles, if these new technologies are identified as a possible option for use within a product category, specific requirements and test methods to assess their safety should be defined.

5 Accessibility of mechanical hazards

5.1 General

Within the mechanical section no reference is made to specific areas of access, known as access zones. It would be wrong for this guidance document to specify exact areas of access as these should be determined in relation to the hazards and risks of individual products and risks when drafting the standard. As a general guidance to the types of contact associated with mechanical hazards, the following examples are given:

— the hazardous part is in reach of the child from the intended position of use in particular by head, mouth, hands or feet and there is a high probability for frequent, intensive and/or prolonged contact. Requirements need to address this primary contact;

— the hazardous part may be reached by the child or any other child beyond the intended position of use. The product is considered to remain in its intended position(s). Access to hazardous parts is gained by passing/moving around the product or when proceeding to the intended position. The risk of harm deriving from frequent, intensive and/or pro-longed contact may be less probable;

— the hazardous part exists, but cannot be reached by any child.

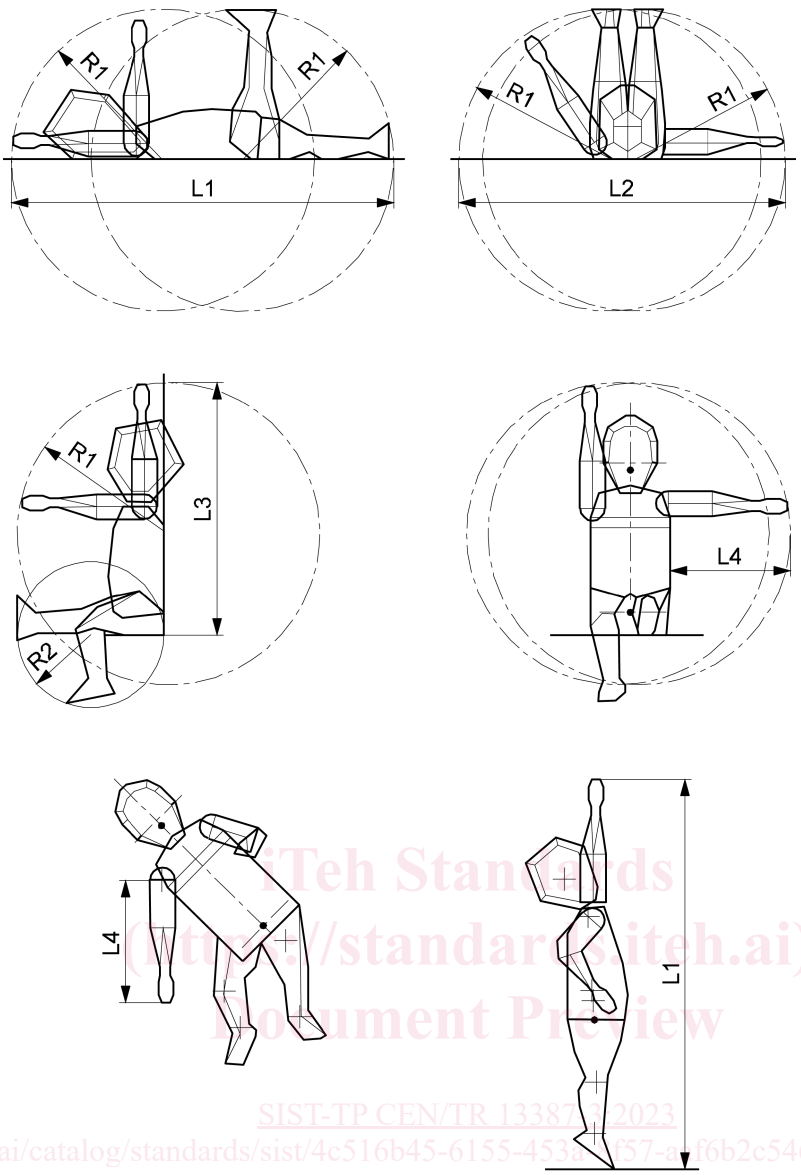
Irrespective of the access category, the reasonably foreseeable conditions of use should always be considered when designing children's products and/or writing product standards.

5.2 Accessibility areas

Information for determination of accessibility areas in connection with age group is given in Table 1 and Figure 1. These reach envelopes are based on a computer simulation; therefore, the dimensions should be treated with care. If in the future experiments with children are undertaken, these figures in the table may be determined more accurately.

