BRITISH STANDARD

BS EN
913 : 1996

Gymnastic equipment — General safety requirements and test methods

The European Standard EN 913 : 1996 has the status of a British Standard

ICS 97.220.30

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee SW/14, Gymnasium and sports equipment, upon which the following bodies were represented:

All England Women's Hockey Association
Association of County Councils
British Amateur Gymnastics Association
British Athletic Federation
British Sports and Allied Industries Federation
Central Council of Physical Recreation
Consumer Policy Committee of BSI
English Basketball Association
Home Office
Institute of Trading Standards Administration
Physical Education Association
Sports Council
Sports Hall and Fitness Equipment Association

This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Board, was published under the authority of the Standards Board and comes into effect on 15 December 1996

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference SW/14
Draft for comment 92/47657 DC

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Contents

National foreword

This British Standard has been prepared by Technical Committee SW/14 and is the English language version of EN 913 : 1996 *Gymnasium equipment — General safety requirements and test methods*, published by the European Committee for Standardization (CEN). It supersedes BS 1892 : Part 1 : 1986, which will be amended by 31 December 1997 to limit its scope to boxing rings and practice and games netting and supporting trackways. This is necessary to ensure that the following standards, which are not being revised in CEN, retain valid cross-references to BS 1892 : Part 1.

BS 1892 : Section 2.6 *Gymnasium equipment*
Part 2 *Particular requirements*
Section 2.6 *Specification for boxing rings*

BS 1892 : Section 2.11 *Gymnasium equipment*
Part 2 *Particular requirements*
Section 2.11 *Specification for practice and games netting and supporting trackways*

It will also ensure that cross-references to BS 1892 : Part 1 in the following standard remain valid while CEN is preparing standards to replace it:

BS 1892 : Section 2.10 *Gymnasium equipment*
Part 2 *Particular requirements*
Section 2.10 *Specification for safety requirements for mats, mattresses and landing areas*

BS EN 913 specifies safety requirements that are generally applicable to gymnastic equipment. For particular types of equipment, these requirements are supplemented or modified by requirements of particular standards. These particular standards have not been developed as Parts of EN 913, but have been independently numbered. Particular care should be taken to ensure that an appropriate combination of standards is used. Special care is required in applying this general standard alone to equipment for which no particular standard has yet been published.

Cross-references

Publication referred to	Corresponding British Standard
EN 292-1 : 1991	BS EN 292 *Safety of machinery — Basic concepts, general principles for design* Part 1 : 1991 *Basic terminology, methodology*
	DD ENV 1991 *Eurocode 1: Basis of design and actions on structures*
ENV 1991-2-1 : 1995	Part 2.1 : 1996 *Actions on structures — Densities, self-weight and imposed loads*
ENV 1991-2-3 : 1995	Part 2.3 : 1996 *Actions on structures — Snow loads*
ISO 6487 : 1987	BS AU 228 *Impact tests on road vehicles* Part 1 : 1989 *Specification for measurement techniques and general instrumentation*

Compliance with a British Standard does not of itself confer immunity from legal obligations.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 913

March 1996

ICS 97.220.30

Descriptors: sports equipment, gymnastic equipment, safety, accident prevention, specifications, stability, tests, marking

English version

Gymnastic equipment — General safety requirements and test methods

Matériel de gymnastique —
Exigences générales de sécurité et méthodes d'essai

Turngeräte —
Allgemeine sicherheitstechnische Anforderungen und Prüfverfahren

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 136, Sports, playground and other recreational equipment, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 1996, and conflicting national standards shall be withdrawn at the latest by September 1996.

This European Standard is one of several standards, each of which deals with a particular type or a particular group of gymnastic equipment. Gymnastic equipment of any type not covered by a relevant European Standard, is covered by this general standard.

When preparing this European Standard, the Committee, bearing in mind both the intended use and reasonably foreseeable misuse of equipment, directed its attention to the aspects relevant to safety in identifying the hazards present, and included requirements with a view to avoiding or reducing risks emanating from such hazards.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope

This standard specifies general safety requirements and test methods for all pieces of gymnastic equipment for foundation, participation and performance and excellence, intended for supervised use.

