

# Chemicals used for treatment of water intended for human consumption — Polyaluminium hydroxide silicate sulfate

The European Standard EN 886:2004 has the status of a  
British Standard

ICS 71.100.80

## National foreword

This British Standard is the official English language version of EN 886:2004. It supersedes BS EN 886:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment, 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 committee can be obtained on request to its secretary.

### 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, the EN title page, pages 2 to 16, an inside back cover and a back cover.

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

### Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 2 December 2004

© BSI 2 December 2004

ISBN 0 580 44946 7

English version

## Chemicals used for treatment of water intended for human consumption - Polyaluminium hydroxide silicate sulfate

Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Polyhydroxysulfatesilicate d'aluminium

Produkte zur Aufbereitung von Wasser für den Menschlichen Gebrauch - Polyaluminiumhydroxidsilikatsulfat

This European Standard was approved by CEN on 30 September 2004.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, 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

## Contents

	Page
Foreword.....	3
Introduction .....	4
1 Scope .....	5
2 Normative references .....	5
3 Description .....	5
4 Purity criteria.....	8
5 Test methods.....	9
6 Labelling - Transportation - Storage.....	10
Annex A (informative) General information on polyaluminium hydroxide silicate sulfate.....	12
Annex B (normative) General rules relating to safety.....	15
Bibliography.....	16

## Foreword

This document (EN 886:2004) has been prepared by Technical Committee CEN/TC 164 "Water supply", the secretariat of which is held by AFNOR.

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

This document supersedes EN 886:2001.

Significant technical differences between this edition and EN 886:2001 are as follows:

- a) replacement of the reference to EU Directive 80/778 of July, 15 1980 with the latest Directive in force (see[1]);
- b) expansion of annex A by addition of A.2 "quality of commercial product".

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

## Introduction

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

- 1) this document provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;
- 2) 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.

**NOTE** Conformity with this document does not confer or imply acceptance or approval of the product in any of the Member States of the EU or EFTA. The use of the product covered by this document is subject to regulation or control by National Authorities.

## 1 Scope

This document is applicable to polyaluminium hydroxide silicate sulfate used for treatment of water intended for human consumption. It describes the characteristics of polyaluminium hydroxide silicate sulfate and specifies the requirements for polyaluminium hydroxide silicate sulfate and refers to the corresponding analytical methods. It gives information on its use in water treatment. It also determines the rules to safe handling and use of polyaluminium hydroxide silicate sulfate (see annex B).

## 2 Normative references

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

EN 1302, *Chemicals used for treatment of water intended for human consumption - Aluminium based coagulants - Analytical methods.*

ISO 3165, *Sampling of chemical products for industrial use - Safety in sampling.*

ISO 6206, *Chemical products for industrial use - Sampling – Vocabulary.*

## 3 Description

### 3.1 Identification

#### 3.1.1 Chemical name

Polyaluminium hydroxide silicate sulfate.

#### 3.1.2 Synonym or common names

Polyaluminium silicate sulfate, PASS.

#### 3.1.3 Relative molecular mass

Variable (see 3.1.4).

#### 3.1.4 Empirical formula

Polyaluminium hydroxide silicate sulfate is a synthetically manufactured polymerized basified aluminium salt containing silicate. The structure of the product is polymeric.

$\text{Al}(\text{OH})_a(\text{SO}_4)_b(\text{SiO}_x)_c$  with  $a + 2b + 2c(x - 2) = 3$

and  $a = 1,05$  to  $2,0$

$b = 0,30$  to  $1,12$

$c = 0,005$  to  $0,10$

$x = 2,0$  to  $4,0$

#### 3.1.5 Chemical formula

Variable (see 3.1.4).

## EN 886:2004 (E)

### 3.1.6 CAS Registry Number<sup>1)</sup>

(Aluminium hydroxide silicate sulfate): 131148-05-5.

### 3.1.7 EINECS reference<sup>2)</sup>

The following is a list of EINECS reference numbers for products or their starting materials.

Basic aluminium sulfate, PAS 259-881-7

Aluminosilicate 215-475-1

Sodium sulfate 231-820-9

## 3.2 Commercial form

The product is available as a liquid.

## 3.3 Physical properties

### 3.3.1 Appearance

Polyaluminium hydroxide silicate sulfate is a colourless, slightly opalescent liquid.