Table 1 — Reach envelopes for guidance in the specification of accessibility areas in standards – anthropometric data related to Figure 1

Dimension (mm) ›	Overhead Reach	Overhead Reach on tiptoes	Span	Overhead Reach Sitting	Arm Reach	Buttock-Foot	Lower Leg Length
Age group	L1	L1'	L2	L3	L4	R1	R2
0 month to 6 months	760	-	660	550	250	300	150
6 months to 12 months	880	960	770	610	290	380	190
12 months to 36 months	1 160	1 260	1 020	770	420	550	275
36 months to 48 months	1 270	1 370	1 070	810	460	630	315
NOTE All dimensions are based on P95 values. L1, L1', L2, L3, L4, have been assessed with the computer program ADAPS (© 79–93 TU-Delft University of Technology, Faculty of Industrial Design Engineering). R1 = buttock - foot length (Annex A, Table 3). R2 = 0,5 x R1.							



NOTE ©79-93 TU-Delft University of Technology Faculty of Industrial Design Engineering.

Figure 1 — Reach envelopes for determination of accessibility areas

5.3 Product information

In order to ensure mechanical safety, the information for the carer should include appropriate instructions and warnings. For example:

— the need for restraint system and its adjustment;

— the opening and closing of products;

— the operation of safety locks for foldable parts;

— the method of attachment to fixed structures or to other products.

Instructions should also inform the carer of the need to inspect the product regularly and also to use only replacement parts that are approved by the manufacturer/supplier.

CEN/TR 13387-5 “Product information” gives detailed advice concerning the presentation of product information.

6 Entrapment hazards

6.1 Introduction

To avoid entrapment of head, neck, fingers, feet, and hands, safety distances are recommended in relation to the anthropometric data (see CEN/TR 13387-1:2018, Annex A) of the growing child. It is important to take into account the intended age and/or development level of the child. As a priority, those parts of a product which are accessible when a child is using the product as foreseeable should be considered. It may also be appropriate for gaps and openings beyond these accessible areas to be addressed. Gaps and openings which are inaccessible need not to be considered. However, V-shaped openings or V-shaped arrangements of structural members should be avoided.

Important entrapment hazards are:

— entrapment of the neck in situations where the child is incapable of raising its body weight to relieve the pressure (e.g.: crawling child on the outside of play pen, V shapes, etc.);

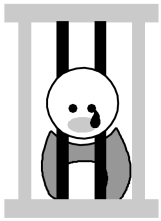
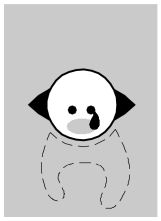
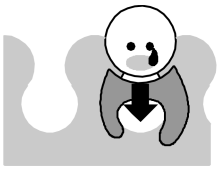
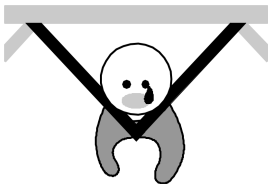
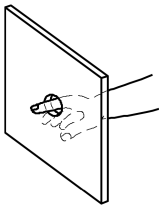
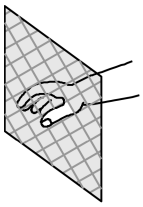
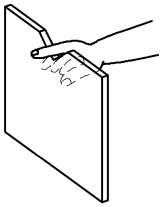
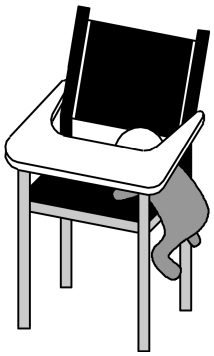
— entrapment of the neck in situations where the child slips through a gap feet first (e.g.: child slipping between bars/slats);

— entrapment of fingers, which may cause loss of blood supply to the tips.

If it is possible to position a child care article next to other furniture or a wall and create an entrapment hazard between them, an instruction should be included to warn carers of this possible entrapment hazard. When considering entrapment hazards dynamic situations should be considered as well as static hazards. The dynamic situation will increase the force being applied to a trapped torso or finger through the weight, movement or momentum of the child which will increase the risk of injury.

To assist with this an entrapment matrix has been included, see Table 2, which was based on work done in ISO/IEC Guide 50. This entrapment matrix does not impart any hierarchy in the severity of the hazards shown and the specific hazard clause should be referred to.

Table 2 — Entrapment matrix

Body part	Completely bound openings		Partially bound openings	V shapes
	Rigid	Non-rigid		
Head neck, head first				
Finger				
Head neck, feet first				

6.2 Entrapment of head and neck

6.2.1 Rationale

Head and neck hazards occur when the child is in a position where its body weight is supported by its neck and the child is incapable of lifting its body weight to relieve pressure on its neck. When this occurs, it will cause airways to close and restrict the blood flow, leading to brain damage.

The risk of head and neck entrapment increases as the child's mobility and ability increases, enabling the child to access a wider range of hazards and products. The hazard is directly related to the size of the child's head and hip.

The hazard can be avoided by limiting the size and shape of completely bound, partially bound and 'V' shaped openings (see definitions in 6.2.2).