NOTE. In French, the English terms 'foundation, participation and performance and excellence' cannot be translated, since they are not referred to as such in reality. Moreover, it was decided to withdraw these terms from all the standards concerning gymnastic equipment.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-1	*Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*
ENV 1991-2-1	*Eurocode 1: Basis of design and actions on structures — Part 2-1: Actions on structures — Densities, self-weight and imposed loads*
ENV 1991-2-3	*Eurocode 1: Basis of design and actions on structures — Part 2-3: Actions on structures — Snow loads*
ISO 6487	*Road vehicles — Measurement techniques in impact tests — Instrumentation*

3 Hazard assessment

The assessment of hazards has been based on EN 292-1. Twelve categories of hazard or sources of hazard have been considered relevant to gymnastic equipment. These are as follows:

a) crushing;
b) shearing;
c) cutting and severing;
d) entanglement and trapping;
e) impact;
f) stabbing or puncture;
g) friction and abrasion;
h) mechanical strength;
i) movement, including sliding;
j) ergonomic design;
k) fire;
l) information.

4 Definitions

For the purposes of this standard, the following definitions apply.

4.1 hazard

A source of possible injury or damage to health.

4.2 body mass

The mass of the person(s) using the equipment.

4.3 static load

The load acting on the equipment due to its structure, added weights and prestressed components.

4.4 dynamic factor

A factor to take account of the increase in effective body mass during a dynamic movement.

4.5 safety factor

A factor intended to cover uncertainties in the body loading and dynamic factor used, and which does not cover allowance for variations in materials and manufacturing processes.

4.6 variable load

A load due to factors other than the static and body loads.

5 General safety requirements

5.1 Surface finish

Sharp edges and protruding parts

Corners, edges and protruding parts in the user's free space that freely project more than 8 mm, and are not shielded by adjacent areas which are not more than 25 mm from the edge of the projecting part, shall be rounded off (see figures 1 and 2). This shall be assessed by carrying out a tactile inspection, visual inspection and measurement. The minimum radius of the chamfer shall be 3 mm.

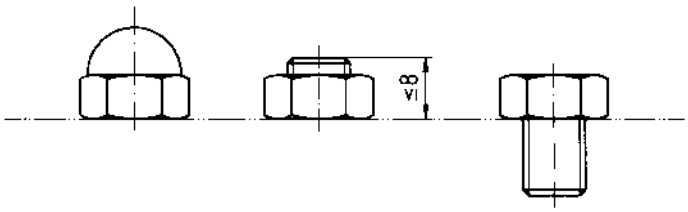
Protruding bolt threads in the user's free space shall be permanently covered, e.g. with cap nuts. Nut and bolt heads that protrude less than 8 mm shall be free from burrs (see figure 1). No burrs shall be caused as a result of welding.

Where practical, protruding bolt threads in the user's free space shall be avoided by passing the bolt from the other side.

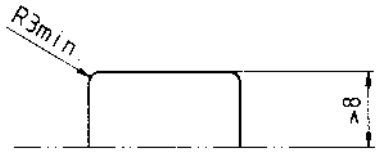
Nuts and bolts shall be safeguarded against working themselves loose.

Items of protection padding shall be attached in such a way as to ensure their remaining in place during use.

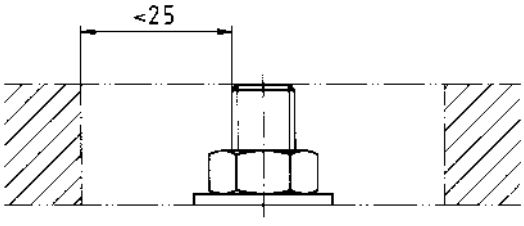
Dimensions in millimetres



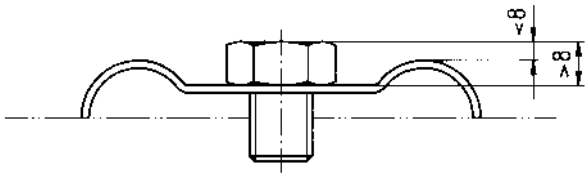
Covered Without burr



Rounded protrusion



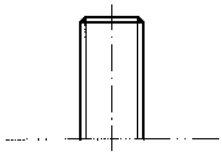
Covered by adjacent parts



Without burr and partially covered by adjacent part

Figure 1. Examples of permissible protruding parts

Dimensions in millimetres



Uncovered protruding exterior screw thread

Unprotected, overhanging sharp-edged (hard) equipment part

Figure 2. Examples of non-permissible protruding parts

5.2 Entrapment

5.2.1 *Gaps and shearing/crushing points*

When in use, there shall be no gaps and/or shearing/crushing points that can create a danger of entrapment.

This shall be assessed by carrying out a visual inspection and measurement using the methods specified in annex A. This also applies to all parts used during adjustment and transportation of equipment.

