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## Inflatable play equipment — Safety requirements and test methods

*Équipements de jeux gonflables — Exigences de sécurité et méthodes d'essai*



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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](http://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](http://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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 83, *Sports and other recreational facilities and equipment*.

## Introduction

Play is the means by which children discover and understand the world in which they live and is an essential element in a child's physical and mental growth.

It is important for children's rounded development that, through play, they arrive at an understanding of danger which provides a basis for assessing safety in a variety of situations. The balance between challenge and safety is an important consideration.

The inflatable play equipment referred to in this International Standard can provide different levels of challenge and recreation. This International Standard aims to minimize the level of risk and the possibility of serious injury while allowing children to enjoy themselves when playing in or on inflatable equipment.

This International Standard acknowledges the difficulties of addressing safety issues by age criteria alone because the ability to handle risk is based on the individual user's level of skill and not age. Moreover, users other than the intended age range will make use of the inflatable equipment, in which case, the provisions of this International Standard still apply.

It is not the purpose of the requirements of this International Standard to affect a child's need to play, nor to lessen the contribution that inflatable play equipment makes either to the child's development or meaningful play from an educational point of view.

Where inflatable play equipment is combined with other items of children's playground equipment, the relevant standards applying to the other items of equipment is to also be consulted.

# Inflatable play equipment — Safety requirements and test methods

## 1 Scope

This International Standard is applicable to inflatable play equipment intended for use by children up to 14 years of age individually and as a group activity.

This International Standard specifies safety requirements for inflatable play equipment for which the primary activities are bouncing and sliding. It sets measures to address risks and also to minimize accidents to users for those involved in the design, manufacture, and supply of inflatable play equipment. It specifies information to be supplied with the equipment. The requirements have been laid down bearing in mind the risk factor based on available data.

This International Standard specifies the requirements that will protect a child from hazards that he or she may be unable to foresee when using the equipment as intended or in a manner that can be reasonably anticipated.

This International Standard is not applicable to inflatable water-borne play and leisure equipment, domestic inflatable toys, air-supported buildings, inflatables used solely for protection, inflatables used for rescue, or other types of inflatable toys where the primary activity is not bouncing or sliding.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2307, *Fibre ropes — Determination of certain physical and mechanical properties*

ISO 8124-3, *Safety of toys — Part 3: Migration of certain elements*

ISO 9554, *Fibre ropes — General specifications*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

IEC 60529, *Degrees of protection provided by enclosures (IP code)*

EN 1177, *Impact attenuating playground surfacing — Determination of critical fall height*

## 3 Terms and definitions

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

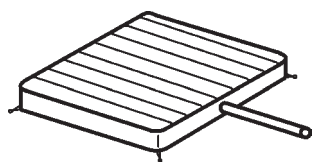
**NOTE** In order not to confine the application of this International Standard to those items of equipment currently in use, and hence, allow freedom of design for the manufacture of new equipment, only the fundamental forms of equipment and motion are listed.

### 3.1

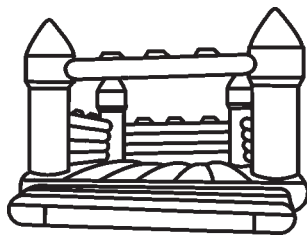
#### **inflatable play equipment**

structure relying on a continuous supply of air to maintain its shape on or in which users may play, bounce, and/or slide

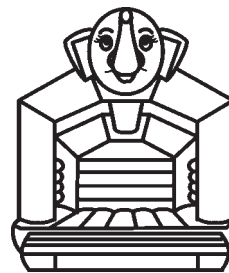
Note 1 to entry: Also referred to as an/the inflatable.



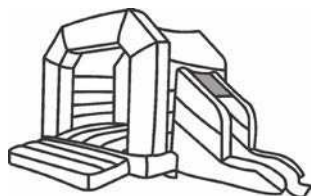
a) Flat-bed  
(4 open sides)



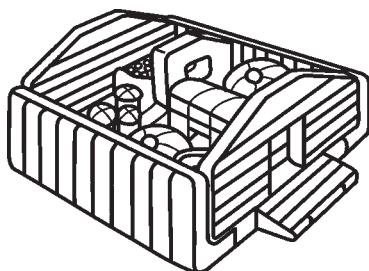
b) Castle (3 walled sides,  
1 open side)



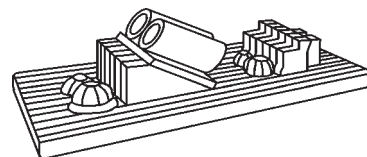
c) A-frame inflatable  
(3 walled sides, 1 open side)



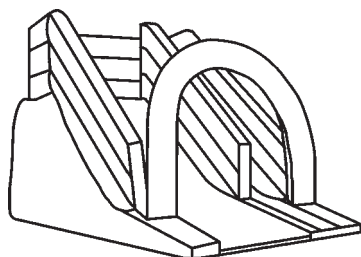
d) Bounce/Slide combination



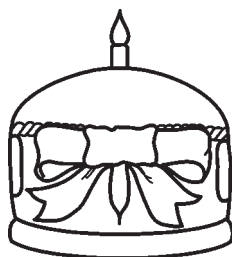
e) Multi-play centre



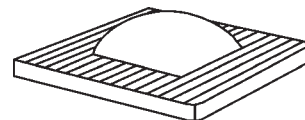
f) Obstacle course



g) Inflatable slide



h) Enclosed inflatable



i) Soft mountain

Figure 1 — Examples of inflatable play equipment

**3.2 blower**  
powered machine used to continuously inflate the structure

**3.3 connection tube**  
part of the inflatable structure to which the *blower* (3.2) is connected

**3.4 controller**  
person, company, or hirer (those who hire to others) having responsibility for the overall control, inspection, and maintenance of the equipment

**3.5 operator**  
person appointed by a *controller* (3.4) to be in charge of the operation of the equipment at any time when it is available for use by the public

**3.6 attendant**  
person working under the control and direction of an *operator* (3.5) to assist in the operation of the equipment



**3.7****inspection body**

organization, part of an organization or individual with the appropriate competence to carry out one or more of the following inspections:

- design review;
- assessment of conformity to design;
- initial testing;
- annual main inspection

**3.8****free height of fall**

greatest vertical distance from the clearly intended body support to the *impact area* (3.16) below

[SOURCE: ISO 8124-4:2014, 3.8, modified]

**3.9****critical fall height**

maximum free heights of fall for which a surface will provide an acceptable level of impact attenuation

**3.10****open side**

any external side of an inflatable with no containing wall

**3.11****step**

step to aid the access/egress of users into and out of the *playing area* (3.22) of the inflatable making the transition between the height of the playing area and the ground

**3.12****ramp**

ramp to aid the access/egress of users into and out of the *playing area* (3.22) of the inflatable making the transition between the height of the playing area and the ground

**3.13****platform**

surface on which a user may stand

**3.14****squeeze**

play item which is often attached to and forms part of *inflatable play equipment* (3.1), the purpose of which is to squeeze the user whilst not entrapping them while allowing the user to pass through a gap with a degree of difficulty

**3.15****entrapment**

hazard in which a body, or part of a body, or clothing, can become trapped

**3.16****impact area**

area surrounding the *open side(s)* (3.10) of an inflatable

**3.17****run-out**

intended deceleration zone at the bottom of a slide

**3.18****anchorage system**

method of fixing an inflatable to the ground using stakes

**3.19**

**ballast system**

method of fixing an inflatable to the ground using weights

**3.20**

**user height**

maximum height of persons allowed to use the inflatable

**3.21**

**free space**

space in, on, or around the inflatable that can be occupied by a user undergoing a movement forced by the equipment (for example, sliding, bouncing)

**3.22**

**playing area**

space in or on the inflatable intended for play

**3.23**

**falling space**

space in or around the inflatable that can be passed through by a user falling from an elevated part of the equipment

Note 1 to entry: The falling space commences at the *free height of fall* (3.8).

## **4 Safety requirements**

### **4.1 Materials**

#### **4.1.1 Fabrics**

Fabrics shall be flame retardant.

Fabrics and joints in fabrics shall be of adequate tear and tensile strength for the weight of the intended user and have sufficient air retention to enable the inflatable, when pressurized to the level specified in the operations manual, to resume its shape after distortion under load.

The following fabrics shall be used in those structural parts of the inflatable where force or stress is applied by the user:

- a) minimum tear strength 350 N (see test method Annex E);
- b) minimum tensile strength 1 850 N (see ISO 1421);
- c) minimum coating adhesion 100 N (see ISO 2411).

#### **4.1.2 Thread**

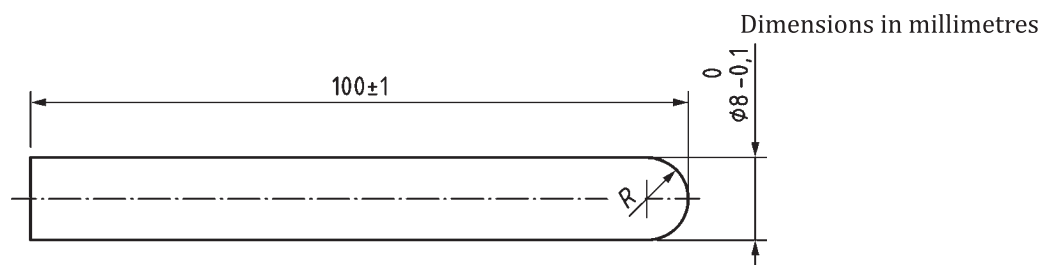
Threads shall be non-rotting yarn and at least 88 N tensile strength. Stitching shall be lock-stitch. The length of individual stitches shall be a minimum of 3 mm and a maximum of 8 mm.

#### **4.1.3 Netting**

Retention netting is commonly used to define the playing area to contain the users and to retain items of mobile play equipment, such as balls. Retention netting shall not significantly impair visibility. Retention netting shall be strong enough to contain the largest/heaviest user for whom the inflatable is designed.

In order to prevent users from climbing retention netting the mesh size, where the netting is more than 1 m vertical height and accessible to the user, shall be 30 mm or less to exclude users' feet.

Where netting is used for roofs and is accessible to the user, the mesh size shall be small enough to prevent the 8 mm finger rod from passing through (see [Figure 2](#)).



**Figure 2 — 8 mm finger rod**

Clamber netting (commonly laid on slopes to form foot and hand holds) shall be securely fixed to prevent lifting by the user. The rope from which it is made shall be at least 12 mm in diameter and shall be securely knotted. Strand ends shall be treated to prevent fraying. Care shall be taken when heat sealing so as not to form hard or sharp edges.

#### 4.1.4 Ropes

Ropes shall be fixed at both ends and the total amplitude of swing shall not exceed 20 % of the distance between the fixing points, such that it shall not be possible to make a loop in the rope of large enough diameter to allow probe E to pass through (see [Figure D.1](#)).

NOTE This requirement is intended to remove the risk of strangulation.

The rope diameter shall be between 18 mm and 45 mm.

Fibre ropes (textile type) shall conform to ISO 9554 or ISO 2307. Alternatively, a works certificate shall be supplied stating the material used and the safe working load. Monofilament plastics ropes shall not be used.

#### 4.1.5 Zips

Zips shall withstand air pressures and tension generated within the structure. Zips used for entrances and exits shall be reliable, easy to use, able to open from both sides, and shall allow access and egress by adults. Zips used for deflation purposes shall have the puller hidden from view (e.g. by a flap or pocket).

#### 4.1.6 Dangerous substances and decorative finishes

Dangerous substances shall not be used for inflatable play equipment in such a way that they can cause adverse health effects to the user. Paints and other decorative finishes shall conform to ISO 8124-3.

