BRITISH STANDARD

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Artificial sports surfaces —

Part 4: Specification for surfaces for multi-sports use

Committees responsible for this British Standard

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Association of Playing Fields and Landscape Managers
British Association of Landscape Industries
British Carpet Manufacturers' Association Ltd.
British Floor Covering Manufacturers' Association
British Sports and Allied Industries Federation
British Textile Technology Group
Consumer Policy Committee of BSI
Contract Flooring Association
Department of the Environment (Building Research Establishment)
Fibre Bonded Carpet Manufacturers' Association
Fibre Building Board Organization (FIDOR)
Home Office
Institute of Groundsmanship
Institute of Leisure and Amenity Management
International Association for Sports Surface Sciences
National Playing Fields Association
National Turfgrass Council
RAPRA Technology Ltd.
Sports Council
Sports Turf Research Institute
Synthetic Sports Surface Association
Tennis Court Constructors' Federation (TCCF)
Textile Institute

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Foreword

This Part of BS 7044 has been prepared under the direction of the Textiles and Clothing Standards Policy Committee.

It is based on Part 2 of the Sports Council Specification for Artificial Sports Surfaces, 1984, but has been significantly rearranged and revised. Ideally, all sports activities would have the surface individually specified, but economic pressures dictate that in many installations a number of sports have to be played in the same space and often on the same surface. For this reason, requirements for surfaces for multi-sports use are given in this Part of BS 7044.

The likelihood of injury is a complex function of the properties of the surface and the nature of the sport to be played. The relevant physical properties are stiffness, energy absorption, friction and roughness. Particularly for a multi-sports surface it is not possible to define a complete safety specification nor to specify absolute limits for all relevant properties which will be applicable to all sports.

Repeated interaction between the ball and players' footwear and the surface will inevitably result in wear due to both abrasion and fatigue processes. In practice, these processes cannot be separated and it is not possible to reproduce precisely in the laboratory the complex service conditions. Again, in service, the surface may be subject to complex patterns of temperature, sunlight and water. It is not possible to reproduce these conditions precisely in the laboratory. Consequently, the methods for measuring durability and environmental resistance cannot be readily used to predict service life, but the requirements specified set minimum standards which, if met, should result in satisfactory durability.

WARNING. It is incumbent upon the owners of, or operators of, a sports facility to satisfy themselves as to the suitability of the surface from a safety aspect for the sports to be played.

It is considered essential that this Part of BS 7044 is read in conjunction with BS 7044-1.

While the tests are intended to assess the most important features of a product to be used as an artificial sports surface, they cannot remove the necessity for regular inspection and maintenance, which is essential for reliable operation.

Product certification. Users of this Part of BS 7044 are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 7044 specifies requirements for artificial surfaces for multi-sports use, i.e. surfaces for installation where a number of different sports will be played. The requirements apply to the complete surface, i.e. the top layers and the substrate.

NOTE 1 It should be noted that requirements for surfaces for a particular sport may render those surfaces incompatible with requirements for other sports. Advice on requirements for surfaces for an individual sport should be sought from the governing bodies of the sport in question.
NOTE 2 A recommended test schedule is given in Appendix A.
NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Dimensions

Each surface shall be laid with an overall slope in any direction no greater than 1 in 100.

Any localized bumps or hollows shall be not greater than 6 mm on an indoor area and not greater than 10 mm on an outdoor area when measured using a 3 m straightedge, and not greater than 3 mm when using a 300 mm straightedge.

NOTE 1 A suitable method of measurement using a straightedge is described in BS 8203.

Deviation from the finished plane shall be not greater than ± 6 mm at any point on an indoor area and shall be not greater than ± 25 mm at any point on an outdoor area.

NOTE 2 The surface should be dimensionally stable so that, in normal use, it should not lift or buckle through the actions of temperature and weather, or from the interaction with equipment or players. The thermal expansion of the surface should be such that, with the recommended method of fixing to the substrate, the surface does not lift or buckle over the temperature range – 5 °C to + 40 °C.

For any class of artificial grass sports surface (see BS 7044-1) the mean pile height measured before any sand infill shall not vary by more than ± 15 % of the mean height and the distribution of the pile over the surface shall be uniform. In cases of dispute the pile height shall be determined by measuring the overall thickness and the thickness of the backing by the method described in BS 4051.

NOTE 3 The area of surface will normally be at least the minimum area required by the rules of the sports to be played. Information may be obtained from the governing bodies of the sports in question.
NOTE 4 Pronounced surface patterns or artificial grass may not be suitable for some sports and, if in doubt, information should be sought from the governing bodies of the sport in question. A rough surface on a rigid material will increase the risk of injury from cuts and grazes and may substantially reduce ball life through abrasion.

