BS EN 16272-1:2012

BSI Standards Publication

Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance

Part 1: Intrinsic characteristics — Sound absorption in the laboratory under diffuse sound field conditions

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 16272-1:2012.

The UK participation in its preparation was entrusted to Technical Committee RAE/2, Railway Applications - Track.

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

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

Published by BSI Standards Limited 2012.

ISBN 978 0 580 74706 9

ICS 17.140.30; 93.100

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2012.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16272-1

October 2012

ICS 93.100

English Version

Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 1: Intrinsic characteristics - Sound absorption in the laboratory under diffuse sound field conditions

Applications ferroviaires - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustiques - Partie 1: Caractéristiques intrinsèques - Absorption acoustique en salle réverbérante dans des conditions de champ acoustique diffus

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Einrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 1: Produktspezifische Merkmale - Schallabsorption (Labormethode) bei diffusen Schallfeldern

This European Standard was approved by CEN on 15 September 2012.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16272-1:2012: E

Contents

Page

Foreword

This document (EN 16272-1:2012) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

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 April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This European Standard is one of the series EN 16272 "*Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance*" as listed below:

— *Part 1: Intrinsic characteristics — Sound absorption in the laboratory under diffuse sound field conditions*

— *Part 2: Intrinsic characteristics — Airborne sound insulation in the laboratory under diffuse sound field conditions*

— *Part 3-1: Normalised railway noise spectrum and single number ratings for diffuse field applications*

— *Part 3-2: Normalized railway noise spectrum and single number ratings for direct field applications* [1)]

— *Part 4: Intrinsic characteristics — In situ values of sound diffraction under direct sound field conditions* [1)]

— *Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions* [2)]

— *Part 6: Intrinsic characteristics — In situ values of airborne sound insulation under direct sound field conditions* [1)]

— *Part 7: Extrinsic characteristics — In situ values of insertion loss* [2)]

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

1) In preparation.

2) This document has been prepared as a CEN Technical Specification and is in preparation.

Introduction

Where a sound reflecting surface is installed along a railway, it may be effective to use sound absorbing devices on its rail side to reduce additional noise nuisance caused by reflected sound. This treatment may be needed in the presence of the following:

— noise barriers, rocks or retaining walls that can reflect sound waves toward unprotected areas;

— vertical cuttings or reflective surfaces that face each other;

— tunnels and their approaches;

— trains passing close to a barrier where reflections between the train and the barrier may give rise to a reverberant field and thus reduce barrier effectiveness.

This European Standard specifies a test method for assessing the sound absorption performance of noise barriers and related devices acting on airborne sound propagation designed for railways (a measure of intrinsic performance). It is not concerned with determining sound absorption performance in situ, nor with determining the acoustic efficiency at receiver positions (insertion loss), which additionally depend on factors which are not related to the product itself, e.g. the dimensions of the barrier and quality of installation work and site factors such as site geometry, ground impedance, meteorological effects, etc. The test is designed to allow the intrinsic sound absorption performance of the device under test to be measured and the resulting rating should aid the selection of the devices for particular railway applications.

The measurements results of this method for sound absorption are comparable but not identical with the results of the FprCEN/TS 16272-5 method, mainly because the present method assumes a diffuse sound field (where all angles of incidence are equally probable), while the FprCEN/TS 16272-5 method uses a directional sound field. Values of the sound absorption coefficient measured with the method described in this European Standard can be converted to conventional values of a reflection coefficient taking the complement to one. In this case, research studies suggest that a quite good correlation exists between data measured according to the method described in the present European Standard and data measured according to the method described in FprCEN/TS 16272-5.

The test method described in this European Standard should not be used to determine completely the intrinsic characteristics of sound absorption for noise reducing devices to be installed in non-reverberant conditions, e.g. alongside railways in open space.

This method may be used to qualify noise reducing devices for other applications, e.g. to be installed along roads or nearby industrial sites. In such cases, the single-number ratings should be calculated using an appropriate spectrum.