NOTE Attention is drawn to the provisions of European Regulation (EC) No. 1907/2006.<sup>[4]</sup> Such materials include, for example, asbestos, lead, formaldehyde, coal tar oils, carbolineums, and polychlorinated biphenyls (PCBs).

## 4.2 Design

### 4.2.1 Anchorage

The inflatable shall be provided with an anchorage and/or ballast system and any necessary accessories enabling the inflatable to be securely fixed to the ground. Each inflatable shall have at least six anchorage points.

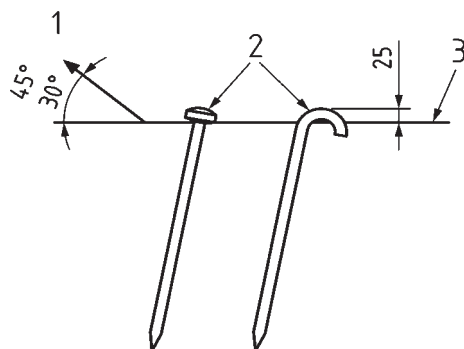
The number of anchorage points shall be calculated in accordance with Annex A. They shall be distributed around the perimeter of the inflatable (see also [4.2.3](#)) and shall be fitted with metal ends.

The maximum wind-speed in which inflatables shall be used outdoors is 38 km/h (Force 5 on the Beaufort Scale; see Annex B).

When used outdoors, the inflatable shall be secured to the ground, preferably with ground stakes where the ground is suitable. Each anchorage point on the inflatable and all of the components of the anchorage and/or ballast system, e.g. ropes, webbings, metal attachments, stakes, and weights shall withstand a force of 1 600 N. The direction of the exerted force shall be at an angle to the ground of 30° to 45°. Ground stakes shall incline away from the direction of the exerted force. Ground stakes shall be a minimum of 380 mm in length and a minimum of 16 mm in diameter and their tops shall be rounded. The system shall expose no more than 25 mm of the stake above ground level (see [Figure 3](#)).

When the inflatable is used indoors, the anchorage and/or ballast system should be used, when necessary, to maintain stability.

Dimensions in millimetres



**Key**

- 1 direction of force
- 2 rounded tops
- 3 ground level

**Figure 3 — Examples of ground stakes**

On hard standing where ground stakes cannot be used, the inflatable shall be secured to the ground by equally effective method, e.g. attaching each of the anchorage points to fittings already in the ground, or to sandbags or other weights, if these are capable of supporting the 1 600 N load. If the inflatable is secured to a vehicle or other movable machinery, such vehicles or machinery shall be immobilized and be under the control of an operator.

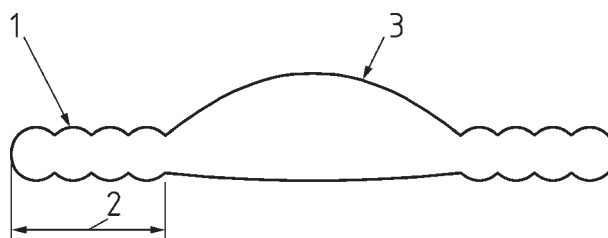
**4.2.2 Structural Integrity**

The minimum air pressure inside the structural parts of the inflatable shall be 1 kPa (100 mm water gauge). Inflated chambers that are entered by the user are not considered to be structural parts of the inflatable, e.g. enclosed dome type inflatables. Pressure in the playing area of soft mountains shall be no greater than 0,25 kPa (25 mm water gauge), but shall maintain a pressure sufficient to prevent grounding. Pressure in the surrounding safety apron of soft mountains shall be at least 1 kPa (100 mm water gauge; see [Figure 4](#)).

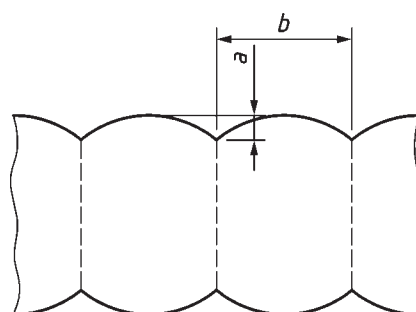
The depth of the trough on the surface of any platform shall be a maximum of 33 % of the width of the adjacent panel measured when inflated (see [Figure 5](#)).

Containing walls shall be vertical (90 ± 5)°. Towers that support containing walls shall be in the same plane. Containing walls and towers shall be strong enough to contain the largest and/or heaviest user for whom the inflatable is designed.

Playing areas, surrounding safety aprons, steps, and/or ramps shall support the weight of the largest and/or heaviest user for whom the inflatable is designed without grounding (see Annex C for the test method).

**Key**

- 1 surrounding safety apron
- 2 tread depth
- 3 playing area

**Figure 4 — Section through a soft mountain****Key**

- a* depth of trough — measured when inflated
- b* width of adjacent panel

**Figure 5 — Trough depth****4.2.3 Access/Egress**

A step or ramp shall be wide enough to cover the entire access/egress aperture with overlap according to [Figure 6](#).

A step or ramp shall have a tread depth of a minimum of 1,5 times the height of the adjacent playing area platform to which it is attached (see [Figure 6](#)).

The playing area of soft mountains shall be completely surrounded by an inflated safety apron. This safety apron shall have a minimum tread depth of 1,6 m times or 0,5 times the height of the playing area measured from the ground when inflated and in the unloaded condition, whichever is greater.

In the event of air supply failure, the deflation time shall be sufficient to allow users of the inflatable to be evacuated safely.

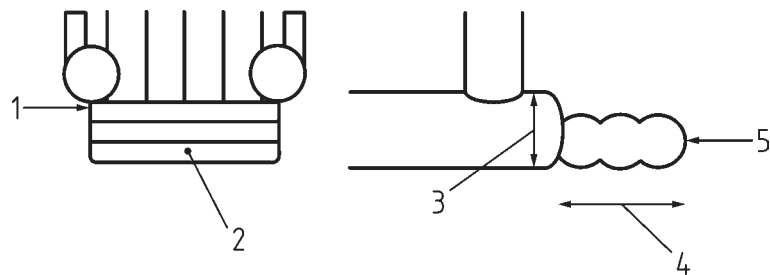
**NOTE** Deflation time can be considerably lengthened by inserting a non-return flap in the outlet nozzle of the blower or at the joint of the connection tube and structure.

Inflatables shall be designed to ensure that adults are able to gain access in order to assist users.

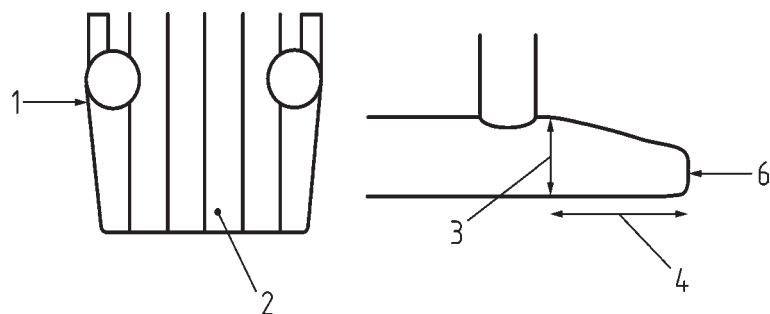
On any open side, the free height of fall shall be no greater than 630 mm from the ground in the unloaded condition (600 mm in the loaded condition).

On any open side, the extent of the impact area shall be at least 1,2 m. The surface in the impact area shall meet the requirements for impact attenuation so that the critical fall height of the surfacing, according to EN 1177 or National equivalent impact attenuation test method, is at least 630 mm. The impact areas

of adjacent inflatables and/or other play equipment shall not overlap. Materials such as soil, turf, and sand have some impact-attenuating properties. Impact-absorbing mats may be used (see [Figure 7](#)).



a) step detail

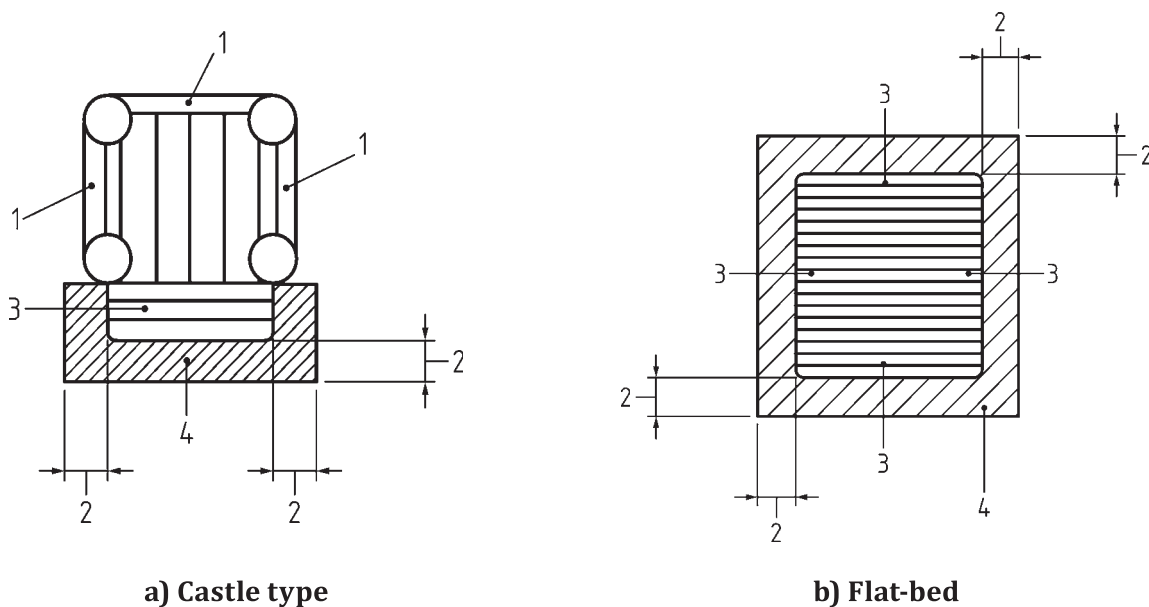


b) ramp detail

**Key**

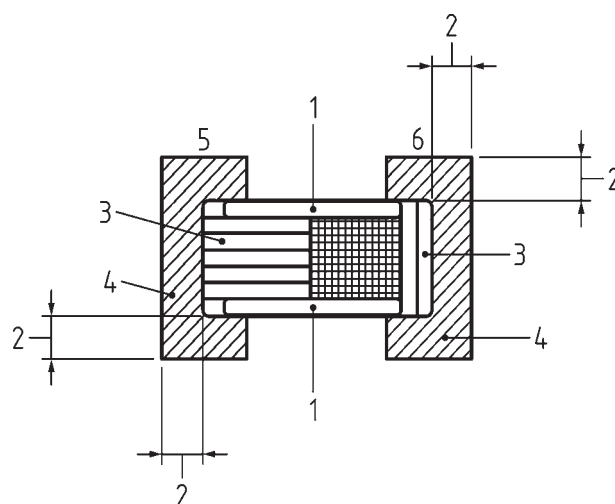
- |   |  |   |             |
|---|--|---|-------------|
| 1 | overlap                                  | 4 | tread depth |
| 2 | open side                                | 5 | step        |
| 3 | height of adjacent playing area platform | 6 | ramp        |

**Figure 6 — Step or ramp detail**



a) Castle type

b) Flat-bed



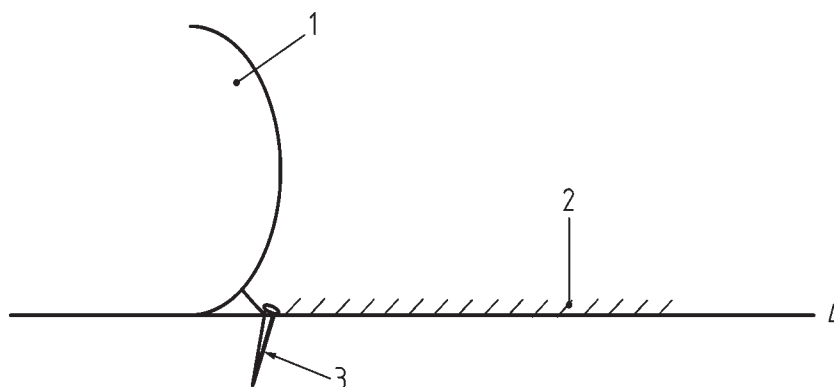
**c) Up and over slide**

**Key**

- |   |                |   |             |
|---|----------------|---|-------------|
| 1 | walled side    | 4 | impact area |
| 2 | at least 1,2 m | 5 | exit        |
| 3 | open side      | 6 | entrance    |

**Figure 7 — Impact area**

Anchorage points in impact areas shall be avoided if possible, but where necessary, anchorage points shall be connected to the bottom perimeter edge or seam of the inflatable and shall extend as short a distance as practicable from the inflatable (see [Figure 8](#)).