### 3.3.2 Density

The density depends on the particular composition, especially the aluminium ion content, expressed as a mass fraction of aluminium (Al) in %.

Typical value is 1,25 g/ml for 4,2 % Al.

### 3.3.3 Solubility in water

Polyaluminium hydroxide silicate sulfate is fully miscible with water.

NOTE Depending on the particular product, dilute solutions can hydrolyse and form a precipitate.

### 3.3.4 Vapour pressure at 20 °C

Not known.

### 3.3.5 Boiling point at 100 kPa<sup>3)</sup>

100 °C.

### 3.3.6 Crystallization point

Typical value is 0 °C for 4,2 % Al.

### 3.3.7 Specific heat

Not known.

---

1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

3) 100 kPa = 1 bar.



**3.3.8 Viscosity (dynamic)**

Typical value is 11 mPa.s for 4,2 % Al at 25 °C.

**3.3.9 Critical temperature**

Not applicable.

**3.3.10 Critical pressure**

Not applicable.

**3.3.11 Physical hardness**

Not applicable

**3.4 Chemical properties**

Polyaluminium hydroxide silicate sulfate is a mildly acidic liquid which hydrolyses and forms a precipitate of aluminium hydroxide when diluted beyond a particular concentration.

NOTE Since aluminium compounds are amphoteric in nature, the solubility of aluminium depends on the pH value and the product should be used within an appropriate pH range.

## 4 Purity criteria

### 4.1 General

This document specifies the minimum purity requirements for polyaluminium hydroxide silicate used for the treatment of water intended for human consumption. Limits are given for impurities commonly present in the product. Depending on the raw material and the manufacturing process other impurities may be present and, if so, this shall be notified to the user and when necessary to relevant authorities.

**NOTE** Users of the product should check the national regulations in order to clarify whether it is of appropriate purity for treatment of water intended for human consumption, taking into account raw water quality, required dosage, contents of other impurities and additives used in the product not stated in this document.

Limits have been given for impurities and chemical parameters where these are likely to be present in significant quantities from the current production process and raw materials. If in the production process or raw materials lead to significant quantities of impurities, by-products or additives being present, this shall be notified to the user.

### 4.2 Composition of commercial product

The concentration of active matter (aluminium ion content) in the product expressed as grams per kilogram of product shall be not less than 40 g/kg.

The content of aluminium shall be within  $\pm 3\%$  of the manufacturer's declared value.

The relative basicity expressed as the mole ratio OH/3Al shall be greater than 0,35.

### 4.3 Impurities and main by-products

The content of insoluble matter shall not exceed 25 g/kg of Al.

### 4.4 Chemical parameters

The product shall conform to the requirements specified in Table 1.

**Table 1 — Chemical parameters**

Parameter		Limit (mg/kg of Al)		
		type 1	type 2	type 3
Arsenic (As)	max.	14	40	100
Cadmium (Cd)	max.	3	50	100
Chromium (Cr)	max.	30	700	1 000
Mercury (Hg)	max.	4	10	20
Nickel (Ni)	max.	20	700	1 000
Lead (Pb)	max.	40	200	800
Antimony (Sb)	max.	20	40	120
Selenium (Se)	max.	20	40	120

**NOTE** Cyanide (CN<sup>-</sup>) is usually not relevant because of the acidity of the product. Pesticides and polycyclic aromatic hydrocarbons are not relevant since the raw materials used in the manufacturing process are free of them. For maximum impact of the product on trace metal content in drinking water see A.2.

## 5 Test methods

### 5.1 Sampling

#### 5.1.1 General

Observe the general rules of ISO 3165 and take into account ISO 6206

#### 5.1.2 Sampling from drums and bottles

##### 5.1.2.1 General

**5.1.2.1.1** Mix the contents of each container to be sampled by shaking the container, by rolling it or by rocking it from side to side, taking care not to damage the container or spill any of the liquid.

**5.1.2.1.2** If the design of the container is such (for example, a narrow-necked bottle) that it is impracticable to use a sampling implement, take a sample by pouring after the contents have been thoroughly mixed. Otherwise, proceed as described in 5.1.2.1.3.

**5.1.2.1.3** Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in 5.1.2.2; otherwise, take samples as described in 5.1.2.3.