This European Standard should be read in conjunction with:

— EN 16272-3-1, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 3-1: Normalised railway noise spectrum and single number ratings for diffuse field applications*

— FprCEN/TS 16272-5, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions*

1 Scope

This European Standard specifies the laboratory method for measuring the sound absorption of flat noise barriers or flat claddings for retaining walls or tunnels. It covers the assessment of the intrinsic sound absorption performance of noise barriers and related devices acting on airborne sound propagation designed for railways which can reasonably be assembled inside the testing facility described in EN ISO 354. The test method in EN ISO 354, referred to in this European Standard, is strictly valid only for flat absorbers and in particular excludes devices which act as slightly damped resonators. Some devices will depart significantly from these requirements and in these cases care is needed in interpreting the results.

All noise reducing devices that differ from noise barriers and related devices acting on airborne sound propagation, e.g. devices for attenuation of ground borne vibration and on board devices are out of the scope of this European Standard.

NOTE The test method in EN ISO 354 is based on measurements in a reverberation room where diffuse sound field conditions prevail. As a uniformly applicable method for the determination of the sound absorptive performance of noise reducing devices under free field conditions is still under development, the measurement results according to this European Standard are temporarily considered relevant for application on noise reducing devices in reverberant as well as in free field conditions.

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.

ENV 13005, *Guide to the expression of uncertainty in measurement*

EN 16272-3-1, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 3-1: Normalised railway noise spectrum and single number ratings for diffuse field applications*

EN ISO 354, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354)*

3 Terms and definitions

For the purpose of this document the following terms and definitions apply.

3.1
noise barrier
noise reducing device, which obstructs the direct transmission of airborne sound emanating from railways; it may either span or overhang the railway

Note 1 to entry: Noise barriers are generally made of acoustic and structural elements (see 3.3 and 3.4).

3.2
cladding
noise reducing device, which is attached to a wall or other structure and reduces the amount of sound reflected

Note 1 to entry: Claddings are generally made of acoustic and structural elements (see 3.3 and 3.4).

3.3
acoustic element
element whose primary function is to provide the acoustic performance of the device

3.4
structural element
element whose primary function is to support or hold in place acoustic elements

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

Table 1 — Symbols and abbreviations

Symbol or abbreviation	Designation	Unit
α_{Si}	Sound absorption coefficient in the *i*-th one-third octave band according to EN ISO 354	-
DL_{α}	Single number rating of sound absorption	dB
L	Greatest distance between the side edge of the sample and the post included in the sample	m

5 Test arrangement

The test arrangement shall be as described in EN ISO 354, with the following modifications:

a) The test specimen shall be assembled in the test chamber in the same manner as the manufactured device is used in practice, with the same connections and seals between the component parts.

b) All the reflecting parts exposed on the rail side of the material (posts, brackets and other parts) shall be present on the specimen as in practice.

c) Where posts are employed in construction, at least one post shall be included in the specimen with panels attached on both sides. The length of the panels on one side of the post shall be $L \geq 2$ m (see Figure 1 and Figure 2). The side that would face the rail shall face the inner part of the room (see Figure 1 and Figure 2). The post shall be sealed as in practice.

d) The test specimen shall have a reflecting frame sealed against it on its entire perimeter (see Figure 1 to Figure 5).

e) For testing noise barriers, the specimen shall be placed directly against one of the surfaces (floor, wall or ceiling) of the chamber without any gap (see Figure 1, Figure 2 and Figure 3). If needed, concrete, used as filler, shall be inserted between panels and chamber surface.

f) If the sample under test includes non flat panels, leaving cavities between the panels and the chamber floor, these cavities should be completely filled with concrete (see Figure 3).