**Key**

- |   |   |
|---|---|
| 1 | side of inflatable  |
| 2 | impact area   |
| 3 | anchorage stake as close as practicable to the side of the inflatable |
| 4 | ground level  |

**Figure 8 — Anchorage in an impact area**

Totally enclosed inflatables shall have signs indicating exits which shall be visible in all circumstances. When designed for more than 15 users, there shall be more than one exit and users shall never be more than 5 m from an exit.

### 4.2.4 Blowers

Blowers shall be protected to a minimum of IP23B as defined in IEC 60529, except that the 8 mm finger rod, as illustrated in [Figure 2](#), shall be used instead of the jointed 12 mm test finger.

The 8 mm finger rod may pass through the guard mesh, but shall not, in any position, come into contact with any moving part, hot surface, or exposed electrical connections.

The blower shall be positioned at least 1,2 m from a walled side and 2,5 m from an open side. The connection tube shall be long enough to allow this.

If a blower is sited inside the inflatable structure, it shall be at least 2,5 m from the playing area, safety apron, step, and/or ramp.

The blower, including cabling and controls, shall not be readily accessible to the public.

NOTE See also [4.2.7](#).

### 4.2.5 Entrapment

#### 4.2.5.1 General

Test probes shall be applied with a force of 222 N, unless otherwise stated in the text.

#### 4.2.5.2 Entrapment of the head and neck

Inflatables shall be constructed so that any openings do not create head and neck entrapment hazards by either head first or feet first passage.

Hazardous situations in which this type of entrapment can be encountered include the following:

- completely bound openings through which a user may slide feet first or head first;
- partially bound or V-shaped openings;
- other openings (e.g. shearing or moving openings).

#### a) Completely bound openings

Accessible completely bound openings with a lower edge more than 600 mm above a platform shall be tested in accordance with [D.2.1](#).

Probes C or E shall not pass through any opening, unless it also allows the passage of the large head probe D.

#### b) Partially bound and V-shaped openings

Partially bound and V-shaped openings with an entrance at 600 mm or more above a platform shall be constructed so that either

- 1) the opening is not accessible when tested in accordance with [D.2.2](#), or
- 2) if accessible at a position of 600 mm or more above a platform when tested in accordance with [D.2.2](#), depending on the angular orientation range of the opening (see [Figure D.4](#)), shall conform to the following:

Range 1: (Template centre line  $\pm 45^\circ$  from vertical) When the template apex contacts the base of the opening, the depth of the opening shall be less than the length of the template to the underside of the shoulder section;

Range 2: (Template centre line from horizontal to  $+45^\circ$ ) When the template apex contacts the base of the opening, the depth of the opening shall be less than the "A" portion of the template. If



the depth of the opening is greater than the "A" portion of the template, all parts of the opening above the "A" portion shall also allow insertion of the shoulder section of the template or probe D;

Range 3: No template test requirements.

**c) Other openings (e.g. shearing or moving openings)**

Non-rigid members (for example, ropes) shall not overlap if, by doing so, they create openings that do not conform to the requirements for completely bound openings.

**4.2.5.3 Entrapment of clothing/hair**

Inflatables shall be constructed for hazardous situations including the following:

- a) gaps or V-shaped openings, in which a part of clothing can become trapped while, or immediately before the user is undergoing a forced movement;
- b) protrusions, in which clothing entrapment can be encountered are not created.

Slides shall be constructed so that openings located within the free space (see [Figure 9](#)) do not trap the toggle when tested in accordance with [D.3](#).

The cylindrical space is shown in [Figure 9](#) and its dimensions are given in [Table 1](#). In determining the free space, the possible movements of the equipment and the user shall be taken into account.

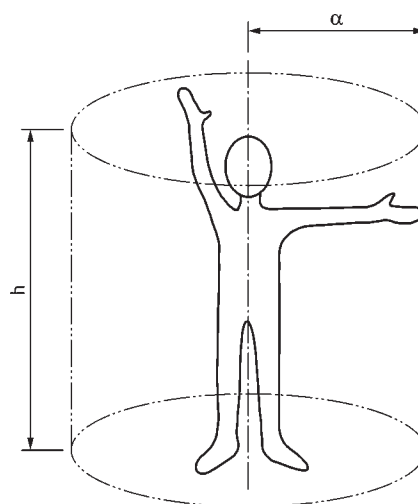
NOTE 1 The toggle test (see [D.3](#)) is restricted to the free space, as practical experience has shown that natural materials and connections between different parts can vary over time. The definition of free space (see [3.21](#)) does not include the three-dimensional area in which the falling movement takes place.

Special consideration should be given when using elements of circular cross-section, e.g. round tubes or poles, to avoid clothing entanglement within the falling space.

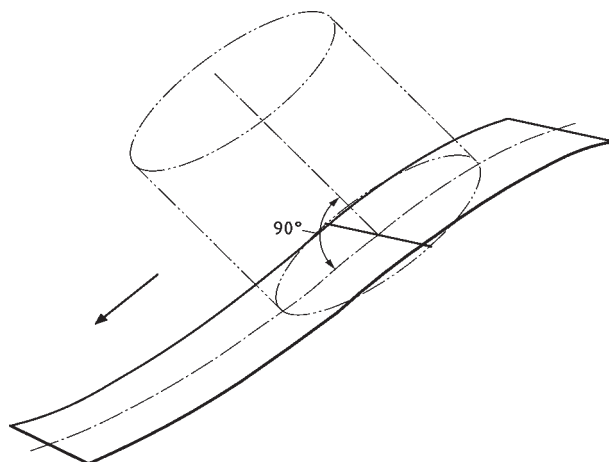
Roofs shall be constructed so that they do not trap the toggle when tested in accordance with [D.3](#).

Spindles and rotating parts shall be constructed so as to prevent entanglement of clothing or hair.

NOTE 2 This can be achieved by use of suitable covering or shields.



**a) Standing user**



b) Example of a slide

Figure 9 — Free space

Table 1 — Dimensions of the cylinder for the determination of the free space

Dimensions in millimetres

Type of use	Radius ( $\alpha$ )	Height ( $h$ )
Standing	1 000	1 800
Sitting	1 000	1 500
Hanging	500	300

NOTE 1 In case of hanging,  $h = 300$  because of the possibility that the user pulls himself or herself up.  
 NOTE 2 In certain cases, the dimensions of the free space can be altered. In some cases, these will be given in the parts of this International Standard covering individual types of equipment.

4.2.5.4 Fingers entrapment

Inflatables shall be constructed so that there are no hazardous gaps in which fingers can be trapped while the rest of the body is moving or continuing in motion involuntarily, e.g. sliding, bouncing.

Openings within the free space, where the user is subjected to forced movement, and holes which have a lower edge more than 1,0 m above the platform, when tested in accordance with Annex D (D.4), shall conform to one of the following requirements:

- a) 8 mm finger rod (see Figure 2), when applied with a force of 30 N, shall not pass through the minimum cross section of the opening and the profile of the opening shall be such that the rod cannot be locked in any position when set in motion as given in Figure D.10;
- b) if the 8 mm finger rod passes through the opening, the 25 mm finger rod (see Figure 10), when applied with a force of 30 N, shall also pass through the opening provided that the opening does not permit access to another finger entrapment site.

Dimensions in millimetres

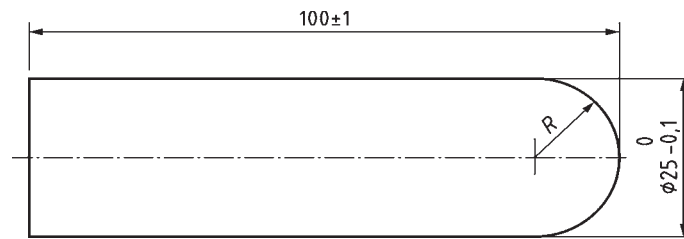
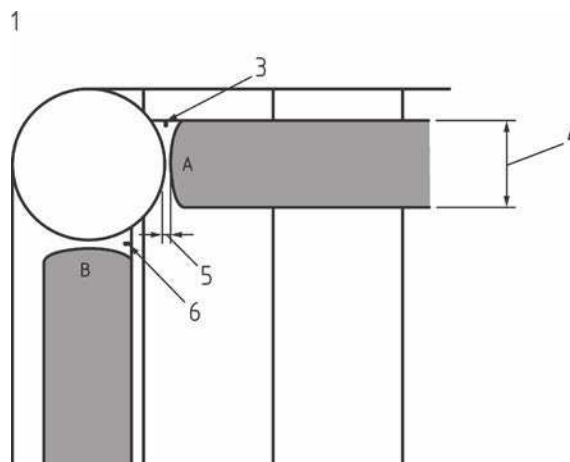


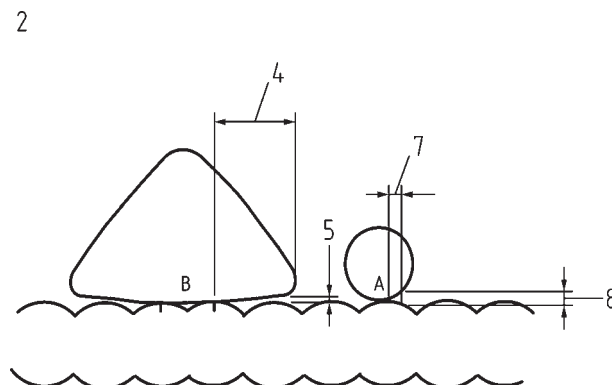
Figure 10 — 25 mm finger rod

#### 4.2.5.5 Body entrapment

Adjacent inflated surfaces shall be more than 120 mm apart if the aperture formed is more than 200 mm deep (see [Figure 11](#)).



a) Wall to tower attachment at A forms an entrapment point; wall to tower attachment at B does not form an entrapment point



b) Large slide at B forms an entrapment point; the ball fixed at A does not form an entrapment point

**Key**

1	walled castle viewed from above	5	less than 120 mm
2	section across playing area	6	wall to tower attachment point
3	wall to tower attachment point	7	less than 200 mm
4	more than 200 mm	8	8 more than 120 mm

**Figure 11 — Entrapment**

**Inflatable tunnels**

- An inflatable tunnel of 75 cm length or less shall, for the purposes of this International Standard, be regarded as a squeeze.
- A tunnel of between 75 cm and 2,0 m length shall be of at least 50 cm internal diameter.
- A tunnel of more than 2,0 m length shall be of at least 75 cm internal diameter.

**Inflatable squeeze**

- A squeeze shall not be longer than 75 cm.
- The diameter of the initial opening shall be at least 40 cm.
- The smallest aperture of the squeeze shall allow the large head probe to pass through with the application of a force of 222 N.
- The entire length of the inner squeeze panel shall be capable of being expanded to at least 40 cm diameter.