3 Performance

All classes of surface shall comply with Table 1 to Table 5, as appropriate.

4 Essential information

The following information shall be supplied by the manufacturer to the purchaser.

NOTE This information should also, as far as possible, be included in any test reports.

a) The number and date of this British Standard, i.e. BS 7044-4:1991[1)].

b) The designation "NOT IMPACT ENERGY ABSORBING", "FLAMMABLE", "LOW PERMEABILITY" (Class 0 surfaces[2)] only), where appropriate.

c) The substrate(s) to which the test results relate, the depth of substrate, type of material including particle size and shape, and method of bonding, if any.

d) The colour and reflectance of the surface as defined in BS 4800.

e) Details of which types of paint and/or tape can be applied effectively and without damage to the surface or significantly affecting the playing characteristics, or other line marking methods available, e.g. inlaid or woven lines.

f) The means and substances to be used to carry out regular maintenance in the form of cleaning of the surface.

g) The details of any other regular maintenance, e.g. resealing or topping up the level of sand and, where appropriate, the sealants that may be used.

h) An assurance that the surface does not contain in its finished state any substance which is known to be toxic or carcinogenic when in contact with skin, and that no toxic or carcinogenic substance(s) will be released as a vapour or dust during normal use.

i) The principal sports for which the surface is intended.

[1)] Marking BS 7044-4 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

[2)] As defined in BS 7044-1.

Table 1 — Ball/surface interaction

Property	Sports ball	Performance	Test method
Rebound resilience (wet and dry[a])		No difference at 5 + 0, – 2 °C, 23 ± 2 °C and 40 ± 2 °C within the range given below:	Method 1 of BS 7044-2.1:1989
	Basketball	50 % to 70 %	
	Handball	40 % to 60 %	
	Hockey — outdoor	8 % to 20 %	
	Netball	45 % to 65 %	
	Soccer	25 % to 50 %	
Ball roll[b] (wet)	Hockey — outdoor	5 m to 15 m	Method 2 of BS 7044-2.1:1989
Velocity change of a rolling ball[c]	Football	0.10 m/s to 0.75 m/s	Method 3 of BS 7044-2.1:1989

NOTE Spin may be measured using method 4 of BS 7044-2.1:1989.

[a] A wetting procedure is given in Appendix C.

[b] The method for ball roll gives a direct measure of the distance a ball with a given velocity will roll, but requires a large test area and is affected by wind and surface irregularities. A greater ball roll than 15 m may be found on some artificial sports surfaces and it should not be inferred that these are unsuitable, particularly for indoor ball games. No limits can be laid down for ball roll, other than for outdoor hockey, because of the range of sports which may be played and the variety of balls which may be used.

[c] The method for velocity change measures the rate at which the surface slows the rolling ball and does not require a very large test area. No limits can be laid down for velocity change, other than for football, because of the range of sports played and variety of balls used and the lack of available data.

Table 2 — Person/surface interaction

Property	Performance	Test Method
Traction coefficient (wet and dry)	1.1 to 2.0	Method 1 of BS 7044-2.2:1990
Slip resistance (wet and dry)	Between 60 and 140	Method 3 of BS 7044-2.2:1990[a]
Peak deceleration	Surfaces shall either give a peak *g* of 200 from a drop height of not less than 1.0 m, or shall be designated "NOT IMPACT ENERGY ABSORBING". For class MD/0, HD/0 and SR/0 surfaces[b], the requirement shall also be met when wet	Method 4 of BS 7044-2.2:1990

[a] This method is not applicable to use on non-sand filled artificial grass surfaces because of uncertainty in the length of the contact path.

[b] As defined in BS 7044-1.