6.2.2 Terms and definitions related to entrapment hazards

6.2.2.1

completely bound opening

opening that is continuously surrounded on all sides by the material of the product, see Figure 2

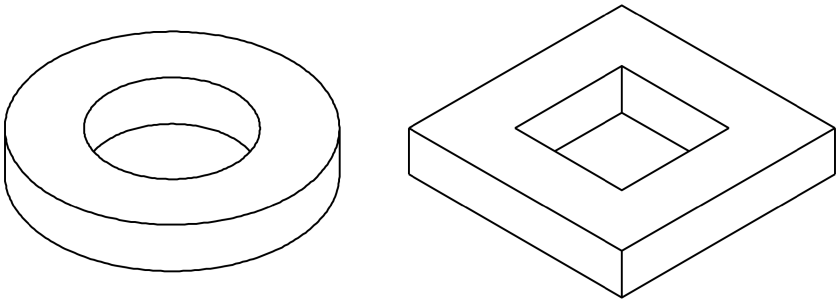


Figure 2 — Examples of completely bound openings

6.2.2.2 partially bound opening

opening that is partially surrounded by the material of the product, see Figure 3

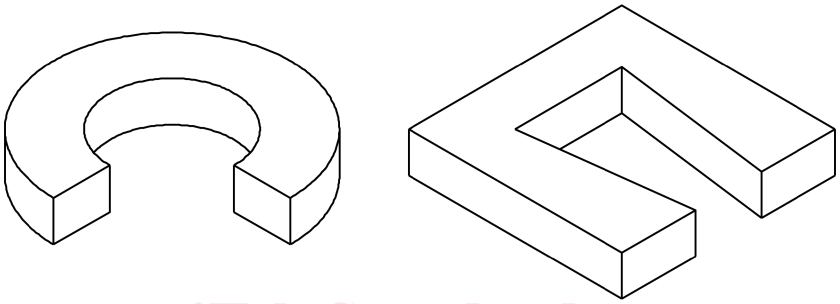


Figure 3 — Examples of partially bound openings

6.2.2.3

V shaped opening

opening where there is a slot that narrows towards the bottom, see Figure 4

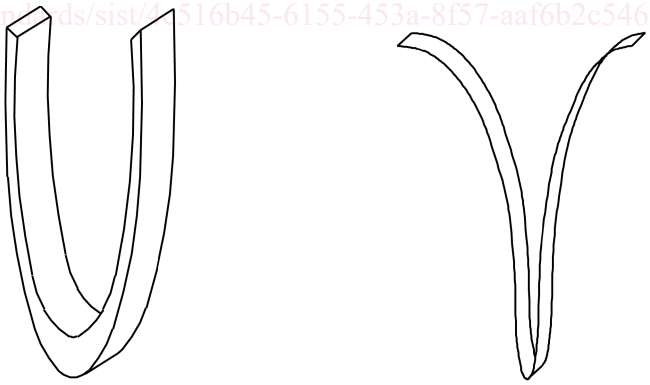


Figure 4 — Examples of V shaped openings

6.2.2.4 irregular shaped opening

opening that does not have a symmetrical shape, see Figure 5

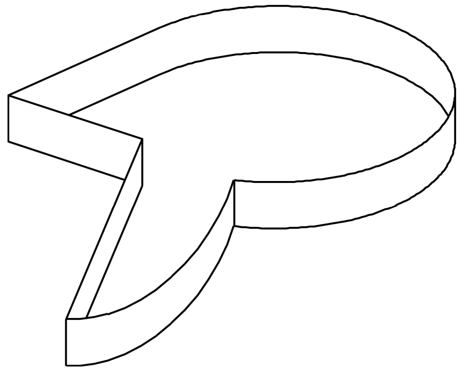


Figure 5 — Example of an irregular shaped opening

6.3 Requirements

When tested in accordance with 6.5.1 or 6.5.2, if openings allow passage of the small probe, the large probe should pass through. The opening that allows the large probe to pass completely through should comply with the requirement for partially bound, V and irregular shaped openings when tested in accordance with 6.5.3.

Partially bound, V and irregular shaped openings should be constructed so that:

a) portion B of the template does not enter the opening when tested in accordance with 6.5.3, see Figure 10 and Figure 11; or

b) the apex of portion A of the template contacts the base of the opening when tested in accordance with 6.5.3, see Figure 12.

6.4 Test equipment

6.4.1 Probe philosophy

To cover all aspects of head and neck entrapment four types of probes are required, the hip probe, the small head probe, the large head probe and the template for partially bound and V-shaped openings. The size of individual probes is determined to meet the age range of the child, see the figures and tables for the various probes.

6.4.2 Hip probe

The hip probe, Figure 6, represents the hip of the smallest child in each age range. The probe size corresponds to the size of the child as follows:

— dimension ‘A’ represents the hip breadth;

— dimension ‘B’ represents hip depth;

— dimension ‘C’ represents the radius C after calculation based on hip circumference.

The dimensions of the hip probe are based on the anthropometric data, see Table 3.