

PAS 888:2013

Publicly accessible outdoor exercise equipment – Specification



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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.

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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 It will be withdrawn upon publication of its content in, or as, a British Standard.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:

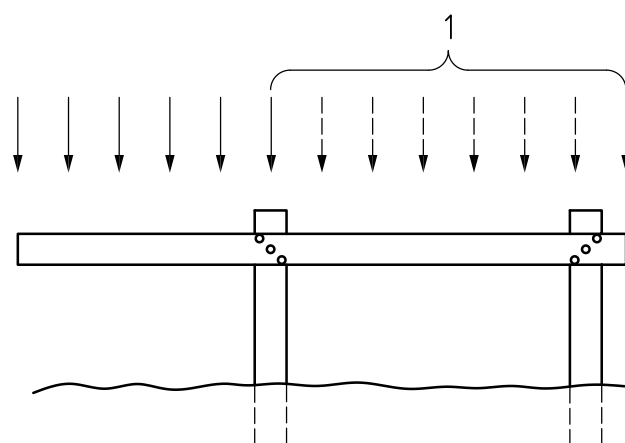
- a) minimize rotting or corrosion in parts necessary for stability;
- b) allow for controlled degradation and the need for decommission;
- c) be used without collapse within the foreseen annual inspection period when maintained correctly.

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.

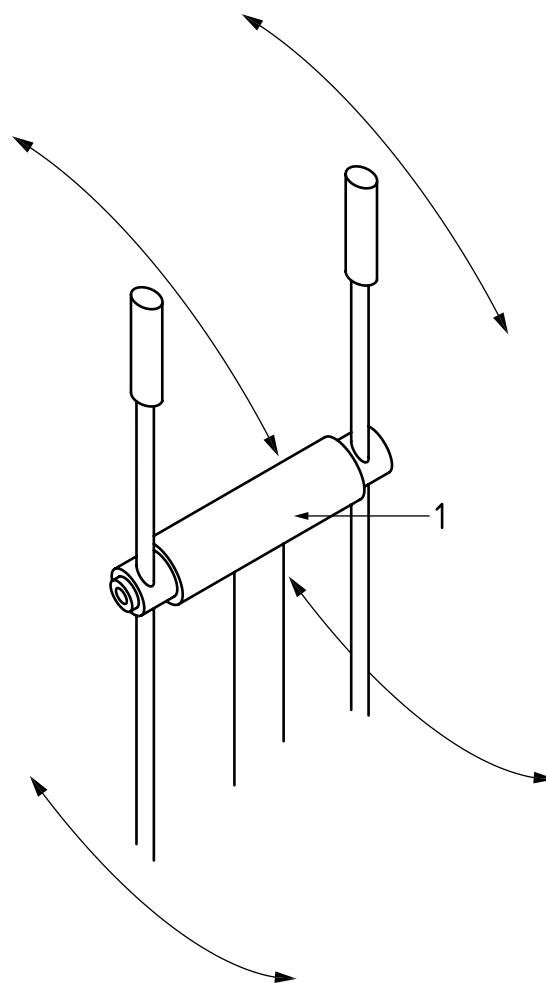
NOTE 2 Static handholds or grasp points should be provided in practical locations where parts providing support are able to move when a user is accessing or exiting an item (see Figure 2).

