BS 7971-5:2016

BSI Standards Publication

Protective clothing and equipment for use in violent situations and in training

Part 5: Footwear – Requirements and test methods

bsi.

Publishing and copyright information

Published by BSI Standards Limited 2016

ISBN 978 0 580 75837 9

ICS 13.340.10

The following BSI references relate to the work on this document:
Committee reference PH/3/12
Draft for comment 16/30280808 DC

Publication history

BS 7971-5 first published September 2004
BS 7971-11 first published August 2006
First published together as BS 7971-5 August 2016

Amendments issued since publication

Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 10, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 7971 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 August 2016. It was prepared by Subcommittee PH/3/12, *Protective clothing and equipment for use in violent situations and training* under the authority of Technical Committee PH/3, *Protective clothing*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 7971 supersedes BS 7971-5:2004, which is withdrawn, and partly supersedes BS 7971-11:2006.

Information about this document

This part of BS 7971 has been substantially revised in association with the Home Office. The aims of the revision were to amalgamate appropriate content from BS 7971-1, BS 7971-2, BS 7971-5 and BS 7971-11 and to reference the Home Office publication*, Blunt trauma protector standard for UK police (2007)* [N1]. This British Standard contains public sector information licensed under the Open Government Licence v2.0.

This full revision of the standard introduces the following principal changes by addition of clauses covering:

- innocuousness;
- sizing;
- marking;
- user information;
- modified resistance to chemicals;
- testing for flame spread; and
- integral metatarsal protection.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller 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 British Standard cannot confer immunity from legal obligations.

Attention is drawn to Regulation (EU) 2016/425 [1)] [1].

[1)] Regulation (EU) 2016/425 replaces Directive 89/686/EEC, which remains in use until April 2018.

Introduction

Footwear used in specialist operational situations and in training is intended to reduce the risk of injury to the user, who might be faced with threats such as impact, heat, flame and the effects of certain liquids, which in some circumstances could also be burning liquids.

In the period of time since the initial publication of the BS 7971 suite of standards, products in general use have evolved to reflect the changing threat and operational needs of the user, including the need for protection from more penetrative chemical threats. In the selection of suitable footwear, optimum protection has to be balanced with operational requirements in an environment where the option of increasing protection levels as a threat escalates might not be viable.

Consideration has been made for new advances in technology identified at the time of revision, particularly in the area of metatarsal protection.

Operational requirements were taken into account during the preparation of this revision.

Principal changes between this and the previous edition are outlined in the Foreword.

1 Scope

This part of BS 7971 specifies requirements and test methods for footwear, which is to be used predominantly but not exclusively by police and prison officers in specialist operational situations and in training and by others who might be exposed to attack and assault in the course of their duties.

NOTE 1 Civilian groups working alongside police or prison services in specialist operational situations might find by risk assessment that this British Standard offers additional protection for such activities and threats not within the scope of other standards.

NOTE 2 This British Standard does not cover external, over-the-boot metatarsal protection which is intended to be considered in the next revision of BS 7971-4.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 5131-5.13:1980, *Methods of test for footwear and footwear materials – Part 5: Testing of complete footwear – Section 5.13: Measurement of the strength of stitched seams in upper and lining materials*

BS EN ISO 6942:2002, *Protective clothing – Protection against heat and fire – Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat*

BS EN ISO 13997, *Protective clothing – Mechanical properties – Determination of resistance to cutting by sharp objects*

BS EN ISO 20345, *Personal protective equipment – Safety footwear*

Other publications

[N1] HOME OFFICE SCIENTIFIC DEVELOPMENT BRANCH. *HOSDB Blunt trauma protector standard for UK police (2007).* Publication No. 20/07. St Albans: Home Office, 2007. [2)]

3 Terms and definitions

For the purposes of this part of BS 7971, the terms and definitions given in BS EN ISO 20345 and the following apply.

3.1 integral metatarsal protector
permanent, non-removable part of the boot providing protection to the metatarsal area

4 Requirements

4.1 Requirements based on BS EN ISO 20345

4.1.1 General

Footwear shall conform to all the basic requirements of BS EN ISO 20345 for a classification 1 product. In addition it shall meet the following additional requirements of BS EN ISO 20345 as detailed in Table 1.

