

Plastics piping systems for water supply — Polyethylene (PE) —

Part 5: Fitness for purpose of the system

The European Standard EN 12201-5:2003 has the status of a
British Standard

ICS 23.040.01; 91.140.60

National foreword

This British Standard is the official English language version of EN 12201-5:2003. Collectively, EN 12201-1, EN 12201-2 and EN 12201-5 comprise a revision of:

- BS 6572:1985, *Specification for blue polyethylene pipes up to nominal size 63 for below ground use for potable water*;
- BS 6730:1986, *Specification for black polyethylene pipes up to nominal size 63 for above ground use for cold potable water*.

It is intended that these British Standards will be declared obsolescent by March 2005.

NOTE 1 The UK water industry has indicated that following the publication of this British Standard, the following Water Industry Specification will be declared obsolescent by March 2005 and retained for reference where applicable:

- WIS 4-32-14, *Specification for PE 80 and PE 100 electrofusion fittings for nominal sizes up to and including 630 mm¹⁾*;
- WIS 4-32-15, *Specification for PE 80 and PE 100 spigot fittings and drawn bends for nominal sizes up to and including 1 000 mm¹⁾*.
- WIS 4-32-17 (Issue 2), *Specification for polyethylene pressure pipes for pressurised water supply and sewerage duties¹⁾*.

The UK participation in its preparation was entrusted by Technical Committee PRI/88 (previously PRI/61), Plastics piping systems, to Subcommittee PRI/88/2 (previously PRI/61/2), Plastics piping systems for pressure applications, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

NOTE 2 It was decided not to proceed with the publication of prEN 12201-6, *Recommended practice for installation*, and that existing national practices would be applicable. In the UK, in the absence of a British Standard covering installation, it is the opinion of Technical Committee PRI/88, Plastics piping systems, that reference to the *Polyethylene Pipe Systems Manual*²⁾, a joint publication of WRc and BPF Plastic Pipes Group represents established UK practice.

NOTE 3 Part 7 has been prepared as a CEN/TS, to allow further development. CEN/TS 12201-7 is not mandatory under the Public Procurement Directive.

¹⁾ Published by WRc, Swindon.

²⁾ WRc/BPF PLASTIC PIPES GROUP. *Polyethylene Pipe Systems Manual*. Swindon: WRc, 2002.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, was published under the authority of the Standards Policy and Strategy Committee on 5 December 2003

© BSI 5 December 2003

ISBN 0 580 42980 6

Attention is drawn to the following statutory regulations:

Health and Safety at Work etc. Act 1974 and subsequent regulations.

Attention is also drawn to any appropriate safety precautions. It is assumed in the drafting of a standard that the execution of its provisions is entrusted to appropriately qualified people.

Additional information

With reference to the Introduction, as yet there is no pan-European agreement on water quality requirements, so existing UK regulations remain in force. Regulation 25 of the Water Supply (Water Quality) Regulations 1989 specifies the circumstances in which water undertakers may use products in contact with water supplies in England and Wales. As part of the UK regulations, all pipes and fittings used to convey drinking water supplies are required to be approved under the provisions of Regulation 25(1) (a) or (b) as appropriate and the Water Regulation Advisory Scheme (WRAS) to ensure that their use will not cause adverse effect on water quality or a risk to health of consumers. In Scotland and Northern Ireland there are similar provisions. These regulations will be revised as necessary to comply with the EU Drinking Water Quality Directive.

The UK National Annex NA attached to this standard provides additional information on the selection and installation of piping systems and components in the UK.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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 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, the EN title page, pages 2 to 13 and a back cover.

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

BS EN 12201-5:2003

English version

Plastics piping systems for water supply - Polyethylene (PE) - Part 5: Fitness for purpose of the system

Systèmes de canalisations en plastique pour alimentation
en eau - Polyéthylène (PE) - Partie 5: Aptitude à l'emploi

Kunststoff-Rohrleitungssysteme für die Wasserversorgung
- Polyethylen (PE) - Teil 5: Gebrauchstauglichkeit des
Systems

This European Standard was approved by CEN on 4 December 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

EN 12201-5:2003 (E)**Contents**

Foreword	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions, symbols and abbreviations	6
4 Fitness for purpose of the system	6
4.1 General	6
4.2 Preparation of assemblies for testing	7
4.3 Butt fusion joints	7
4.4 Electrofusion joints	8
4.5 Mechanical jointing	9
4.6 Conditioning	9
4.7 Retest in case of failure at 80 °C	10
Bibliography	12

Foreword

This document EN 12201-5:2003 has been prepared by Technical Committee CEN /TC 155, "Plastics piping systems and ducting systems" the secretariat of which is held by NEN.

