

# Impact absorbing playground surfacing — Performance requirements and test methods

ICS 97.200.40

|                           |
|---------------------------|
| Confirmed<br>January 2010 |
|---------------------------|

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee SW/65, Children’s playground equipment, upon which the following bodies were represented:

- Association of Play Industries
- BSI Testing
- Co-opted experts
- Consumer Policy Committee of BSI
- Department for Culture, Media and Sport
- Health and Safety Executive
- Institute of Leisure and Amenity Management
- Institute of Sport and Recreation Management
- Landscape Institute
- Local Government Association
- National Playing Fields Association
- RAPRA Technology Ltd
- Royal College of Paediatrics and Child Health
- Royal Society for the Prevention of Accidents
- Safety Assessment Federation Ltd
- Timber Research and Development Association

This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 December 1998

© BSI September 2009

First published 31 August 1989  
Second edition 15 December 1998

The following BSI references relate to the work on this standard:  
Committee reference SW/65  
Draft for comment 98/702935 DC

ISBN 978 0 580 69247 5

## Amendments issued since publication

| Amd. No. | Date              | Text affected                                   |
|----------|-------------------|-------------------------------------------------|
| 13935    | 9 December 2002   | Addition of clause 8                            |
| A2       | 30 September 2009 | Addition of Annex A, and Note 2 to scope clause |
| C1       | 30 September 2009 | Correction to contents list                     |
|          |                   |                                                 |

# Contents

|                                                                                    | Page               |
|------------------------------------------------------------------------------------|--------------------|
| Committees responsible                                                             | Inside front cover |
| Foreword                                                                           | ii                 |
| Introduction                                                                       | 1                  |
| 1 Scope                                                                            | 1                  |
| 2 Normative references                                                             | 1                  |
| 3 Terms and definitions                                                            | 1                  |
| 4 Resistance to abrasive wear                                                      | 2                  |
| 5 Slip resistance                                                                  | 4                  |
| 6 Resistance to indentation                                                        | 6                  |
| 7 Ease of ignition                                                                 | 8                  |
| 8 Tensile properties                                                               | 9                  |
| Annex A (informative) Assessment of the retention of impact attenuating properties | 11                 |
| Bibliography                                                                       | 12                 |
| Figure 1 — Apparatus for determination of slip resistance                          | 5                  |

## Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

## Foreword

This British Standard has been prepared by Technical Committee SW/65 and is a revision of BS 7188:1989, *Methods of test for impact absorbing playground surfaces*, which was withdrawn on 31 December 1998.

BS 7188:1998+A2:2009 supersedes BS 7188:1998 as amended by amendment No. 1, which is withdrawn.

This standard was first published in 1989 as a series of test methods for impact absorbing playground surfacing, at which time it introduced the term “critical height” as a means of describing the effectiveness of surfaces in absorbing the impact of a headfirst fall. “Critical height” was the distance through which a standard headform could be dropped on to the surface before it experienced a severity index of 1 000 (a parameter originating from head injury studies available at that time).

The European Committee for Standardization (CEN) accepted the general principle of measuring the effectiveness of playground surfacing in this way and adapted the procedure to take account of more recent research into means of measuring the potential for head injury and other anthropometric data on children’s head size and mass. The result of these discussions was the approval in August 1997 of EN 1177, *Impact absorbing playground surfacing — Safety requirements and test methods*.

The test method described in BS EN 1177 uses the term “critical fall height”, the distance through which a standard headform could be dropped on to the surface before it experiences a head injury criterion (HIC) value of 1 000 (HIC being a refinement of the original severity index concept, which measures maximum severity experienced over any period during the impact event).

Specifiers and purchasers of impact absorbing playground surfacing may continue, therefore, to express their requirements in the familiar terms of the critical height needed for any given situation by using BS EN 1177. However, because the headform used to create the impact and the mathematical basis by which the severity of the event is assessed are both different from the original British Standard method, there is no simple relationship between values obtained for critical height by these two methods. Specifiers should be careful to ensure, therefore, that test reports and certificates describing surfacing products now refer, as appropriate, to BS EN 1177 or BS 7188:1998+A2:2009.

The test method for critical height is intended to be universally applicable to all types of impact absorbing surfacing, from loose-fill particulate materials to prefabricated rubber tiles.

The first edition of BS 7188 also contained test procedures for measuring other properties (resistance to abrasive wear, slip resistance, resistance to indentation and ease of ignition) which were primarily relevant to moulded tiles, mats and cast in-situ rubber surfaces. These four other test methods have been retained in this new edition of BS 7188, but may in time also be superseded by equivalent CEN test methods for these properties.

The recommended performance limits for surfacing products when tested to these methods were previously set out in Amendment No. 2 to BS 5696-3, *Play equipment intended for permanent installation outdoors — Part 3: Code of practice for installation and maintenance*. For the convenience of users, this new edition of BS 7188 now incorporates these limits as requirements within each respective clause. BS 5696-3 was withdrawn on 31 December 1998.