##### 5.1.2.2 Surface sampling

Take a sample using a suitable ladle. Lower the ladle into the liquid until the rim is just below the surface, so that the surface layer runs into it. Withdraw the ladle just before it fills completely and allow any liquid adhering to the ladle to drain off. If necessary, repeat this operation so that, when the other selected containers have been sampled in a similar manner, the total volume of sample required for subsequent analysis is obtained.

##### 5.1.2.3 Bottom sampling

Take a sample using an open sampling tube, or a bottom-valve sampling tube, suited to the size of container and the viscosity of the liquid.

When using an open sampling tube, close it at the top and then lower the bottom end to the bottom of the container. Open the tube and move it rapidly so that the bottom of the tube traverses the bottom of the container before the tube is filled. Close the tube, withdraw it from the container and allow any liquid adhering to the outside of the tube to drain off.

When using a bottom-valve sampling tube, close the valve before lowering the tube into the container and then proceed in a similar manner to that when using an open sampling tube.

##### 5.1.2.4 Sampling from tanks and tankers

From each access point, take samples as follows:

- a) from the surface of the liquid, using a ladle as described in 5.1.2.2;
- b) from the bottom of the tank or tanker, using a sampling tube as described in 5.1.2.3 or using specially designed bottom-sampling apparatus;
- c) from one or more positions, depending on the overall depth, between the bottom and the surface using a weighted sampling can.

### 5.2 Analyses

Use the relevant methods described in EN 1302.

## 6 Labelling - Transportation - Storage

### 6.1 Means of delivery

The product shall be delivered in tankers of corrosion-resistant materials suitable for the purpose.

NOTE The manufacturer can provide advice on suitable materials.

In order that the purity of the product is not affected, the means of delivery shall not have been used previously for any different product or it shall have been specially cleaned and prepared before use.

### 6.2 Risk and safety labelling according to the EU-Directives<sup>4)</sup>

The following labelling requirements shall apply to polyaluminium hydroxide silicate sulfate at the date of publication of this document:

— symbols and indications of danger:

Xi : Irritant;

— nature of special risks attributed to dangerous substances:

R 36 : Irritating to eyes;

— safety advice concerning dangerous substances:

S 26 : In case of contact with eyes, rinse immediately with plenty of water and seek medical advice;

S 37/39 : Wear suitable gloves and eye/face protection.

NOTE Annex I of the Directive 67/548/EEC on Classification, packaging and labelling of dangerous substances and its amendments and adaptations in the European Union contains a list of substances classified by the EU. Substances not in this annex I should be classified on the basis of their intrinsic properties according to the criteria in the Directive by the person responsible for the marketing of the substance.

### 6.3 Transportation regulations and labelling

The commercial product is not classified as a dangerous product for road, rail, sea and air transportation.

### 6.4 Marking

The marking shall include the following:

— the name : "polyaluminium hydroxide silicate sulfate" trade name, grade and type;

— the net mass;

— the name and the address of the supplier and/or manufacturer;

— the statement "This product conforms to EN 886".

---

4) See bibliography [2].

## 6.5 Storage

### 6.5.1 General

Storage tanks shall be of corrosion-resistant material suitable for the purpose.

NOTE 1 The manufacturer can provide advice on suitable materials.

NOTE 2 Storage tanks located outside can require protection against extreme temperature, depending on freezing point and maximum storage temperature: refer to manufacturer's information on permissible temperatures.

### 6.5.2 Long term stability

Polyaluminium hydroxide silicate sulfate is usually stable.

### 6.5.3 Storage incompatibilities

Avoid contact with chlorites, hypochlorites and sulfites.

The product reacts aggressively with some metal surfaces (e.g. galvanized metal, aluminium, copper, zinc and alloys of these metals).

The product is incompatible with iron salts and aluminium sulfate.