**4.2.6 Hard objects, sharp angles, and edges**

There shall be no hard and/or sharp angles or edges in any part of the inflatable accessible to the users (e.g. outside seams with a raw edge, square inflated corners, sharp-pointed cones).

Users shall not be able to come into contact with any hard object placed inside or adjacent to the inflated structure while it is in use or during accidental deflation.

Any hard object positioned over the playing area and supported by air pressure shall have an additional independent support system.

**4.2.7 Electrical installations**

Electrical installations shall conform to applicable national standards/regulations.

Controls of electrical installations shall not be readily accessible to the public.

Electrical cables shall be secured away from users and the public.

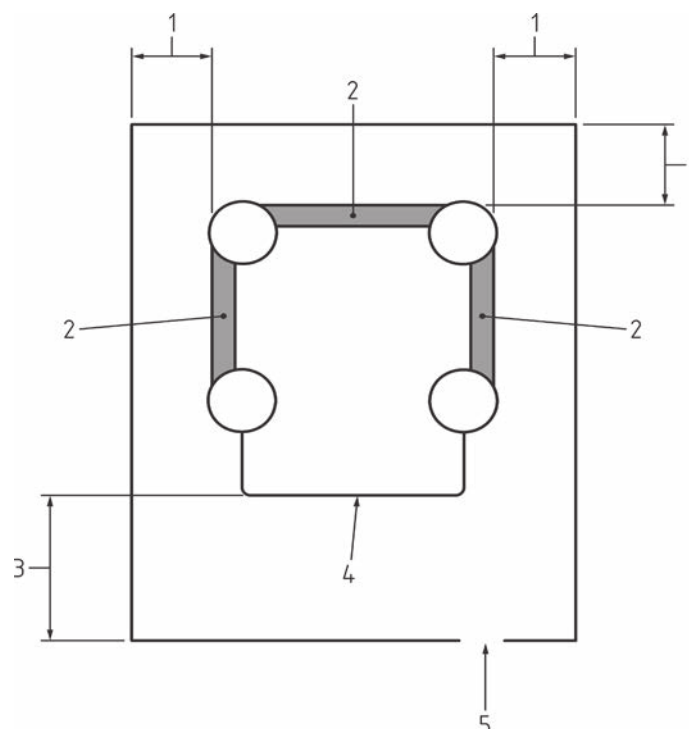
**4.2.8 Siting**

The inflatable shall be sited well away from possible hazards, such as overhead power lines or other obstacles with hazardous projections (e.g. fences and/or trees).

The inflatable shall not be erected on a site with more than a 5 % slope in any direction.

The site shall be cleared of debris and/or sharp objects on, or embedded in, the surface.

If, for crowd-control purposes, a perimeter fence is used, it shall be at least 1,8 m from walled sides and at least 3,5 m from open sides. A gateway shall be 1,0 m wide (see [Figure 12](#)).

**Key**

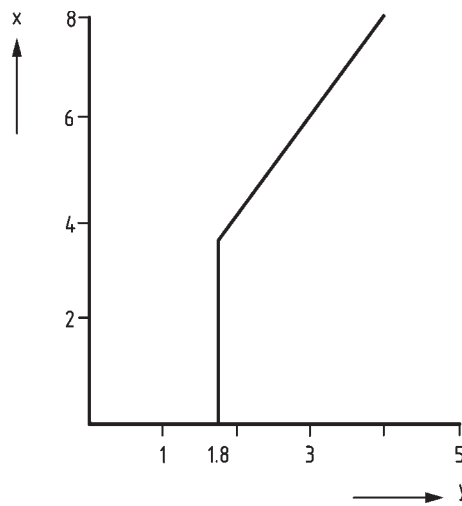
- 1 at least 1,8 m
- 2 walled side
- 3 at least 3,5 m
- 4 open side
- 5 1 m gateway

**Figure 12 — Positioning of perimeter fence**

A clear area, free of any obstacle that could cause injury, shall be maintained around the inflatable. The extent of this clear area shall be established by dividing the height of the highest platform by two. The minimum clear area shall be 1,8 m on walled sides and 3,5 m on open sides (see [Figure 13](#)).

An exception to this rule is when an inflatable, with inflated walls, is sited directly against a solid wall or walls, for example, the walls of a building. In such a case, the solid wall(s) shall be 2,0 m higher than the highest platform height, unless the platform has a permanent roof. Use of this exception shall not result in the creation of additional hazards.

Dimensions in metres



**Key**

- x height of highest platform
- y extent of clear area

**Figure 13 — Clear area around inflatable**

**4.2.9 Containment**

Containing wall height shall be measured from the surface of the platform to the top of the wall at 90° to the platform.

Walls for containing users, known as outside walls, are required where the platform height is greater than 0,6 m.

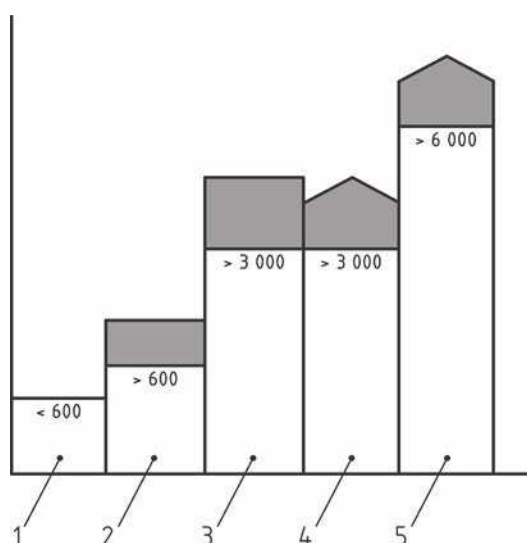
Inflatables with a platform height between 0,6 m and 3,0 m shall have a containing wall height equal to at least the height of the user. Containing walls of 1,8 m height are sufficient for users of any height.

Inflatables with a platform height between 3,0 m and 6,0 m shall have a containing wall height at least 1,25 times the height of the user, or the platform area shall be permanently roofed to contain the user.

Inflatables with a platform height over 6,0 m shall have containing walls and a permanent roof fitted (see [Figure 14](#)).

The minimum internal height of such containing walls and permanent roof, measured from the surface of the platform to the under-side of the roof, shall be at least 0,75 m.

Dimensions in millimetres

**Key**

- 1 no containing walls required
- 2 containing walls required of user height
- 3 containing walls required 1,25 times user height
- 4 alternative to 3, add a permanent roof
- 5 both containing walls and permanent roof required

**Figure 14 — Containing wall heights on platforms**

#### 4.2.10 Wall heights on slopes

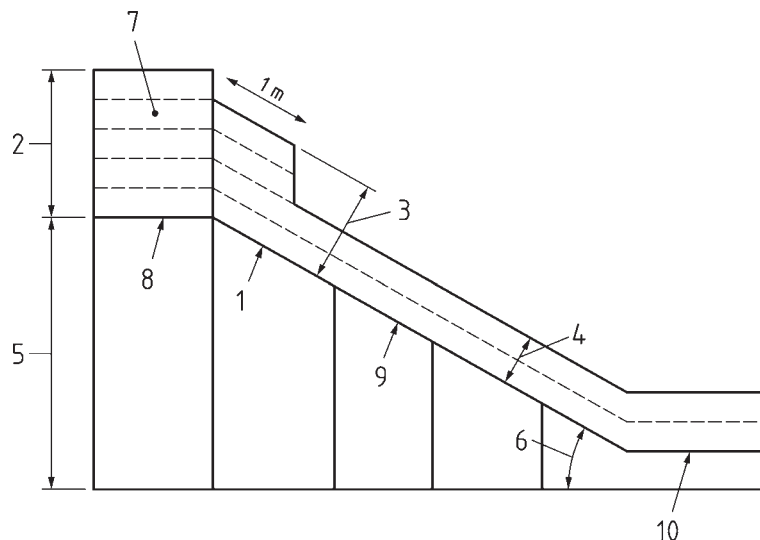
Slopes of less than 30° shall be treated as a platform.

Containing wall heights on slopes shall be measured from the surface of the slope to the top of the wall at 90° to the slope.

The height of the containing walls on the slope of a slide or climbing ramp of more than 30° inclination shall be, for the first meter at the top, at least the height of the user and for the remainder, at least 50 % of the height of the user (see [Figure 15](#)).

On a slope or climbing ramp over 6,0 m high, containing walls and a permanent roof shall be fitted. The minimum internal height of such containing walls and roof, measured from the surface of the slope to the under-side of the roof, shall be 75 cm.

On bounce/slide combinations, where the highest platform height is 1,5 m or lower (measured from the ground) and provided that users are forced to sit or crouch on entering the slide, containing walls for the highest 750 mm of the slope shall be at least 50 % of user height and for the remainder of the slope, at least 300 mm.



**Key**

- |   |                      |    |                  |
|---|----------------------|----|------------------|
| 1 | first metre of slope | 6  | more than 30°    |
| 2 | wall height          | 7  | wall             |
| 3 | user height          | 8  | platform surface |
| 4 | 50 % of user height  | 9  | sliding surface  |
| 5 | platform height      | 10 | run-out          |

**Figure 15 — Containing wall heights on slopes**

**4.2.11 Run-out**

All slides shall include a run-out section at the bottom which shall have an average inclination of not more than 10°.

The length of the run-out section, measured from the end of the radius or angle at the bottom of the sliding section, shall be a minimum of 50 % of the height of the highest platform of the slide measured from the ground and in any case, a minimum of 300 mm.

When a stop-wall is fitted at the end of the run-out section, 50 cm shall be added to the length of the run-out. The height of a stop-wall shall be at least user height. The height of the containing walls on the sides of a run-out section, if fitted, shall be at least 50 % of the user height.

**4.2.12 Ventilation**

The playing area shall be well-ventilated.

**4.3 Number of users**

To determine the maximum safe number of users allowed to play on an inflatable at one time, the designer shall consider all circumstances which might affect the safe number.

These include the following:

- a) height of the user;
- b) size of the playing area;
- c) type of activity, e.g. bouncing, sliding;
- d) inflated shapes mounted on the playing area;



- e) access and egress.

This list is not exhaustive.

#### 4.4 Supervision

An inflatable shall not be used without supervision.

When an inflatable is unattended, it shall be deflated and the power source disabled.

The controller shall determine the number and suitability of supervisory personnel required to operate inflatables safely by considering matters such as the maximum number of users marked on inflatables, the age of the users, the environment in which inflatables are being used, the visibility of playing areas, and the information provided by the manufacturer/supplier. Supervisory personnel consists of one operator and as many attendants as determined by the controller. Supervisory personnel shall be easily recognized.

### 5 Test methods and reports

Before testing, the equipment shall be assembled according to the manufacturer's/supplier's instructions. Testing shall be carried out using the most appropriate method, e.g. measurement, visual examination, and practical tests.

Test reports shall be prepared in accordance with ISO/IEC 17025 and shall include at least the following:

- a) number and date of this International Standard;
- b) details of the equipment tested;
- c) details of the condition of the equipment including any defects observed;
- d) test results.

Test reports shall be supplied upon request to owners/controllers/operators.

### 6 Information to be provided by the supplier/manufacture

#### 6.1 General product information

The supplier/manufacture shall provide information in the appropriate language(s) of the country in which the equipment is to be installed and used. The information shall

- a) be printed legibly and in a simple form,
- b) be conveyed using illustrations, wherever possible, and
- c) include at least details of installation, operation, inspection, and maintenance.