Table 3 — Durability

Property	Performance	Test method
Abrasion resistance to abrasive wheels	Mass loss of surfaces other than artificial grasses[a] shall be not greater than 3.0 g per 1 000 revolutions. Abrading wheels shall be in accordance with section 3 of BS 7188:1989 If the surface is a laminate of different materials, the top layer shall not be abraded completely through, unless this is stated by the manufacturers to be replaceable as part of normal maintenance	Method 1 of BS 7044-2.3:1990[bc]
Abrasion resistance to metal blades	Mass loss of non-sand filled artificial grass surfaces shall be not greater than 0.2 g per 2 000 revolutions	Method 2 of BS 7044-2.3:1990[c]
Fatigue resistance	Surface shall show no signs of cracking or tearing or any delamination of bonded layers. When brushed, the pile of artificial grass surfaces shall show no evidence of cracking or fracture	Method 3 of BS 7044-2.3:1990[d]
Low temperature impact resistance	Class 0 surfaces[e] shall show no signs of cracking or permanent distortion	Method 4 of BS 7044-2.3:1990
Spike resistance	The following surfaces shall not be damaged to greater than grade 2: a) class SR/0 surfaces[e], using 9 mm spikes; b) class SR/0 surfaces[e] to be used for javelin run-up, using 12 mm spikes; c) class SR/I surfaces[e], using 6 mm spikes	Method 5 of BS 7044-2.3:1990
Resistance to indentation	3 mm maximum for class 0 and I surfaces[e] after 1 500 min	Method 6 of BS 7044-2.3:1990

[a] Needle punch materials are not considered to be artificial grasses.

[b] This method is unsuitable for materials with loose or unbound components.

[c] Methods 1 and 2, as described in BS 7044-2.3, do not reproduce precisely the complete service conditions and cannot readily be used to predict service lifetime. Important factors, in addition to mass loss, include the thickness of material available to be abraded and the degree of splitting and matting of artificial grass. When assessing surfaces, the abraded test pieces should be visually inspected and the condition noted.

[d] A loading of either 5 ± 0.1 kg for testing class HD/0, HD/I, SR/0 and SR/I surfaces[e], or 2.5 ± 0.05 kg for testing class MD/0 and MD/I surfaces[e], is used.

[e] As defined in BS 7044-1.

Table 4 — Environmental resistance

Property	Performance	Test method
Resistance to ozone	The top layer of flexible polymeric surfaces shall show no signs of cracking, except that any cracks in the regions of the clamps shall be ignored. For surfaces intended to be portable the backing also shall meet this requirement	Method 1 of BS 7044-2.4:1989
Resistance to air ageing	Surface shall meet the requirements for resilience (see Table 1), abrasion resistance to abrasive wheels or abrasion resistance to metal blades, as appropriate, and fatigue resistance (see Table 3)	Method 2 of BS 7044-2.4:1989
Resistance to water	Class 0 surfaces[b] shall meet the requirements for resilience, (see Table 1) abrasion resistance to abrasive wheels or abrasion resistance to metal blades, as appropriate, and fatigue resistance (see Table 3) and seam strength (see Table 5)	Method 3 of BS 7044-2.4:1989
Resistance to artificial weathering	Class 0 surfaces[b] shall meet the requirements for resilience (see Table 1), abrasion resistance to abrasive wheels or abrasion resistance to metal blades, as appropriate, and fatigue resistance (see Table 3) The change of colour of the surface shall be not less than rating 3 of the grey scale specified in BS 1006-A02	Method 4 of BS 7044-2.4:1989
Critical radiant flux[a]	Surfaces shall either have a critical radiant flux of 5 kW/m^2 or shall be designated "FLAMMABLE"	ISO/DIS 9239

[a] The results of the test give an indication of one aspect of the fire exposure behaviour of the surface but cannot be used to give a full assessment of its fire properties in all situations.
The fire performance of the complete installation should be assessed in accordance with BS 6336, i.e. consideration should be given to the design of the product, to the risks to which it may be exposed and to the end-use environment. It is envisaged that a surface with a critical radiant flux of less than 5 kW/m[b] will be acceptable in low fire hazard situations.
[b] As defined in BS 7044-1.

Table 5 — Miscellaneous

Property	Performance	Test method
Colour transfer	The transfer of colour from the surface shall give a result not less than rating 3 of the grey scale specified in BS 1006-A03 For class 0 surfaces[b] the test shall be carried out on test pieces previously subjected to method 3 of BS 7044-2.4:1989	Method 1 of BS 7044-2.5:1990
Seam strength	15 N/mm minimum (direct tension method) 0.25 N/mm minimum (peel method) After ageing in accordance with method 3 of BS 7044-2.4:1989 the seam strength shall not have deteriorated by more than 20 % of the unaged result	Method 2 of BS 7044-2.5:1990[ab] Method 3 of BS 7044-2.5:1990[b]
Infiltration rate	Class 0 surfaces[c] shall either have an infiltration rate of not less than 100 mm/h or shall be designated "LOW PERMEABILITY"	Method 4 of BS 7044-2.5:1991[d]

[a] This method is suitable for testing all types of loose-laid (or only partially adhered) artificial sports surfaces that incorporate chemically or mechanically bonded butt joints including sewn seams as the manner of joining adjacent lengths of artificial sports surface.