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 2003, and conflicting national standards shall be withdrawn at the latest by March 2005.

This standard is a Part of a System Standard for plastics piping systems, which is a standard for plastics piping of a particular material for a specified application. There are a number of such Systems Standards.

System Standards are based on the results of the work being undertaken in ISO/TC 138 "*Plastics pipes, fittings and valves for the transport of fluids*", which is a Technical Committee of the International Organization for Standardization (ISO).

They are supported by separate standards on test methods to which references are made throughout the System Standard.

The System Standards are consistent with standards on general functional requirements and standards on installation practices.

This European Standard consists of the following Parts, under the general title *Plastics piping systems for water supply — Polyethylene (PE)*

- *Part 1: General.*
- *Part 2: Pipes.*
- *Part 3: Fittings.*
- *Part 4: Valves.*
- *Part 5: Fitness for purpose of the system (this standard).*
- *Part 7: Guidance for the assessment of conformity¹⁾*

NOTE It was decided not to publish a Part 6: Recommended practice for installation. Instead, existing national practices would be applicable.

This Part of EN 12201 includes a Bibliography

System Standards for piping systems of other plastics materials used for the conveyance of water include the following:

EN 1452, *Plastics piping systems for water supply — Unplasticized poly(vinyl chloride) (PVC-U).*

prEN 1796, *Plastics piping systems for water supply with or without pressure — Glass-reinforced thermosetting plastics (GRP) based on polyester resins (UP).*

For components which have conformed to the relevant national standard before [DAV], as shown by the manufacturer or by a certification body, the national standard may continue to be applied until the [DAV + 24 months].

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

¹⁾ to be published as as a CEN/TS

EN 12201-5:2003 (E)

Introduction

The System Standard, of which this is Part 5, specifies the requirements for a piping system and its components when made from polyethylene (PE). It is intended to be used for water supply intended for human consumption, including the conveyance of raw water prior to treatment.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard:

- a) this standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;
- b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

Requirements and test methods for components of the piping system are specified in EN 12201-1, EN 12201-2^[1], EN 12201-3^[2] and EN 12201-4^[3]. PrCEN/TS 12201-7^[4] gives guidance for the assessment of conformity.

This Part of this European Standard covers the characteristics of the fitness for purpose of the system.

1 Scope

This Part of this European Standard specifies the characteristics of the fitness for purpose of the assembled piping systems intended for the conveyance of water intended for human consumption, including raw water prior to treatment.

It also specifies the test parameters for the test methods referred to in this standard.

In conjunction with other Parts of this European Standard (see Foreword) it is applicable to PE pipes, fittings, valves, their joints and to joints with components of other materials intended to be used under the following conditions:

- a) a maximum operating pressure, MOP, up to 25 bar ²⁾ ;
- b) an operating temperature of 20 °C as a reference temperature.

NOTE 1 For applications operating at constant temperatures greater than 20 °C up to 40 °C, see annex A of EN 12201-1:2003.

EN 12201 covers a range of maximum operating pressures and gives requirements concerning colours and additives.

NOTE 2 It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national guidance or regulations and installation practices or codes.

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 (including amendments).