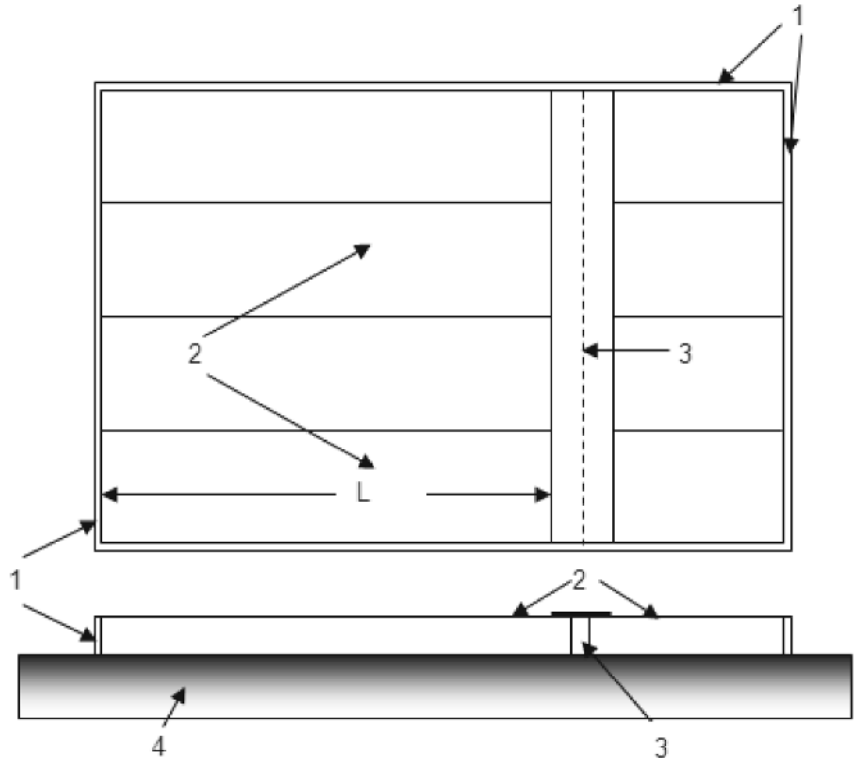
g) If the sample under test includes a post it is recommended to cut it to fit the panel thickness.

h) If the sample under test includes a post having a thickness larger than that of the acoustic elements and protruding toward the interior of the test chamber, the reflective area created by the post fitting the acoustic elements shall be reproduced covering it by reflective strips (see Figure 4).

i) If the sample under test includes a post having a thickness larger than that of the acoustic elements and protruding toward the floor of the test chamber, the cavities created by the post under the acoustic elements shall be completely filled with concrete (see Figure 5).

j) Any combination of the conditions above may be applied in order to be sure that no cavities, gaps or plenum exist between the sample under test and the chamber surface unless explicitly prescribed for the device in its normal use.

k) For testing absorptive cladding for use on retained cuttings, tunnel walls and other reflective surfaces, the specimen shall be mounted against one of the surfaces of the chamber leaving the same gap and using the same components as proposed for the actual construction. In this case, the mounting conditions and components, e.g. the distance between the back of the sample and the surface of the chamber, shall be clearly reported.

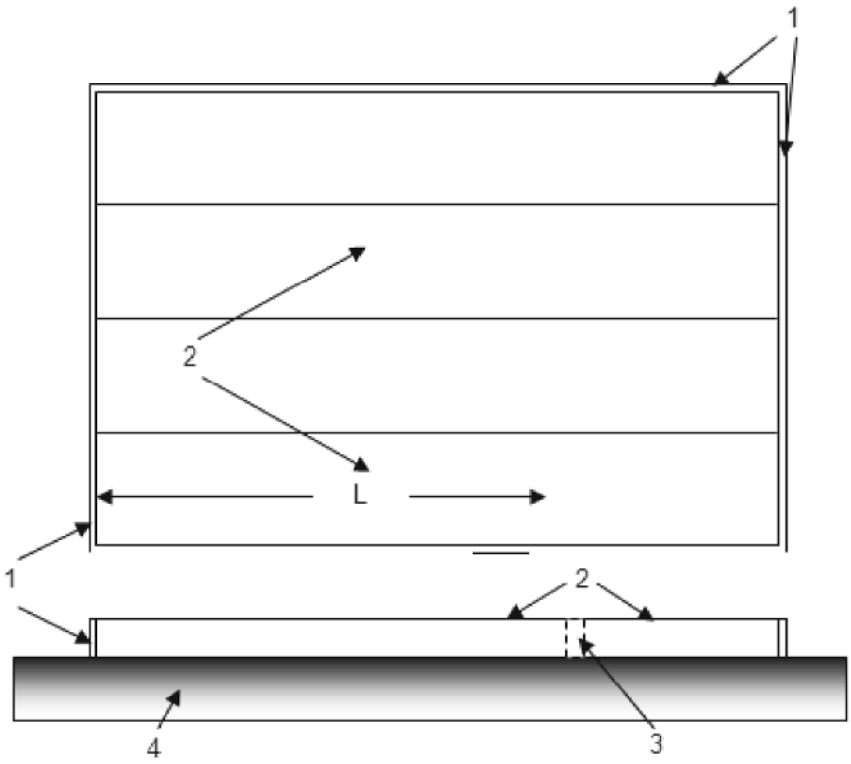


Key

1 reflective frame
2 panels
3 post
4 chamber surface (floor)