Table 1 **Additional requirements from BS EN ISO 20345**

	Requirement	Symbol
Whole footwear	Upper height – Design C or D	–
	Penetration resistance	P
	Electrical properties – antistatic	A
	Resistance to inimical environments – heat insulation	HI
	Resistance to inimical environments – cold insulation	CI
	Energy absorption of the seat region	E
	Water resistance (dynamic machine method)	WR
	Ankle protection	AN
Outsole	Resistance to hot contact	HRO
	Resistance to fuel oil	FO
	Cleated outsole	–

4.1.2 Innocuousness

The manufacturer shall ensure, by testing or by declaration, that the materials or their derivatives shall not be known to harm the user, i.e. that they shall not be known to contain any toxic, carcinogenic, allergenic or otherwise harmful substances that could be released under foreseeable conditions of use.

[2)] Available from <http://ped-cast.homeoffice.gov.uk/standards//20-07_HOSDB_Blunt_Trauma_Protector_Standard_(2007)_Limb_Torso.pdf> [last viewed 8 August 2016].

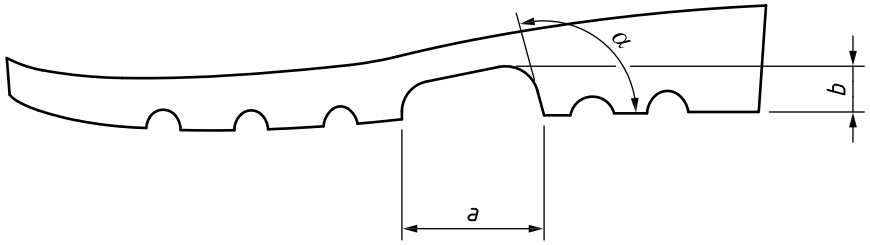
4.2 Additional requirements

In addition to meeting the requirements of BS EN ISO 20345 as detailed in Clause **4** of this British Standard, footwear shall meet the requirements specified in Table 2.

Table 2 **Additional requirements – footwear**

Property	Test method	Requirement
Maximum width of outsole	Visual inspection and measurement	Width of size 8 at widest point: ≤115 mm
Heel breast on outsole	Visual inspection and measurement (see Figure 1)	Dimension *a* ≥35 mm Dimension *b* ≥10 mm Angle α > 90° < 120°
Tongue	Visual inspection and measurement	Internal or external bellows extending to at least half the height of the upper as measured from the featherline.
Seam strength of structural seams in stitched footwear	BS 5131-5.13:1980	Seam strength ≥15 N/mm
Chemical resistance of the upper	**5.1** using a) 50% ISO-octane/50% toluene (petrol substitute); b) Methyl Isobutyl Ketone (AR grade); c) 50% ethanol/50% water; d) 30% aqueous sulfuric acid; and e) 40% aqueous sodium hydroxide.	There shall be no penetration of liquid through the structure of the boot after 10 min ±30 s and no more than slight visible damage to the surface, fittings or structure of the boot after 1 h ±2 min.
Radiant heat	BS EN ISO 6942:2002, Method B at a heat flux density of 20 kW/m^2	Test samples to be cut from area 1 shown in Figure 2. RHTI 24 (i.e. Radiant Heat Transfer Index as defined in BS EN ISO 6942:2002) ≥13 s.
Additional ergonomics – running	**5.2**	At least two of the three wearers to be able to complete all actions without discomfort and without the fastening system loosening to the point that the footwear was coming off.
Burning behaviour	**5.3**	Total burn time of main boot (i.e. excluding laces) ≤120 s. Footwear to remain intact (i.e. no holing through full thickness of upper, seams to remain intact). No signs of thermal damage (such as charring or melting) on inner surface of boot.
Cut resistance	BS EN ISO 13997	Minimum cutting force 15 N when tested on the area defined in Figure 2.