EN 712, *Thermoplastics piping systems — End-load-bearing mechanical joints between pressure pipes and fittings — Test method for resistance to pull-out under constant longitudinal force.*

EN 713, *Plastics piping systems — Mechanical joints between fittings and polyolefin pressure pipes — Test method for leaktightness under internal pressure of assemblies subjected to bending.*

EN 715, *Thermoplastics piping systems — End-load bearing joints between small diameter pressure pipes and fittings - Test method for leaktightness under internal water pressure, including end thrust.*

EN 911, *Plastics piping systems — Elastomeric sealing ring type joints and mechanical joints for thermoplastics pressure piping — Test method for leaktightness under external hydrostatic pressure.*

EN 921:1994, *Plastics piping systems — Thermoplastics pipes — Determination of resistance to internal pressure at constant temperature.*

EN 12201-1:2003, *Plastics piping systems for water supply — Polyethylene (PE) — Part 1: General.*

ISO 11413:1996, *Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting.*

ISO 11414:1996, *Plastics pipes and fittings — Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion .*

ISO 13953:2001, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint.*

ISO 13954:1997, *Plastics pipes and fittings — Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm.*

²⁾ 1 bar = 10⁵ N/m².

EN 12201-5:2003 (E)

ISO 13955:1997, *Plastics pipes and fittings — Crushing decohesion test for polyethylene (PE) electrofusion assemblies*.

ISO/DIS 13956:1996, *Plastics pipes and fittings — Determination of cohesive strength — Tear test for polyethylene (PE) assemblies*.

3 Terms and definitions, symbols and abbreviations

For the purposes of this European Standard, the terms and definitions, symbols and abbreviations given in EN 12201-1:2003 together with the following apply.

3.1

electrofusion joint

joint between a PE socket or saddle electrofusion fitting and pipe or fitting with spigotted ends. The electrofusion fittings are heated by the Joule effect of the heating element incorporated at their jointing surfaces, causing the material adjacent to them to melt and the pipe and fitting surfaces to fuse

3.2

butt fusion joint

joint made by heating the planed ends of matching surfaces by holding them against a flat heating plate until the PE material reaches fusion temperature quickly removing the heating plate and pushing the two softened ends against one another

3.3

saddle fusion joint

joint made by heating the curved surface of a saddle and the outside surface of a pipe by holding them against a heated tool until the PE material reaches fusion temperature, quickly removing the heated tool and pushing the two softened surfaces against each other

3.4

mechanical joint

joint made by assembling a PE pipe to an other PE pipe or any other element of the piping system that generally includes a compression part to provide for pressure integrity, leaktightness and resistance to end loads. A support sleeve inserted into the pipe bore may be used to provide a permanent support for the PE pipe to prevent creep in the pipe wall under radial compressive forces

NOTE Metallic parts of these fittings or valves can be assembled to metallic pipes by screw threads, compression joints, welded or flanged connections, including PE flanges. The fitting or valve can allow either a dismountable or permanently assembled joint.

3.5

fusion compatibility

ability of two similar or dissimilar polyethylene (PE) materials to be fused together to form a joint which conforms to the performance requirements of this standard

4 Fitness for purpose of the system

4.1 General

This clause details the preparation of test assemblies and the tests required to verify the fusion process under normal and extreme conditions and compatibility.

4.2 Preparation of assemblies for testing

4.2.1 General

This clause specifies the methods for preparing test assemblies taking into account the extremes of pipe/fitting manufacturing tolerances, field assembly, equipment tolerances, ambient temperature variations during installation and where appropriate sealing and component material and tolerances. Test pieces for pressure testing shall be closed with pressure tight end-load-bearing caps, plugs or flanges, which shall be provided with connections for the entry of water and release of air.

4.2.2 Grouping

For purpose of this standard the following groups for pipes, fittings and valves given in Table 1 shall apply.

Table 1 — Size groups for pipes, fittings and valves

	Size group			
	1	2	3	4
Nominal outside diameter d_n	≥ 16 and < 75	≥ 75 and < 250	≥ 250 and < 710	≥ 710

4.2.3 Fitting types

- Fittings with spigot ends;
- Electrofusion socket fittings;
- Electrofusion saddle fittings;
- Mechanical fittings.

4.3 Butt fusion joints

4.3.1 Assemblies under extreme conditions

Testing shall be carried out if requested by the purchaser or end user.

- The assemblies shall be prepared using pipe and or fittings with spigot ends having the same MRS and SDR in accordance with ISO 11414:1996 under minimum and maximum conditions listed in Table B.1 of ISO 11414:1996 and including misalignment requirements given in item a) of clause 6 of ISO 11414:1996;
- The number of test pieces shall be as follows : One diameter from the manufacturer's own product range per product type;
- The assembly shall conform to the requirements specified in Table 3 for the characteristics hydrostatic strength (165 h at 80 °C) and tensile strength for butt fusion joints.