5.2.2 *Unintentional dropping*

Where a transport system is used, it shall not be possible for the equipment to drop when loaded at one end with a minimum weight of 75 kg.

When a transportation device encounters a threshold, the mechanism shall not be able to disengage or drop unintentionally.

5.3 Stability and strength

5.3.1 *General*

Verification of the stability and strength of equipment shall be achieved by engineering calculation or by testing in accordance with the procedures specified in annex B.

NOTE. Testing is the preferred method and is usually required in the individual product specifications. The horizontal force to be applied is calculated from 40 % of the self-weight of equipment, with a minimum of 90 N.

5.3.2 *Stability*

When tested in accordance with annex B, equipment shall neither tilt nor slide.

5.3.3 *Strength*

When tested in accordance with annex B, equipment shall not collapse or fracture, or show any permanent deformation that would result in an additional safety hazard as described in the standard.

5.4 Adjustment devices

Any adjustment devices shall prevent accidental changes during use of the device or the equipment.

None of the operating levers shall protrude into the user's free space.

This shall be assessed by carrying out a visual inspection and operation of the adjustment device.

5.5 Shock absorption of top padding

When tested in accordance with the method specified in annex C, the peak acceleration shall not exceed 500 m/s^2 (50*g*).

6 Marking

All gymnastic equipment shall bear the following marking:

a) the number of the relevant European Standard;

b) means to identify the manufacturer and/or the responsible supplier.

Annex A (normative)
Determination of entrapment

A.1 Principle

Test probes of specified dimensions are offered to potential entrapment points and a note is made of whether or not they can be inserted.

A.2 Apparatus

Test probes of dimensions as described in figures A.1 and A.2.

A.3 Conditioning and test temperature

Condition the equipment and test probes for a minimum of 3 h in the test temperature of (23 ± 2) °C.

A.4 Procedure

A.4.1 *Head and neck entrapment (general)*

Try to insert the cone-shaped probe (figure A.1) into the opening. Note if it cannot enter the opening (opening less than 110 mm) or, if it can enter, if it will pass the opening with its largest dimension (230 mm).

A.4.2 *Head and neck entrapment (partially bound openings)*

Try to insert the cone-shaped probe (figure A.1) into the opening. Note if it becomes stuck and if it touches the bottom of the opening (see figure A.3).

A.4.3 *Head and neck entrapment (V-shaped openings)*

Try to insert the cone-shaped probe (figure A.1) into the opening along the direction of its median line. Note if at least two points of the bottom circumference of the probe touch adjacent parts or the bottom of the opening (see figure A.4).

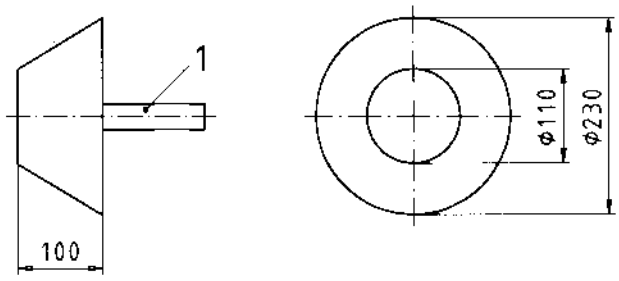
A.4.4 *Finger entrapment*

Try to insert the rods (figure A.2) into the opening. Note if the 8 mm probe will pass the minimum cross-section of the opening and, if it does, if it can be locked in any position when set in motion as shown in figure A.5. Note if the 25 mm probe will also pass the opening and if the opening gives access to another finger entrapment site.

A.5 Expression of results

Record whether or not the probes enter or become trapped in the opening as described in **A.4**.

Dimensions in millimetres



1 Handle

Figure A.1 Cone-shaped probe

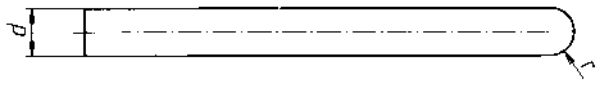
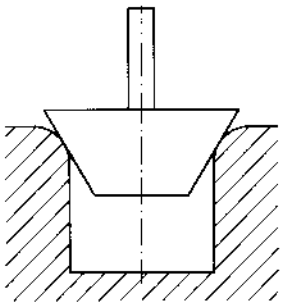