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

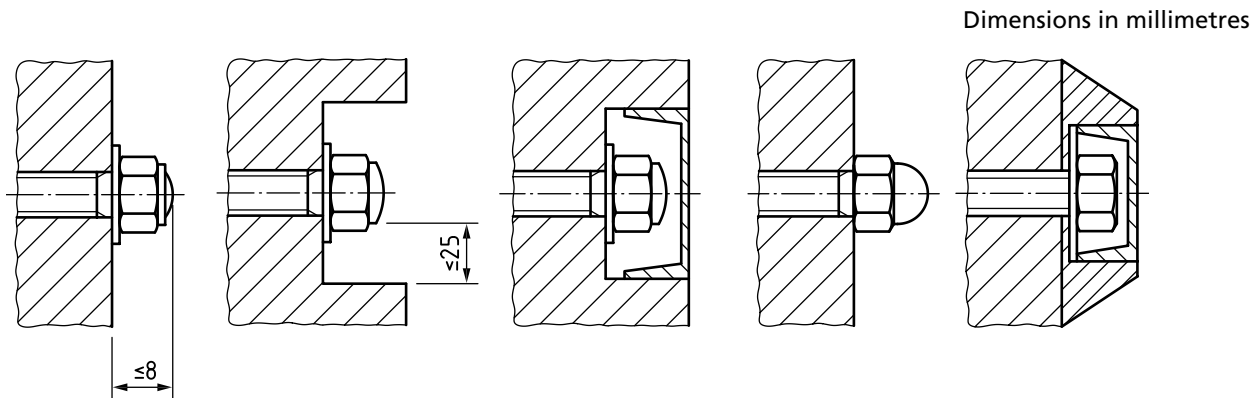
Figure 2 – Example of static grasp alternative



Key

1 Example of a static grasp to aid access or egress

Figure 3 – Examples of protection for nuts and bolts



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.*

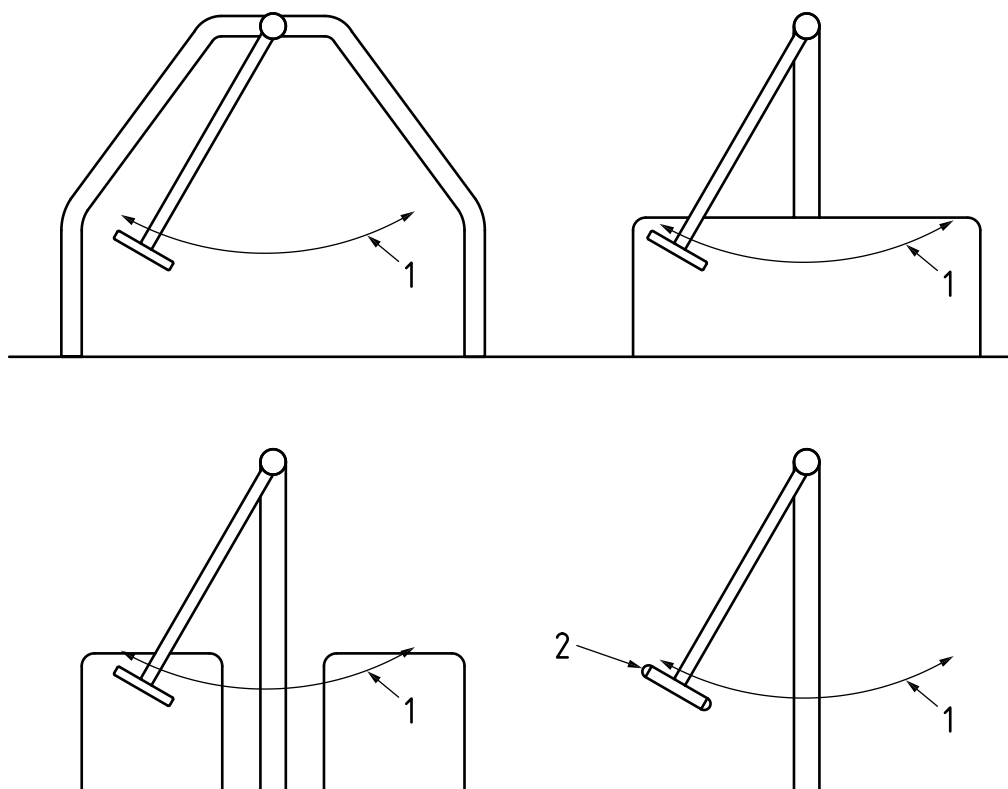
4.2.7.2 Pendulums

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 $<55^\circ$ 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.*