4.3.2 Assemblies between components of different MRS

Testing shall be carried out if requested by the purchaser or the end user:

- The assemblies shall be prepared using pipe and or fittings with spigot ends of the same SDR having different MRS in accordance with ISO 11414:1996 under normal conditions at 23 °C;
- The number of test pieces shall be as follows : one diameter from the manufacturer's product range per product type;
- The assembly shall conform to the requirements specified in Table 3 for the characteristic tensile strength for butt fusion joints.

EN 12201-5:2003 (E)

4.4 Electrofusion joints

4.4.1 Assemblies with pipes and components having different MRS and SDR

4.4.1.1 When applicable the assemblies shall be prepared in accordance with the scheme listed in Table 2 using pipe and components having different MRS and SDR in accordance with Condition 1, listed in Table C.1 of ISO 11413:1996.

4.4.1.2 The number of test pieces shall be as follows : The smallest diameter from each size group and plus the largest diameter from the manufacturer's own product range per product type (see Table 1).

4.4.1.3 The assembly shall conform to the requirement specified in Table 3 for the Characteristic "cohesive resistance for electrofusion socket fittings" or "cohesive resistance for electrofusion saddle fittings" as appropriate.

Table 2 — Sampling scheme

Electrofusion fitting	Pipe or component					
	PE 63		PE 80		PE 100	
	SDR max.	SDR min.	SDR max.	SDR min.	SDR max.	SDR min.
PE 63	X	--	--	X	--	X
PE 80	X	--	X	--	--	X
PE 100	X	--	X	--	--	X

4.4.2 Assemblies under extreme conditions

4.4.2.1 The assemblies shall be prepared using pipe having the same MRS and SDR as the fitting in accordance with Conditions 2 and 3 listed in Table C.1 of ISO 11413:1996 and using $T_{\min}$ and $T_{\max}$ as recommended by the fittings manufacturer.

If accepted by the purchaser the minimum and maximum energy conditions 2 and 3 may be replaced by a nominal energy at a given ambient temperature T_a defined by the fitting manufacturer (see 3.4 of ISO 11413:1996).

For straight equal electrofusion socket fittings (couplers) test joints on selected diameters out of the product range which shall be prepared with a gap of $0,05d_n$ between the pipe end and the maximum theoretical depth of penetration of the fitting, where for diameters greater than 225 mm the adjoining pipes shall be arranged to provide the maximum angular deflection possible for the fitting, limited to $1,5^\circ$. Saddle fittings shall be fused to the test pipe whilst pressurised with water to the maximum rated pressure. The pipe shall be cut immediately after the manufacturer's prescribed cooling time has elapsed.

NOTE These joints with electrofusion saddle fittings should be prepared taking into account national safety regulations.

4.4.2.2 The number of test pieces shall be as follows : One diameter from each size group and including the smallest and largest diameter from the manufacturer's own range per product type (see Table 1).

4.4.2.3 The assembly shall conform to the requirements specified in Table 3 for the characteristic "cohesive resistance for electrofusion socket fittings" or "cohesive resistance for electrofusion saddle fittings" as applicable.

4.5 Mechanical jointing

4.5.1 PE pipes of different MRS and SDR for jointing by mechanical fittings shall be prepared and assembled in accordance with the manufacturers instructions.

4.5.2 The number of test pieces shall be as follows : One fitting per diameter from product types out of the manufacturer's own product range.

4.5.3 The assemblies shall conform to the requirements specified in Table 3.

4.6 Conditioning

Unless otherwise specified by the applicable test method as specified in Table 3, the test pieces shall be conditioned at (23 ± 2) °C before testing.