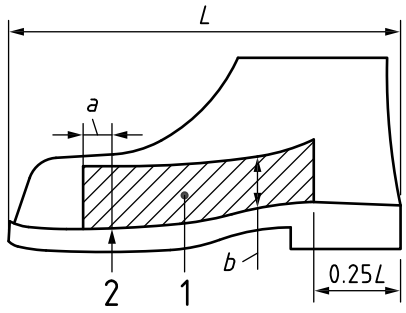
Figure 1 **Outsole dimensions**



Key

a	Waist height	α	Heel breast angle
b	Heel breast height		

Figure 2 **Radiant heat test area**



Key

1	Protective area	a	Overlap of 10 mm over toecap
2	Rear edge of toecap	b	Minimum height of 30 mm above the feather line

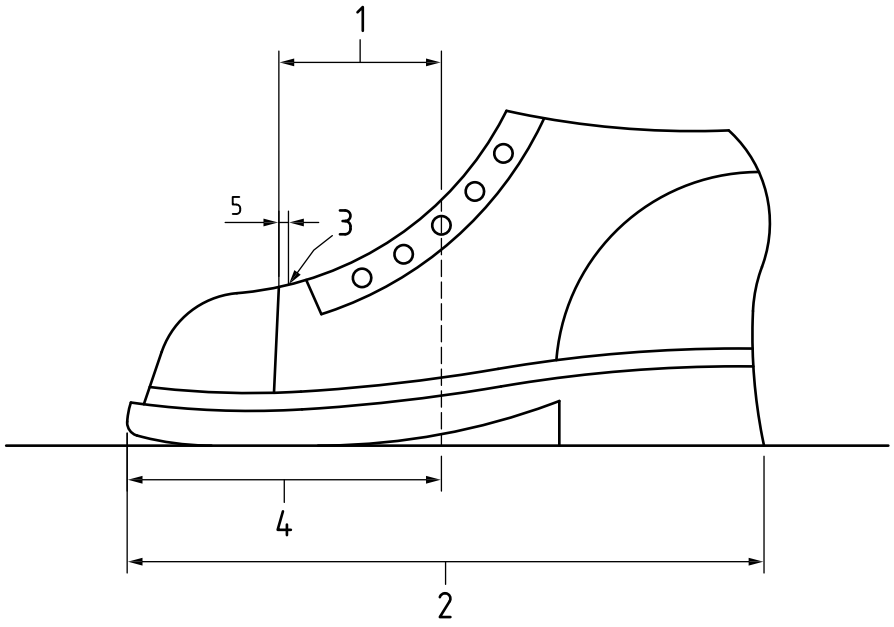
4.3 Optional requirements

Integral metatarsal protectors shall meet the transmitted force requirements specified in *Blunt trauma protector standard for UK police (2007)* [N1]. They shall be tested within the "as worn" structure of the boot, using the ambient preconditioning only and an impact energy of 15 ±0.5 J and shall have a minimum length of protection as shown in Figure 3.

NOTE It has been found that the best methodology for sample preparation is for the upper of the boot to be fastened as intended to be worn and then cut from its sole and opened down the back seam area to allow it to be placed across the anvil for testing.

Figure 3 **Minimum length of metatarsal protection**

Dimensions in millimetres



Key

1 Minimum length of integrated metatarsal protection
2 Length of boot
3 Starting point of protection – within 5 mm of end of toe cap
4 Minimum end point of protection – greater than 50% of length of boot

5 Test methods and method guidance

5.1 Chemical resistance testing

5.1.1 Principle

Whole boot samples are exposed for a short period of time to a limited volume of specific liquids which might be encountered in operational use.

Damage to the materials and structure of the boot including ingress through seams and manufactured structure is assessed following a short and then extended period.

5.1.2 Method

A single boot sample shall be evaluated per chemical to be applied.

a) Clean the boot with a dry absorbent paper to remove any residue or manufacturing finishes.

b) Store the boot for at least 24 h in an environment at 20 ±2 °C and 65 ±5% rh.

c) Fasten the boot.

d) Fill the boot with absorbent paper as a trace medium for liquid ingress. Ensure the paper is in contact with the seams of the boot at the front, bellows and lacing in particular.

e) Prepare a minimum of 70 ml of each of the following test liquids:

1) 50% ISO-octane/50% toluene (petrol substitute);

2) Methyl Isobutyl Ketone (AR grade);

3) 50% ethanol/50% water;

4) 30% aqueous sulfuric acid; and

5) 40% aqueous sodium hydroxide.

f) Place the boot into a metal tray of a sufficient size to allow residual liquid to drain from around the boot during application. Use a new boot for each test.

g) Lightly mark the sides and tongue area of the test sample with a horizontal line approximately 5 mm below the top of the bellows of the tongue.

NOTE 1 This is to allow accurate application of the test solution in a position below the bellows of the tongue (a waxed pencil or chalk have been found to be suitable) and to minimize any incidence of accidental spillage during application into the inner of the boot.

h) Pour 60 ±6 ml of test liquid evenly across the two sides and front of the boot and leave any spilled volume in the tray in contact with the sole until the first examination is completed. It is useful to have the boot at an angle of approximately 45° when pouring chemicals onto the side sections.