#### 6.2 Pre-information

The supplier/manufacture shall provide information concerning the safety of the equipment prior to accepting an order. This information shall include at least the following where relevant:

- a) height clearance and space required to operate the equipment safely;
- b) surfacing requirement;
- c) overall packed dimensions and weight;
- d) intended age range or height range and number of users allowed;

- e) certification of conformity with this International Standard.

### **6.3 Installation information**

The supplier/manufacturer shall provide installation information which shall include at least the following:

- a) list of equipment;
- b) method of anchorage and number of anchor points;
- c) maximum safe wind speed;
- d) siting, height, and space requirement;
- e) maximum allowable slope of the site;
- f) crowd control measures;
- g) need to keep users off of the inflatable during inflation and deflation;
- h) type and size of blower required.

### **6.4 Operating information**

The supplier/manufacturer shall provide operating information which shall include at least the following information and instructions:

Need for/to of the following:

- a) constant supervision;
- b) admit users to the inflatable in a controlled and safe manner;
- c) restrict the maximum height of the user to the design height;
- d) restrict the maximum number of users at one time to the design number;
- e) use at least the minimum number of operating personnel;
- f) users to remove their footwear;
- g) users to remove hard, sharp, or dangerous objects from their person;
- h) users to remove glasses when practicable;
- i) prohibit the consumption of food, drink, and gum;
- j) keep the entrance free from obstruction;
- k) prohibit the users from climbing or hanging on the containing walls;
- l) prohibit somersaults and rough play;
- m) operator and/or attendants to watch the activity on the inflatable constantly;
- n) operator and/or attendants to use a whistle or other signal to attract the attention of the users;
- o) operator and/or the attendants to separate larger, more boisterous users from smaller ones;
- p) inflatable to be evacuated during refuelling of a blower powered by an internal combustion engine.

The supplier/manufacturer shall also provide information on what to do in the event of an emergency or accident.

## 6.5 Inspection and maintenance information

The supplier/maker shall provide information on the inspection and maintenance of the equipment. The information shall specify the type and frequency of inspections.

## 7 Inspection, maintenance, and alteration

### 7.1 Inspection

Inflatable play equipment shall be inspected at suitable intervals to ensure that deterioration in the equipment is detected and remedied in good time.

#### 7.1.1 Routine Inspection

The controller shall carry out, or appoint a person to carry out, routine inspection.

Routine inspection shall be carried out before use each time the equipment is made available for use. The check shall include the following:

- site is suitable;
- all anchorages are secure and in place;
- ancillary equipment is in position (e.g. impact-absorbing mats);
- there are no significant holes or rips in the fabric or seams;
- correct blower is being used;
- internal air pressure is sufficient to give a firm and reliable footing;
- there are no exposed electrical parts and no wear on cables;
- plugs, sockets, switches, etc. are not damaged;
- connection tube and blower are firmly attached to each other;
- blower is safely positioned and its mesh guards are intact.

The equipment shall not be used by the public until any defects identified in the routine inspection have been rectified.

#### 7.1.2 Annual inspection

The controller shall ensure that an annual inspection is carried out by an inspection body which shall include any part of the inflatable and its ancillaries which may affect safe operation of the equipment. It shall include checks of the following:

- previous inspection reports and certificates where appropriate;
- identification of the inflatable and blower (e.g. serial numbers);
- anchorage system for wear, rips, or chafing;
- type and number of ground anchors or ballast for conformity with the design specification;
- inflatable structure for wear or rips in the fabric;
- walls and towers (when fitted) for firmness and uprightness;
- internal air pressure to be sufficient to give a reliable and firm footing;

- internal ties for wear and tear, particularly at loose or exposed ends;
- bed seams, wall-to-bed seams, and wall-to-tower connections;
- mesh guards at the inlet and outlet of the blower;
- condition of the impellor and blower casing;
- condition of electrical wiring and/or installations;
- presence of the fuel cap (petrol-engined blowers).

Inspection of some of these items may need to be done inside the inflatable. The above list is not exhaustive.

## **7.2 Maintenance**

### **7.2.1 General**

Carrying out of repairs while the equipment is in use shall be avoided.

### **7.2.2 Routine maintenance**

Preventative measures to maintain levels of safety and performance. Such measures include the following:

- cleaning the inflatable;
- removal of debris and contaminants;
- rust control on the blower;
- cleaning the blower air intake.

### **7.2.3 Corrective maintenance**

Corrective maintenance are measures to correct defects or to re-establish the necessary levels of safety. Such measures include the following:

- replacement of worn or defective parts;
- repair of splits or delaminated seams;
- repair of holes and cuts;
- repair or replacement of defective structural components.

## **7.3 Alteration**

Alteration to any part of the equipment that could affect its essential safety shall only be carried out after consultation with the supplier/manufacturer or a competent person. The equipment shall only be put into use again when alterations have been inspected and passed by an inspection body.

## **8 Marking**

Each inflatable shall be legibly and permanently marked with at least the following:

- type and size of blower required;
- maximum height of the user;
- maximum number of users;

- unique identifying number(s);
- year of manufacture;
- name and address of one of either the supplier/manufacturer, importer, or authorized representative;
- number and date of this International Standard.

Connection tube(s) shall be marked so as not to be confused with any other tube(s), e.g. inspection tubes, deflation tubes.

These markings shall all be clearly visible when the equipment is in use.

Each blower shall be legibly and permanently marked with at least the following:

- type and size;
- unique identifying number;
- year of manufacture;
- name and address of the supplier/manufacturer;
- number and date of this International Standard.

These markings shall all be clearly visible when the equipment is in use.

## 9 Documentation

The controller shall keep available documentation and records relating to the safety of the equipment. These shall include the following:

- information provided by the supplier/manufacturer;
- certificate of inspection and testing;
- records of inspection;
- records of maintenance;
- records of alteration;
- accident reports.

## Annex A (normative)

### Calculation of number of anchor-points

The number of anchor-points required shall be calculated independently for each side using the following formulae and values:

First, calculate  $F$  which is the force working on each side.

$$F = C_w \frac{\rho}{2} V^2 A \quad (\text{A.1})$$

where

$F$  is the force;

$C_w$  is the wind coefficient;

$\rho$  is the density of air;

$V$  is the maximum wind speed;

$A$  is the area of exposed surface;

using the following default values:

$$C_w = 1,5;$$

$$\rho = 1,24 \text{ kg/m}^3;$$

$$V = 11,1 \text{ m/s (mean of Force 6 Beaufort).}$$

and by determining  $A$  by measurement and/or calculation.

Calculate the number of anchor-points required using this formula rounded up:

$$\frac{F}{1600 \text{ N}} \times 1,5 \quad (\text{A.2})$$

This calculation shall be repeated for each side.

NOTE Corner anchors count 50 % on each side.

## Annex B (informative)

### Beaufort Scale of wind force

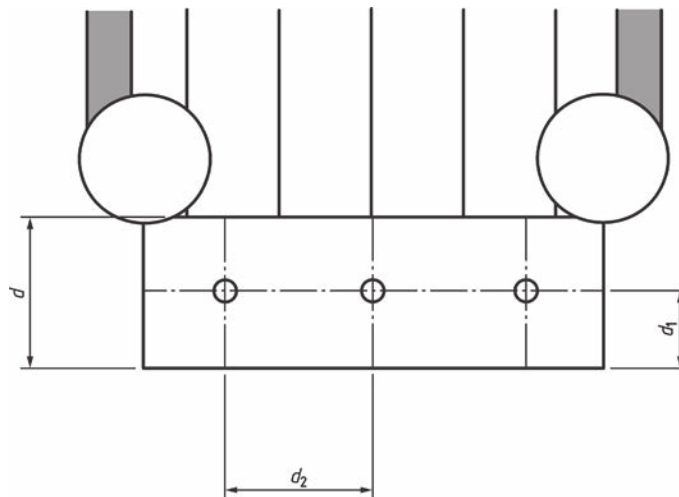
The Beaufort Scale is a scale for measuring the strength or velocity of wind where the various strengths are represented by numbers. It was formulated in 1805 by Sir Francis Beaufort and has since then been periodically revised. It ranges from 0 (calm) when the wind is less than 1 mph (1,61 km/h) to 12 (hurricane) when the wind exceeds 73 mph (117,72 km/h).

**Table B.1 — Beaufort Scale of wind force**

Force	Description	Identification	Wind speed	
			mph	km/h
0	Calm	Smoke rises vertically.	<1	<1
1	Light air	Direction of wind shown by smoke drift, but not by wind vanes.	1 to 3	1,1 to 5,5
2	Light breeze	Wind felt on face; leaves rustle, wind vanes moved by wind.	4 to 7	5,6 to 11
3	Gentle breeze	Leaves and small twigs are in constant motion. The wind extends a light flag.	8 to 12	12 to 19
4	Moderate breeze	Raises dust and loose paper. Small branches are moved.	13 to 17	20 to 28
5	Fresh breeze	Small trees in leaf begin to sway.	18 to 24	29 to 38
6	Strong breeze	Large branches in motion. Whistling heard in telegraph wires. Umbrellas difficult to use.	25 to 30	39 to 49
7	Near gale	Whole trees in motion. Inconvenience felt when walking against wind.	31 to 38	50 to 61
8	Gale	Twigs break off trees. Walking impeded.	39 to 46	62 to 74
9	Strong gale	Slight structural damage occurs. Chimney pots and slates are dislodged.	47 to 54	75 to 88
10	Storm	Trees uprooted. Considerable structural damage occurs.	55 to 63	89 to 102
11	Violent storm	Widespread damage occurs.	64 to 72	103 to 117
12	Hurricane	—	>73	>118

## Annex C (normative)

### Test method for grounding



**Key**

If  $d > 1$  m then  $d_1 = 0,5$  m

If  $d < 1$  m then  $d_1 = 1/2$  d

1 m =  $d_2$

**Figure C.1 — Positioning of test weights**

- a) Draw an imaginary 1,0 m square grid on the surface to be tested starting 0,5 m from the edge. In cases where  $d$  is less than 1,0 m, the testing point shall be in the middle of  $d$ .
- b) Place the weight indicated in [Table C.1](#), in turn, onto each point where the grid lines intersect.
- c) Spread the weight applied at each point over a circle of 36 cm diameter.

**Table C.1 — Weights**

<b>Designed for user height</b>	1,0 m	1,2 m	1,5 m	1,8 m
<b>Weight to be applied</b>	25 kg	35 kg	65 kg	85 kg



## Annex D (normative)

### Test methods for entrapment

#### D.1 General

Unless stated otherwise, tolerances of the probes in this Annex are as follows:

- a)  $\pm 1$  mm for dimensions;
- b)  $\pm 1^\circ$  for angles.

In situations of doubt, when using the probes relating to the tolerance, an accurate measurement should be made to ensure the opening is in accordance with the nominal dimension of the probe.

All tests shall be performed in the most onerous way.