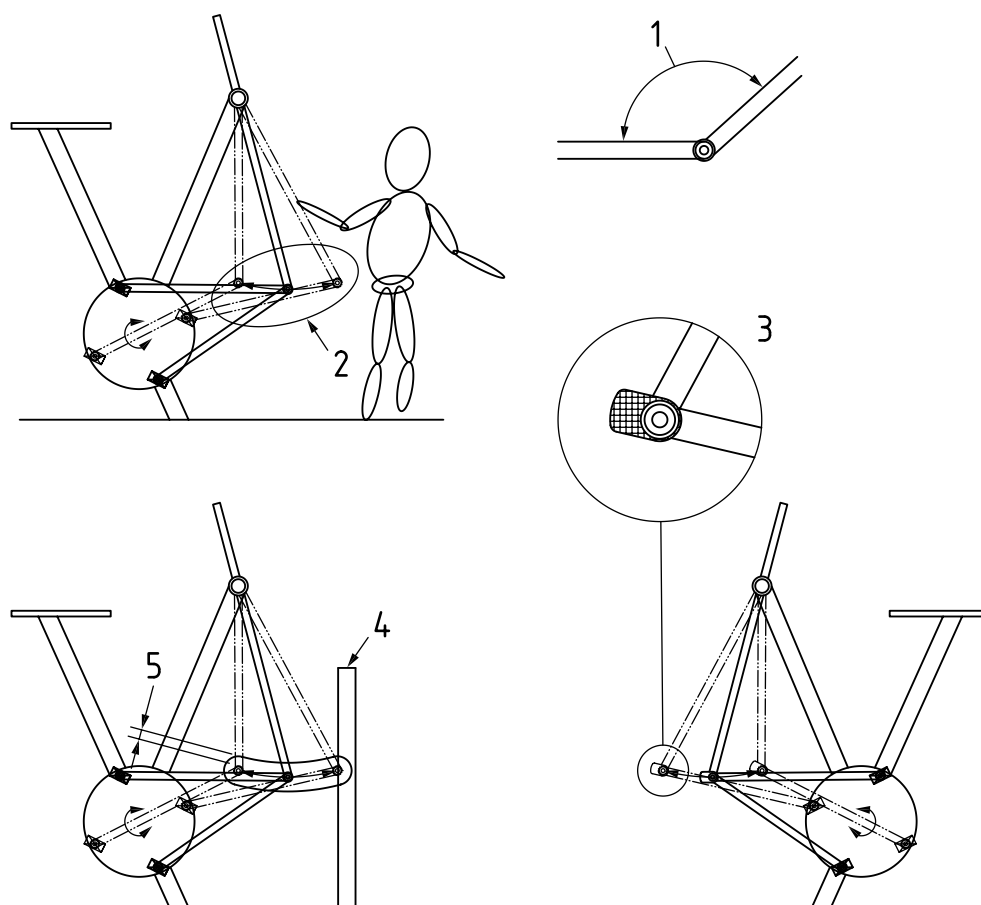
Figure 4 – Examples showing protection from pendulum movement



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 $>135^\circ$
- 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 $> 135^\circ$ 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