## Annex A (informative)

### General information on polyaluminium hydroxide silicate sulfate

#### A.1 Origin

##### A.1.1 Raw materials

Depending on product and manufacturer the polyaluminium hydroxide silicate sulfate is manufactured from:

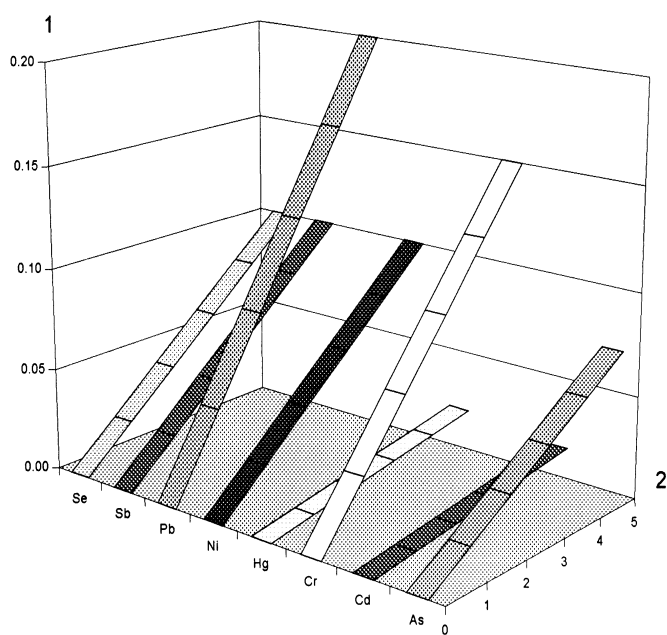
- aluminium hydroxide;
- silica;
- aluminium metal;
- bauxite or clay;
- sodium aluminate;
- sodium silicate;
- sulfuric acid;
- sodium hydroxide;
- calcium carbonate.

##### A.1.2 Manufacturing process

The typical manufacturing process is the reaction of a raw material containing aluminium or aluminium compounds with sulfuric acid, followed by reaction with an alkali metal silicate and an alkali metal aluminate to yield the final product.

#### A.2 Quality of commercial product

The three types of polyaluminium hydroxide silicate specified in Table 1 reflect the quality of commercially available products. Figures A.1 to A.3 show the maximum concentrations of trace metals that would be added to the raw water by the addition of products corresponding to the purity levels specified in Table 1. It can be seen that the concentrations of metal added are well below the Parametric Values given in the EU Directive 98/83/EC (see [1]) at typical product doses. Furthermore, the figures overstate the concentrations of metals that would be present in the treated water since a substantial proportion of the trace metals will be incorporated in the sludge. Users of this product should select an appropriate grade and type to enable them to achieve treated water quality targets taking into account raw water characteristics, required dosage, process plant conditions and other relevant factors.

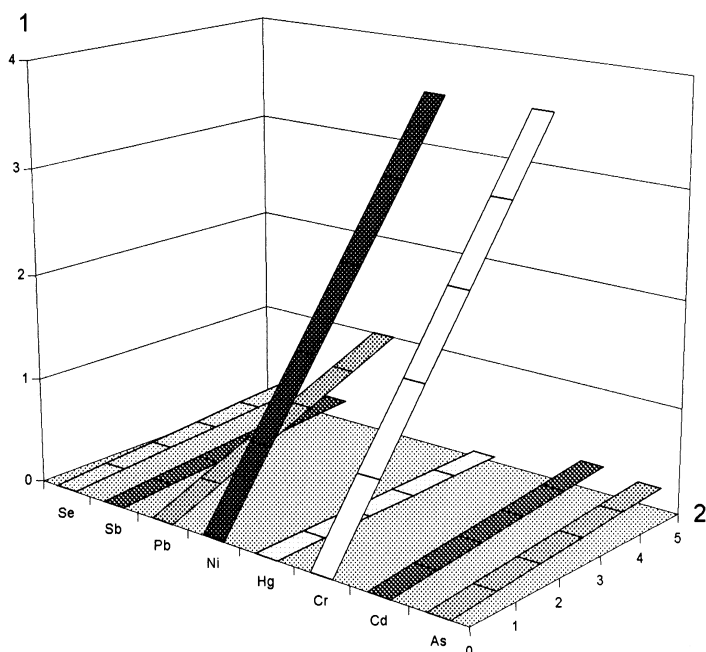


A	B
As	10
Cd	5
Cr	50
Hg	1
Ni	20
Pb	10
Sb	5
Se	10

**Key**

- 1 Maximum addition to water  $\mu\text{g/l}$  metal
- 2 Product dosage  $\text{mg/l Al}$  - Typical dose
- A Element
- B Drinking water limit  $\mu\text{g/l}$