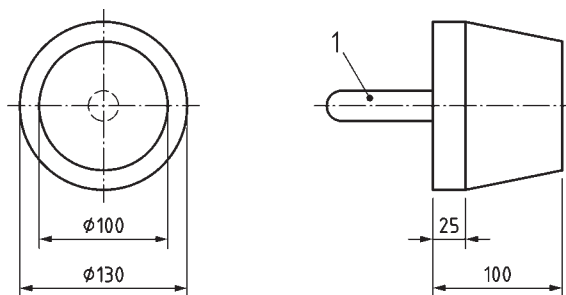
#### D.2 Head and neck entrapment

##### D.2.1 Completely bound openings

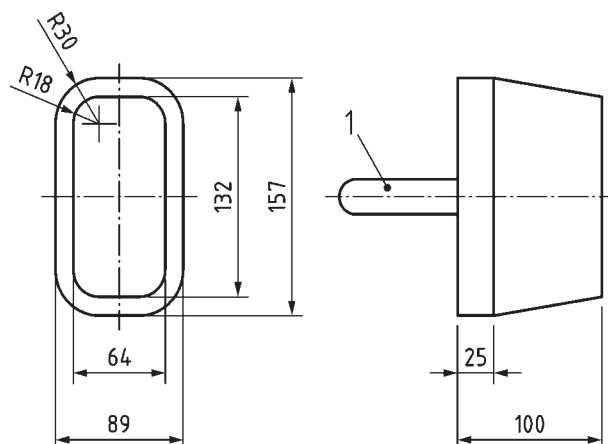
###### D.2.1.1 Apparatus

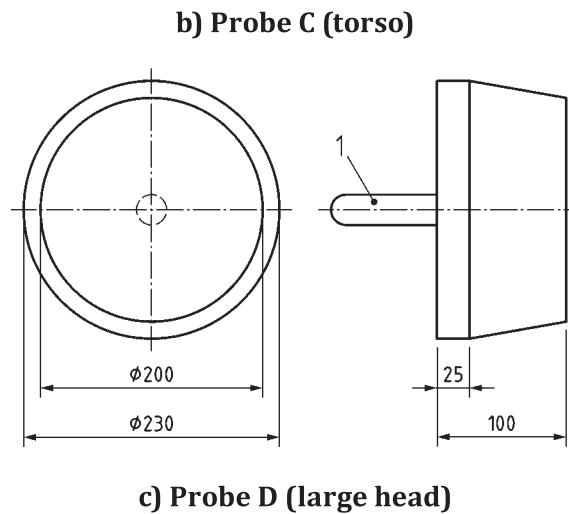
Probes as illustrated in [Figure D.1](#).

Dimensions in millimetres



a) Probe E (small head)





**Key**

1 handle

**Figure D.1 — Probes for determination of head and neck entrapment in completely bound openings**

**D.2.1.2 Procedure**

Apply successively the probes, as illustrated in [Figure D.1](#), to each relevant opening. Record and report the passage of any probe through the opening. If any of the probes are not freely passing through the opening, apply a force of  $(222 \pm 5)$  N to the probe. When the torso probe is used, it is safer to force the body through the opening first because if the body passes through, then the head will also pass through. Apply the probe with the axis perpendicular to the plane of the opening.

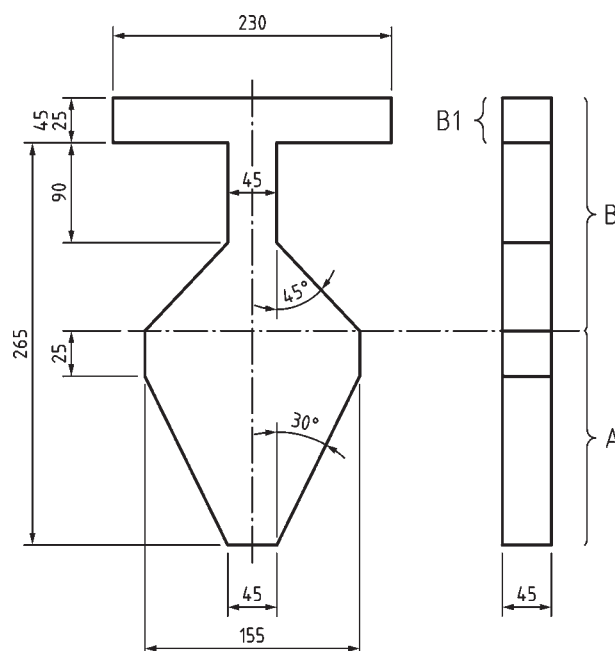
**NOTE** The head probe dimensions are based on those for an older child and, therefore, there will be a large tolerance if assessing equipment for use by a young child.

**D.2.2 Partially bound and V-shaped openings**

**D.2.2.1 Apparatus**

Test template, as illustrated in [Figure D.2](#).

Dimensions in millimetres

**Key**

- A "A" portion of probe
- B "B" portion of probe
- B1 shoulder section

**Figure D.2 — Test template for assessment of head and neck entrapment in partially bound and V-shaped openings**

**D.2.2.2 Procedure**

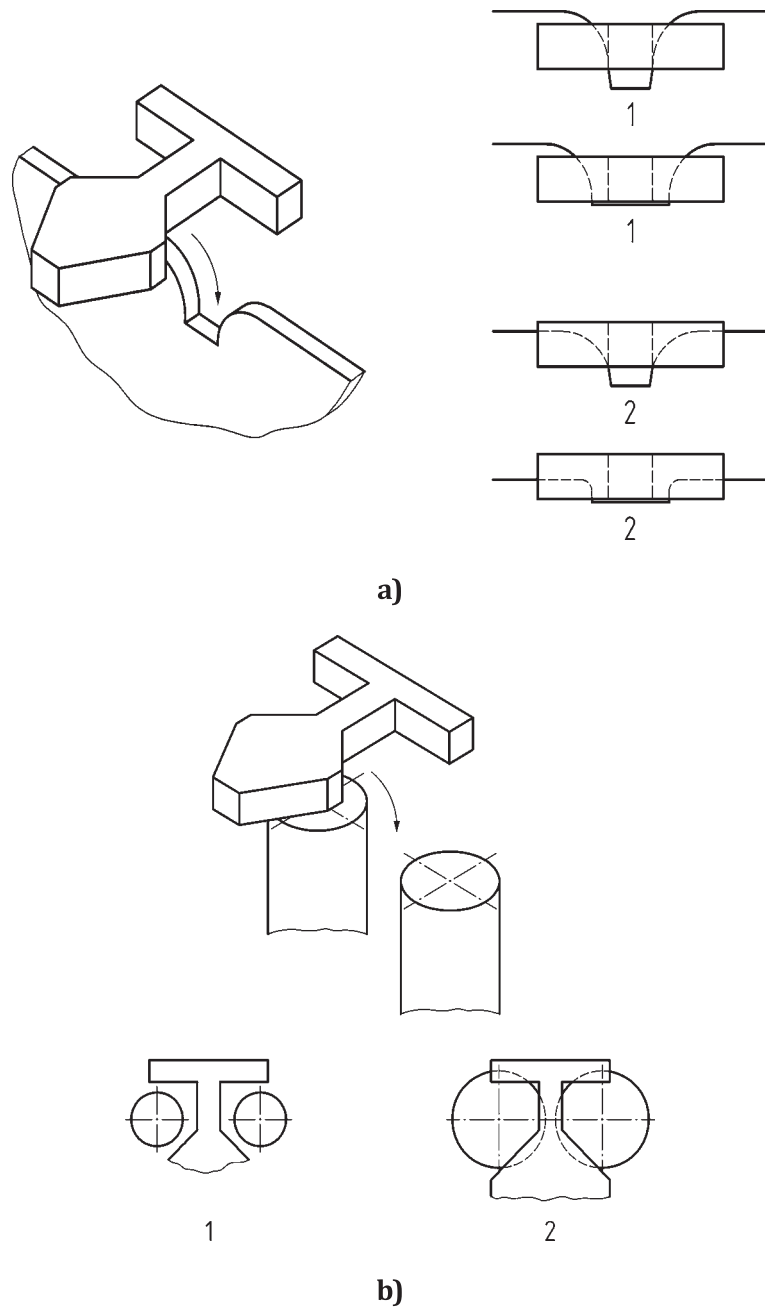
Position the "B" portion of the test template between and perpendicular to the boundaries of the opening, as shown in [Figure D.3](#). Record and report whether the template fits within the boundaries of the opening, or if it cannot be inserted to its full thickness.

If the test template can be inserted to a depth greater than the thickness of the template (45 mm), apply the "A" portion of the test template so that its centre line is orientated to check the extremities of the opening, as well as the centreline.

Ensure that the plane of the test template is parallel and applied in line with the opening, as shown in [Figure D.4](#).

Insert the test template along the opening until its motion is arrested by contact with the boundaries of the opening. Record and report the results including the angle of the template centreline relative to the

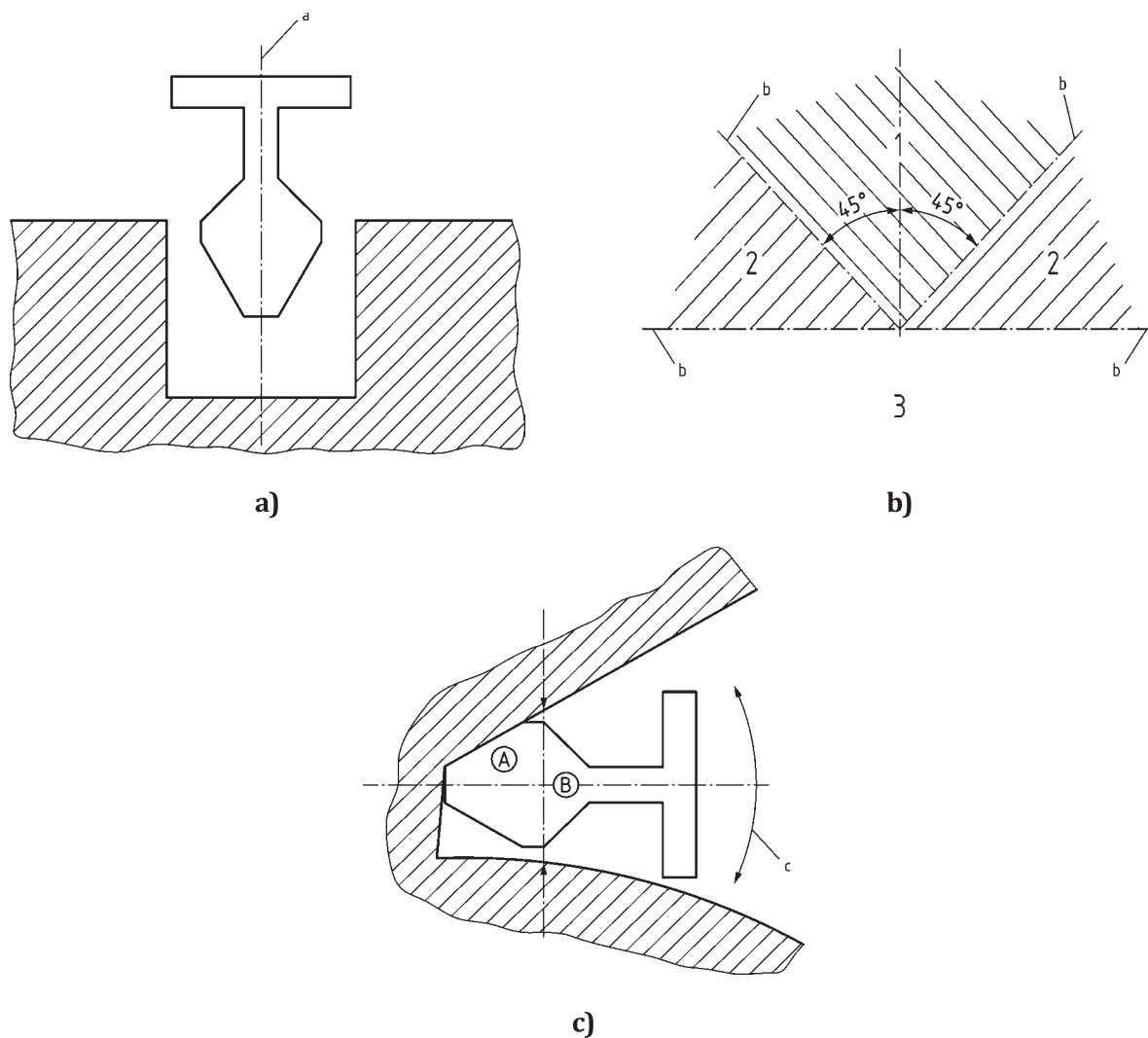
vertical and horizontal axes (see [Figure D.4](#)) as this will determine the pass/fail requirements given in [4.2.5.2](#) (see [Figure D.5](#) and [Figure D.6](#) for examples of the assessment for the different angular ranges).