It is assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

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

**Compliance with a British Standard cannot confer immunity from legal obligations.**

## Introduction

In addition to the critical fall height now assessed by BS EN 1177, this standard provides methods of test and recommended performance limits for resistance to abrasive wear, slip resistance, resistance to indentation and ease of ignition. The full range of information able to be provided by BS EN 1177 and BS 7188 will provide the designer and operator of children's playgrounds with the necessary detailed information to enable the most appropriate surfaces to be provided.

## 1 Scope

This standard specifies performance requirements for impact absorbing playground surfacing and describes the relevant methods of test, in addition to and using different criteria from those given in BS EN 1177. It covers the following:

- a) the ability of the surface to resist abrasive wear;
- b) the slip resistance of the material;
- c) the ability of the material to resist indentation by point loading and to recover from sustained loading;
- d) the response of the material to a particular source of ignition.

NOTE 1 It does not give an indication of what contribution the product would make to an established fire or its response to a longer ignition source.

This standard is to be used in conjunction with BS EN 1177.

NOTE 2 Information on how the impact attenuating properties of the surfacing can be monitored on site, if required, is given in Annex A.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 812-114:1989, *Testing aggregates — Part 114: Method for determination of the polished-stone value.*

BS 903-A2:1995, *Physical testing of rubber — Method for determination of tensile stress-strain properties.*

BS 907, *Specification for dial gauges for linear measurement.*

BS 2782-5:1995, *Methods of testing plastics — Method 540B: Methods of exposure to laboratory light sources (xenon arc lamp, enclosed carbon arc lamp, open-flame carbon arc lamp, fluorescent tube lamps).*

BS 4790:1987, *Method for determination of the effects of a small source of ignition on textile floor coverings (hot metal nut method).*

BS EN 1177:1998, *Impact absorbing playground surfacing — Safety requirements and test methods.*

BS EN 20105-A02:1995, *Textiles — Test for colour fastness — Part A02: Grey scale for assessing change in colour (including half-steps).*

BS EN ISO 5470:1999, *Rubber or plastics coated fabrics — Determination of abrasion resistance — Taber abrader.*

BS ISO 188:1998, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat-resistance tests.*

BS ISO 5893:2002, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification.*

ISO 1926:1979, *Cellular plastics — Determination of tensile properties of rigid materials.*

## 3 Terms and definitions

For the purposes of this British Standard, the definitions given in BS EN 1177:1998 and the following apply.

### 3.1

#### **slip resistance**

force which resists the relative movement of a shod foot, when in contact with a floor surface

### 3.2

#### **wear index**

numerical expression of the resistance to wear, in terms of the rate of loss in mass by a specimen in the test procedure described

### 3.3

#### **wear ratio ( $\rho$ )**

numerical expression of the ratio of the wear index at the beginning of the test procedure to that at the end of the test

### 3.4

#### **afterglow**

persistence of glowing of a material, under specified test conditions, after cessation of flaming or, if no flaming occurs, after removal of the ignition source

## 4 Resistance to abrasive wear

### 4.1 Performance requirements

When tested by the method described in 4.2, 4.3, 4.4, 4.5, 4.6 and 4.7, moulded tiles, mats and cast in-situ rubber surfaces shall exhibit the following performance:

a) wear index:

— for each of the four specimens tested, the wear index shall be less than 1.0;

b) wear ratio:

— for each of the four specimens tested, the wear ratio ( $\rho$ ) shall be not less than 1.0 and not more than 3.0.

### 4.2 Principle

Samples of the material, some of which have been subjected to an accelerated ageing process, are abraded in a consistent manner. The loss of material is compared to the original mass of the sample to calculate the wear index. The wear index is compared over time to calculate the wear ratio.

### 4.3 Apparatus

**4.3.1 Rotary platform abrasion machine**, with twin abrasion heads as specified in ISO 5470. The abrading wheels shall be H 18, freshly refaced in accordance with the manufacturer's instructions. The wheels shall bear down on the surface of the sample under a load of 4.90 N per wheel. The apparatus shall be fitted with a suction device to remove loose material from the abraded area of the specimen, continuously throughout the test.

**4.3.2 Air circulating oven**, conforming to ISO 188, clause 4.

### 4.4 Test specimens

Four test specimens shall be tested, each representative of the material under test. The dimensions of the test specimens shall be either 100 mm  $\pm$  5 mm square, or in the form of a disc, 100 mm  $\pm$  5 mm in diameter, whichever is more convenient. The thickness of the test specimen shall be uniform and not more than 10 mm. Impact absorbing surfaces are frequently formed from products which may be substantially thicker than 10 mm. In such cases, the thickness of the test specimen shall be reduced to 10 mm  $\pm$  1 mm by uniformly cutting or machining the underside of the material to achieve the required thickness. Any process used for reducing the thickness of the specimen shall not involve any significant heat build-up of the specimen, nor alter the use-surface of the specimen in any way. The two faces of the prepared specimen shall be parallel.

A hole 7 mm  $\pm$  0.5 mm in diameter shall be drilled or punched through the exact centre of each test specimen, in order to enable it to be secured to the rotary platform of the test apparatus.