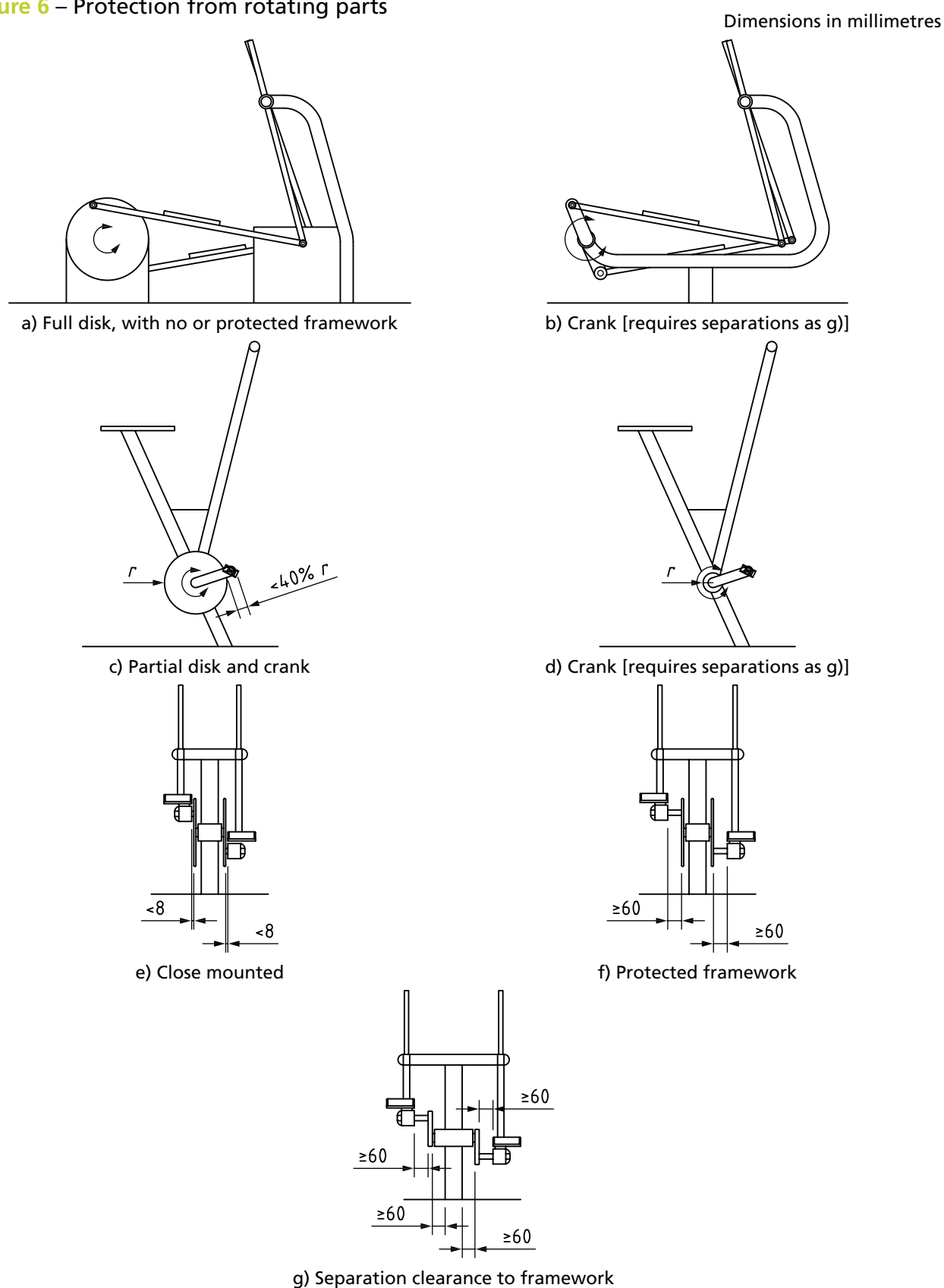
Rotating parts shall not cause a sheering action with adjacent stationary or moving parts.

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, cowl 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



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 $\pm 45^\circ$ from vertical): when the template apex contacts the base of the opening, the depth of the opening shall be less than the distance of the template to the underside of the shoulder section;

- range 2 (template centre line from horizontal to $+45^\circ$): when the template apex contacts the base of the opening, the depth of the opening shall be less than the "A" portion of the template. If the depth of the opening is greater than the "A" portion of the template, all parts of the opening above the "A" portion shall also allow insertion of the shoulder section of the template or probe;

- 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.