NOTE 2 It has been found that using smaller containers each holding 20 ±2 ml of the test liquid per side and across the centre front makes application more consistent.

i) Leave the samples for a period of 10 min ±30 s prior to removal from the tray and assess any initial damage.

j) Remove the absorbent paper from inside the boot and, if any liquid penetration is visible as damp patches, note the location of ingress and make a comment on the severity of ingress (none/slight/moderate/severe).

k) 1 h ±2 min after pouring the chemical, carry out a visual inspection of the boot, comparing it to an original (or photographs) and note any damage or visual change (for example, surface marking or damage, damage to components, lack of functionality). Check the area under any lacing or fastenings where spilt liquid might be trapped and not easily visible.

NOTE 3 The test sample should be cut open to assess any internal damage.

5.2 Method for determination of ergonomic penalty during walking/running

Three sizes of footwear shall be tested, one from towards the upper end of the size range, one from the lower end of the size range and one from the middle of the size range. The three wearers, who shall have feet of a size suitable for the test footwear and shall be physically fit enough to run 100 m in footwear of their own choice shall attempt the below actions a) to b) while wearing the test footwear. If the footwear is intended for both male and female wearers at least one wearer shall be male and one shall be female.

NOTE If considered necessary (e.g. as recommended by the manufacturer), a break-in wear period and the use of thick socks is permitted.

Actions:

a) Walk for 100 m and then run at a steady pace for 100 m.

b) Move rapidly up a typical 10–12 rise of stairs and then walk down the stairs.

A record shall be made as to whether or not it was possible to achieve each action and whether or not there was any discomfort or whether the fastening system had loosened to the point that the footwear was coming off.

5.3 Method for determination of burning behaviour

a) Clean the boot with dry absorbent paper to remove any residue or manufacturing finishes.

b) Store the boot for at least 24 h in an environment at 23 ±2 °C and 50 ±5% rh.

c) Fasten the boot.

d) Prepare 15 ±1 ml of a solution of 50% toluene and 50% ISO octane.

e) Place the boot on an open metal grill with a metal tray directly beneath it.

f) Lightly mark the sides and tongue area of the test sample with a horizontal line approximately 5 mm below the top of the bellows of the tongue.

NOTE This is to allow accurate application of the test solution in a position below the bellows of the tongue (a waxed pencil or chalk have been found to be suitable) and to minimize any incidence of accidental spillage during application into the inner of the boot.

g) Pour 15 ±1 ml of test liquid evenly across the two sides and front of the boot and leave any spilled volume left in the tray in contact with the sole until the first examination is completed. It is useful to have the boot at an angle of approximately 45 degrees when pouring chemicals onto the side sections.

h) Wait 10 ±1 s from the end of the pouring process as g) above and then remove the metal tray beneath the grill before immediately igniting the solution on the boot.

i) Record the time for the flames on the boot to completely extinguish (total burn time) – ignore any flaming of the laces.

j) If the total burn time is between 120 s and 135 s and if the burning is slight (restricted to the lace area only) such that it is difficult to determine if this is due to the burning of the laces, repeat the test using a new sample with the laces removed. Record both results and use the second result as the total burn time.

k) After all flaming has stopped, examine the boot for any signs of holing through the full thickness of the upper, seams which are no longer intact or any other damage to the integrity of the boot. Cut open the boot and examine the inner surface for signs of thermal damage such as melting, dripping or charring.

6 Marking

6.1 Permanent marking

NOTE Footwear that conforms to this British Standard also conforms to the basic requirements of BS EN ISO 20345 and can be marked accordingly.

Footwear shall be permanently and conspicuously marked with at least the following information:

a) the name or trademark of the manufacturer or their authorized representative in the EU or in the country where the item is to be placed on the market;

b) a commercial name or code that uniquely identifies the footwear;

c) the size designation;

d) date of manufacture (month and year) and batch number;

e) the number of this British Standard, i.e. BS 7971-5, and date; [3] and

f) where integral metatarsal protection is provided, the code IM adjacent to the number of the British Standard, i.e. BS 7971-5 IM.

6.2 Removable marking

Removable marking shall be attached to the footwear as issued, indicating whether or not metatarsal protection is provided by the footwear.

NOTE For example, a swing tag stating "This boot does/does not have metatarsal protection".