**Figure A.1 — Maximum impact of polyaluminium hydroxide silicate, type 1, on trace metal content of water**

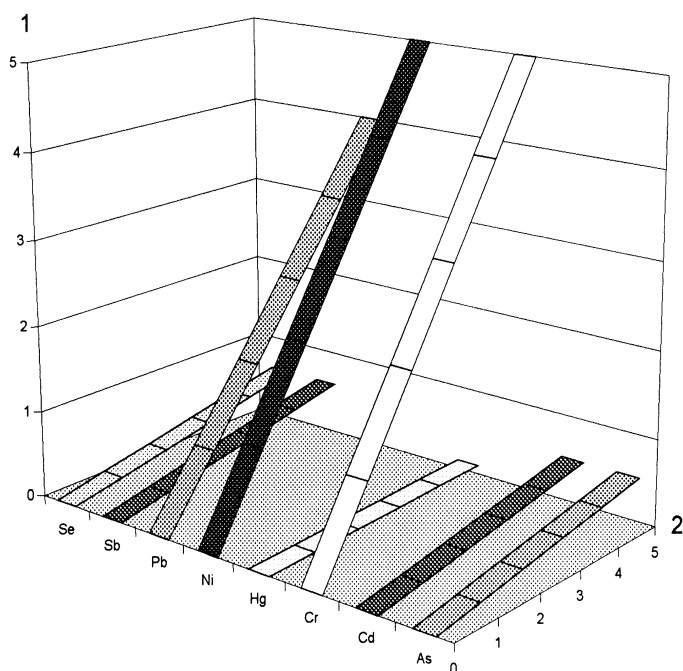


A	B
As	10
Cd	5
Cr	50
Hg	1
Ni	20
Pb	10
Sb	5
Se	10

**Key**

- 1 Maximum addition to water  $\mu\text{g/l}$  metal
- 2 Product dosage  $\text{mg/l Al}$  - Typical dose
- A Element
- B Drinking water limit  $\mu\text{g/l}$

**Figure A.2 — Maximum impact of polyaluminium hydroxide silicate, type 2, on trace metal content of water**



A	B
As	10
Cd	5
Cr	50
Hg	1
Ni	20
Pb	10
Sb	5
Se	10

**Key**

- 1 Maximum addition to water µg/l metal
- 2 Product dosage mg/l Al - Typical dose
- A Element
- B Drinking water limit µg/l

**Figure A.3 — Maximum impact of polyaluminium hydroxide silicate, type 3, on trace metal content of water**

**A.3 Use**

**A.3.1 Function**

The product is used as a coagulant, and sometimes simultaneously as a precipitant.

**A.3.2 Form in which the product is used**

The product is used as delivered or according to the manufacturer's recommendations.

**A.3.3 Treatment dose**

The treatment dose is generally in the range of 1 mg/l to 15 mg/l expressed as Al, depending on raw water quality.

**A.3.4 Means of application**

The product is usually applied using a positive-displacement metering pump. Sufficient turbulence should be provided at the point of addition to promote rapid dispersion.

**A.3.5 Secondary effects**

- Reduction of pH value and alkalinity;
- increase of respective anion concentration.

**A.3.6 Removal of excess product**

The water purification process should be operated under conditions (e.g. pH) in which aluminium ions in the system are precipitated and reduced below the maximum allowable concentration.



## Annex B (normative)

### General rules relating to safety

#### B.1 Rules for safe handling and use

The supplier shall provide current safety instructions.

#### B.2 Emergency procedures

##### B.2.1 First aid

In case of contact with skin, wash thoroughly with cold water and seek medical advice if irritation persists.

In case of contact with eyes, rinse thoroughly with cold water and seek medical advice.

In case of ingestion, seek medical advice immediately.

##### B.2.2 Spillage

Put on protective clothing. Collect and dispose of spillages carefully.

NOTE Local regulations might apply to the disposal of this product.

##### B.2.3 Fire

The product is a non-flammable liquid. Any extinguishing media can be used. The product can liberate sulfur oxides when boiled to dryness or heated above 200 °C.

## Bibliography

- [1] 98/83/EC, *Council Directive of 3 November 1998 on the quality of water intended for human consumption.*
- [2] 67/548/EEC, *Council Directive of 27th June 1967 on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances and its amendments and adaptations.*



---

---

## 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](mailto: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](mailto: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](mailto: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](mailto:copyright@bsi-global.com).