NOTE L ≥ 2 m.

Figure 1 — Illustration of sample arrangement for devices having visible posts — Top: front view; Bottom: side view

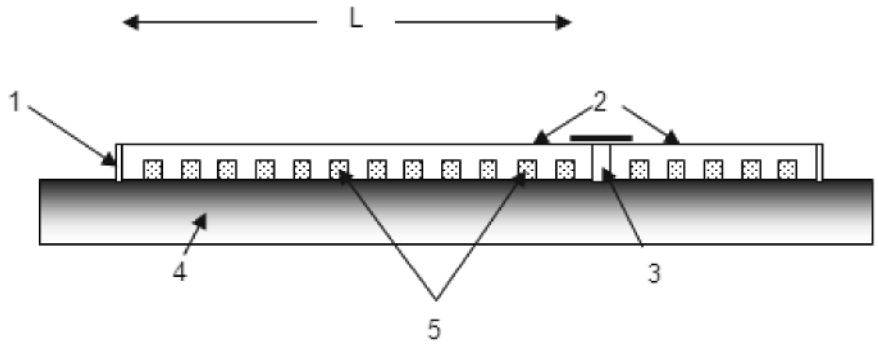


Key

1 reflective frame
2 panels
3 post
4 chamber surface (floor)

NOTE L ≥ 2 m.

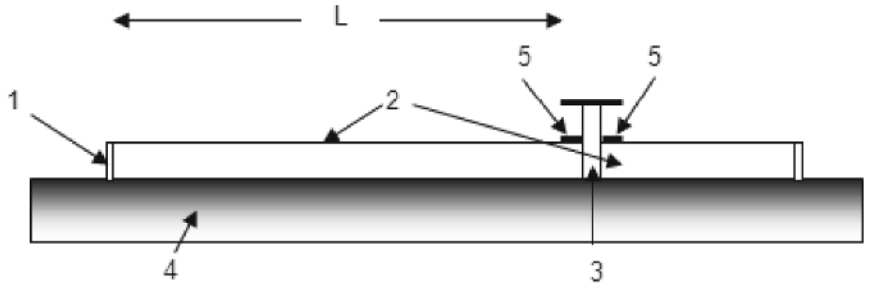
Figure 2 — Illustration of a flat sample arrangement for devices having visible posts — Top: front view; Bottom: side view



Key
1 reflective frame
2 panels
3 post
4 chamber surface (floor)
5 filler (concrete)

NOTE L ≥ 2 m.

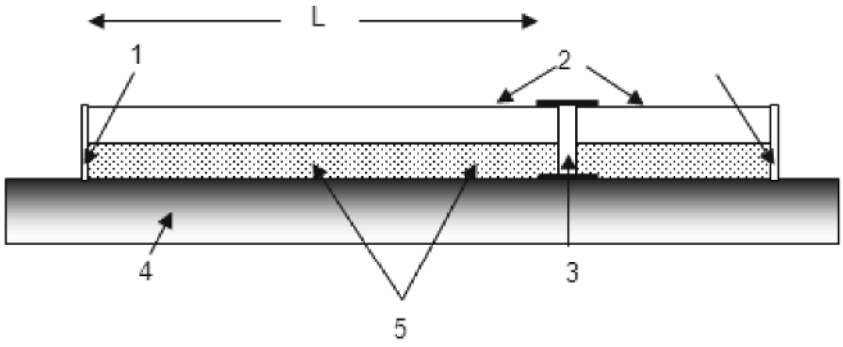
Figure 3 — (Side view) Illustration of a sample arrangement where the flat side under test is facing the chamber while the other side is non-flat and directly against one of the surfaces (floor) of the chamber without any gap



Key
1 reflective frame
2 panels
3 post
4 chamber surface (floor)
5 reflective strips

NOTE L ≥ 2 m.