7 Manufacturer's information to user

NOTE Footwear that conforms to this British Standard also conforms to the basic requirements of BS EN ISO 20345 and can be supplied with information meeting that standard accordingly.

Footwear shall be supplied with at least the following information and instructions:

a) the name and full address of the manufacturer and/or their authorized representative;

b) reference to this British Standard, i.e. BS 7971-5;

c) explanation of any markings and levels of performance;

d) basic explanation of the tests that have been applied to the footwear, if applicable;

e) instructions for use:

1) inspection to be carried out by the wearer before use;

2) fitting and how to put on and take off the footwear;

3) application (basic information on possible uses and, where detailed information is given, the source);

4) limitations of use (e.g. temperature range);

5) instructions for storage and maintenance, with maximum periods between maintenance checks (if important, drying procedures to be defined);

6) instructions for cleaning and/or decontamination;

7) warning about degradation due to inadequate cleaning and/or decontamination;

8) obsolescence deadline or period of obsolescence;

9) if appropriate, warnings against problems likely to be encountered (modifications can invalidate compliance, e.g. using non-approved laces);

10) if helpful, additional illustrations, part numbers, etc;

11) guidance on method of disposal.

[3] Marking BS 7971-5:2016 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 solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

f) recommendation that a full ergonomic assessment with other PPE or clothing items which are to be worn in conjunction with the footwear is to be conducted by the specifiers/users;

g) reference to accessories and spare parts, if relevant;

h) type of packaging suitable for transport, if relevant.

For antistatic footwear, the following wording shall be supplied:

"Antistatic footwear should be used if it is necessary to minimize electrostatic build-up by dissipating electrostatic charges, thus avoiding the risk of spark ignition of, for example, flammable substances and vapours, and if the risk of electric shock from any electrical apparatus or live parts has not been completely eliminated. **It should be noted, however, that antistatic footwear cannot guarantee adequate protection against electric shock as it only introduces a resistance between foot and floor.** If the risk of electric shock has not been completely eliminated, additional measures to avoid this risk are essential. Such measures, as well as the additional tests mentioned below, should be a routine part of the accident prevention programme at the workplace.

Experience has shown that, for antistatic purposes, the discharge path through a product should normally have an electrical resistance of less than 1 000 MΩ at any time throughout its useful life. A value of 100 kΩ is specified as the lowest resistance limit of a product, when new, in order to ensure some limited protection against dangerous electric shock or ignition in the event of any electrical apparatus becoming defective when operating at voltages of up to 250 V. However, under certain conditions, users should be aware that the footwear might give inadequate protection and additional provisions to protect the wearer should be taken at all times.

The electrical resistance of this type of footwear can be changed significantly by flexing, contamination or moisture. This footwear might not perform its intended function if worn in wet conditions. It is, therefore, necessary to ensure that the product is capable of fulfilling its designed function of dissipating electrostatic charges and also of giving some protection during its entire life. It is recommended that the user establish an in-house test for electrical resistance, which is carried out at regular and frequent intervals.

Footwear can absorb moisture and can become conductive if worn for prolonged periods in moist and wet conditions.

If the footwear is worn in conditions where the soling material becomes contaminated, wearers should always check the electrical properties of the footwear before entering a hazard area.

Where antistatic footwear is in use, the resistance of the flooring should be such that it does not invalidate the protection provided by the footwear.

In use, no insulating elements should be introduced between the inner sole of the footwear and the foot of the wearer. If any insert is put between the inner sole and the foot, the combination footwear/insert should be checked for its electrical properties."

If the footwear is supplied with a removable insock, it shall be made clear in the leaflet that testing was carried out with the insock in place. A warning shall be given that the footwear shall only be used with the insock in place and that the insock shall only be replaced by a comparable insock supplied by the original footwear manufacturer. If the footwear is supplied without an insock, it shall be made clear in the leaflet that testing was carried out with no insock present. A warning shall be given that fitting an insock can affect the protective properties of the footwear.

Bibliography

Other publications

[1] EUROPEAN COMMUNITIES. Regulation (EU) 2016/425 of the European Parliament and of the Council of 9 March 2016. Luxembourg: Office for Official Publications of the European Communities, 2016. [4)]

[4)] Regulation (EU) 2016/425 replaces Directive 89/686/EEC, which remains in use until April 2018.

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.
- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services
Tel: +44 345 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 345 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.