Table A.1

Dimensions in millimetres

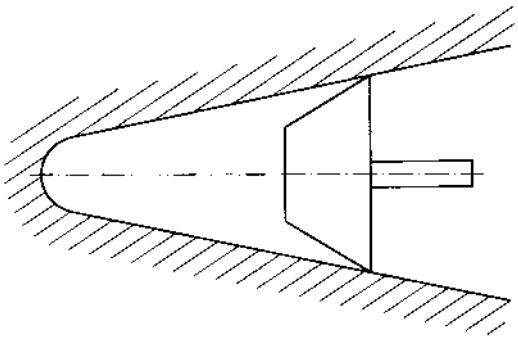
r	4	12,5
d	8	25

Figure A.2 Rods

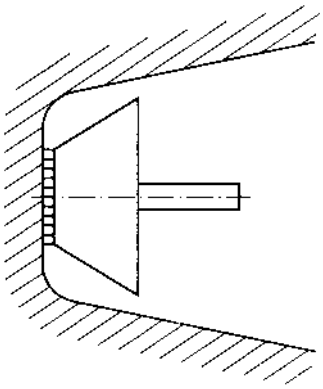


a) Fail

Figure A.3 Example of procedure A.4.2



a) Fail



b) Pass

Figure A.4 Example of procedure A.4.3

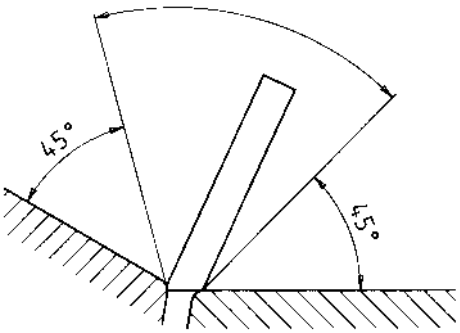


Figure A.5 Example of procedure A.4.4

Annex B (normative)

Protocol for mechanical loading for determination of stability and strength

B.1 Principle

A test force is determined by combining a body load, a static load and a variable load and applying appropriate dynamic and safety factors.

$$F_t = m_b \cdot a \cdot C_d \cdot S + F_s + L_v$$

where

F_t is the test force to be applied, in newtons;

m_b is the body mass, in kilograms;

a is the acceleration, in m/s^2;

NOTE. For vertical forces $a = g = 9{,}81$ m/s^2; for horizontal forces, a is given in table B.2.

C_d is the dynamic factor (see table B.2);

S is the safety factor (see **B.1.4**);

F_s is the static load, in newtons;

L_v is the variable load, in newtons.

NOTE. This allows for snow or wind effects, etc.

In most practical cases the static load, F_s, is naturally present and does not have to be included.

For gymnastics and sports equipment, it is extremely unlikely that a variable load will have to be considered, and L_v will therefore be zero.

B.1.1 *Static load*

The static load, where required to be included in the calculation of the test load, shall include the maximum added weights to be used with the equipment.

B.1.2 *Body mass*

The human body mass to be used is based on the 95th percentile of the distribution of body masses expected to be encountered.

For use by adults, or by adults and children, this shall be taken as 95 kg.

For use by children up to the age of 14 only, it shall be taken as 70 kg.

Where the equipment can reasonably be expected to be used by more than one person at the same time, the total body mass shall be taken from table B.1, which makes allowances for the probability of different body weights being present.

The distribution of the loading by the total body mass shall be as intended in use of the apparatus, e.g. evenly distributed or equally distributed at set stations. Where more than one loading position can reasonably be expected, the worst case loading position shall be assumed.

For stability testing where the normal action produces a stabilizing as well as a destabilizing force, e.g. vaulting, this shall be accounted for either by the angle of application of the force or by applying an additional static load.

Table B.1 Body mass for multiple use

Number of users	Mass, adult kg	Mass, children kg
1	94	70
2	180	130
3	263	189
5	429	304
10	833	588

B.1.3 *Dynamic factor and horizontal acceleration*

Preferably, the dynamic factor should be determined from the average of factors measured experimentally in tests with a typical range of persons carrying out the movement in question. In the absence of such data, the factors given in table B.2 shall be assumed.

Table B.2 Dynamic factors

Action	Dynamic factor	Horizontal acceleration m/s^2
Bar and exercise	2,5	20
Jumping	2,5	—
Jump and grasp	2,5	—
Squat vault	2,5	10

B.1.4 *Safety factor*

For the purposes of this standard, the safety factor shall be taken as 1,2 unless the product standard specifies a higher figure for high-risk equipment.