Figure 4 — (Side view) Illustration of sample arrangement for devices having posts with a thickness larger than that of the acoustic elements and protruding toward the interior of the test chamber



Key
1 reflective frame
2 panels
3 post
4 chamber surface (floor)
5 filler (concrete)

NOTE L ≥ 2 m.

Figure 5 — (Side view) Illustration of sample arrangement for devices having posts with a thickness larger than that of the acoustic elements and protruding toward the floor of the test chamber

6 Test procedure and evaluation

The sound absorption coefficient α_{Si} in each one-third octave band in the range 100 Hz to 5 kHz shall be determined using the method described in EN ISO 354.

NOTE In this European Standard, the basic test method is derived from EN ISO 354:2003. In the current version of the basic test method, an essential change was introduced compared to the previous version of EN ISO 354:1985, viz. the application of a method of correction for changes in sound attenuation in air introduced by changes in air temperature and humidity during the test. Because this correction was not applied in the previous version of the EN ISO 354 test method, the results from the current version may deviate considerably from the results obtained with the previous version of the method. Specifically for test samples with a high absorption coefficient these changes may amount to 1 dB or 2 dB for the single number rating DL_{α} according to EN 16272-3-1, either in a positive or a negative sense. The effect of the application of the correction will be most noticeable in the higher frequency bands.

7 Measurement uncertainty

The uncertainty of results is obtained from measurements according to EN ISO 354. If reported, the expanded uncertainty together with the corresponding coverage factor for a stated coverage probability of 95 % as defined in ENV 13005 shall be given. More information on measurement uncertainty is given in Annex A.

8 Test report

8.1 Expression of results

The one-third octave band values of the sound absorption coefficient α_{Si} shall be given at all frequencies of measurement in tabular form and in the form of a graph. The values shall be rounded to the nearest second decimal place.

The measurement uncertainty of the sound absorption coefficient α_{Si} shall be given at all frequencies of measurement.

If a single-number rating of sound absorption is to be calculated, then this shall be done in accordance with EN 16272-3-1.

8.2 Further information

The test report shall contain:

a) reference to this European Standard;

b) description of test conditions including mounting position (floor, wall or ceiling), procedures and equipment used in accordance with EN ISO 354;

c) full description of the test specimen including manufacturer's name and product identifier with sectional drawings and photographs showing mounting conditions, masses, densities, dimensions and specifications of panels, posts and seals, sound absorbing materials, including any internal component;

d) name and address of the organisation which performed the measurements;

e) signature of the person responsible for the test;

f) date of the test.

Annex A
(informative)

Measurement uncertainty

A.1 General

The accepted format for expression of uncertainties generally associated with methods of measurement is that given in ENV 13005. This format incorporates an uncertainty budget, in which all the various sources of uncertainty are identified and quantified, from which the combined total uncertainty can be obtained. The data necessary to enable such a format to be adopted in the case of this European Standard are the same as for EN ISO 354, because the measurement procedure is the same (see Clause 5). Therefore reference shall be made to EN ISO 354 and related treatment of the measurement uncertainty.

A.2 Measurement uncertainty based upon reproducibility data

The information on measurement reproducibility can be helpful towards the derivation of measurement uncertainties, but it is incomplete. In particular, it does not give an analysis of the various components of measurement uncertainty and their magnitudes.

In the absence of data for uncertainty contributions, values for the standard deviation of reproducibility, when available, may be used as an estimate of the combined standard uncertainty of determinations of sound absorption coefficient. A value may then be selected for the coverage factor, and the product of the two will yield an estimate of the expanded measurement uncertainty, with the chosen coverage probability. By convention, a coverage probability of 95 % is usually chosen. To avoid any misinterpretations, the chosen coverage probability should always be stated in test reports together with the expanded measurement uncertainty.

Bibliography

[1] FprCEN/TS 16272-5, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions*

This page deliberately left blank

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.

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 bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

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.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 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.

...making excellence a habit.™