**Key**

- 1 accessible
- 2 not accessible

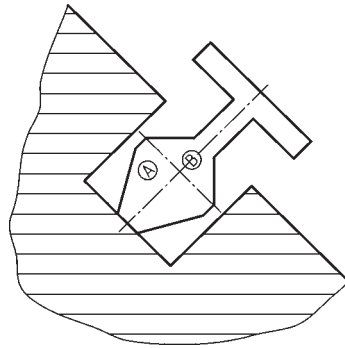
**Figure D.3 — Method of insertion of the "B" portion of the test template**



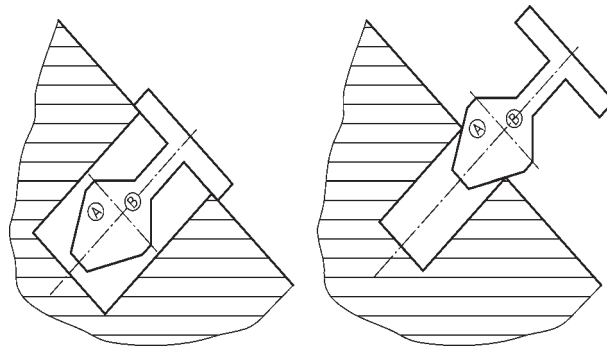
**Key**

- 1 range 1
- 2 range 2
- 3 range 3
- a Insertion angle for assessing the range.
- b Template centre line.
- c Check all insertion angles.

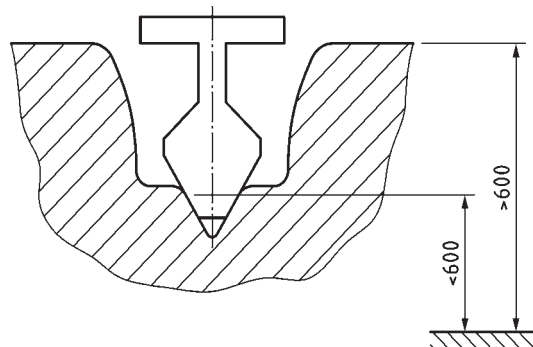
**Figure D.4 — Checking all insertion angles to determine range**



**a) Passes if front section fully enters aperture to a maximum depth of (template shoulder depth) 265 mm**



**b) Fail**

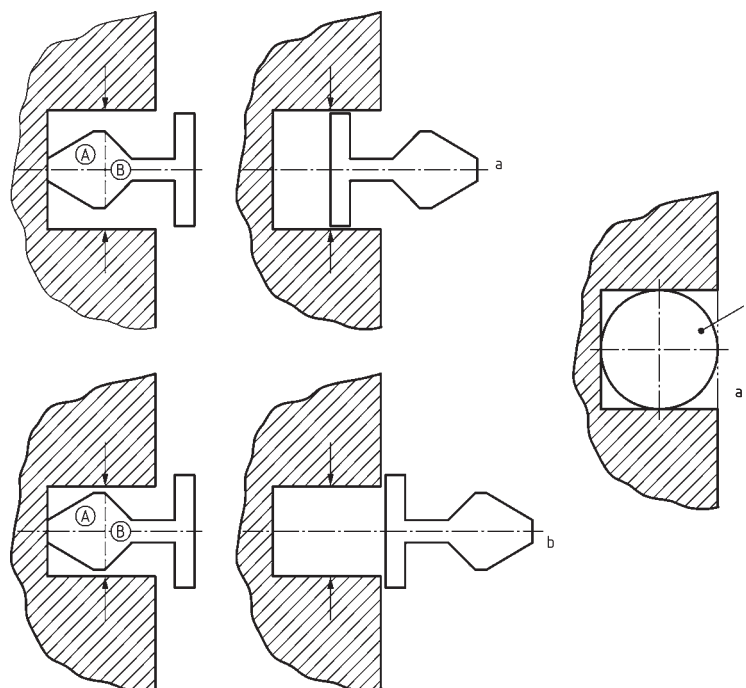


**c) Pass**

**Key**

- >600 mm = more than 600 mm above the playing surface
- <600 mm = less than 600 mm above the playing surface

**Figure D.5 — Range 1 method of insertion of the "A" portion of the test template**



### Key

- 1 large head probe D
- a Pass.
- b Fail.

**Figure D.6 — Range 2 method of insertion of the "A" portion of the test template followed by insertion of the shoulder of the template or probe D**

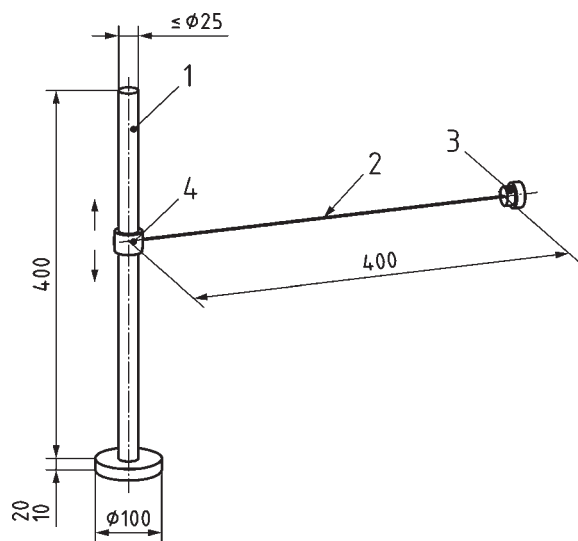
## D.3 Entrapment of clothing (toggle test)

### D.3.1 Apparatus

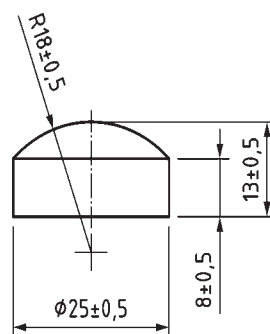
Test device, as shown in [Figure D.7 a\)](#), comprising the following:

- toggle, as shown in [Figure D.7 b\)](#), made of polyamides (PA) (e.g. nylon), polytetrafluoroethylene (PTFE), which have been found to be suitable materials;
- chain, as shown in [Figure D.7 c\)](#);
- collar, detachable, and with good slip;
- pole.

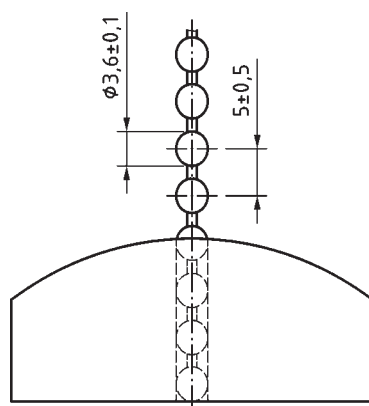
Dimensions in millimetres



a) Complete test device



b) Toggle



c) Chain

**Key**

- 1 pole
- 2 chain
- 3 toggle
- 4 collar

**Figure D.7 — Test device**

**D.3.2 Procedure**

**Slides**

Position the test device perpendicularly in the starting section of the slide 200 mm from the transition point of the starting section and at the appropriate lateral location as shown in [Figure D.8](#).

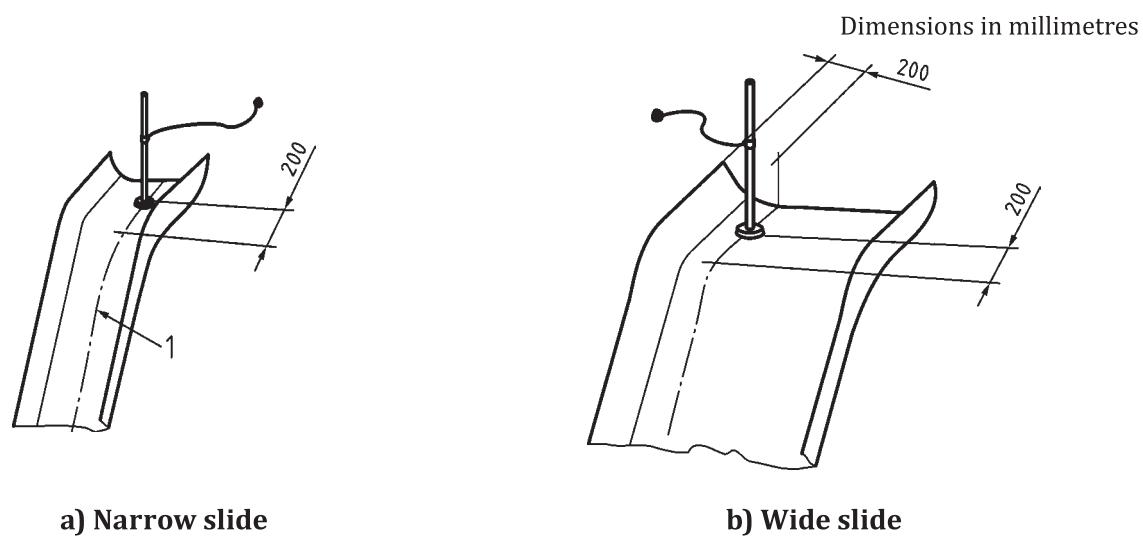
Randomly, place the toggle and chain under the action of its own weight to all positions within range without applying additional force or influence.

NOTE The objective of this test is to replicate the natural motion of a clothing toggle.



In the event that the test device is obstructed, apply a maximum force of 50 N in the direction of the forced movement. If the device is released, this position within the equipment passes the test.

Record and report where any entrapment of the toggle or chain occurs.



**Key**

1 centre line

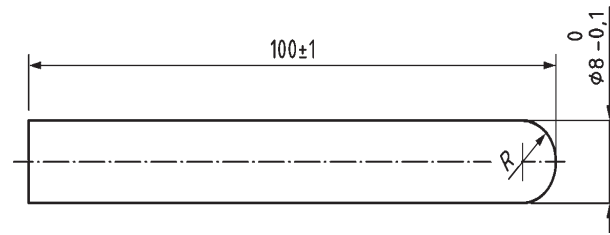
**Figure D.8 — Position of the test device on slides**

## D.4 Finger entrapment

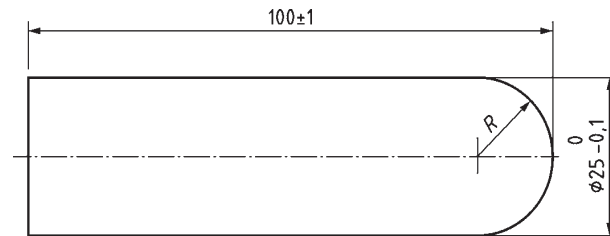
### D.4.1 Apparatus

Finger rods, as illustrated in [Figure D.9](#).

Dimensions in millimetres



a) 8 mm diameter finger rod



b) 25 mm diameter finger rod

**Key**

R spherical radius

**Figure D.9 — Finger rods**

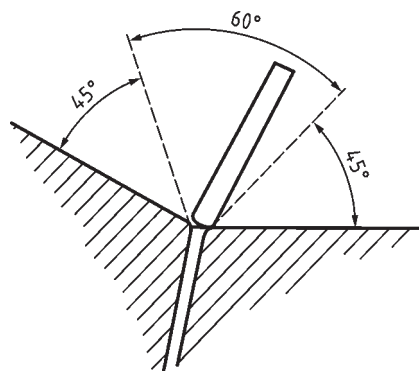
**D.4.2 Procedure**

Apply the 8 mm diameter finger rod to the minimum cross section of the opening and, if the rod does not pass through, rotate it as illustrated in [Figure D.10](#).