B.1.5 *Variable loads*

In particular cases where additional loads can be encountered, they shall be included in the determination of total loading. Snow, wind and temperature loads, if applicable, shall be taken from ENV 1991 : 2-1, 2.3, allowing for a reference period of 10 years.

B.1.6 *Number of users on the equipment*

The number of users is the maximum number for which the equipment is stated to be suitable by the manufacturer.

B.2 Apparatus

B.2.1 *A means of applying the specified force* without shock, with a deviation of ± 2 %.

B.2.2 *A loading pad or strap* to apply the load over the area specified in **B.3.2**.

B.2.3 *A means of measuring deflection* to a deviation of ± 1 mm.

B.2.4 *A timer* accurate to ± 1 s.

B.3 Procedure

B.3.1 *General*

The basic procedure for loading tests is given in **B.3.4**. It can be used for determining stability, strength, stiffness or residual deformation. Unless otherwise specified in the product specification, the load shall be applied over the area and/or the time given below. The level of loading, the direction of loading and the parameters to be measured shall be as given in the product specification.

NOTE. This test procedure does not cover fatigue by repeated loading.

B.3.2 *Loading area*

Plane surfaces: a rigid plate (100 ± 1) mm $\times$ (100 ± 1) mm.

Bars: a strap (100 ± 1) mm wide.

B.3.3 *Loading time*

Apply the load for 1 min^{+10}_{0} s.

Measure residual deflection 30 min^{+30}_{0} s after removal of the load.

B.3.4 *Test procedure*

Position and fix the equipment as for normal use or as given in the product specification.

If deflection is required, measure the position of the loaded component from any convenient datum point.

Apply the force at the position and in the direction specified for the time given in **B.3.3**.

Note any tilting, sliding or fracture, or measure the deflection, as required.

Remove the load.

After the time given in **B.3.3**, note any damage or measure the residual deflection, as required.

B.4 Expression of results

Express the level of stability by whether tilting or sliding has occurred.

Express stiffness as the deflection under load, in millimetres.

Express the strength by whether fracture or other damage has occurred.

Express the residual deflection by the deflection remaining, in millimetres.

Annex C (normative)

Determination of shock absorption of padding

C.1 Principle

A striker is dropped onto the surface and the deceleration during the impact is monitored.

C.2 Apparatus

C.2.1 *A metal indenter* conforming to the essential dimensions and mass as shown in figure C.1.

C.2.2 *Means of releasing the striker* to allow the indenter to fall smoothly and vertically.

C.2.3 *An accelerometer* rigidly mounted on the indenter as shown in figure C.1.

C.2.4 *Instrumentation* to record, display and process the accelerometer signals, having a channel frequency class, including the accelerometer, of 1000 Hz in accordance with ISO 6487 and sampling frequency of not less than 10 kHz.

C.3 Test piece

A piece of protective padding, with its covering if relevant, of minimum length 500 mm and minimum width 500 mm laid on a smooth, solid concrete floor. Alternatively, where feasible, the padding can be tested as attached to the equipment in service.

C.4 Conditioning and test temperature

Condition the test piece for a minimum of 3 h at the test temperature of (23 ± 2) °C.

C.5 Procedure

Raise the indenter to the required height and lock into position.

Release the indenter and allow it to fall vertically onto the test piece.

Record the signal from the accelerometer throughout the impact.

Display the recorded signal and examine the trace to ensure that it contains no spurious peaks, etc.

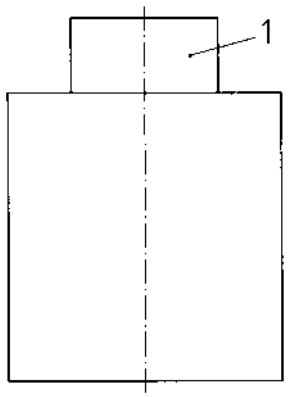
Process the data to obtain the peak deceleration during the impact, *g*.

Carry out five tests at the same location, at intervals of between 1 min and 3 min.

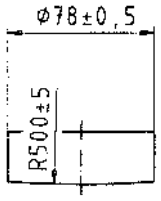
C.6 Expression of results

Express the measure of shock absorbency as the mean value of peak acceleration values from the last three impacts.

Dimensions in millimetres



1 accelerometer



Total mass of each indenter:
$(8 \pm 0{,}5)$ kg

Figure C.1 Indenter and accelerometer

Annex D (informative)

Bibliography

Eurocode 1 — *Basis of design and actions on structures* — Part 2-4: *Actions on structures — Wind actions*[1)]

[1)] In preparation.

List of references

See national foreword.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

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