EN 12201-5:2003 (E)

Table 3 — Characteristics for fitness for purpose of the system

Characteristics	Requirements	Test parameters		Test method
Fusion joints				
Hydrostatic strength at 80 °C	No failure during test period of any test pieces	End caps Number of test pieces ^b Conditioning period Type of test Test temperature Test period Circumferential (hoop) stress for: PE 40 PE 63 PE 80 PE 100	Type a) ^a see clause 4 Shall conform to EN 921:1994 Water-in-water 80 °C ^c 165 h 2,5 MPa 3,5 MPa 4,5 MPa 5,4 MPa	EN 921:1994
Cohesive resistance for electrofusion socket fittings	Length of initiation rupture ≤ L ₂ /3 in brittle failure	Test temperature Number of test pieces ^b	23 °C Shall conform to clause 4	ISO 13954:1997 or ISO 13955:1997
Cohesive resistance for electrofusion saddle fittings	Surface rupture: ≤ 25 %, brittle failure	Test temperature Number of test pieces ^b	23 °C Shall conform to clause 4	ISO/DIS 13956:1996
Tensile strength (butt fusion joints)	Test to failure ductile: pass brittle: fail	Test temperature Number of test pieces ^b	23 °C Shall conform to clause 4	ISO 13953:2001
Mechanical joints ^d				
Leaktightness under internal pressure	No leaks	Test period Test pressure Number of test pieces ^b	1 h 1,5 × PN of pipe 1	EN 715
Leaktightness under internal pressure when subjected to bending	No leaks	Test period Test pressure Number of test pieces ^b	1 h 1,5 × PN of pipe 1	EN 713
External pressure test	No leaks	Test pressure Test period Test pressure Test period Number of test pieces ^b	Δp ₁ = 0,01 MPa 1 h Δp ₂ = 0,08 MPa 1 h 1	EN 911
Resistance to pull out under constant longitudinal force	No pull-out or separation of the pipe from the fitting	Test temperature Test period Force	23 °C 1 h Shall conform to EN 712	EN 712
^a Type b) end caps may be used for tests for diameters ≥ 315 mm.				
^b The number of test pieces given indicates the quantity required to establish a value for the characteristic described in the table.				
^c Premature ductile failures are not taken into account, for retest procedure see 4.7.				
^d Mechanical joints up to and including 63 mm, test methods for sizes greater than 63 mm are under development.				

4.7 Retest in case of failure at 80 °C

A fracture in a brittle mode in less than 165 h shall constitute a failure, however if a sample in the 165 h test fails in a ductile mode in less than 165 h, a retest shall be performed at a selected lower stress in order to achieve the minimum required time for the selected stress obtained from the line through the recommended stress/time points given in Table 4.

Table 4 — Test parameters for the retest of the hydrostatic strength at 80 °C

PE 40		PE 63		PE 80		PE 100	
Stress MPa	Test period h	Stress MPa	Test period h	Stress MPa	Test period h	Stress MPa	Test period h
2,5	165	3,5	165	4,5	165	5,4	165
2,4	230	3,4	295	4,4	233	5,3	256
2,3	323	3,3	538	4,3	331	5,2	399
2,2	463	3,2	1000	4,2	474	5,1	629
2,1	675			4,1	685	5,0	1000
2,0	1000			4,0	1000		

Bibliography

- [1] EN 12201-2, *Plastics piping systems for water supply — Polyethylene (PE) — Part 2: Pipes.*
- [2] EN 12201-3, *Plastics piping systems for water supply — Polyethylene (PE) — Part 3: Fittings.*
- [3] EN 12201-4, *Plastics piping systems for water supply — Polyethylene (PE) — Part 4: Valves.*
- [4] prCEN/TS 12201-7, *Plastics piping systems for water supply — Polyethylene (PE) — Part 7: Guidance for the assessment of conformity.*

National Annex NA (informative)**Additional information on the selection and installation of piping systems and components in the UK**

The responsible UK committee gives the following advice concerning the selection and installation of piping systems and components conforming to this British Standard.

- a) Water supply companies and other entities deemed to be within the scope of the Public Procurement Directive (PPD) are obliged to use EN 12201-1, EN 12201-2, EN 12201-3, EN 12201-4 and EN 12201-5 produced under EC/U mandate, if they wish to purchase PE pipe systems or components within its scope.
- b) This Standard is intended for use in conjunction with EN 12201-2, EN 12201-3 and EN 12201-4, as it tests the compatibility of the components and the efficacy of the jointing systems of assemblies of components in withstanding positive and negative pressures.

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: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager. Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553. Email: copyright@bsi-global.com.