Record and report if the rod enters the opening and if it locks in any position when moved through the conical arc, as shown in [Figure D.10](#).

If the 8 mm diameter finger rod passes through the opening, apply the 25 mm diameter finger rod.

Record and report if the 25 mm diameter finger rod passes through the opening and, if it does, whether access is then given to another finger entrapment site.



**Figure D.10 — Rotation of the 8 mm diameter finger rod**

## Annex E (normative)

### Test method for tear strength

#### E.1 Maximum value tongue tear, apparatus

A low inertia, autographic constant rate of traverse cloth tensile testing machine of a suitable range, power-operated at a rate of  $(100 \pm 10)$  mm/min. Under the conditions of use, the error of the indicated or recorded maximum force at any point in the range in which the machine is used does not exceed  $\pm 1\%$  of the force. The width of jaws is not less than the width of the specimen.

#### E.2 Preparation of test specimens

Five specimens ( $200 \text{ mm} \times 60 \text{ mm}$ ) shall be cut with the longer dimension in the longitudinal direction of the roll and five more specimens shall be cut with the longer dimension in the transverse direction of the roll. The strips shall be evenly spaced from the full usable length and width of the sample and not within 50 mm of the selvedge.

In each specimen, a lengthways tongue,  $100 \text{ mm} \times 20 \text{ mm}$ , shall be cut as shown in [Figure E.1](#), the line *abcd* shall be drawn on each face of the specimen at a distance of 50 mm from the end of the tongue.

In case of coated fabrics of high tear strength, if the tongue breaks or threads are pulled from the fabric instead of being broken, wider specimens,  $200 \text{ mm} \times 150 \text{ mm}$ , shall be used with the tongue 50 mm wide.

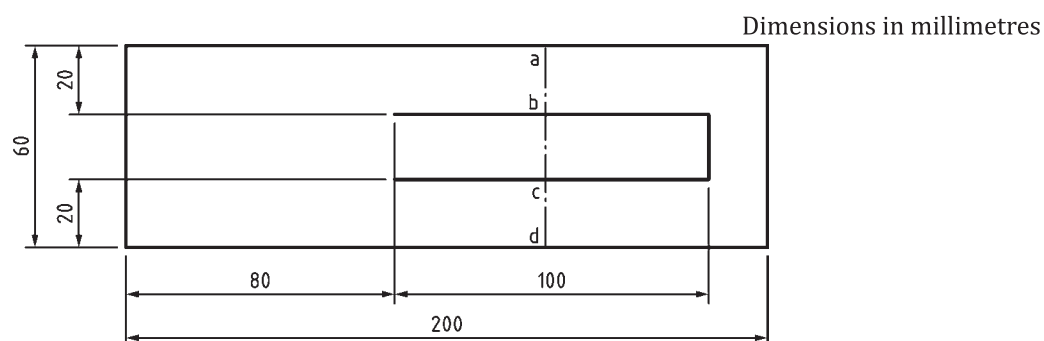


Figure E.1 — Specimen

#### E.3 Conditioning

Condition the test specimens in accordance with the following method. If determinations are to be made on wet test specimens, totally immerse these for a minimum of 1 h at  $(20 \pm 2)$  °C in an aqueous solution of a non-ionic wetting agent of concentration not more than 0,1 % (m/m). Thoroughly rinse in water and test within 1 min of removal from the water.

#### E.4 Preconditioning

When the textile substrate is of a highly hygroscopic material, or where the method of test requires a high degree of accuracy, moisture equilibrium (i.e. equilibrium reached by the coated fabric when, after exposure to air in motion, there is no appreciable change in mass) shall be approached from the

dry side of the hysteresis curve by pre-conditioning the test pieces in an atmosphere having a relative humidity of not greater than 10 % and a temperature of between 60 °C and 70 °C.

NOTE Air at 65 % humidity and 20 °C will, when heated at constant pressure to between 60 °C and 70 °C, have a relative humidity of approximately 5 %. Higher temperatures can lead to changes in some coatings.

## **E.5 Characteristics of test atmospheres**

The use of one of the following atmospheres shall be fixed by the particular standard or specification for each test or material. The choice of one of these alternatives will depend on the prevalent usage in individual countries and the variant used shall be reported in the test report.

Atmosphere "A"

- temperature  $(20 \pm 2)$  °C – relative humidity  $(65 \pm 5)$  %

Atmosphere "B"

- temperature  $(23 \pm 2)$  °C – relative humidity  $(50 \pm 5)$  %

Atmosphere "C" (tropical)

- temperature  $(27 \pm 2)$  °C – relative humidity  $(65 \pm 5)$  %

Atmosphere "D" (temperature control only)

- temperature  $(23 \pm 2)$  °C

Atmosphere "E" (tropical temperature control only)

- temperature  $(27 \pm 2)$  °C

## **E.6 Methods of conditioning**

The test pieces shall be freely exposed to the standard atmosphere "A", "B" or "C" until they are in equilibrium. Equilibrium with the standard atmosphere is deemed to have been reached when successive weighing, at intervals of 2 h, of the test pieces freely exposed to the moving air differ by less than 0,1 %.

For fabrics coated on one side only, a minimum of 16 h exposure is recommended.

For fabrics coated on both sides, a minimum of 24 h is recommended.

The test pieces shall be freely exposed to the standard atmosphere "D" or "E" for a period of 3 h.

## **E.7 Procedure**

Carry out the tests in the atmosphere for conditioning and testing described above.

Adjust the testing machine to the rate of clamp movement given in apparatus above and select an appropriate force capacity range. Disengage any pawls or other arrestments which would prevent two-way movement of the weighting device. Set the clamps 100 mm apart.

Clamp the tongue of the specimen symmetrically in the headstock jaws so that the line *bc* is just visible (see [Figure E.2](#)). Similarly, grip the legs of the specimen symmetrically in the traversing jaws so that the lines *ab* and *cd* are just visible and the legs of the specimen are parallel to the force of tear.

Set the traversing jaws in motion. After 60 mm of the fabric has been torn, remove the pen and disengage the drive.

Dimensions in millimetres

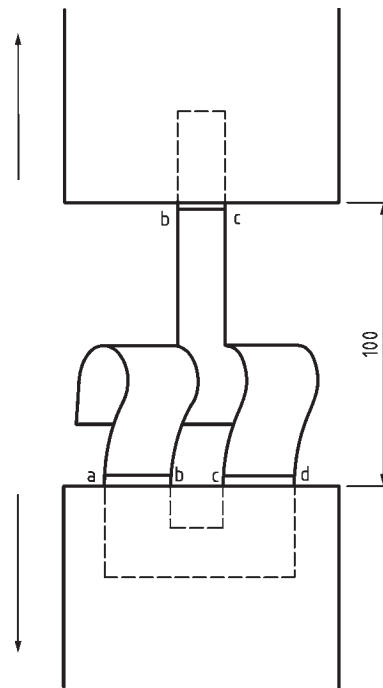
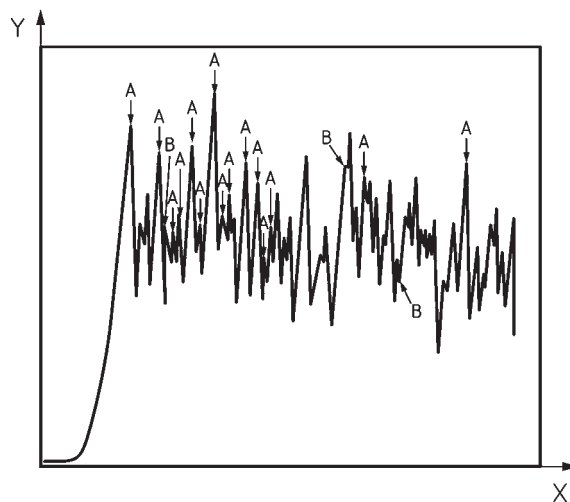


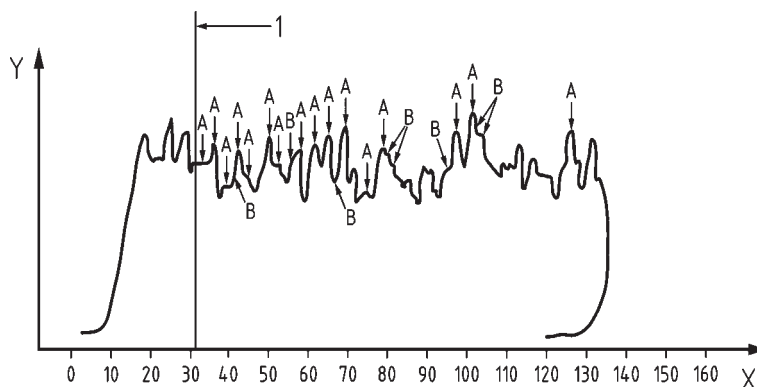
Figure E.2 — Method of clamping specimen

### E.8 Calculation and expression of results

The trace obtained may consist of a series of peaks, as shown in [Figure E.3](#), or a relatively smooth curve as shown in [Figure E.4](#). From the five maximum values recorded, determine the mean value in Newtons as the longitudinal or transverse tear strength, according to whether longitudinal or transverse threads, respectively are torn.



a) Electronic response time



**b) Mechanical response at low inertia**

**Key**

X load

Y direction of tear (trace length)

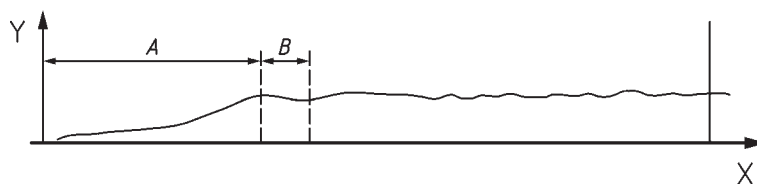
NOTE *Determination of median value.* Figure E.3 a) represents a typical autographic trace. A “peak” is a point on the trace where the gradient changes from positive to negative. Points marked A are peaks, points marked B are not peaks. The importance of the peaks in the trace is that they give the force on the specimen at the instant of rupture.

**Figure E.3 — Typical autographic traces**

The median value of tearing resistance is the value such that half the number of peaks have higher values and half have lower values.

To determine the median value, count the total number of peaks ( $n$ ). If  $n$  is an odd number, count downwards starting at the uppermost peak, a number of peaks equal to  $(n + 1)/2$ . The number of the last peak counted is the median peak.

If  $n$  is an even number, the median value is taken as midway between peaks  $n/2$  and  $(n/2) + 1$ .



**Key**

X load

Y direction of tear (trace length)

NOTE The type of trace illustrated is not suitable for use in determining median values. This type of trace is usually associated with high inertia instruments and with certain types of non-woven substrates. In such cases, if the instrument is capable of indicating the average or mean force exerted during the test, the value so indicated can be reported as the mean tear strength without reference to the trace. This type of trace can be used where only maximum values are required.

**Figure E.4 — Autographic trace without definite peaks**

**E.9 Test report**

The test report shall include the following particulars:

- a) description of the coated fabric;

- b) mean tear strength in both the longitudinal and transverse directions. Indicate clearly that the results are based on maximum values and report the method of test used. If a rip-stop fabric has been tested, report the number of rip-stop bars per unit length of the sample and the number torn through per specimen during test;
- c) specimen size used;
- d) details of any deviation from the standard test procedure;
- e) number and date of this International Standard.

## Bibliography

- [1] ISO 1421, *Rubber- or plastics-coated fabrics — Determination of tensile strength and elongation at break*
- [2] ISO 2411, *Rubber- or plastics-coated fabrics — Determination of coating adhesion*
- [3] ISO 8124-4:2014, *Safety of toys — Part 4: Swings, slides and similar activity toys for indoor and outdoor family domestic use*
- [4] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC





