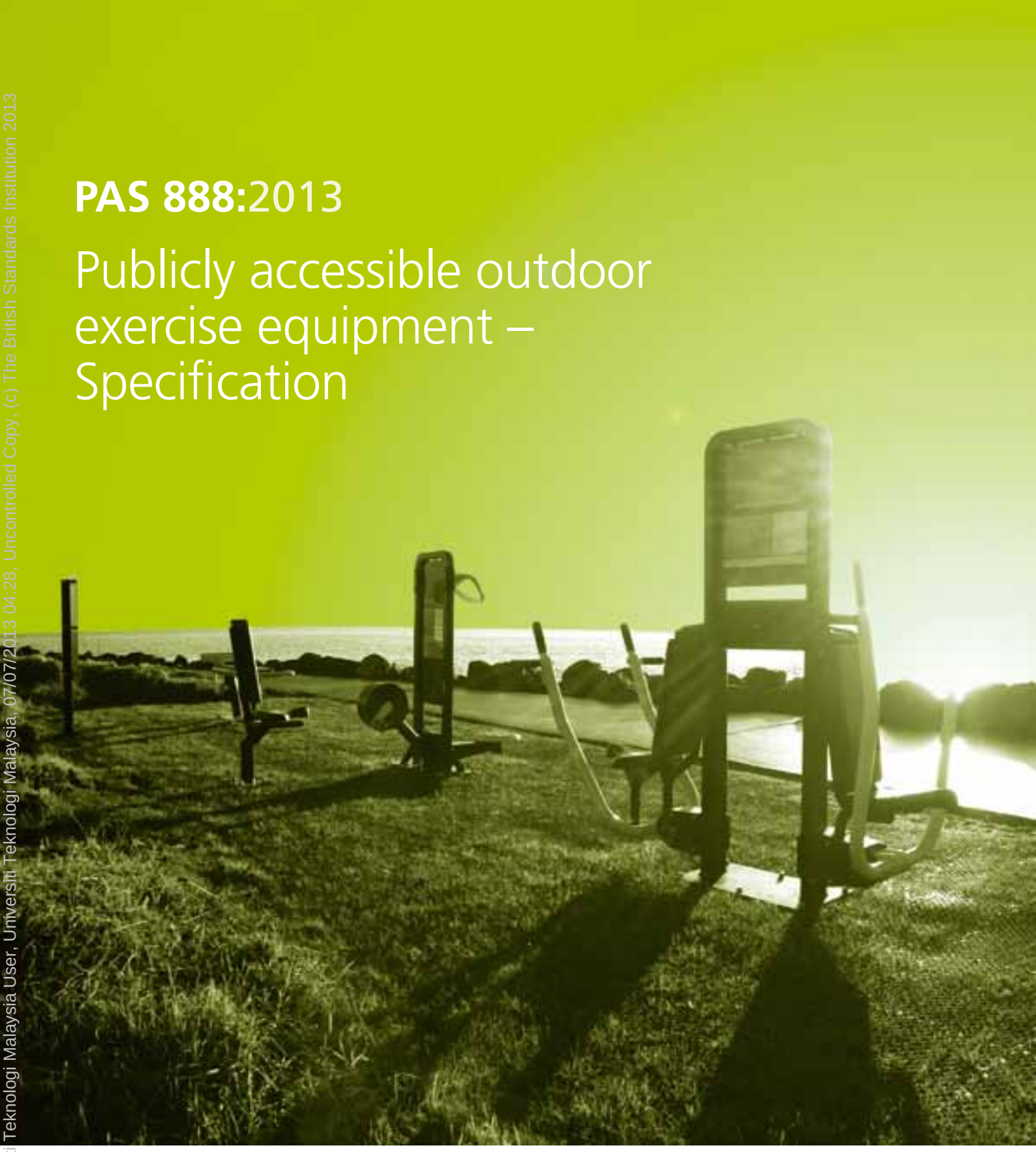
PAS 888:2013

Publicly accessible outdoor exercise equipment – Specification



tgo the great outdoor gym company

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Publishing and copyright information

ISBN 978 0 580 72822 8

ICS 97.220.40

Publication history

First published April 2013

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Foreword

This PAS was sponsored by The Great Outdoor Gym Company. Its development was facilitated by BSI Standards Limited and it was published under licence from The British Standards Institution. It came into effect on 30 April 2013.

Acknowledgement is given to the following organizations that were involved in the development of this PAS as members of the Steering Group:

- adidas
- The Chartered Institute for the Management of Sport and Physical Activity
- Dudley Primary Care Trust
- The Great Outdoor Gym Company
- Lappset
- London Southbank University
- ukactive
- Vision Redbridge

Acknowledgement is also given to the members of a wider review panel who were consulted in the development of this PAS.

This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

Information about this document

Product certification. Users of this PAS are advised to consider the desirability of independent third-party certification of product conformance to this PAS. Users seeking assistance in identifying appropriate assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentation conventions

The provisions of this PAS are presented in roman type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, recommendations, explanation and general informative material is presented in italic type, and does not constitute a normative element.

Contractual and legal considerations

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

Compliance with a PAS does not in itself confer immunity from legal obligations.

Introduction

This PAS is the first UK standard for the full range of outdoor exercise and fitness equipment in what is a comparatively new industry.

The Great Outdoor Gym Company is a leading company in the outdoor gym industry that has worked in partnership with adidas, Sport England, military fitness personnel, professional athletes and other bodies to produce practical exercise equipment with demonstrable fitness benefits. They have also led and contributed to independent research [1] on outdoor gym usage, which has shown that all ages and fitness abilities participate all year round without professional supervision.

This PAS specifies safety requirements that are generally applicable to permanently installed, publicly accessible outdoor fitness and exercise equipment. The PAS encompasses the whole of the industry including manufacturers, specifiers, installers, maintenance providers and inspectors, thereby allowing each to be verified as compliant to or complying with this PAS.

This PAS has drawn heavily upon the wealth of knowledge and experience available within both BS EN 1176 and BS EN 957 and is significantly influenced by them.

Refusal of admittance and access to outdoor gyms of children as a safety precaution, by using signs or other restrictions which can be ignored or overlooked, is highly problematic due to many factors, including a breach in supervision or help by peers. Whilst children are not the intended users, this PAS accepts that children are to be expected to use outdoor gym equipment unsupervised in publicly accessible locations and indeed the independent research conducted across dozens of outdoor gym sites in the UK strongly backs this up [1].

Requirements of significant importance, such as elimination of head and neck entrapments and protection against inadvertent falls, have been written with this in mind. It is also recognized that there is an increasing need for provision for outdoor gym users with disabilities. This of course requires areas to provide a balance between safety and the offer of the required level of exercise to all possible groups of users. However, for the purposes of protection against head and neck entrapment, this PAS does not take into account people with an increased head size (e.g. hydrocephalus or Downs Syndrome) or the wearing of helmets.

1 Scope

This PAS sets out safety requirements for permanently installed outdoor exercise equipment in unsupervised publicly accessible locations.

The PAS specifies requirements for provision of equipment intended to be used for cardiovascular and repetitive exercise to promote general good health.

The PAS specifies requirements for equipment intended for use by adults and young people. Requirements for accessibility and safety in use for people of all abilities and levels of fitness are specified. Issues surrounding access by children are also included.

This PAS addresses essential safety issues, including those concerning entrapments, crushes, shears, pendulum movements and reciprocating movements.

Guidance is provided on the location or situation of outdoor exercise equipment.

The scope of this PAS does not extend to playground equipment as covered under the BS EN 1176 series of standards, free-access multi-sports equipment as covered under BS EN 15312, stationary training equipment as covered under the BS EN 957 series of standards, artificial climbing structures as covered under the BS EN 12572 series of standards, and rope courses as covered under BS EN 15567.

This PAS does not cover the use of free weights.

2 Normative references

The following referenced documents are indispensable for the application of this PAS. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 335-2, *Durability of wood and wood-based products – Part 2: Definition of use classes. Application to solid wood*

BS EN 350-2:1994, *Durability of wood and wood-based products – Natural durability of solid wood – Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe*

BS EN 351-1:2007, *Durability of wood and wood-based products – Preservative-treated solid wood – Part 1: Classification of preservative penetration and retention*

BS EN 636, *Plywood – Specifications*

BS EN 1177, *Impact absorbing playground surfacing safety requirements and test methods*

BS EN 15312, *Free access multi-sports equipment*

BS EN ISO 10093, *Plastics – Fire tests – Standard ignition sources*

BS EN ISO 14021:2010+A1:2011, *Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)*

BS EN ISO/IEC 17050-1:2010, *Conformity assessment – Supplier's declaration of conformity – Part 1: General requirements*

BS ISO 1834, *Short link chain for lifting purposes – General conditions of acceptance*

ISO 5904:1999, *Gymnastic equipment – Landing mats and surfaces for floor exercises – Determination of resistance to slipping*

3 Terms and definitions

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

3.1 annual main inspection

inspection intended to establish the overall level of safety of equipment, foundations and surfaces

NOTE *Typical checks include the effects of weather, evidence of rotting or corrosion and any change in the level of safety of the equipment as a result of repairs made, or of added or replaced components.*

3.2 assistant

anyone helping another to overcome a physical challenge to access or use the equipment

3.3 barrier

device intended to prevent the user and non-user from falling or passing through

3.4 bodywork

permanent parts of the equipment, structural or non-structural, giving form to it

3.5 climber

equipment with feet and hand positions that can be moved in a reciprocating motion simulating a continuous ascent requiring simultaneous input from hands and feet

3.6 cluster

collective group of items, not physically linked, designed to interact with each other

3.7 collective use

use by more than one user at a time

3.8 competent person

individual (or organization) that has the requisite training and experience, can access the requisite tools, equipment and information, and is capable of carrying out a defined task to a specified standard

3.9 cover

removable parts (with appropriate tools) of equipment provided to protect users and non-users from accessing potential hazards (e.g. moving parts, electrical components), by fully enclosing or guarding such parts in use

NOTE *Temporary removal of covers for maintenance may be necessary.*

3.10 critical fall height

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

NOTE *The critical fall height is determined according to the lowest test result obtained in accordance with BS EN 1177.*

3.11 crushing point

place where parts of the equipment can move towards or against each other, or against a fixed area, so that the whole or part of a body or clothing can be crushed

3.12 design load

maximum potential user load

3.13 dynamic equipment

moving equipment where the user changes the load or the range of movement through the physical characteristics of the user, or by mechanical adjustment

3.14 elliptical trainers

manually operated training equipment which can produce a continuous reciprocating or elliptical foot action which can include upper body activity

NOTE *Elliptical training functions as a continuous and reciprocating closed loop cycle.*

3.15 entrapment

fixed or moving part of the equipment or surface where the whole or part of a body or clothing can become trapped

3.16 equipment

equipment intended for use in physical exercise in publicly accessible outdoor locations

3.17 equipment space

space occupied by equipment during its range of movement

3.18 falling space

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

NOTE *The falling space commences at the free height of fall.*

3.19 footplate

part of equipment designed to contain or support the whole foot, either while moving or stationary

3.20 footrest

part of equipment intended for the feet, either while moving or stationary, where it is necessary for the user to have additional support (e.g. while sitting)

NOTE *A footrest may be a temporary aid to assist a user to access or egress the operating position.*

3.21 forced movement

action on the user or equipment that once started cannot easily be stopped by the user (e.g. use of a chinning bar)

3.22 free height of fall

greatest vertical distance from the clearly intended body support to the impact area below

NOTE *The intended body support includes those surfaces to which access is encouraged, e.g. a seat positioned above a standing surface.*

3.23 free weights

loose weights with which the user can alter the exercise load

3.24 grasp

holding of the hand around part of the circumference of a support

3.25 grip

holding of the hand around the entire circumference of a support

3.26 handhold

something intended for the hand to grip or grasp on

3.27 handrail

rail intended to assist the user to balance

3.28 impact-attenuating surface

surface designed to reduce damage caused to the body in the event of a fall, specifically head injury, by reducing the deceleration effect

NOTE *Testing of impact-attenuating surfaces is determined and undertaken in accordance with BS EN 1177.*

3.29 inspector

competent persons, companies or organizations involved with inspection of equipment, groundworks and surfacing at any time

3.30 installer

persons, companies or organizations involved with installation of equipment, and or groundworks and surfacing and commissioning equipment

3.31 intended user

anyone the equipment is designed to be used by

NOTE This may be restricted by age or size or other factors

3.32 inter-equipment space

minimum space between items of equipment that no part of the equipment can be moved in to

3.33 manufacturer

persons, companies or organizations designing, producing and assembling parts and equipment also persons, companies or organizations importing or supplying parts and equipment

3.34 movement space

space in, on or around equipment that can be occupied by a user undergoing a movement forced by the equipment

3.35 moving equipment

equipment where movement of parts is necessary to complete the intended exercise

NOTE Movement is within a constant range and may include oscillating, cyclical, elliptical, rocking or flexible motions, or a combination of these.

3.36 non-user

people of any age given access to the equipment, not using the equipment who may be within the space occupied by the equipment in use i.e. toddlers, young children or assistants

3.37 obstacle

object or part of the equipment that obstructs or could injure the user or assistant within the free or falling space of the equipment

3.38 operating position(s)

position(s) occupied by the user during the whole range of activity

3.39 operational inspection

inspection, more detailed than routine visual inspection, to check the operation and stability of equipment

NOTE Typical checks include an examination for wear.

3.40 operator

persons, companies or organizations identified as the client at any stage, this can include landlords, authorities and agents from the public and private sectors

3.41 pedal

part of equipment intended to be operated by foot or hand to undertake the exercise

3.42 pendulum movement

action of equipment that is able to swing by gravity with or without load from one raised position to another

3.43 pictogram

simplified illustration to demonstrate the intended exercise

3.44 platform

surface designed for single or multiple users to occupy, in a standing, sitting, kneeling or other position, or to move around on

3.45 resistance

impeding effect on the user by the equipment, to limit speed of operation or increase load using mechanical or non-mechanical means

3.46 routine visual inspection

visual inspection of equipment and the site intended to identify and prevent obvious hazards that could result from normal use, breakdown, vandalism or weather conditions

NOTE *Typical hazards include broken parts and broken bottles.*

3.47 running surface

moving surface intended for walking or running on a treadmill-type machine where the feet are free to leave the surface during use

3.48 seat

support, either stationary or moving, for the user in a sitting position, either with or without a backrest

3.49 shearing point

place where parts of the equipment can move towards, against or past each other, against or past a fixed area so that the whole or part of a body can be cut

3.50 site

outdoor site where equipment is installed temporarily or permanently for free use and access by members of the public

NOTE *Publicly accessible sites may or may not be covered or secured at times.*

3.51 specifier

persons, companies, local authorities, agencies or organizations selecting or purchasing parts and equipment, for installation

3.52 stair climber

equipment similar to a moving mechanical staircase or escalator simulating a continuous staircase

NOTE *Work is carried out by simulating climbing a conventional staircase.*

3.53 standing surface

part or parts of the equipment, either moving or stationary, intended for the feet where it is not necessary for a user to have additional support

NOTE *A standing surface may be an intermediate location (e.g. a step) to assist access to or egress from the operating position.*

3.54 starting position

position occupied by the user at the start of the exercise when correctly using the equipment

3.55 stepper

equipment where the feet move in a reciprocating motion without the foot having to leave the foot pedal simulating a stepping action with some additional resistance

3.56 surface flash

rapid spread of flame over the surface of a material without combustion of the basic structure at that time

3.57 user

people of any age given access to use the equipment for the intended use

3.58 user station

part of the equipment intended to be occupied by the user or users during the activity

4 General requirements

4.1 Materials

4.1.1 General

Materials shall be selected and protected such that the structural integrity of the equipment manufactured from them is not affected before the next relevant maintenance inspection.

NOTE 1 *PAS 888 gives recommendations on maintenance inspections (see Annex C).*

NOTE 2 *The provisions relating to certain materials in this PAS do not imply that other equivalent materials are unsuitable in the manufacture of publicly accessible outdoor exercise equipment.*

NOTE 3 *The selection of materials and their use should be in accordance with appropriate European or National Standards.*

The choice of materials shall be appropriate for local climatic or atmospheric conditions at the site.

Special attention shall be given to surface coatings to avoid potential toxic hazards.

NOTE 4 *Where very low or very high temperatures can be anticipated, care should be taken in material selection to avoid possible hazards through direct skin contact.*

Equipment installed into an area of or being surfaced with a loose particulate material shall have extended parts, ground fixings or foundations designed specifically for the additional installation depth.

4.1.2 Flammability

To avoid risk of fire and associated hazards, materials known to produce surface flash shall not be used.

Particular attention shall be given to newly developed products whose properties might not be fully known.

NOTE *Attention is drawn to national and local building regulations regarding flammability for equipment installed both indoors and outdoors*

Materials used shall be tested in accordance with BS EN ISO 10093.

4.1.3 Wood and associated products

Wooden parts shall be designed in such a way that precipitation can drain off freely and water accumulation shall be avoided.

In cases of ground contact, one or more of the following methods shall be used:

a) use of wood species with sufficient natural resistance in accordance with classes 1 and 2 of the natural resistance classification given in BS EN 350-2:1994, **4.2.2**;

b) construction (e.g. post shoe);

c) use of wood treated with preservatives in accordance with BS EN 351-1:2007, Figure A.1, and with BS EN 335-2, use class 4.

Consideration shall also be given to other factors that can be unsuitable, such as splintering or poisoning.

All components made of wood and associated products, other than those species conforming to a), that affect the stability of the structure and are in constant contact with the ground shall be treated in accordance with c).

Wooden components shall have positive connections that cannot be undone or shifted. Nails or wood screws shall not be used as the only form of connection.

When selecting metal fastenings, consideration shall be given to the species of wood and chemical treatments used, as some will accelerate corrosion of metals if there is contact between them.

Plywood shall be in accordance with BS EN 636 and shall be weatherproofed.

4.1.4 Metals

Metal parts shall be protected against atmospheric conditions and electrochemical corrosion.

Metals that produce toxic oxides that scale or flake shall be protected by a non-toxic coating.

4.1.5 Synthetics

If, during maintenance, it is difficult to determine at what point material becomes brittle, manufacturers shall give an indication of the time period after which the part or equipment should be replaced.

Measures shall be in place to allow visual identification of excessive wear of the gelcoat of GRP (glass-reinforced plastic) products intended for sitting or holding before the user becomes exposed to the glass fibres.

NOTE 1 *This can be achieved, for example, by the use of different-coloured layers in the surface.*

NOTE 2 *Synthetics are often susceptible to permanent failure or deformation in extremes of temperature, so their material characteristics should be tested and proven to be suitable for the effects of solar gain and prolonged freezing expected at the site.*

Measures shall be taken to prevent degradation of materials through ultraviolet radiation.

4.1.6 Hazardous substances

Hazardous substances, as defined by The Control of Substances Hazardous to Health (COSHH) Regulations 2002 [2] , shall not be used in publicly accessible outdoor exercise equipment in such a way that they can cause adverse health effects to the user of the equipment.

NOTE 1 *Attention is drawn to the provisions of European Council Directive 76/769/EEC on dangerous substances and preparations [3]. Prohibited materials include, but are not limited to, asbestos, lead, formaldehyde, coal tar oils, carbolineums and polychlorinated biphenyls (PCBs).*

NOTE 2 *In the event that old wood stock or recycled materials are used, it should be established that CCA (copper, chrome and arsenic) preservative treatments have not been used in any part.*

NOTE 3 *Combinations of materials that may produce hazardous substances during fire or via other catalyst should be avoided.*

4.2 Design and manufacture

4.2.1 General

Equipment shall be designed to provide cardiovascular and repetitive exercise to promote general good health.

The intended exercises shall have demonstrable physical benefits when the equipment is used correctly.

Each user station or activity shall not contradict the requirements of movement and falling spaces of an adjacent item.

NOTE 1 *Equipment may comprise multiple elements that do not physically attach to each other to make a single user location (e.g. a separate seat or information panel).*

NOTE 2 *Equipment may be clustered for collective use, with multiple user stations for simultaneous use, where user interaction and cooperation may or may not be necessary to complete the intended exercises.*

For equipment where the primary exercise function is specifically augmented by one or more secondary activities (e.g. an abdominal bench with added parts designed for stretching), all parts shall conform to the appropriate provisions contained within this PAS.

Equipment shall be designed for each user station to be based upon a 130 kg user. Testing shall be based upon average UK adult male (clothed) weight of 85 kg.

NOTE 3 *Consideration should be given to the possibility of users dressed in heavy winter clothing, footwear and gloves, etc.*

NOTE 4 *All practical measures should be taken to make equipment as inclusive as possible.*

NOTE 5 *The English Federation for Disability Sport have produced and manage the Inclusive Fitness Initiative (IFI) giving guidance to providing inclusive equipment, testing and accrediting to that standard.*

NOTE 6 *Equipment should be designed so that the risk involved in use is apparent and foreseeable by the user.*

Where equipment is designed to have loads or ranges of movement adjustable by the user, by mechanical, hydraulic, dynamic or other means, adjustment shall be easy to achieve and immediately apparent to any user.

NOTE 7 *Ideally, an adjustable mechanism should default or self-reset to the lightest load upon a change of user.*

Free weights shall not be provided or used. Retained or protected weights (stacked) may be used to adjust imposed loads within safe limits, only if users and non-users are fully protected from crush or entrapment of any kind. They shall be located and identified so that a new user can see the level of load from the intended starting position.

All parts of the equipment shall be permanently fixed or constrained to operate within a defined movement range so that in use the full range of movement is clearly apparent and a new user will find the item in a safe position.

NOTE 8 For example, a rowing machine seat may run on a track and the pull handles may be attached by cables; upon release, the handles should return to a starting location, in a controlled way, without leading to a crush or entrapment potential or dropping to the ground or adjacent part of the equipment, while the seat may remain in any safe location.

Unless designed for collective use, user stations shall be designed to discourage access and use by more than one person simultaneously.

Standing surfaces, footplates, footrests and pedals shall be designed to accommodate a UK adult size 13 training shoe (EU 48, or 330 mm long by 125 mm wide), and if a moving part shall allow a full range of movement without obstruction. If it is intended for both feet to be in the same location, the location shall be tested with the pair of adult size 13 training shoes (EU 48, or 330 mm long by 125 mm wide).

The users and public shall be protected from lubricants that could be transferred to clothing or skin.

All parts of equipment shall be designed so that they do not accumulate water.

4.2.2 Structural integrity

For publicly accessible outdoor exercise equipment, the structural integrity for the worst case of the intended combinations of users shall be proven.

Structural integrity, including stability of the equipment, shall be assessed and suitably documented by one of the following:

a) physical testing, in accordance with Annex E;
b) calculation, in accordance with Annex E; or
c) combination of a) and b).

When calculations are carried out in accordance with Annex E, no limit states shall be exceeded at combinations of loads as given in **E.12.2**.

When tested in accordance with Annex E, the equipment shall not show any cracks, damage or excessive permanent deformation (see **E.5**).

Each item of equipment shall resist both the permanent and variable loads acting on it as described in **E.12**.

Where equipment relies on a single post for its stability, its construction shall be designed to:

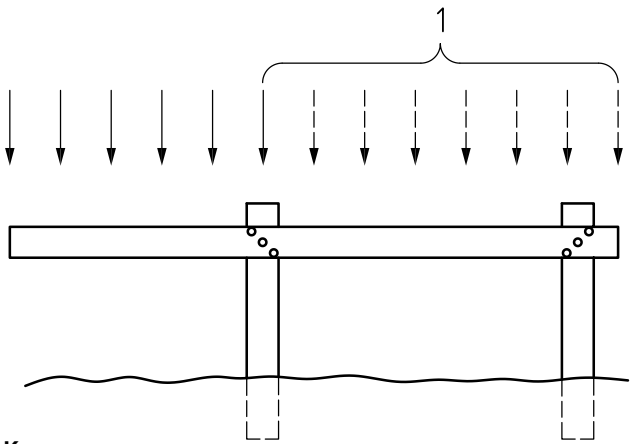
a) minimize rotting or corrosion in parts necessary for stability;
b) allow for controlled degradation and the need for decommission;
c) be used without collapse within the foreseen annual inspection period when maintained correctly.

NOTE 1 No allowance for accidental loads (e.g. loads produced by fire, collision by vehicles or earthquake) need be made for publicly accessible outdoor exercise equipment.

NOTE 2 Publicly accessible outdoor exercise equipment by design is a mechanism for absorbing energy, therefore fatigue of materials is a significant life-limiting factor. All equipment therefore needs to be tested and verified for fatigue. Structural parts should resist the worst-case loading condition when subjected to testing as described.

NOTE 3 To achieve loading and fatigue testing, it may be necessary to remove that part of the user load causing favourable effects, as shown in Figure 1.

Figure 1 – Favourable effect upon loading



Key

1 Remove this part of the load because of favourable effects

4.2.3 Accessibility

All items of equipment shall be demonstrated to provide accessibility and egress to the appropriate user station.

Equipment shall be designed to ensure that assistants are able to gain access to aid users of the equipment as necessary.

Where temporary access is necessary (e.g. a seat that moves to a transfer position), it shall be easily returned and fixed into the intended use position throughout the range of the exercise movement. It shall not be possible to completely remove such parts without specialized tools for maintenance purposes.

With the exception of cluster items, there shall be a minimum inter-equipment space of 1.5 m between separate pieces of equipment, or greater as defined in **4.2.9.3.1** when an item has a falling space requirement, when tested at the greatest range of movement.

NOTE 1 *The requirements for signage are identified in Clause **8**.*

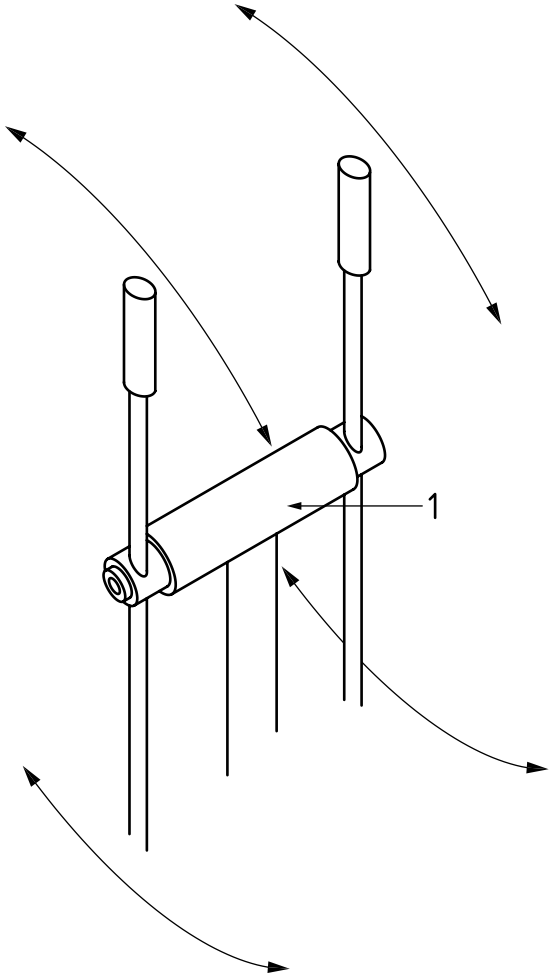
NOTE 2 *Static handholds or grasp points should be provided in practical locations where parts providing support are able to move when a user is accessing or exiting an item (see Figure 2).*

NOTE 3 *Where practical, handholds should be in a contrasting colour.*

NOTE 4 *Surfacing provided under and around equipment should provide an acceptable level of accessibility in all non-extreme weather conditions.*

NOTE 5 *The site should be accessible in all non-extreme weather conditions when completed*

Figure 2 – Example of static grasp alternative

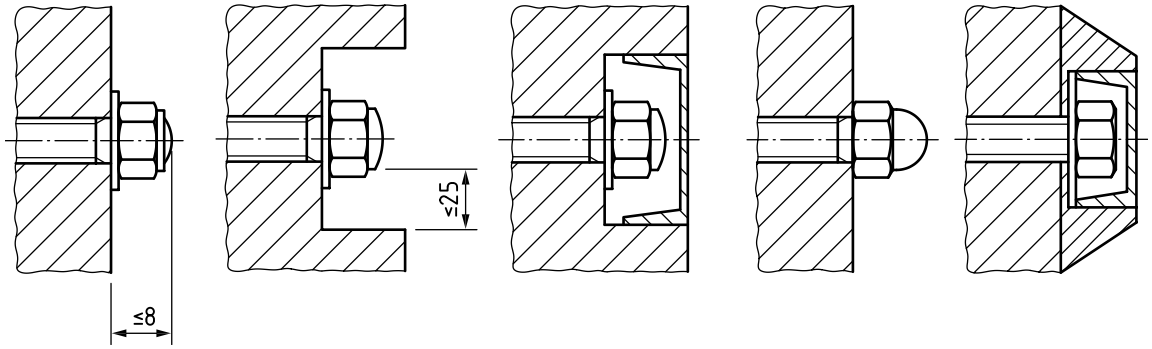


Key

1 Example of a static grasp to aid access or egress

Figure 3 – Examples of protection for nuts and bolts

Dimensions in millimetres



4.2.4 Grips

The cross section of any support designed to be gripped shall have a dimension of not less than 16 mm or more than 50 mm in any direction.

4.2.5 Grasps

The cross section of any support designed to be grasped shall have a width not exceeding 100 mm.

4.2.6 Finish of equipment

The surface finish of materials (e.g. glass fibre) shall be non-splintering.

There shall be no protruding nails, projecting wire rope terminations or pointed or sharp-edged components.

Rough surfaces shall not present any risk of injury. Protruding bolt threads on any accessible part of the equipment shall be permanently covered (e.g. dome-headed nuts). Nuts and bolt heads that project less than 8 mm shall be free from burrs. All welds shall be ground smooth (spatter removed).

NOTE 1 *Figure 3 shows examples of protection for nuts and bolts.*

Corners, edges and projecting parts throughout the equipment that protrude more than 8 mm, and that are not shielded by adjacent areas not more than 25 mm from the end of the projecting part, shall be rounded off. The minimum radius of the curve shall be 3 mm, with the exception of wooden parts, where 5 mm shall be required.

NOTE 2 *This requirement is intended only to prevent injuries caused by unintended contact with components.*

4.2.7 Moving parts

4.2.7.1 General

There shall be no crushing points or shearing points between moving and/or stationary parts of the equipment, or between moving parts and the ground, in accordance with **4.2.8**.

If moving parts of the equipment can endanger the body (e.g. parts rigidly linked having a combined unladen weight >38 kg or a significant driven force), there shall be a ground clearance of at least 230 mm throughout the range of movement.

NOTE 1 *This is to prevent a whole-body crush.*

The underside of moving parts shall be free of sharp or projecting parts and fixings.

Where it can be demonstrated that the moving part cannot endanger the body, a ground clearance of >60 mm shall be acceptable (e.g. a stepper with a static footguard between the footplates).

Unprotected parts from which a high impact force can emanate shall have a tested impact-attenuating construction. When tested with a calibrated accelerometer, there shall be no peak values of acceleration greater than 50 G.

Exposed or accessible restrictors or stop mechanisms shall not be permitted in any part of the equipment (e.g. bump stops).

For equipment where there is a gap or an opening during the range of movement of rigid parts, at any point is >230 mm the minimum closing gap shall be >60 mm so as not to pose a crushing hazard.

For pendulum parts, the required gap shall be achieved within 300 mm from the pivot point or 1/3 of the length of the pendulum part, whichever is the lesser (e.g. a leg swing) (see Figure 4). This shall be tested by the application of the foot probe as described in **4.2.8.5**.

Parts with parallel movement against other parts shall maintain a constant gap for the whole range of movement and shall not create or lead to any crush, shear or entrapment.

Where cables are used, sheaves shall be protected to prevent access by fingers, other parts of the body, hair, jewellery or clothing.

If cogs, belts or chains, etc. are used to transmit drive and where stop or restrictors are needed they shall be enclosed by bodywork, covers or cowlings. Access when undertaking maintenance to such parts shall only be possible with specialized tools.

Exercise equipment shall revert to a safe default position once the user has concluded their activity.

NOTE 2 *This is so a new/non-user does not experience sharp/unexpected equipment movement.*

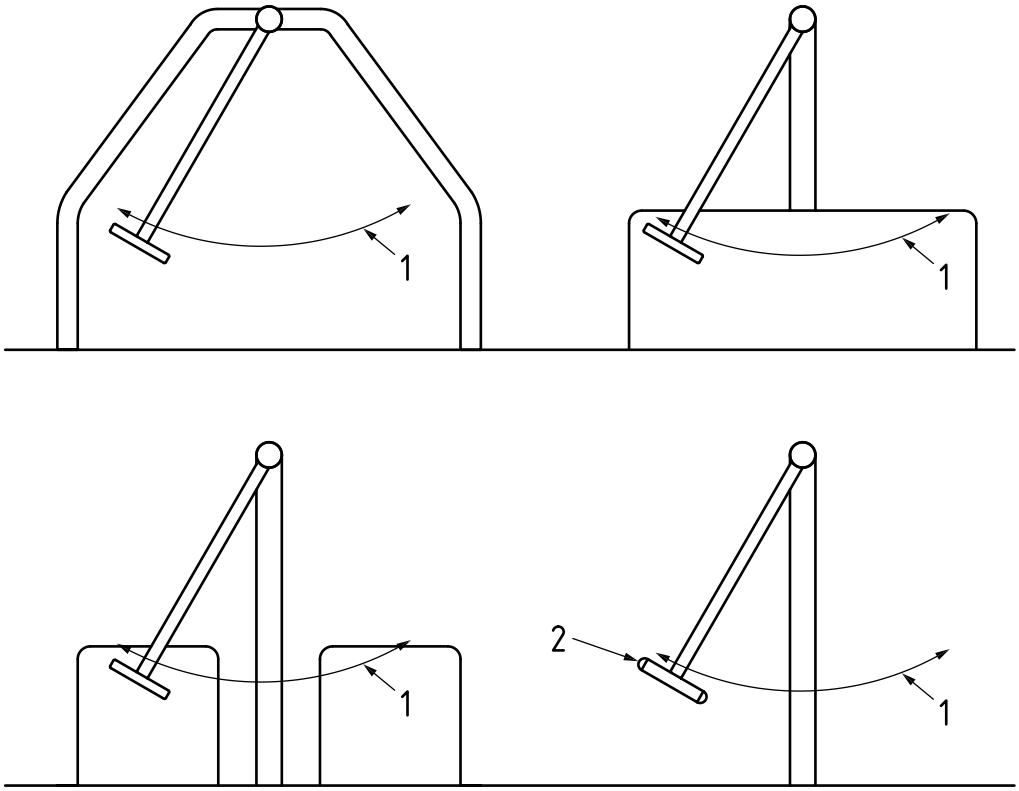
4.2.7.2 Pendulums

Unless tested for and meeting the requirements for impact attenuation (**4.2.9.7**), there shall be no unprotected pendulum movement.

Pendulum parts shall have a reliable restriction of the range <55° from the vertical (that does not create a crush, shear or entrapment potential). The extremes of that range shall protect the user and non-user, by a barrier, part of the frame bodywork or cover being placed to form a static protection beyond the limit of movement range (see Figure 4) or by impact attenuation (**4.2.9.7**).

NOTE *The swing of pendulum parts for some activities may be additionally limited to provide an appropriate limit of range for the intended exercise or user.*

Figure 4 – Examples showing protection from pendulum movement

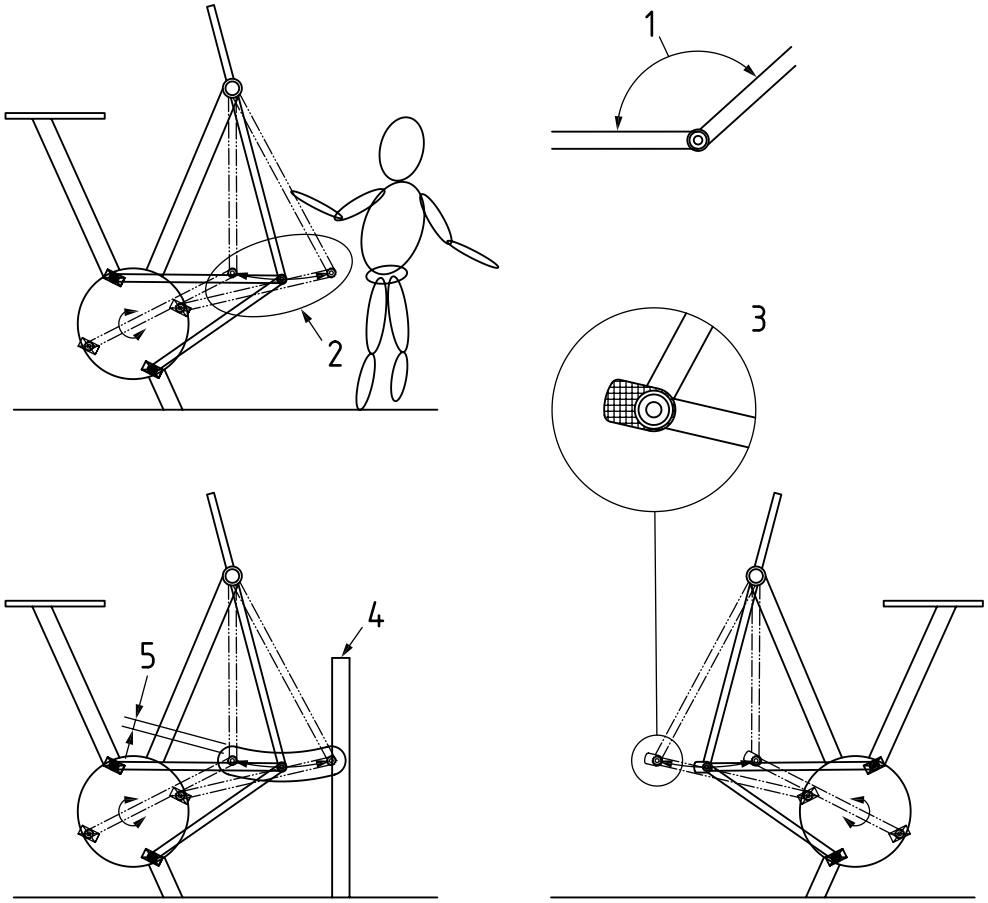


Key

1 Pendulum movement

2 Platform edges meeting impact attenuation requirements

Figure 5 – Protection from rigid reciprocating parts



Key
1 Protection not needed if joint >135°
2 Area of danger to users and non-users
3 Example of protection from reciprocating parts by impact attenuation
4 Example of fixed protection
5 Minimum 50 mm protected area

The range of swing of pendulum parts shall be limited to an appropriate range for the intended exercise.

4.2.7.3 Rigid reciprocating parts

Rigid reciprocating parts shall have the full range of movement of joints > 135° protected by the frame bodywork or covers in any part of the equipment so as to not endanger non-users of the equipment.

NOTE This is typically accepted to be at least 50 mm beyond the range of movement of the joint (see Figure 5).

4.2.7.4 Rotating parts

Rotating parts shall not cause a sheering action with adjacent stationary or moving parts.

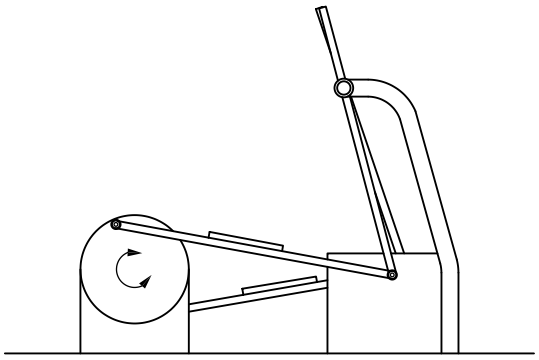
Rotating parts shall not be made by a crank or elliptical or offset disc without a minimum separation of >60 mm or the whole of the range of movement being protected by a centred plate or protective cover.

A centred plate or protective cover shall be at least 60% of the radius of the crank providing a constant gap for the whole rotation with a maximum permitted oscillation of ±3 mm between them. The distance between the crank and plate shall be either <8 mm or >60 mm (see Figure 6).

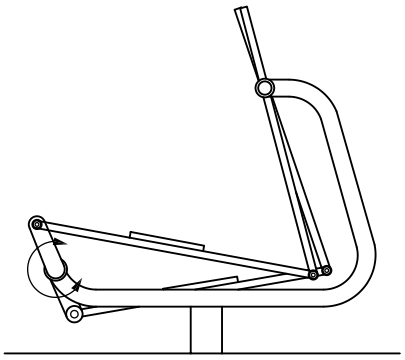
Rotating parts (wheels, shafts, axles, etc.) moving within a static body, cowling or cover shall maintain a constant gap at all times, and shall be designed so that hair, jewellery or clothing cannot be drawn into the opening or mechanism.

Figure 6 – Protection from rotating parts

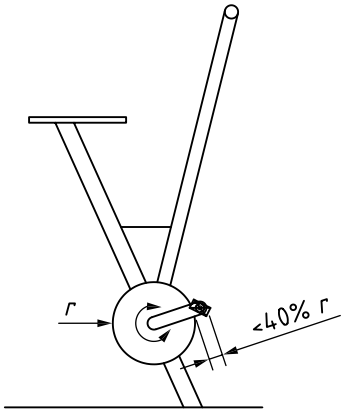
Dimensions in millimetres



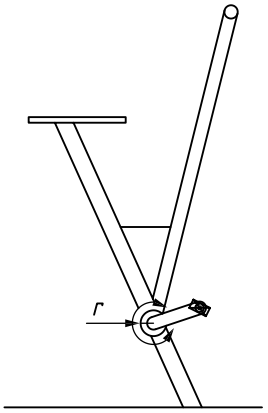
a) Full disk, with no or protected framework



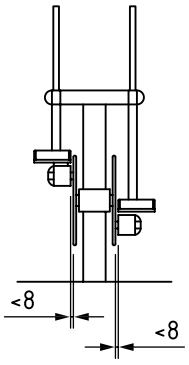
b) Crank [requires separations as g)]



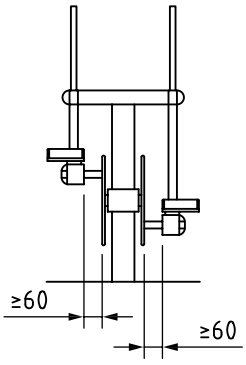
c) Partial disk and crank



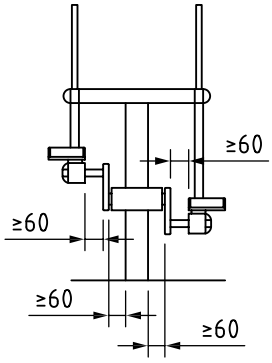
d) Crank [requires separations as g)]



e) Close mounted



f) Protected framework



g) Separation clearance to framework

4.2.8 Protection against entrapment

4.2.8.1 General

Openings shall have no parts that converge in the downward direction at an angle of less than 60°.

NOTE 1 *Test methods for entrapment are given in Annex F.*

NOTE 2 *Possible entrapment situations are illustrated in Annex G.*

4.2.8.2 Entrapment of the head and neck

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

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

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

Accessible completely bound openings with a lower edge more than 600 mm above ground shall be tested in accordance with **F.2.1**.

Probe C or E shall not pass through any opening unless it also allows the passage of the large head probe D (see **F.2.1**).

e) Partly bound and V-shaped openings:

   Partly bound and V-shaped openings with an entrance at 600 mm or more above the ground shall be constructed so that either:

   1) the opening is not accessible when tested in accordance with **F.2.2**; or
   2) if accessible at a position of 600 mm or more above ground when tested in accordance with **F.2.2**, depending on the angular orientation range of the opening (see Figure F.4), they shall conform to the following:
      - range 1 (template centre line ±45° from vertical): when the template apex contacts the base of the opening, the depth of the opening shall be less than the distance of the template to the underside of the shoulder section;
      - range 2 (template centre line from horizontal to +45°): 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;
      - range 3: No template test requirements.

f) Other openings (e.g. shearing or moving openings):
   - non-rigid members (e.g. ropes) shall not overlap if, by doing so, they create openings that do not conform to the requirements for completely bound openings.

4.2.8.3 Entrapment of clothing/hair

Equipment shall be constructed so as not to create hazardous situations, including:

a) gaps or V-shaped openings in which a part of clothing or hair could become trapped while or immediately before the user is undergoing a forced movement;
b) protrusions; and
c) spindles/rotating parts in which clothing or hair entrapment could be encountered.

The toggle test as described in **F.3** shall be applied to situations where users are able to climb, hang, lay sit or stand in an elevated position such that they would not be able to support and free themselves if clothing or hair became entrapped. The test shall be applied only at heights >1 000 mm, unless the movement is linear and >1 000 mm in range, when the test shall extend down to the height of the supporting structure

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

Equipment shall be constructed so that openings located within the movement space do not trap the toggle when tested in accordance with **F.3**.

NOTE 1 *The toggle test (see **F.3**) is restricted to the movement space, as practical experience has shown that natural materials and connections between different parts can vary over time. The definition of movement space (see **3.34**) does not include the three-dimensional area in which the falling movement takes place.*

NOTE 2 *This can be achieved by use of spacers or similar devices to connections.*

4.2.8.4 Entrapment of the whole body

Equipment shall be constructed so that the following hazardous situations, which might cause entrapment, are not created:

a) voids or spaces into which children can crawl with their whole body not specifically designed to be occupied;

b) suspended parts which are heavy or have rigid suspension (parts shall be considered as heavy if their combined unladen mass exceeds 38 kg);

c) parts with movement where a falling user or non-user could be injured.

4.2.8.5 Entrapment of the foot or leg

Equipment shall be constructed so that the following hazardous situations, which might cause entrapment, are not created:

a) completely bound rigid openings in surfaces on which users can walk, run or climb; and

b) footholds, handholds, etc. extending from these surfaces.

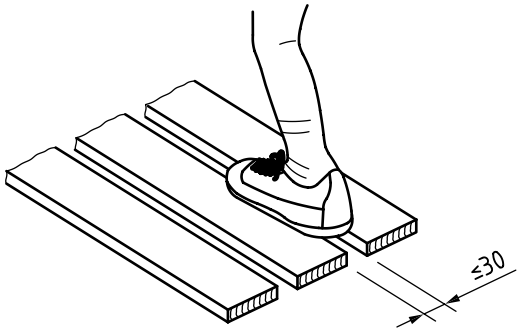
NOTE *In the case of b), the entrapped foot or ankle can be severely injured if the user falls.*

Where there is movement between parts intended for standing and adjacent parts, there shall be no gaps >8 mm or <60 mm between the parts parallel to the direction of the movement.

Static surfaces intended for running or walking shall not contain gaps likely to cause foot or leg entrapment, gaps in the main direction of travel shall not be greater than 30 mm when measured across the direction of travel (see Figure 7). This requirement shall not apply to surfaces inclined more than 45°.

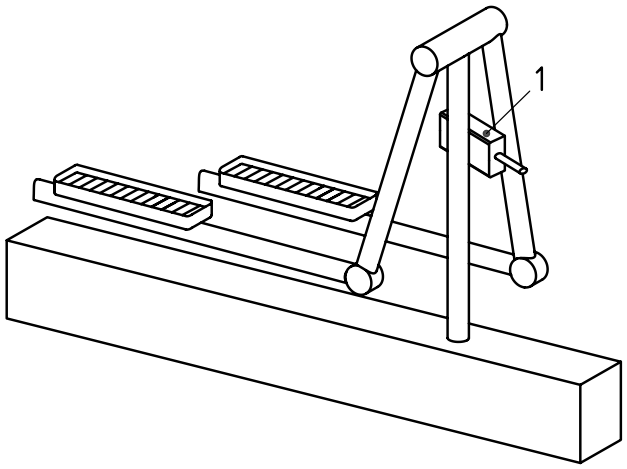
Figure 7 – Measurement of gaps limited to 30 mm

Dimensions in millimetres



Within a 500 mm range of any standing surface (including the ground), footplate, footrest or pedal, the foot probe (see Annex E) shall be applied up to the full depth of 200 mm in any direction or rotation (offering a flat surfaces of the probe to the tested part) to all moving parts and changing openings. In any tested position, the probe shall not become trapped by moving parts (see Figure 8).

Figure 8 – Testing for foot entrapments within 500 mm range of a standing surface



Key

1 Probe applied up to 500 mm from any standing surface

4.2.8.6 Entrapment of fingers

Equipment shall be constructed so that the following hazardous situations, which might cause finger entrapment, are not created:

a) gaps in which fingers can be trapped whilst the remainder of the body is moving or continues in forced movement, for example lifting or rotating; and

b) variable gaps (excluding chains).

Openings within the movement space, where the user is subjected to forced movement, or holes that have a lower edge more than 1 000 mm above the minimum or falling space, when tested in accordance with **F.4**, shall conform to one of the following requirements:

1) the 8 mm finger rod (see Figure F.10) 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 **F.4.2**; or

2) if the 8 mm finger rod passes through the opening, the 25 mm finger rod (see Figure F.10) shall also pass through the opening, provided that the opening does not permit access to another finger entrapment site or moving parts that could crush.

The ends of tubes and pipes shall be closed off to prevent the risk of finger entrapment.

The closures shall not be removable without using tools.

Gaps whose dimensions change during use of the equipment shall have a minimum dimension in any position of 12 mm.

4.2.9 Protection against injuries during movement and falling

4.2.9.1 Determination of free height of fall

Unless stated otherwise, the free height of fall shall be as given in Table 1. In determining the free height of fall, the possible movements of the equipment and of the user shall be taken into account.

NOTE *In general, this means that the maximum range of movement of the equipment will be taken.*

The free height of fall shall not exceed 3 000 mm (see Figure 9).

Figure 9 – Examples showing free height of fall

Dimensions in millimetres

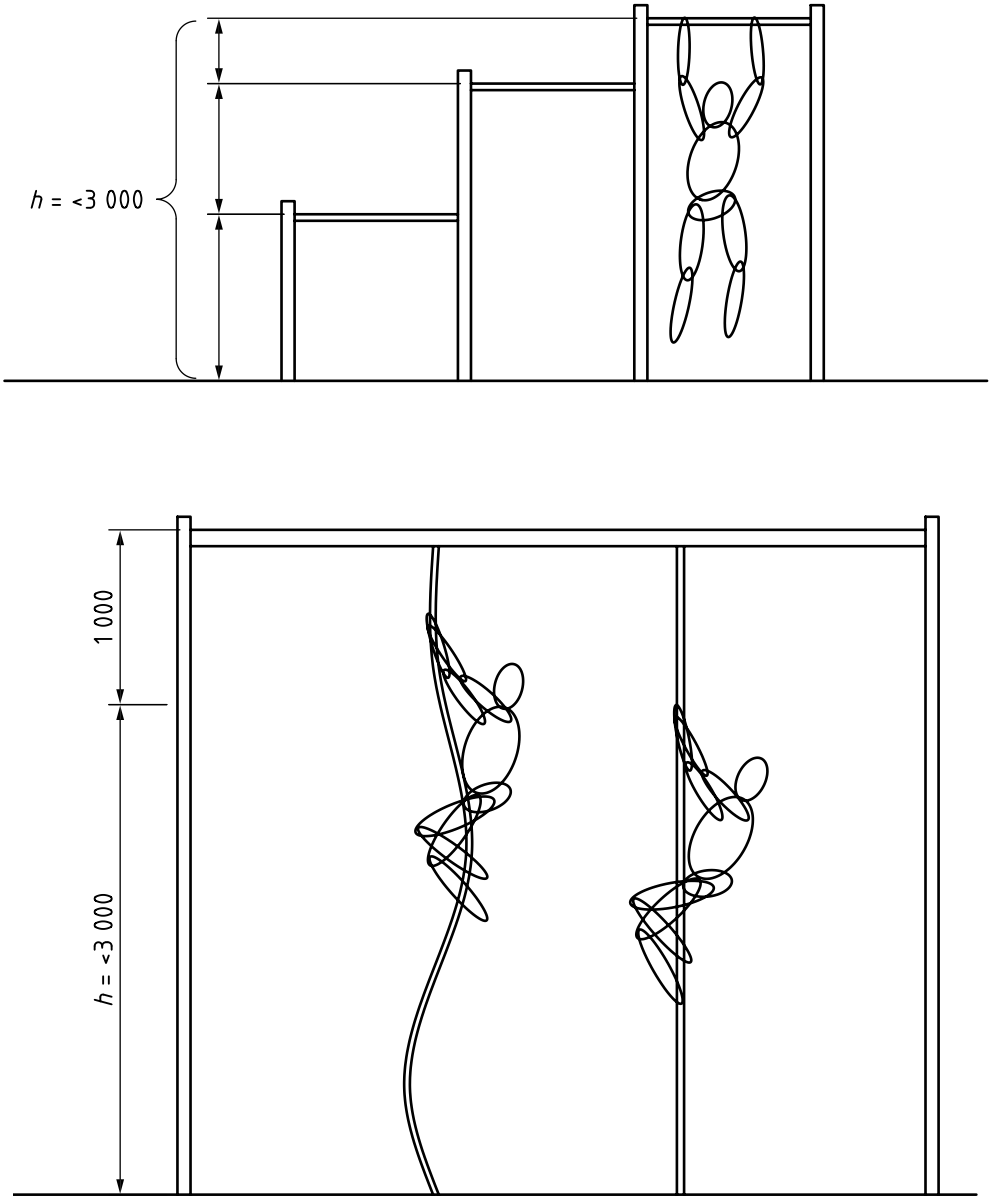


Table 1 – Types of use and free height of fall

Type of use	Vertical distance
Standing	From foot support to surface below
Sitting	From seat to surface below
Hanging (When full body support is provided by the hands only and the whole body can be lifted up to the hand support, see Figure 9)	From hand support height to surface below
Climbing [A)] (When body support is a combination of feet/ legs and hands, e.g. climbing rope)	Maximum foot support: 3 000 mm to the surface below Maximum hand support: 4 000 mm to the surface below (Free height of fall measured from maximum hand support minus 1 000 mm to the surface below)
[A)] Such equipment constructed for climbing shall not allow access to positions with a free height of fall of more than 3 000 mm.	

4.2.9.2 Movement space

This space is represented by a series of cylindrical spaces within which a user and their movement is considered, see Figure 10 a) to d). Each cylindrical space extends throughout the range of movement available.

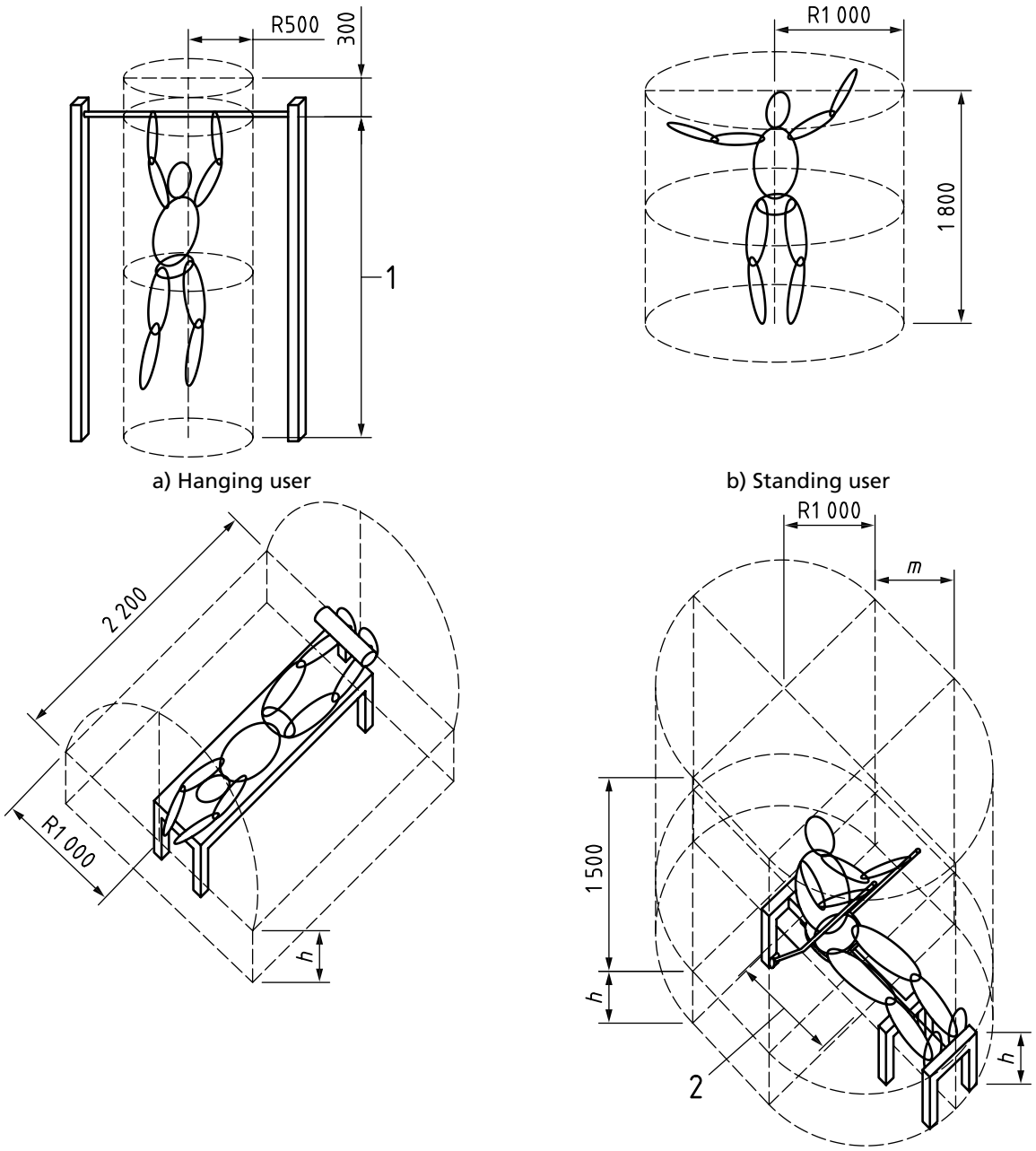
Dimensions of the cylinder are given in Table 2 for specification of the movement space.

In determining the movement space requirements, the movements of the equipment and user shall be taken into account.

Movement spaces for outdoor exercise equipment with multiple user stations may overlap as long as no dangerous situations result (see Figure 10).

Figure 10 – Determination of the movement space; multiple user positions and with moving positions

Dimensions in millimetres



a) Hanging user

b) Standing user

c) Laying user

d) Sitting user with moving position

Key

1 Surface to hanging point

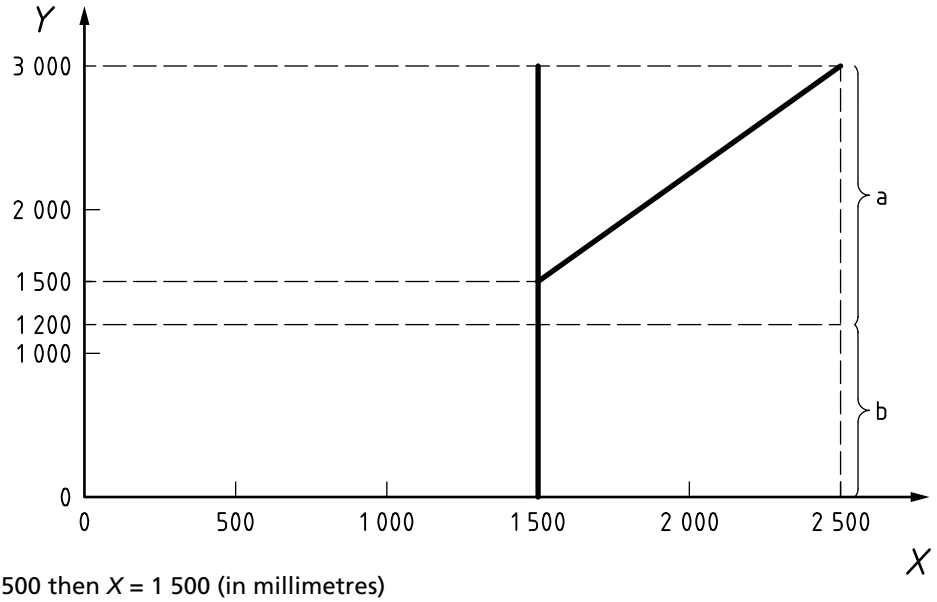
2 *m* = range of movement (seat)

NOTE 1 *The cylindrical space is shown in Figure 10, and its dimensions are given in Table 2. In determining the movement space, the possible movements of the equipment and the user should be taken into account.*

NOTE 2 *Consideration should be given when positioning equipment to provide and maintain a minimum of 2 000 mm clearance above and around the equipment from tree branches and other foliage or obstructions.*

Figure 11 – Extent of the impact area

Dimensions in millimetres



If $Y \geq 1\,200 \leq 1\,500$ then $X = 1\,500$ (in millimetres)

If Y is hanging use only (no foot support) > 1 500 then X remains 1 500

If $Y > 1\,500$ then $X = 2/3Y + 500$ in all other cases

Key

Y free height of fall

X minimum dimension of impact area

a impact attenuating surface with requirements (see **4.2.9.7.2**)

b surface with no requirements, unless there is forced movement (see **4.2.9.7.3**)

Table 2 – Dimensions of the cylinder for the determination of the movement space (Dimensions in millimetres)

Type of use	Radius	Height
Hanging	500	300 above and to surface below hanging grip position
Standing	1 000	1 800
Laying	1 000	1 000 plus support height
Sitting	1 000	1 500 plus seat height
NOTE *In case of hanging, 300 mm is added over the hanging point because of the possibility that the users can pull themselves up (see Figure 12a)*		

4.2.9.3 Extent of the impact area

The dimensions of the impact area shall beas shown in *Figure 11*.

NOTE *Equipment requiring impact-attenuating surfaces is described in* ***4.2.9****.*

4.2.9.4 Extent of the falling space

For equipment described in **4.2.9** or unless otherwise specified, the extent of the falling space shall be at least 1 500 mm around elevated parts of the equipment, measured horizontally and extending from the vertical projection plane below the equipment.

For equipment where hanging use only is possible, falling space is a cylinder around and under the user radiating 1 500 mm from vertically below the extent of the hanging part(s).

In all other instances the falling space shall increase for free heights of fall above 1 500 mm, together with the extent of the impact area (see **4.2.9.3**).

NOTE 1 *Equipment not having a movement space requirement can be modified or designed to be located against or mounted on a wall or other flat vertical structure, provided this does not compromise the activity or create any failure of this PAS.*

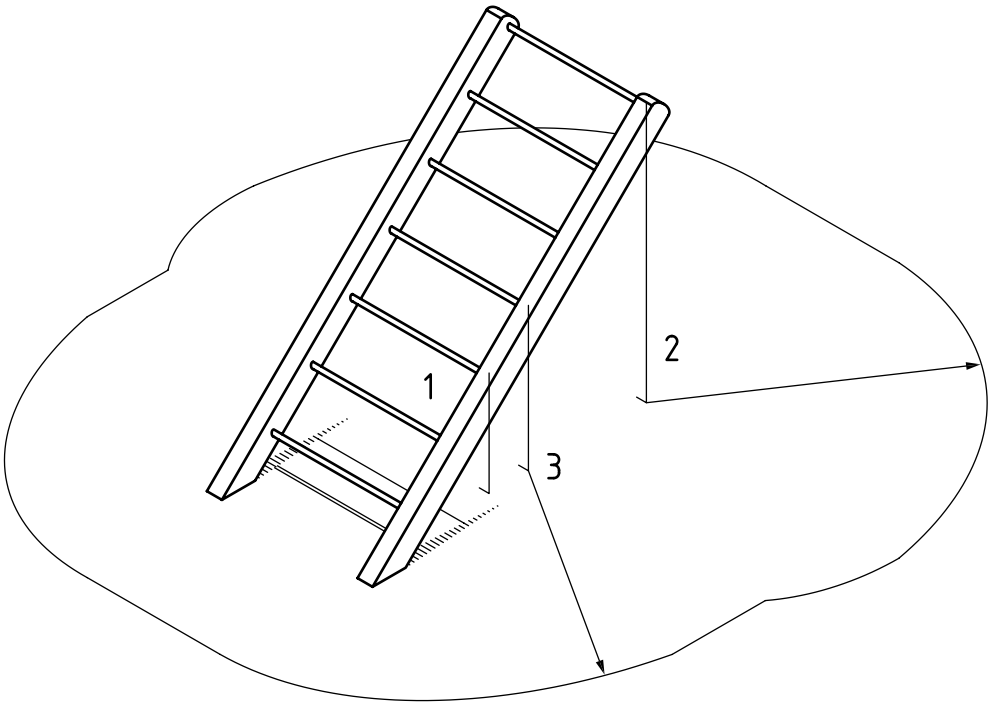
NOTE 2 *This requirement can be varied in certain cases (e.g. increased in the case of forced movement, or reduced in the case of equipment installed on or against a wall or fully enclosed equipment).*

NOTE 3 *In most cases there will be overlapping of falling spaces, including impact areas. Unless specified in other parts of this PAS, overlapping of the falling space where forced movement exists shall not occur.*

NOTE 4 *Examples of falling space are given in Figures 12 and 13.*

Figure 12 – Example of increased falling space where outward fall is possible

Dimensions in millimetres

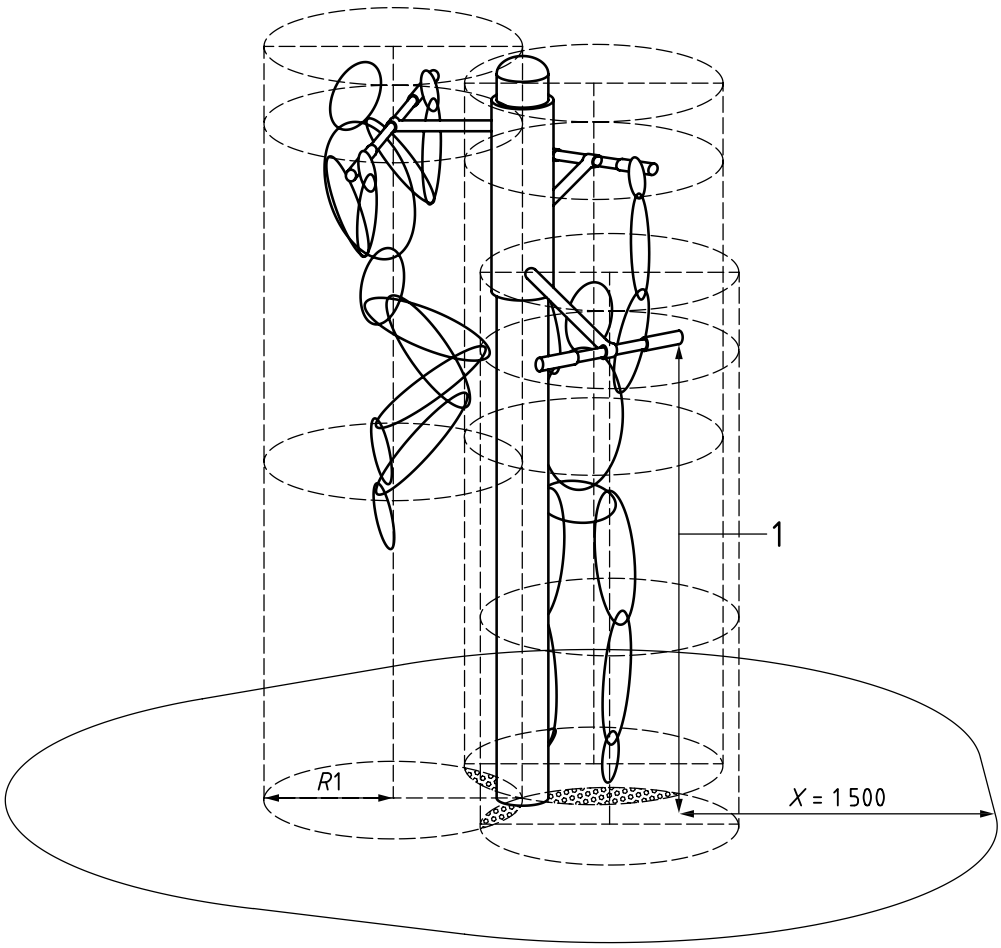


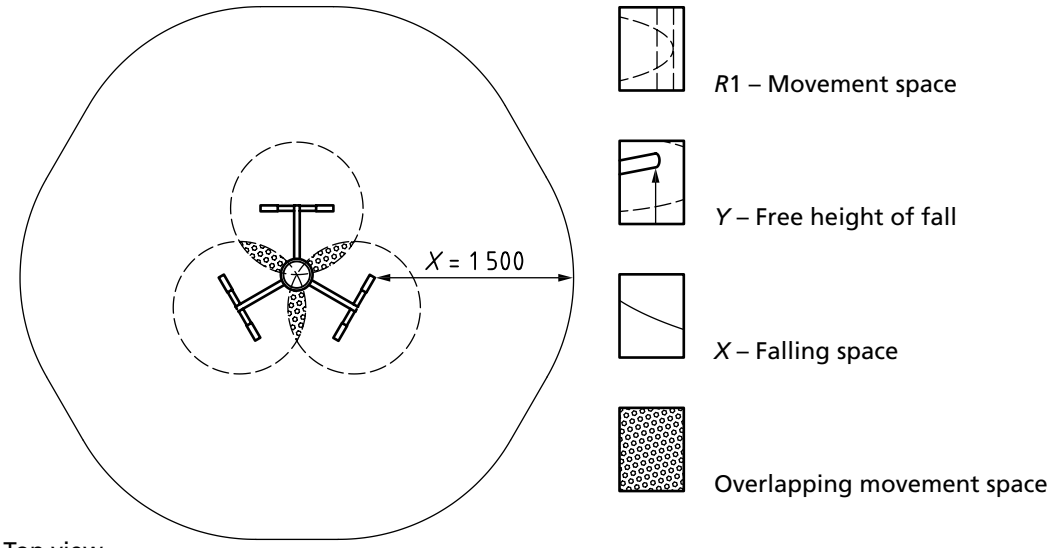
Key

1 Y = <1 200 then X = 0
2 Y = >1 500 then X = 2/3 Y + 500
3 Y = >1 200 <1 500 then X = 1 500
Y free height of fall
X minimum dimension of impact area

Figure 13 – Example of movement space and falling space where activities are in combination, vertical fall only

Dimensions in millimetres





a) Top view

Key

1 $Y > 1\,200 < 3\,000$ hanging use (vertical fall) only = X 1 500 from extent of hanging points

4.2.9.5 Protection against injuries in the movement space for users undergoing a movement that is forced by the equipment

Unless stated otherwise, there shall be no overlapping of adjacent movement spaces, or of movement space and falling space.

The movement space shall not contain any obstacles that interfere with the passage of a user whilst undergoing a forced movement (e.g. tree branches, ropes, cross beams). Parts of the equipment bearing or containing the user, or helping the user to keep balance, shall be permitted within the movement space (e.g. brace structures for dips).

The movement space shall not be intersected by main travelling routes at, or through, the area (e.g. pedestrian pathway).

4.2.9.6 Protection against injuries in the falling space

The falling space shall not con/tain any obstacles onto which a user could fall and cause injuries (e.g. posts not flush with adjacent parts or exposed foundations).

***NOTE** The following parts of equipment may be in the falling space:*

a) adjacent parts of the equipment with a difference in free height of fall of less than 600 mm;

b) parts of the equipment bearing or containing the user, or helping the user to keep balance;

c) parts of the equipment with an inclination of 60° or more from the horizontal.

The falling space may contain load-bearing structural components within a 300 mm radius from the centreline or framework necessary to provide stability to the item and meeting all other requirements of this PAS.

4.2.9.7 Protection against injuries from the surface of the impact area

4.2.9.7.1 General

The surface of the impact area shall be free from sharp-edged parts or projections and shall be installed without creating any entrapment situation (see **4.2.8**).

If loose particulate material is used, it shall be installed to a layer thickness of 100 mm more than that determined by testing to BS EN 1177 to achieve the required critical fall height.

***NOTE** This is to allow for displacement through use.*

4.2.9.7.2 Equipment (as described in 4.2.9) with a free height of fall greater than 1 200 mm (1 500 mm where described)

Beneath all equipment with a free height of fall of more than 1 200 mm (1 500 mm where described), there shall be impact-attenuating surfacing over the entire impact area.

The critical fall height of the surfacing shall be equal to, or greater than, the free height of fall of the equipment.

***NOTE 1** Examples of commonly used impact-attenuating materials are given in Table 3 with the related critical fall heights, tested in accordance with BS EN 1177 and measured partly onsite and partly in the laboratory with different test conditions.*

For material specifications and thicknesses not covered by Table 3, BS EN 1177 shall be used as the method of test for the determination of the critical fall height.

***NOTE 2** The extent of the impact area is given in Figure 12.*

***NOTE 3** Loose material surfaces are not recommended for equipment as they tend to migrate from high-wear areas and can become incorporated into mechanisms leading to high wear and even jams.*

***NOTE 4** Turf without additional reinforcement or stabilization is not recommended for publicly accessible outdoor exercise equipment as it is prone to high wear and panning at entry and exit points.*

Turf as well as having aesthetic appeal also has some useful impact-attenuating properties. Experience has shown that, if well maintained, it is normally effective for fall heights up to 1 000 mm and can be used without the need to conduct a test. For fall heights above 1 000 mm, the performance of turf as an impact-attenuating surface is dependent upon local climatic conditions.

Turf alone can easily become worn and compacted in areas of high wear; this should be considered where moderate or high levels of use are anticipated.

***NOTE 5** Impact-attenuating materials are tested under specific conditions; therefore the performance of these materials may vary in use (e.g. materials under frozen conditions).*

***NOTE 6** Impact-attenuating materials should be adequately maintained. Failure to maintain such surfaces will result in the impact attenuation being significantly reduced.*

Table 3 – Examples of commonly used impact-attenuating materials, depths and corresponding critical fall heights

Material [A]	Description	Minimum depth [B] (mm)	Critical fall height (mm)
Turf/topsoil			≤1 000 [D]
Bark	20 to 80 grain size	200	≤2 000
		300	≤3 000
Woodchip	5 to 30 grain size	200	≤2 000
		300	≤3 000
Sand [C]	0.2 to 2 grain size	200	≤2 000
		300	≤3 000
Gravel [C]	2 to 8 grain size	200	≤2 000
		300	≤3 000
Other materials and other depths Wetpour Tiles Carpet Grass matting	As tested to HIC (see BS EN 1177)		Critical fall height as tested

NOTE Materials in red are not particularly appropriate for publicly accessible outdoor fitness equipment sites.

[A] Materials properly prepared for use in publicly accessible outdoor exercise sites.

[B] For loose particulate material, add 100 mm to the minimum depth to compensate for displacement

[C] No silty or clay particles. Grain size can be identified by use of a sieve test, such as BS EN 933-1.

[D] See NOTE 1 in **4.2.9.7.2.**

4.2.9.8.3 Equipment with a free height of fall not exceeding 1 200 mm

It shall not be necessary to provide or test the critical fall height of a surface beneath publicly accessible outdoor exercise equipment having a free fall height of less than 1 200 mm (1 500 mm where described).

4.2.9.9 Adjacent platforms

If the free height of fall between adjacent platforms is more than 1 200 mm, the upper surface of the lower platform shall present the necessary impact-attenuating properties.

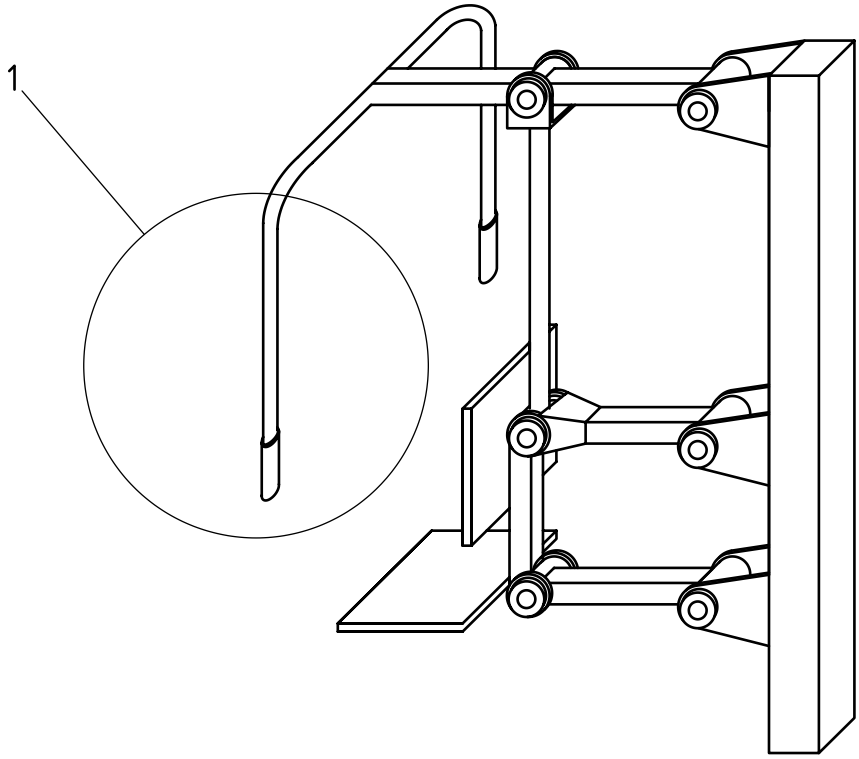
4.2.9.10 Protection against injuries due to other types of movement

The space in, on or around the equipment that can be occupied by the user shall not contain any obstacles that the user is not likely to expect and that could cause injuries if hit by the user. It may be necessary for the intended exercise to be completed for parts of the equipment to project from the item for some or all of the time.

NOTE 1 Where such parts are necessary, bright or contrasting colours should be used to make them as visible as possible.

NOTE 2 Examples of such obstacles are shown in Figure 14.

Figure 14 – Example of necessary protruding part



Key
1 Example of a protruding part of equipment that is required for the function of the item

4.2.10 Chains

Chains, when new, (unless fully enclosed) shall conform to BS ISO 1834 as a minimum and shall have a maximum opening of 8.6 mm in any one direction except where connections are made, where the maximum opening shall be greater than 12 mm or less than 8.6 mm. Chains shall be replaced when a third of the thickness of the material is worn off.

4.2.11 Protection against injuries from friction-generated heat

Parts designed to produce resistance to the user for the purpose of the exercise or to provide a stopping force may become heated through repeated use. Testing shall identify any components where heating may become a factor, and protection shall be put in place to prevent hazardous heat transmission to any part of the equipment the user may come into contact with.

NOTE *Parts such as friction devices, hydraulic or gas struts subject to heating may require ventilation and heat sinks etc. to allow suitable cooling, particularly during periods of hot weather.*

4.2.12 Protection against injuries from other site factors

4.2.12.1 Determination of spaces and areas

Outdoor exercise equipment shall not be placed within defined children's playground areas.

NOTE *In particular, the attention of the designer is directed to possible hazards associated with the close proximity of children's play areas designed for under 8 years of age. Some clear separation such as fencing, mounds, pathway or landscaping is recommended.*

5 Specific requirements

5.1 Strength training equipment, presses, benches, barbells, etc.

For lifted loads, it shall not be possible for the mechanism to drop below the starting position.

Loads forced downwards during the exercise shall self-return to the raised position if released.

Loads shall remain consistent throughout the range of movement of the exercise to the point a stop is reached.

NOTE *Where appropriate, the return can be assisted (e.g. by a gas damper), to allow the muscles to recover.*

For benches and barbells where loads are predetermined or dynamic, the range of movement shall at all times be by control arms or contained within a track or tracks; these shall not give rise to the creation of any entrapment potential. Access to remove the weight or bar shall only be possible with specialized tools.

5.2 Stationary exercise bicycles, hand bikes and other cranked machines

In every example, it shall be easy for the user to stop the mechanism, from a safe working speed, within 180° rotation of the crank. If the mechanism drives a flywheel or other inertia device, the drive shall be in only one direction and a free-wheel mechanism shall be incorporated. Flywheels and other inertia devices shall be fully enclosed; access shall be prevented to any hazardous part of the mechanism.

Inertia shall be measured at the stub axle, pedal, handle or rim and limited to 5 kg.m^2 for upper body cranks or 15 kg·m^2 for lower body cranks.

Pedal straps or toe cups for the feet are permitted but shall not create or lead to any entrapment (see **4.2.8**).

5.3 Running surfaces

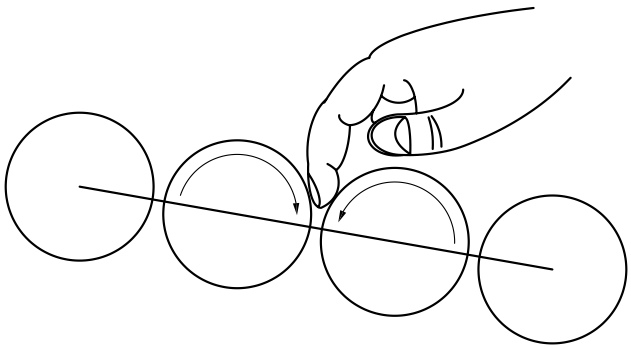
5.3.1 General

Running surfaces that use continuous belts, chains, wheels or rollers shall not be driven but moved solely by user input. This equipment shall be designed and installed to avoid "pull-in" between parts.

NOTE 1 *Surface gaps should be <4 mm in at least one direction. If wheels or rollers form the running surface, they should have a maximum diameter of 65 mm.*

NOTE 2 *Pull-in is where rotating or moving parts draw clothing, hair or body parts into the assembly an example is given in Figure 15.*

Figure 15 – Example of "pull-in" between moving parts



5.3.2 Footplates

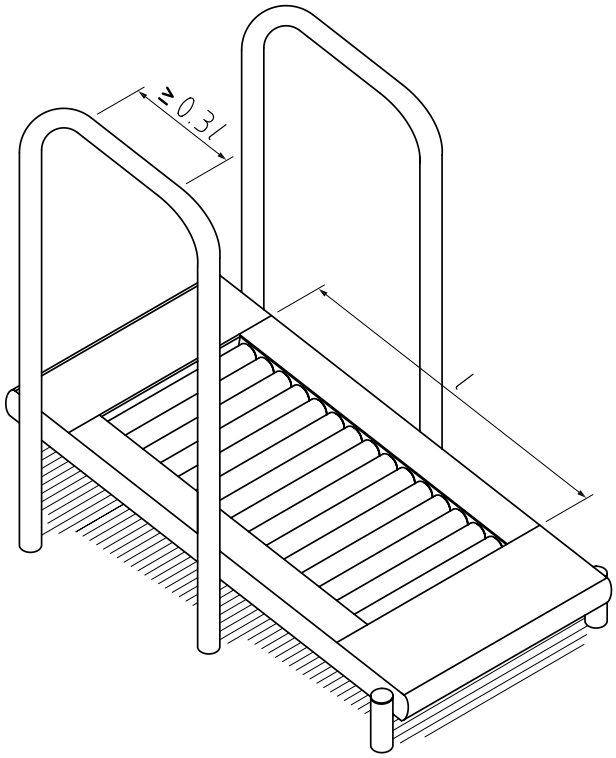
Running surfaces shall be equipped with footplates to the sides and optionally to the ends (see Figure 16), to enable a user to step immediately to a stationary part of the equipment in use. These footplates shall be ±12.5 mm to the adjacent running surface height.

Footplates shall have at least the same length as the running surface and have a minimum width of 80 mm to the sides and 100 mm to the ends if provided.

The footplates shall have a non-slip surface.

NOTE *The side handrails may be attached to the footplates.*

Figure 16 – Example of running surface stationary footplates and handrails



Key
l Length

5.3.3 Side handrails/front handlebar

Running surfaces shall be equipped with side handrails or front handlebar, or both, for user support and emergency dismount.

The front handlebar shall:

a) have a minimum width equal to the running surface equidistant to the longitudinal axis of the running surface;

b) be at a height above the running surface which is comfortable to be grasped by the user.

The side handrails shall have a maximum separation of, and at a height which is comfortable to be grasped by the user.

The length of each side handrail shall not be less than 30% of the length (l) of running surfaces (see Figure 16, where only side handrails are fitted).

5.4 Rowing machines

Where tracks are used for moving parts such as seats, guards shall be required to prevent access or entrapment. In rowing machines where the handle is connected to the machine by a flexible member (e.g. rope, belt or chain), the handle shall have a controlled return. The equipment shall be designed so as to revert to a safe default position (see **4.2.7.1**)

5.5 Steppers, stair climbers and climbers

Adjacent moving parts such as footplates and their supporting parts shall be suitably separated by distance or by a fixed part of bodywork or cover to prevent any entrapment, crush or shear, as described in Clause **4**.

5.6 Elliptical trainers and similar machines

5.6.1 General

In every example, it shall be easy for the user to stop the mechanism, from a safe working speed, within 180° rotation of the crank or one half of the ellipse covered by the footplate. If the mechanism drives a flywheel or other inertia device, the drive shall be in only one direction and a free-wheel mechanism shall be incorporated. Flywheels and other inertia devices shall be fully enclosed; access shall be prevented to any hazardous part of the mechanism.

Inertia shall be measured at the stub axle or rim and limited 15 kg.m^2.

There shall either be continuous bodywork or covers maintaining a constant gap to the moving footplates, and linking parts or the area between the footplates shall be free of hazards at every part of the range of movement, or a separation as defined in **4.2.7.4**.

NOTE *A single tube or spine between the footplates is likely to be passed by the footplate in the range of movement creating a shearing action on each pass, additionally a stationary tube or spine could encourage standing in a hazardous area*

5.6.2 Footplates

The footplates shall have a non-slip surface meeting the size requirements of **4.2.1**.

Footplates shall be protected with a raised guard at least 30 mm high along 60% of the inside edge and the front edge in every instance and the full length of the inside edge when there is no bodywork or cover between adjacent moving parts.

5.7 Climbing items

Items specifically designed for climbing such as a single pole or rope shall be provided with a maximum handhold height of 4 000 mm and a highest foot support not higher than 3 000 mm.

Multiple elements can be placed on a single structure provided that, where there is a movement space requirement, the individual movement space of each element shall not overlap with the free or falling space of another.

5.8 Large wheels

5.8.1 Large wheels and discs

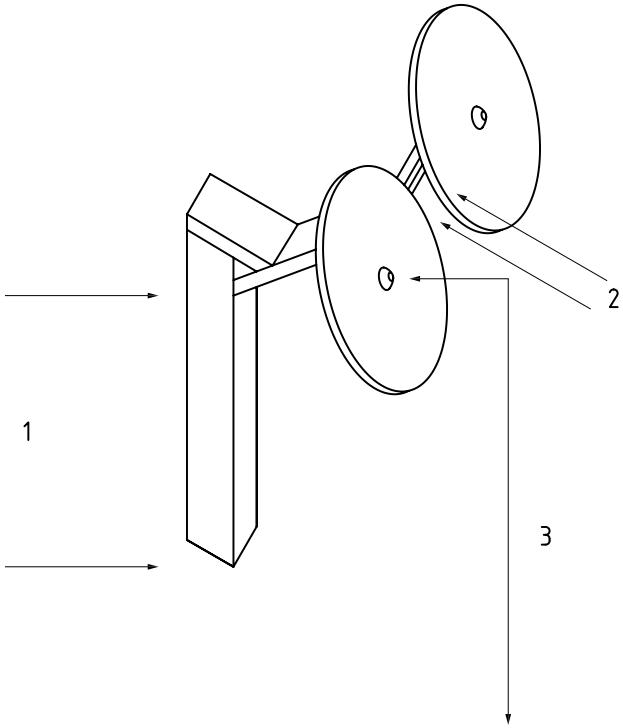
Wheels and discs may have grip, grasp or foot support parts added to one or both faces, provided that this does not create a crush, shear or entrapment.

NOTE Large wheels and discs >200 mm radius should be fully in-filled, to prevent insertion of whole or part of the body, through the whole thickness of the wheel or disc.

5.8.2 T'ai chi discs

The paired discs of T'ai chi machines with centres >1 200 m above the standing surface may be positioned so that paired discs have a closing gap between the disc edges of <230 mm, provided the supporting structure offers no climbable supporting parts (horizontal or near horizontal) for at least 1 000 mm of the vertical structure (see Figure 17). This shall not be considered a failure of **4.2.8.2** when these requirements are met.

Figure 17 – T'ai Chi disc exemption of 4.2.8.2



Key

1 >1 000 mm clear to supporting structure
2 <230 mm
3 >1 200 mm to centres from standing surface

6 Claims of compliance with this PAS

Unless otherwise specified the requirements of Clauses **4** and **5** shall be verified by measurement, visual examination or practical tests (see Annex E) to establish the compliance of the design of the equipment and its suitability for the designed use.

NOTE *Details of acceptable claims of conformity to this PAS, based on an organization's responsibility, are given in Annex A.*

Before testing, the equipment shall be assembled and fixed in accordance with the manufacturer's instructions and to the satisfaction of the manufacturer into a condition similar to its position of use.

Test reports shall be completed separately for each item or model in a range and will include the following:

a) name of the person(s) or organization undertaking the testing and accreditation details and status, date, time(s) and duration of the tests;

b) number and date of this specification, i.e. PAS 888:2013;

c) details of the equipment tested, including name, model number and revisions;

d) details of the condition of the equipment, including any defects observed before the testing;

e) details of any change in the condition of the equipment observed after the testing;

f) test results.

7 Information for users and identification marking

7.1 General

User information shall be:

a) placed in a suitable location on the item of equipment and; or:

b) provided on a free-standing information panel adjacent to the item of equipment in a position that does not interfere with the safe use of the item, with free and or falling space requirements or with any other equipment; or

c) provided on a single information panel giving information for all of the equipment on a site (not suitable if equipment is spaced out over large distances within a site).

***NOTE** It is not always practical to provide full user information on every item; some equipment has a minimal structure or may be too low for information to be presented in an accessible way (e.g. push-ups frame, step beam or step-up block).*

7.2 Information for users

7.2.1 Positioning and accessibility

User information shall be provided such that the relevant information is contained between the height of 700 mm and 1 800 mm above ground, in a location free from obstacles.

All written user information shall be provided in a clear font with markings a minimum of 15 mm high.

***NOTE 1** Ideally, information should be tactile and raised by 400 microns (200 microns minimum), engraved or relief moulded.*

All text shall be horizontal and not wrapped around graphic elements, with lines spaced apart by 1.5 times the font size.

There shall be significant colour contrast to the information provided to the background, and patterned backgrounds shall not interfere with the information by the use of a minimum 10 mm border in the main background colour.

***NOTE 2** All requirements concerning visibility of signage is extracted from the Inclusive Fitness Initiative.*

7.2.2 Minimum content

Information provided shall demonstrate the intended primary exercise, with at least starting and finishing pictograms (except for cyclical exercises, where a single image shall suffice).

Other information shall include as a minimum:

a) the name of the item and the purpose of the primary exercise(s);

b) the maximum intended occupancy and load;

c) a guide to the number of repetitions for beginner, average and advanced users;

d) additional advisory statements to cover the following issues:

- if this equipment appears to be damaged in any way, do not use it;
- only use the equipment if you think you can do so safely;
- never let other people use the equipment at the same time as you (unless the item is designed for multiple use, in which case the maximum safe number of users is stated);
- do not put or carry babies or children on the equipment with you;
- this equipment should only be used as indicated in the information panel;
- stop using the equipment if you become tired or lose concentration;
- do not use this equipment if you are pregnant or have an injury or medical condition, without advice from a doctor;
- do not use this equipment under the influence of alcohol or other drugs;
- do not remove this label.

7.3 Identification marking

Every item of equipment shall be marked for identification legibly, permanently and in a position visible to the viewer whilst standing on the ground, including as a minimum:

a) the name and address or website of the manufacturer or authorized representative;

b) the equipment reference number/code and year of manufacture; and

c) the number and date of this specification, i.e. PAS 888:2013.

8 Information provided by the manufacturer

8.1 General

The manufacturer shall provide written instructions in English.

Information shall be printed legibly.

NOTE 1 *Installation instructions should be supplied in laminated form to protect them from the weather and damage on site.*

NOTE 2 *Illustrations should be used to demonstrate equipment and its parts, use(s), access, installation, etc.*

Information shall include as a minimum:

a) definition of intended user;
b) minimum installed space;
c) surfacing requirements (including free height of fall and extent of surfacing, where needed);
d) overall dimensions of the largest part(s);
e) total mass of the equipment including mass of the heaviest part/section in kilograms;
f) details of the installation, operation, inspection and maintenance of the equipment;
g) a highlighted note drawing the operator's attention to the need to increase inspection/maintenance if the equipment is subject to heavy use, particularly if its stability relies on a single post;
h) declaration of conformity with this PAS.

NOTE *The manufacturer should supply copies of test reports to operators upon request.*

8.2 Installation information

The manufacturer shall supply to the operator (for information of the installer) an equipment delivery parts list.

The manufacturer shall supply installation instructions for the correct assembly, erection and placing of the equipment. This information shall include, at a minimum:

a) minimum space requirements between equipment;
b) equipment and parts identification;
c) erection sequence (assembly instruction and installation details);
d) matching aids where necessary (e.g. signs on parts accompanied by appropriate instructions);
e) need for any special tools, lifting devices, templates or other assembly aids to be used and any precautionary measures to be taken. Where necessary, torque values shall be given;
f) construction space required to install the item of equipment;
g) orientation, if necessary, in relation to sun and wind;
h) details of the required foundation, under normal conditions, anchorage in the ground and the design and location of the foundation;

NOTE *Care should be taken concerning abnormal conditions.*

i) free height of fall (for impact attenuation surfacing needs);
j) need for and details of the application of any painting or treatment; and
k) removal of assembly aids before the equipment is used.

8.3 Maintenance and inspection instructions

8.3.1 Instructions for maintenance

The manufacturer shall provide instructions for maintenance (marked with the number of this PAS), which shall include a statement that the frequency of maintenance will vary with the type of equipment (e.g. large numbers of moving parts), materials used or other factors (e.g. frequency of use, coastal location or air pollution).

The manufacturer shall provide instructions necessary for maintenance, inspection and checking of correct operation and, when appropriate, repair of the equipment.

8.3.2 Instructions for frequency of inspections

The instructions shall specify the frequency with which the equipment or its components should be inspected and shall include guidance on the following, where relevant:

a) routine visual inspection (see **3.46**);

b) operational inspection (see **3.39**). This shall be as indicated by the manufacturer's instruction;

c) annual main inspection (see **3.1**).

Special attention shall be given to "sealed-for-life" parts and equipment where there are a large number of moving parts.

NOTE 1 *For publicly accessible outdoor equipment subject to potential heavy use or vandalism, daily inspection of this type may be necessary.*

NOTE 2 *Examples of visual and operational inspection points are: cleanliness, equipment ground clearances, ground surface finishes, exposed foundations, sharp edges, missing parts, excessive wear (of moving parts) and structural integrity.*

NOTE 3 *The annual main inspection may require excavation or dismantling of certain parts.*

8.4 Information to be provided by the manufacturer of impact-attenuating surfacing

8.4.1 General

The manufacturer of impact-attenuating surfacing shall provide information on the critical fall height of the impact-attenuating surfacing as tested in accordance with BS EN 1177.

8.4.2 Installation

The manufacturer of impact-attenuating surfacing shall provide instructions on the correct installation.

8.4.3 Inspection and maintenance

The manufacturer of impact-attenuating surfacing shall provide instructions on maintenance and inspection procedures.

8.4.4 Identification of impact-attenuating surfacing

The manufacturer of impact-attenuating surfacing shall provide relevant information regarding the identity and performance of the product supplied, in written form for retention by the client on file.

Annex A (normative) Claims of compliance

A.1 General

Claims of conformity to this PAS shall be made in the principal documentation provided for specifications, purchasers and clients, via promotional and technical information and media, for which the claim is being made, in accordance with BS EN ISO/IEC 17050-1 and in the form relevant to that particular claim as provided for in **A.3**. This statement shall include unambiguous identification of the organization claiming conformance.

NOTE 1 *In accordance with the relevant definitions given in BS EN ISO/IEC 17000, the term "certified" is used in this PAS to describe the issuing of an attestation document by an accredited independent third-party certification body. The term "declared", appropriately qualified, is used to identify the other options accepted in this specification.*

NOTE 2 *Particular attention is brought to The General Product Safety Regulations 2005 [4] in relation to any claim of conformity.*

A.2 Scope of claim

In making a claim of compliance to this PAS, the organization, based on their responsibility, shall comply as follows:

- **Manufacturer of outdoor gym equipment**
  All requirements of PAS 888, excluding Annexes B, C and D.
- **Installer of outdoor gym equipment**
  Requirements of Annex B.
- **Maintenance operative of outdoor gym equipment**
  Requirements of Annex C.
- **Inspector of outdoor gym equipment**
  Requirements of Annex D.

If the organization has more than one responsibility, they shall comply with PAS 888 by addressing the relevant mix of requirements and/or annexes, as aforementioned.

A.3 Basis of claim

A.3.1 General

The claim shall identify the type of conformity assessment undertaken as one of:

a) accredited independent third-party certification in accordance with **A.3.2**;

b) other independent third-party verification in accordance with **A.3.3**; or

c) self-verification in accordance with **A.3.4**.

A.3.2 Accredited independent third-party certification

Organizations seeking to demonstrate that their publicly accessible outdoor exercise equipment has been independently verified as being in accordance with this PAS shall undergo assessment by an accredited independent third-party certification body.

A.3.3 Other party verification

Organizations using an alternative method of verification involving parties other than those qualifying as accredited independent third parties shall satisfy themselves that any such party is able to demonstrate compliance with recognized standards setting out requirements for certification bodies.

NOTE *Examples of such recognized standards of competence include BS EN ISO/IEC 17021 and BS EN 45011.*

A.3.4 Self-verification

In undertaking self-verification, organizations shall be able to demonstrate how they have tested for full compliance and made the calculations required in testing for compliance to this PAS. They must make available supporting documentation to any interested party. The appropriate method for self-verification and for presentation of the results shall be through the application of BS EN ISO 14021.

NOTE *Organizations for whom neither independent third-party certification nor other party verification is a realistic option, may rely on self-verification. In so doing, organizations should be aware that other party verification could be required in the event of a legal challenge.*

A.4 Identification of the basis of a claim

All claims of conformity to this PAS shall include identification of the basis of the claim, using the appropriate form of disclosure, as follows:

a) For claims of conformity based on certification in accordance with **A.3.2**: "Compliance and testing of publicly accessible outdoor exercise equipment by [insert unambiguous identification of the claimant] in accordance with PAS 888 [insert references to role-relevant annexes], [insert unambiguous identification of the certifying body] certified."

b) For claims of conformity based on other party assessment in accordance with **A.3.3**: "Compliance and testing of publicly accessible outdoor exercise equipment by [insert unambiguous identification of the claimant] in accordance with PAS 888 [insert references to role-relevant annexes], [insert unambiguous identification of the certifying body] declared."

c) For claims of conformity based on self-verification in accordance with **A.3.4**: "Compliance and testing of publicly accessible outdoor exercise equipment by [insert unambiguous identification of the claimant] in accordance with PAS 888 [insert references to role-relevant annexes], [insert unambiguous identification of the certifying body] self declared."

Annex B (normative) Specification for installers

Installers shall follow the manufacturers and specifiers instructions to:

a) implement minimum space requirements and safety clearances;

b) check equipment and parts identification;

c) perform the correct erection sequence;

d) incorporate matching aids where necessary (e.g. signs on parts accompanied by appropriate instructions);

e) check the need for any special tools, lifting devices, templates or other assembly aids to be used and any precautionary measures to be taken. Where necessary, torque values shall be given;

f) determine the construction space required to install the item of equipment;

g) implement the correct orientation, where necessary, in relation to sun and wind;

h) check details of the required foundation, under normal conditions, anchorage in the ground and the design and location of the foundation (with a note that care should be taken concerning abnormal conditions);

i) verify the correct free height of fall (for impact-attenuating surfacing needs);

j) check the need for and details of the application of any painting or treatment; and

k) remove assembly aids before the equipment is used.

The installer shall verify the installation and commissioning of all equipment in signed and dated documentation provided to the specifier or operator.

Annex C (normative)
Specification for maintenance providers

C.1 Responsibilities

Maintenance providers shall offer a care package (or, if available, a service level agreement) to maintain equipment and installations.

Maintenance providers shall:

a) if necessary, confirm the servicing points and methods of servicing (e.g. lubrication, tightening of bolts, adjustment of tensile components such as ropes);

b) confirm that replacement parts shall conform to manufacturer's specifications;

c) confirm whether special disposal treatment is required for some equipment or parts;

d) identify spare parts;

e) keep drainage holes clear;

f) maintain surfacing: in particular, the levels of loose-fill materials;

g) replace or repair GRP (glass-reinforced plastics) before the glass fibres become exposed through wear or damage.

NOTE *It is the responsibility of the operator to provide for the correct level of maintenance and its funding. Publicly accessible outdoor exercise equipment may be subject to abuse and is exposed to the elements. Particular attention is needed for moving parts, stops and restrictors that should be expected to have high levels of wear.*

C.2 Frequency

Allowance shall be made for new and high-profile sites, and for equipment that may require a period of running in or settling.

NOTE *The frequency of maintenance will vary for individual items of equipment and will be influenced by the quality of the inspections undertaken. The installation environment or popularity of a site or item of equipment will also influence the level of maintenance required.*

C.3 Recording

A record of maintenance undertaken on items of equipment shall be maintained, including photographs and written details of location, date and time of the visit, the work completed and the person(s) completing the work.

Annex D (normative) Specification for inspection

D.1 Types of inspection

Inspection shall include:

a) routine visual inspection (see **3.46**) by the operator. The frequency of inspections shall be agreed with the site operator;

b) operational inspection (see **3.39**) by a competent person. This shall be as indicated by the manufacturer's instruction;

c) annual main inspection (see **3.1**) by a competent person.

Special attention shall be given to "sealed-for-life" parts and equipment where there are a large number of moving parts

NOTE 1 *For publicly accessible outdoor equipment subject to potential heavy use or vandalism, daily inspection of this type may be necessary.*

NOTE 2 *Examples of visual and operational inspection points are: cleanliness, equipment ground clearances, ground surface finishes, exposed foundations, sharp edges, missing parts, excessive wear (of moving parts) and structural integrity.*

NOTE 3 *The annual main inspection may require excavation or dismantling of certain parts.*

D.2 Methods of inspection

Methods of inspection shall include the following.

a) Routine visual inspections shall be recorded for the date, time and operative undertaking the inspection with reports being limited to issues found at the site and any actions taken. The operative requires only basic training to complete this task and no tools are required.

b) Operational inspections shall be recorded for the date, time and operative undertaking the inspection with reports including any issues found at the site and any actions taken. The frequency of inspections shall be agreed with the site operator. The operative shall be trained as necessary, will test the full operation of the equipment, observe any wear, failures, damage or missing parts and report any findings to the site operator expediently. The inspector shall be competent in this type of inspection. Some tools may be required.

c) Annual main inspection shall be recorded for the date, time and operative undertaking the inspection with reports including any issues found at the site and any actions taken. The operative shall be trained as necessary (RPII Annual Inspector or equivalent), will test the full operation of the equipment, observe any wear, failures, damage or missing parts, test site, equipment and surfacing requirements for compliance to this PAS, and report any findings to the site operator expediently. The inspector shall be competent in this type of inspection. Test probes (see Annex F) and some tools may be required.

Annex E (normative)
Physical testing, theoretical testing and calculation of structural integrity

E.1 General

The manufacturer shall undertake testing to demonstrate that outdoor gym equipment is sufficiently robust so as to meet the demands likely to be experienced when installed in an unsupervised location.

The physical tests described in clauses **E.6** to **E.11** are intended to replicate maximum loads with a safety factor without endangering public or testers. Strength of equipment may also be calculated so that structural integrity can be demonstrated by theoretical testing.

E.2 Test conditions

Unless otherwise specified in the following, the requirements shall be verified by measurement, visual examination or practical tests.

Before testing an item, it shall be confirmed as being in a serviceable condition, installed and maintained correctly.

Tests carried out in a laboratory shall be conducted at (20 ±5) °C after conditioning the equipment for a minimum of one hour at the test temperature. For tests carried out on site, the ambient temperature shall be recorded.

If testing is undertaken in a public location, suitable precautions shall be taken to ensure public safety.

NOTE *If an item is located for testing only, the surface level of the test area should be adjusted to demonstrate the intended installation heights.*

Test loads shall be placed on or applied from the intended user location, if it is more practical to replace a part with a temporary rig to facilitate safe testing of a machine or part this should be made and recorded i.e. replacement of a footplate assembly with a driven cam or actuator.

E.3 Test interfaces

E.3.1 Foot load

A foot load shall be tested using; a circular pad (100 ±5) mm in diameter with a minimum thickness of 25 mm and a Shore C hardness, bonded to a load plate of the same diameter.

E.3.2 Hand load

A hand (grip) load shall be tested using a loop of strap (900 ±5) mm wide × 400 mm long, fixed to the test equipment in a balanced manner by both ends.

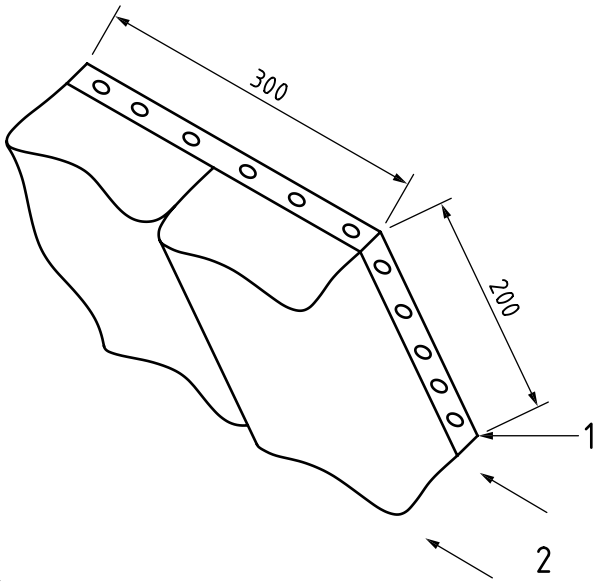
E.3.3 Seat load

A seat (posterior) load shall be tested using a rectangular pad 300 mm × (200 ±5) mm in any direction, constructed on a suitable load plate with a canvas or leather bag, forming two pockets by the addition of a centre divider, attached suitably, and filled with dry sand to give an average thickness of 75 mm (see Figure E.1).

NOTE *The applied weight of the device may be included in the test load.*

Figure E.1 – Seat load test pad

Dimensions in millimetres



Key

1 Load plate
2 Average 75 fill thickness

E.3.4 Equivalent loading

For some equipment, the specific tests specified in **E.3.1**, **E.3.2** and **E.3.3** are not always appropriate, but the demonstrated strength shall be at least equivalent to that tested for in those tests.

E.4 Design load

An individual user shall be considered to have a maximum body weight of 130 kg (design load) but for calculating user loads, the average weight of 85 kg shall be used. Loads representing each user (in cases of multiple simultaneous users) shall be applied as a single foot, hand or seat load for each user, as described in **E.3.1**.

Where multiple users can occupy an item simultaneously, whether intended or not (e.g. a step beam), the maximum number of users shall be calculated as described in **E.12.3** and the load shall be applied as a single foot, hand or seat load for each user as described in **E.3** for each user up to the theoretical maximum.

The load position(s) shall be recorded, and the testing interface as described in **E.3** shall be applied.

***NOTE** The interface load face should be adapted to retain the loading in a stable manner using guide rails, straps or a harness.*

For loads applied by pulling or winching, a dynamometer shall be used to achieve and verify

E.5 Permanent deformation

Permanent deformation shall be measured as a percentage of the length of the tested part and shall be less than 2% of that length. If the item cannot be assessed by length, an equivalent value shall be substituted.

E.6 Static load testing

Static loads shall be applied to each load position (i.e. foot plate, hand hold and seat) in turn up to the maximum number of possible users, to a total of three times the design load (390 kg) per user. The maximum load shall be sustained for a period of ten minutes and then removed, at which time the permanent deflection shall be recorded.

E.7 Moving load testing

For moving equipment, loads shall be applied to each moving load position (i.e. foot plate, hand hold and seat) in turn to a total of two times the design load (260 kg), with the load being secured.

The loaded machine shall be taken through the full range of movement, with the load applied for 50 000 cycles for rotating parts, 10 000 cycles for linear parts, and 20 000 cycles for pendulum movement parts.

The machine shall be driven by the intended input part (i.e. foot plate, pedal or handle).

***NOTE 1** Adaptation of the input part may be needed to safely attach the testing rig, any such adaptations should be recorded.*

Following each test, the load shall be removed and the permanent deflection recorded.

Where the action is not cyclical, 90% of the full range of movement shall be tested.

Where limiters or stops are required, these shall be subjected impacts to the full number of cycles using a test load of 50% of the design load (i.e. 65 kg) dropped from 150 mm or equivalent and any permanent damage to limiters or stops shall be recorded.

Additionally limiters and stops shall be subjected to overload testing to a total of two times the design load (260 kg) dropped from 150 mm or equivalent, with no additional travel limiting used, repeated five times and any permanent damage recorded.

***NOTE 2** For cyclical tests, it may be necessary to partly or fully counter the imposed load to balance the machine to facilitate testing (not reducing the tested load).*

E.8 Dynamic load testing

For dynamic equipment, the design load shall be applied to each moving load position (i.e. foot plate, hand hold or seat), with any required counter load imposed to balance the machine, to a total of two times the design load (260 kg) at each point, with all loads being secured.

The machine shall be driven by the intended input part (i.e. foot plate, pedal or handle).

Following each test, the load shall be removed and the permanent deflection recorded.

E.9 Drop testing

Drop testing shall be applied to each load position (i.e. foot plate, hand hold or seat) in turn up to the design load (130 kg), with the load being positioned by a suitable guide.

The test load shall be raised to the maximum extent of the action, or 150 mm above the impact point for cranks or fixed parts.

The load shall be allowed to drop freely.

The test shall be repeated for 10 cycles, with any permanent deflection being recorded.

E.10 Shatter testing – Moulded seats, cowlings, covers, displays, etc.

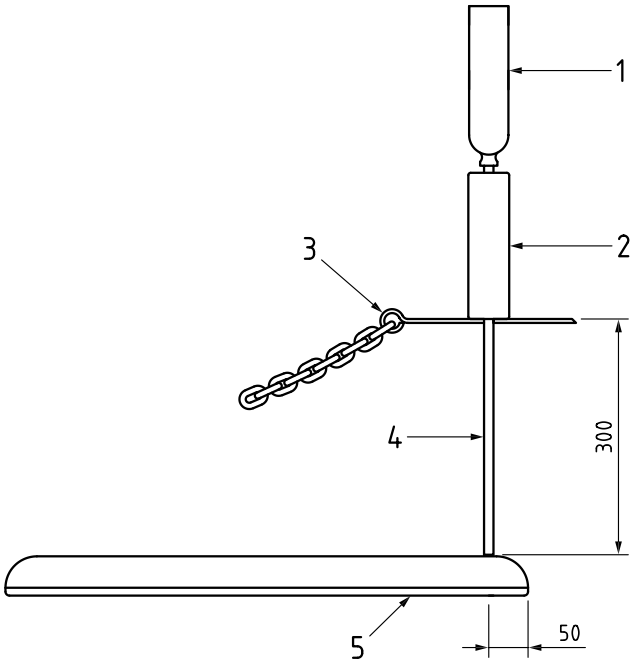
Moulded parts shall be subjected to a specific test designed to replicate a strike during an act of vandalism with a heavy object. The test is to verify mouldings have sufficient resistance to shattering that could lead to exposed fibres or sharp edges.

A test rig comprising of a guide rod (500 mm × 12 mm diameter), vertically fixed on which a free sliding (12.7 mm centre bored) cylindrical mild steel billet (50 mm diameter with a 3 mm edge radius and a mass of 1.5 kg) is raised 30 mm to an indicator mark or hole and released (see Figure E.2).

The part being tested shall be mounted either in its intended location or in a simulation of this, the test rig is positioned and centred vertically 50 mm inboard from vertical or near vertical parts of the moulding being tested. The test is repeated five times in the same location and the results are recorded. Any shattering, delamination or exposure of fibres shall be recorded as a failure. Repeat the test around the perimeter of the part every 100 mm, in a grid and at corners of 60° or greater.

Figure E.2 – Example of a drop test rig for moulded parts

Dimensions in millimetres



Key

1 Rigid suspension point
2 Test mass
3 Removable pin or other release mechanism
4 Guide bar
5 Part being tested

E.11 Pull testing

E.11.1 Exposed arms, levers and pedals, etc.

Exposed arms, levers and pedals etc. shall be subjected to pull testing at right angles to the assembly.

The testing rig shall apply a (90 ±5) mm wide strap to the part to be tested, centred 100 mm or less from the outermost part of the arm, lever or pedal being tested, with a cable attached (around a pulley or pulley system, as necessary, without load reduction) to allow weights to be vertically loaded to 100 kg.

The maximum load shall be sustained for a period of ten minutes and then removed, at which time any permanent deflection shall be recorded.

The test shall be repeated in 90° rotations where appropriate (i.e. forwards, backwards and to both sides).

E.11.2 Seat backrests

Seat backrests shall be subjected to pull testing at right angles to the assembly.

The testing rig will apply a strap (90 ±5) mm wide × 1 000 mm long, fixed to the test equipment in a balanced manner by both ends to the part to be tested, centred 100 mm from the outermost part of the backrest, with a cable attached (around a pulley or pulley system, as necessary, without load reduction) to allow weights to be vertically loaded to 130 kg.

The maximum load shall be sustained for a period of 10 min and then removed, at which time any permanent deflection shall be recorded.

The test shall be repeated in 90° rotations where appropriate (i.e. forwards, backwards and to both sides).

E.11.3 Mainframes and supporting framework of equipment

Mainframes and supporting framework of equipment shall be subjected to pull testing to anchor points 7.5 m away on the ground.

The item to be tested shall be set in or secured to the ground or ground socket as specified by the manufacturer.

A suitable fixing point shall be added to the highest point of the mainframe or fixed part of the equipment for the testing rig to be attached.

A chain or cable, winch and dynamometer shall be attached, and a load of 130 kg be applied and sustained for a period of five minutes, removed for five minutes and repeated for three cycles with no adjustments to fixings between cycles.

Following each tested location, any permanent deflection shall be recorded.

The test shall be repeated in 90° rotations where appropriate (i.e. forwards, backwards and to both sides).

E.12 Loads for theoretical testing and calculation of structural integrity

E.12.1 General

All calculations shall be recorded and maintained to demonstrate suitability.

E.12.2 Loads

Loads to be calculated shall include:

a) permanent loads consisting of;
   i) self-weight of the structure and of the assemblies;
   ii) pre-stressing loads, e.g. climbing rope;
   iii) mass of added weights, where adjustment by the user is possible (highest and lowest values shall be considered);
b) variable loads consisting of:
   i) user moved loads or load points (highest and lowest values as well as positive and negative effects shall be considered)
c) user loads consisting of:
   i) total mass;
   ii) dynamic factor.

It shall not be necessary to consider snow load, wind load or temperature load unless the surface areas considered to be loadable of an item exceed 9 000 000 mm^2 where BS EN 1991 shall be referenced.

E.12.3 User loads

To calculate the area occupied by users on any standing surfaces (not undertaking an activity) allow a 600 mm diameter vertical cylindrical space or a (500 × 500) mm square by 2 000 mm high per user (U).

The loads resulting from users of the equipment shall be based on the following load system:

a) total mass of users (U_{tot}) able to access the equipment

U = 85 kg per user multiplied by

$_{tot}$ = total number of users (Calculation E.1)

NOTE *For the purpose of this PAS a user shall be assumed to have the national average clothed mass of 85 kg; anthropometric data for adults can be used to supplement this when only partial body loading is calculated.*

b) distribution of user loads

The user loads shall be considered locally and collectively on the equipment as there may be additional considerations caused by uneven loading.

Every single point of the equipment for standing, walking or climbing upon, or a flat surface greater than 100 mm wide and which has less than a 30° angle from the horizontal, shall be able to carry the loads imposed by users.

This also applies to rungs or steps for supporting the user's feet

The number of users, U, on a line shall be calculated from the following:

line elements with an inclination up to and including 60°:

$U = L_{pr}/0.6$ (Calculation E.2)

line elements with an inclination greater than 60°:

$n = L/1.20$ (Calculation E.3)

where:

L is the length of the element in millimetres;

L_{pr} is the length of the element projected down to a horizontal plane, in millimetres.

Line type elements are rungs in ladders and in climbing equipment, poles and ropes.

The number of users, n, on a surface area shall be calculated from the following:

planes with inclination up to and including 60°:

$U = A_{pr}/0.36$ (Calculation E.4)

planes with inclination greater than 60°:

$U = A/0.72$ (Calculation E.5)

where:

A is the area, in millimetres squared;

A_{pr} is the area projected down to a horizontal plane, in millimetres squared;

Area type elements are platforms, lattice type platforms, ramps and nets.

The width of the plane shall be greater than 600 mm. Planes having a smaller width shall be treated as line type elements.

Where these types of element can be used from both sides, e.g. nets or grids, the number of users, n, shall be based on the area of one side only. These types of element will not be loaded as densely as platforms.

E.13 Method of calculation of structural integrity

E.13.1 General principles: limit state

Each structure and structural element, e.g. connections, foundations, supports, shall be calculated taking into account the load combinations of **E.12.2**.

The preferred method of calculation shall be based on the general principles and definitions for limit states as specified in the appropriate structural Eurocodes.

Well established technical rules and methods of construction practice, other than this method, may be used provided that the level of safety is at least the same.

***NOTE** Limit states are states beyond which the structure no longer conforms to this part of PAS 888.*

In symbolic form, a limit state can be written as:

$\gamma_F \times S \leq R/\gamma_M$ (Calculation E.6)

where:

γ_F is a partial safety factor for loads;

γ_M is a partial safety factor for materials;

S is the load effect;

R is the resistance of the structure.

To allow for uncertainties in the actual loads and in the model used for determining loads, loads are multiplied by a partial safety factor for loads (γ_F).

To allow for uncertainties in the actual material properties and in the models used for determining forces in the structure, the strength of the structure is divided by a partial safety factor for materials (γ_m).

In most cases, the symbolic representation given here cannot be used to represent the limit state because the actual formulation is often non-linear, e.g. in cases where loads have to be combined.

E.13.2 Ultimate limit state

Ultimate limit states requiring consideration include:

a) loss of equilibrium of the structure or any part of it, considered as a rigid body;

b) failure by excessive deformation, rupture, or loss of stability of the structure or any part of it.

***NOTE** Ultimate limit states are those associated with collapse, or with other forms of structural failure, which can endanger the safety of people.*

E.13.3 Serviceability limit state

Where serviceability requirements are made, the preferred method of calculation shall be based on the principles for serviceability limit state as specified in the appropriate structural Eurocodes.

The deflection criteria for serviceability limit states mentioned in the appropriate Eurocodes do not apply to fitness equipment.

***NOTE** Serviceability limit states correspond to states which do not conform to specified service criteria.*

Annex F (normative)
Test methods for entrapment

F.1 General

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

a) ±1 mm for dimensions; and

b) ±1° for angles.

In situations of doubt when using the probes relating to the tolerance an accurate measurement shall 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.

F.2 Head and neck entrapment

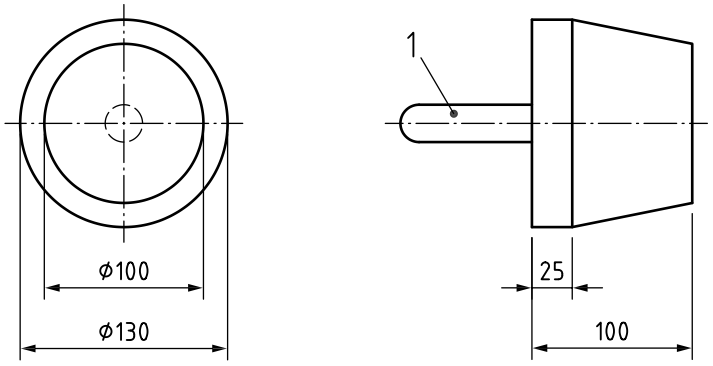
F.2.1 Completely bound openings

F.2.1.1 Apparatus

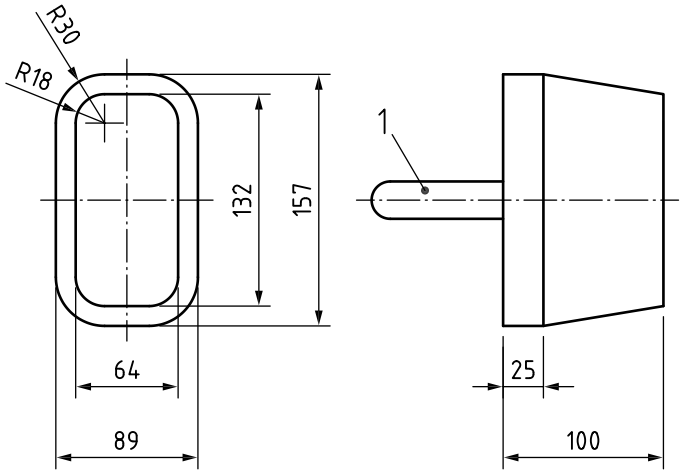
Probes, as illustrated in Figure F.1.

Figure F.1 – Probes for the determination of head and neck entrapment and (probe D) potential crushes

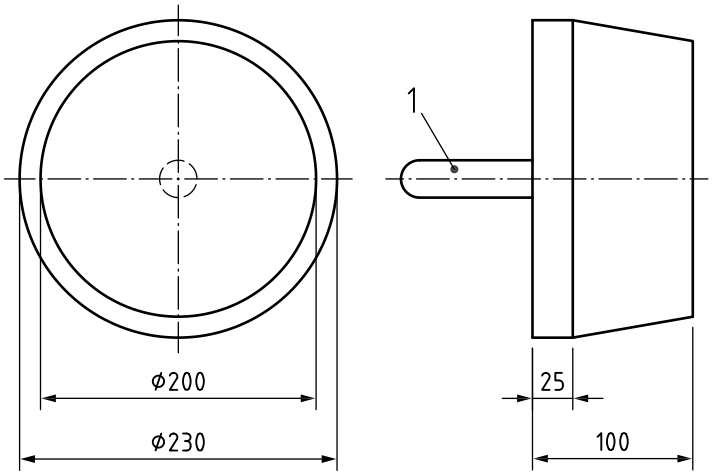
Dimensions in millimetres



a) Probe E (small head)



b) Probe C (torso)



c) Probe D (large head)

Key

1 Handle

NOTE *As other national and European Standards utilize the same probe set the established identification has been used. Probes A and B are not used in this PAS.*

F.2.1.2 Procedure

Apply successively the probes as illustrated in Figure F.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 ±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.*

F.2.2 Partly bound and V-shaped openings

F.2.2.1 Apparatus

Test template, as illustrated in Figure F.2.

F.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 F.3. Record and report whether the template fits within the boundaries of the opening or if it cannot be inserted to its full thickness.

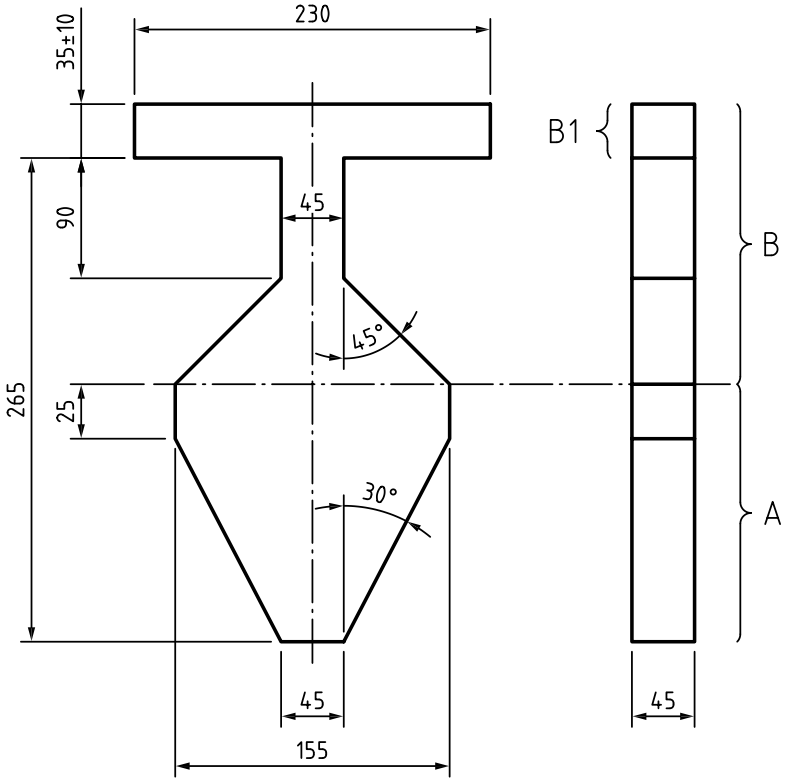
If the test template can be inserted to a depth greater than the thickness of the template (45 mm), apply the "A" portion of the test template, so that its centre line is orientated to check the extremities of the opening as well as the centreline.

Ensure that the plane of the test template is parallel and applied in line with the opening, as shown in Figure F.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 F.4) as this will determine the pass/fail requirements given in **4.2.8.2**. See Figures F.5 and F.6 for examples of the assessment for the different angular ranges.

Figure F.2 – Test template for assessment of head and neck entrapment in partly bound and V-shaped openings

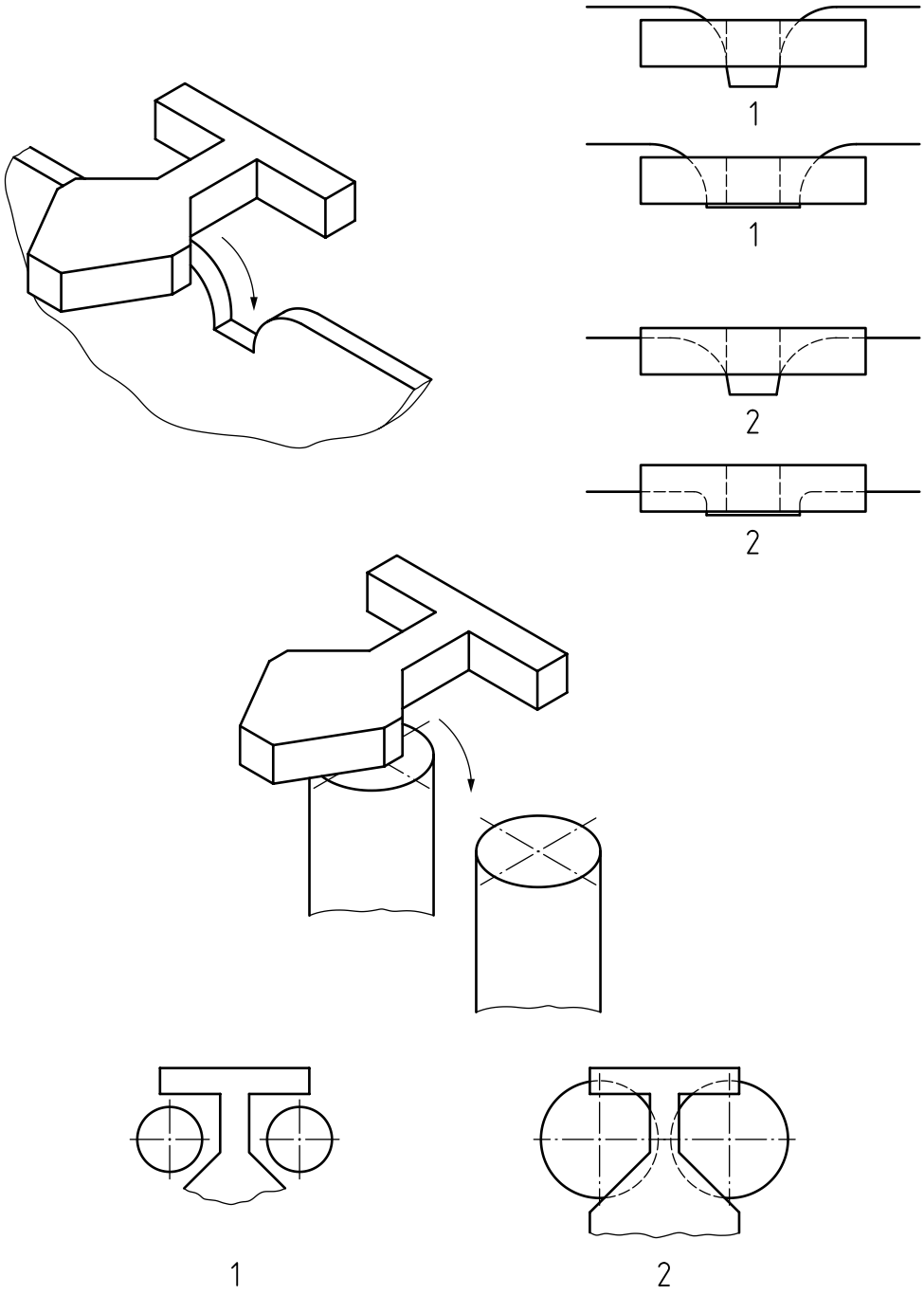
Dimensions in millimetres



Key

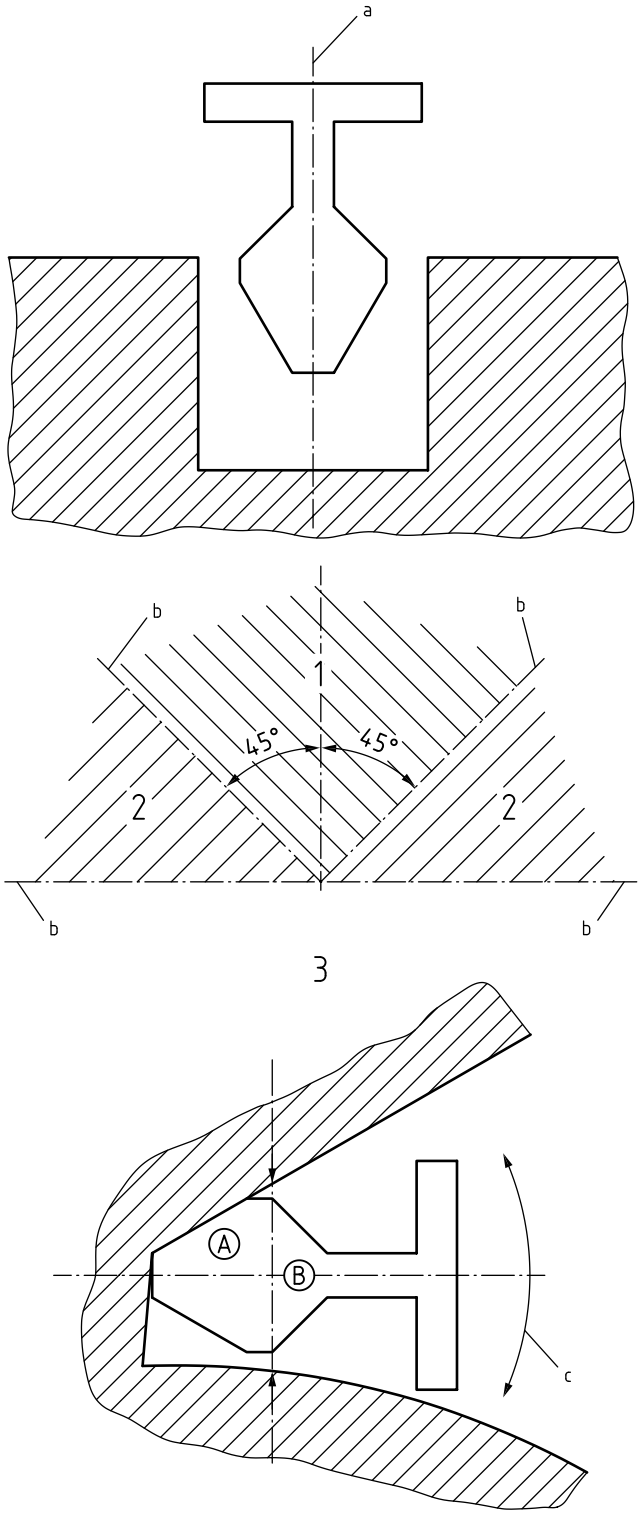
A "A" portion of probe
B "B" portion of probe
B1 Shoulder section

Figure F.3 – Method of insertion of the "B" portion of the test template



Key
1 Accesible
2 Not accessible

Figure F.4 – Checking all insertion angles to determine range

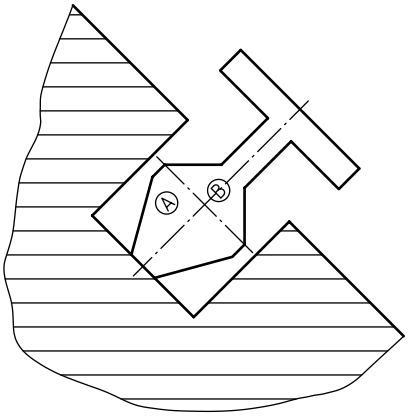


Key

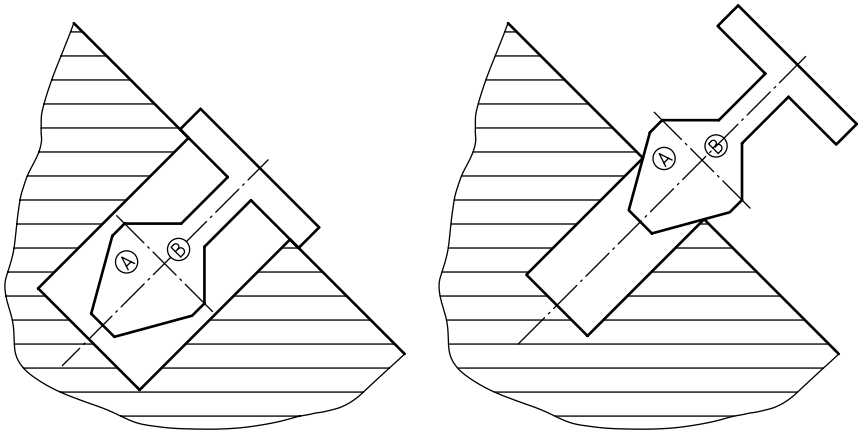
1	Range 1	a	Insertion angle for assessing the range
2	Range 2	b	Template centre line
3	Range 3	c	Check all insertion angles

Figure F.5 – Range 1 method of insertion of the "A" portion of the test template

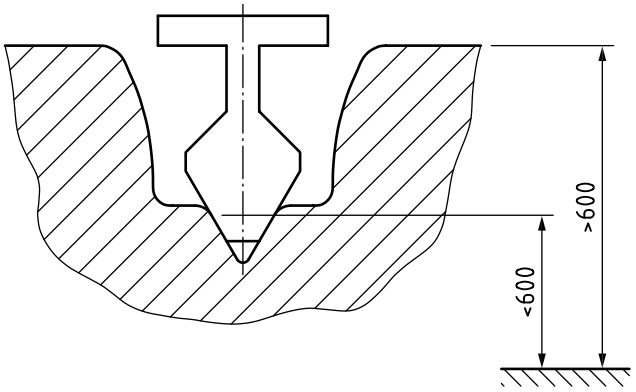
Dimensions in millimetres



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



b) Fail



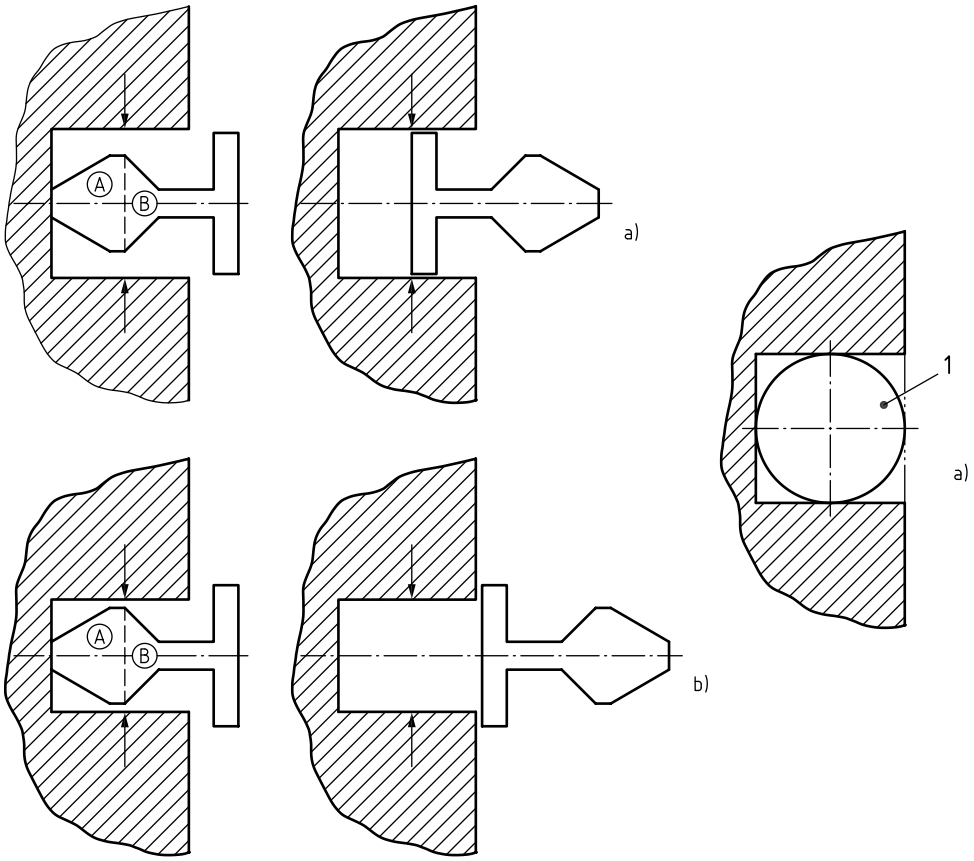
c) Pass

Key

1 >600 mm = more than 600 mm above the playing surface

2 <600 mm = less than 600 mm above the playing surface

Figure F.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



Key

a) Pass
b) Fail
1 Large head probe D

F.3 Entrapment of clothing (toggle test)

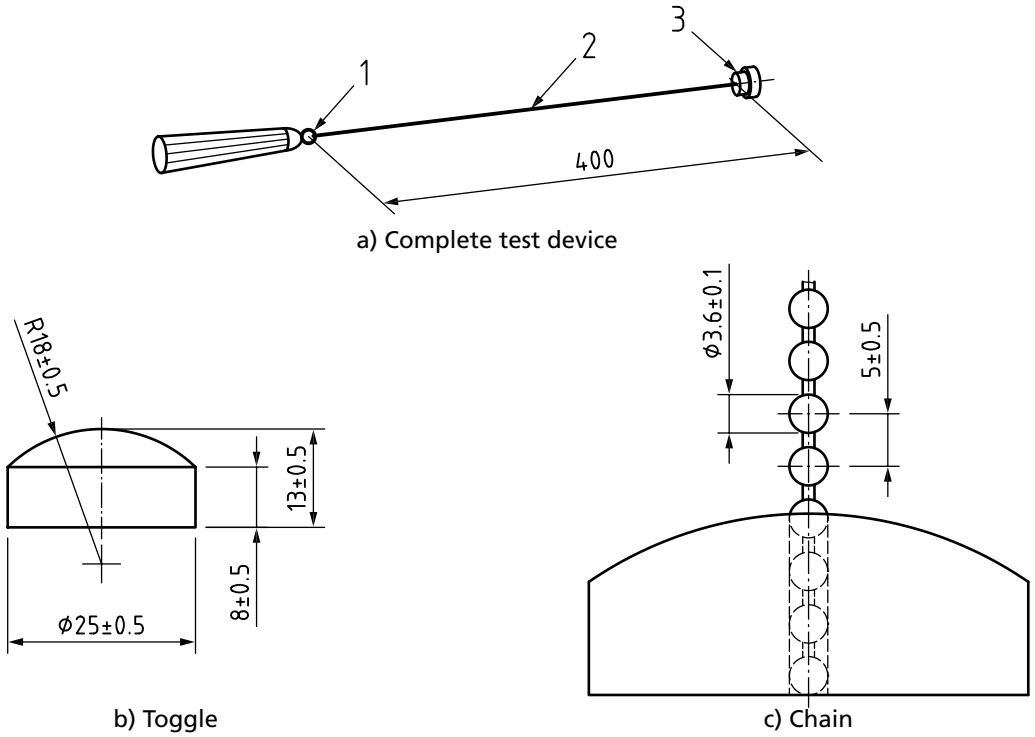
F.3.1 Apparatus

Test device, as shown in Figure F.7a), comprising: toggle, as shown in Figure F.7b), made of polyamides (PA) (e.g. nylon), polytetrafluoroethylene (PTFE), which have been found to be suitable materials; chain, as shown in Figure F.7c);

Handle suitable to determine the end of the measured chain.

Figure F.7 – Test device for clothing (toggle test)

Dimensions in millimetres



a) Complete test device

b) Toggle

c) Chain

Key

1 Handle
2 Chain
3 Toggle

F.3.2 Procedure

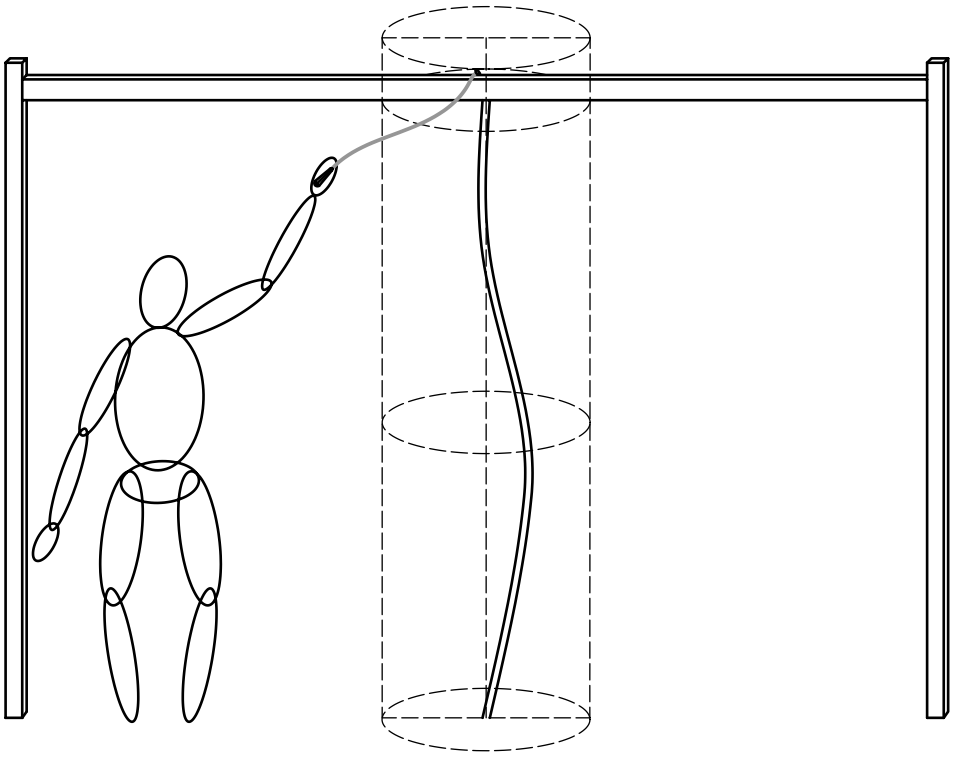
The handle of the test device is maintained anywhere within the movement space cylinder as described in **4.2.9.2** and the toggle is randomly placed about any adjacent parts, to all positions within range, without applying additional force, influence or contrivance, and under its own weight establish if it can become lodged or obstructed (see Figure F.8).

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.

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

If the forced movement has an adjacent access point such as a deck, the test area shall be continued at the width of the movement space cylinder until the handle is 200 mm into that access point.

Figure F.8 – Position of the test device in movement spaces and access points



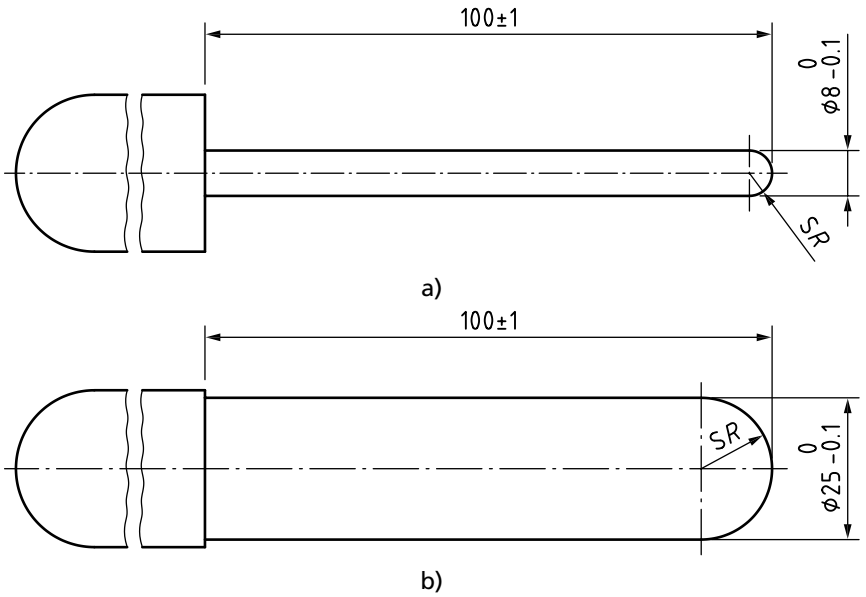
F.4 Finger entrapment

F.4.1 Apparatus

Figure 9 depicts finger rods to be used for a finger entrapment test.

Figure F.9 – Finger rods

Dimensions in millimetres



Key

SR Spherical radius

F.4.2 Procedure

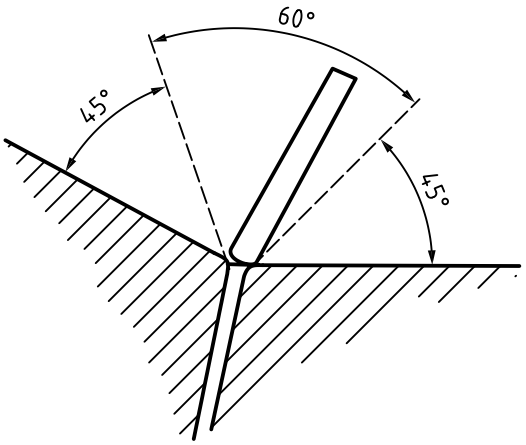
Apply the 8 mm diameter finger rod to the minimum cross section of the opening and, if the rod does not pass through, rotate it as illustrated in Figure F.10.

Record and report if the rod enters the opening and if it locks in any position when moved through the conical arc shown in Figure F.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 F.10 – Rotation of the 8 mm diameter finger rod



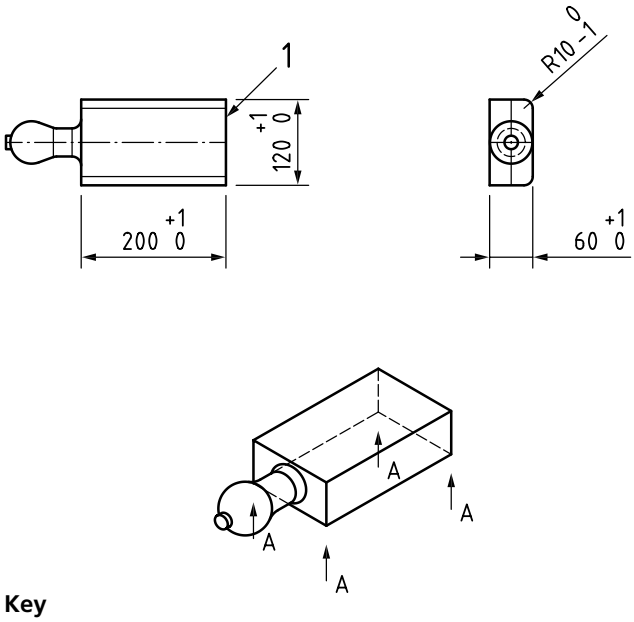
F.5 Foot entrapment

F.5.1 Apparatus

Foot probe, as illustrated in Figure F.11.

Figure F.11 – Foot probe

Dimensions in millimetres



Key
1 Front

F.5.2 Procedure

The probe can be placed on a moving surface whilst it is moved through its range with at least three of the contact points (A in Figure F.11) in contact with the surface. The probe can be placed on stationary standing surface whilst adjacent moving parts are moved through their range with at least three of the contact points (A in Figure F.11) in contact with the surface. The probe can be held by the handle and moved anywhere within a 500 mm of any standing surface (including the ground), foot plate, footrest or pedal the foot probe (Figure F.11) will be applied up to the full depth of 200 mm in any direction or rotation (offering flat surfaces of the probe to the tested part), to all moving parts and changing openings. In any tested position the probe shall not become trapped by moving parts. Record and report any occurrences.

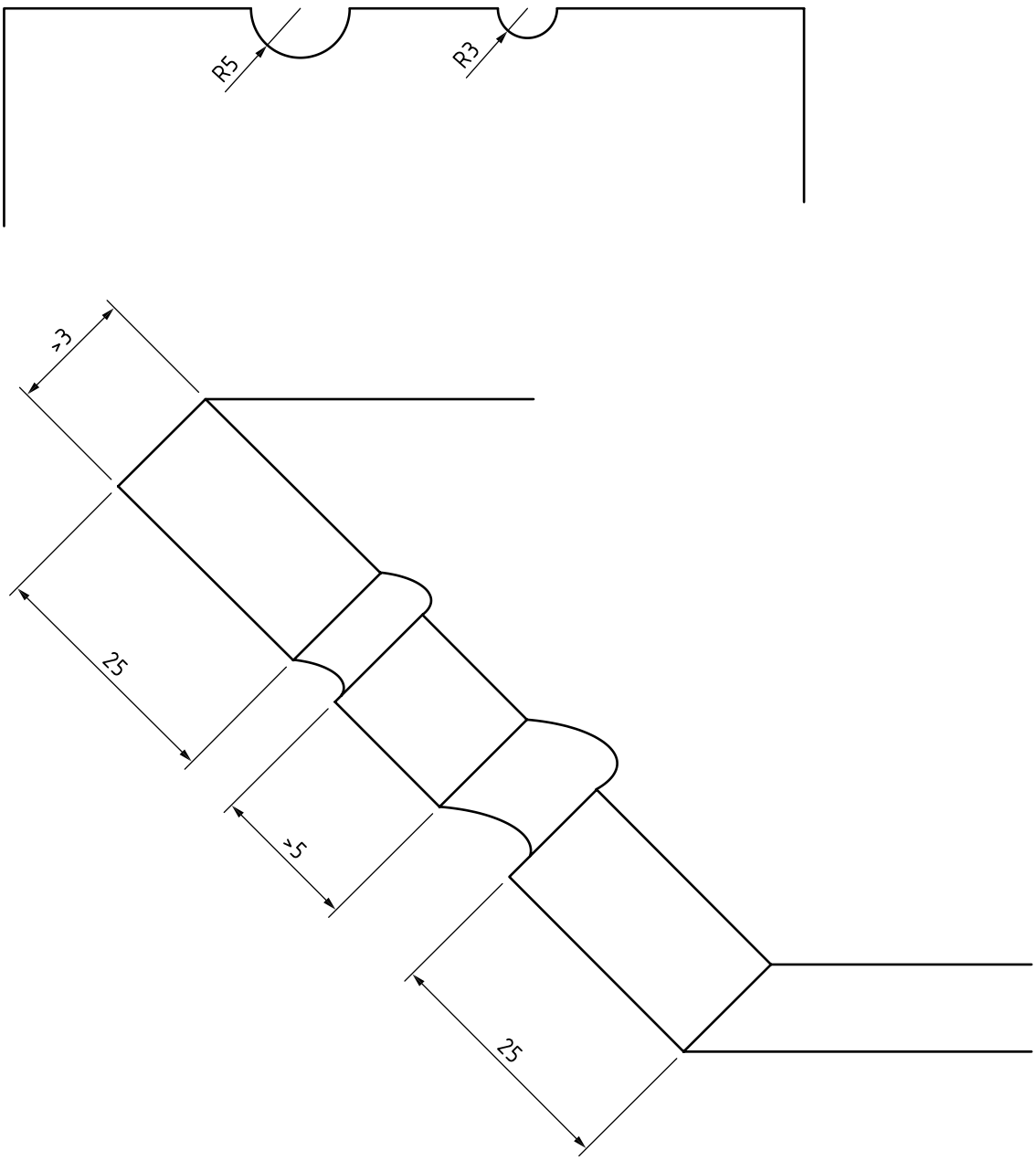
F.6 Radius to finished edges

F.6.1 Apparatus

Radius gauges for 3 mm and 5 mm edges, as illustrated in Figure F.12.

Figure F.12 – Radius gauge

Dimensions in millimetres



F.6.2 Procedure

The appropriate gauge shall be placed on any exposed edge to confirm the radius is at least sufficient. An edge is considered to be exposed if protrudes more than 8 mm, and is not shielded by adjacent areas that are not more than 25 mm from the end of the projecting part, shall be rounded off. The minimum radius of the curve shall be 3 mm with the exception of wooden parts where 5 mm is required. For angles >60° the gauge shall be applied and either a single point of contact recorded and reported as a failure, continuous or multiple contacts shall pass.

Annex G (informative)
Overview of possible entrapment situations

Table G.1 illustrates the various entrapment types and identifies how these are applicable in various situations to the whole or part of the body.

NOTE *The illustrations are indicative but are not exhaustive.*

Within this PAS specific hazards have been identified and written to allow for a practical application of the test probes and gauges in any situation that can be identified as hazardous or potentially injurious.

Table G.1 – Possible entrapment situations

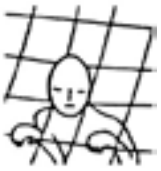
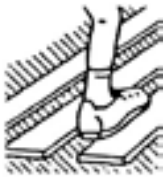
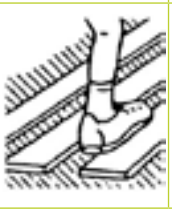
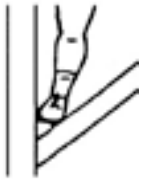
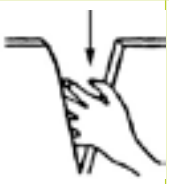
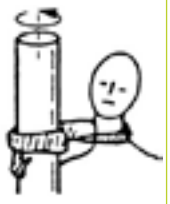
		1	2	3	4	5	6
		Completely bound openings		Partly bound openings	V-shapes	Protrusions	Moving parts of equipment
		Rigid	Non-rigid				
A	Whole body						
B	Head/neck head first						
C	Head/neck feet first						
D	Arm and hand						
E	Leg and foot						

Table G.1 – Possible entrapment situations *(continued)*

		1	2	3	4	5	6
		Completely bound openings		Partly bound openings	V-shapes	Protrusions	Moving parts of equipment
		Rigid	Non-rigid				
F	Finger						
G	Clothing						
H	Hair						

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ISBN 978-0-580-72822-8