[b] Where a joint is chemically or mechanically bonded and also reinforced it may be appropriate for both tests to be carried out.

[c] As defined in BS 7044-1.

[d] In preparation.

Appendix A Test schedule

The requirements in this standard cannot all be tested on a completed installation, nor can they all be tested on samples in a laboratory. Hence, to comply fully with the specification, a test schedule is required which includes both laboratory samples and a completed installation.

Where the requirements can be tested both on laboratory samples and on the installation, testing on the installation is preferred because results may be dependent on the exact laying procedure and on the substrate used. However, for demonstrating compliance for tender purposes tests on laboratory samples are acceptable. In such cases tests have to be carried out with the substrate which will be used in service whenever required by the particular test method, and the test report has to detail the substrate used.

It is recommended that, however test results are obtained to demonstrate general compliance of a system with this Part of BS 7044, the actual installation in question is tested on completion to all requirements of the specification.

The necessary testing requirements are given in Table 6, together with an indication as to whether testing should be on a laboratory sample or an installation.

NOTE For tests normally carried out only in the laboratory it may be possible in cases of dispute, for example, to lift sections of surface for laboratory tests.

Appendix B Design levels

The design level of any point within a sports area should be referred to a temporary benchmark within the area. Design level is calculated by consideration of the design gradients over the area.

Design levels are to be checked by taking levels on a 3 m grid on indoor areas and on outdoor areas up to 900 m^2 and on a 10 m grid on outdoor areas greater than 900 m^2.

The level of the sports area relative to its surroundings will often be of importance, but is a separate matter.

Appendix C Wetting procedure

The sample under test, or, in the case of on-site tests an area larger than necessary for the test which is to be carried out, is saturated by the application of an excess of water.

For laboratory tests, the application to the test piece of a layer of water of equal thickness to the sample will ensure saturation. On site, a similar principle may be followed, provided that some information is available on the construction of the facility. In the absence of any such information, 50 L/m^2 of water should be applied to the test area.

After allowing the sample to drain for 30 min 5 L/m^2 of water is applied to the test area and the test is carried out within 5 min.

Table 6 — Test schedule

Test	Laboratory	Installation
Overall dimensions		x
Slope		x
Evenness		x
Pile height	x	x
Rebound resilience	x	x
Rebound resilience at sub-ambient and elevated temperatures	x	
Ball roll	x[a]	x
Velocity change of a rolling ball	x	x
Spin[b]	x	x
Traction	x	x
Slip resistance	x	x
Peak deceleration	x	x
Abrasion resilience to abrasive wheels or metal blades	x	
Fatigue Resistance	x	
Low temperature impact resistance	x	
Fatigue Resistance	x	
Low temperature impact resistance	x	
Spike resistance	x	
Resistance to indentation	x	
Resistance to ozone	x	
Resistance to air ageing	x	
Resistance to water	x	
Resistance to artificial weathering	x	
Critical radiant flux	x	
Colour transfer	x	
Seam strength	x	
Infiltration rate	x[c]	x
Colour	x	x
Reflectance	x	x

[a] The large sample size required restricts laboratory testing.

[b] See note to Table 1.

[c] Laboratory testing will only be satisfactory for development purposes.

Publication(s) referred to

BS 1006, *Methods of test for colour fastness of textiles and leather.*
BS 1006-A02, *Grey scale for assessing change in colour.*
BS 4051, *Method for determination of thickness of textile floor coverings.*
BS 4800, *Schedule of paint colours for building purposes.*
BS 5204, *Specification for straightedges.*
BS 5750, *Quality systems.*
BS 6336, *Guide to development and presentation of fire tests and their use in hazard assessment.*
BS 7044, *Artificial sports surfaces.*
BS 7044-1, *Classification and general introduction.*
BS 7044-2.1, *Methods for determination of ball/surface interaction.*
BS 7044-2.2, *Methods for determination of person/surface interaction.*
BS 7044-2.3, *Methods for determination of durability.*
BS 7044-2.4, *Methods for determination of environmental resistance.*
BS 7044-2.5, *Miscellaneous.*
BS 7188, *Methods of test for impact absorbing playground surfaces.*
BS 8203, *Code of practice for installation of sheet and tile flooring.*
ISO/DIS 9239, *Floorcoverings — Determination of critical radiant flux using a radiant heat energy source.*
Sports Council Specification for Artificial Sports Surfaces, 1984 — Part 2: Surfaces for general sports use[3)4)].

[3)] Referred to in the foreword only.
[4)] Available from The Sports Council, 16 Upper Woburn Place, London, WC1H 0QP.

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