BS EN 13141-2:2010

BSI Standards Publication

Ventilation for buildings — Performance testing of components/products for residential ventilation

Part 2: Exhaust and supply air terminal devices

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 13141-2:2010. It supersedes BS EN 13141-2:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/2, Ventilation for buildings, heating and hot water services.

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.

ISBN 978 0 580 61453 8

ICS 91.140.30

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 September 2010.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13141-2

July 2010

ICS 91.140.30

Supersedes EN 13141-2:2004

English Version

Ventilation for buildings - Performance testing of components/products for residential ventilation - Part 2: Exhaust and supply air terminal devices

Ventilation des bâtiments - Essais des performances des composants/produits pour la ventilation des logements - Partie 2: Bouches d'air d'évacuation et d'alimentation

Lüftung von Gebäuden - Leistungprüfungen von Bauteilen/Produkten für die Lüftung von Wohnungen - Teil 2: Abluft- und Zuluftdurchlässe

This European Standard was approved by CEN on 22 April 2010.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 13141-2:2010: E

Contents

Page

Foreword

This document (EN 13141-2:2010) has been prepared by Technical Committee CEN/TC 156 “Ventilation for buildings”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

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 supersedes EN 13141-2:2004.

The position of this European Standard in the field of the mechanical building services is shown in Figure 1.

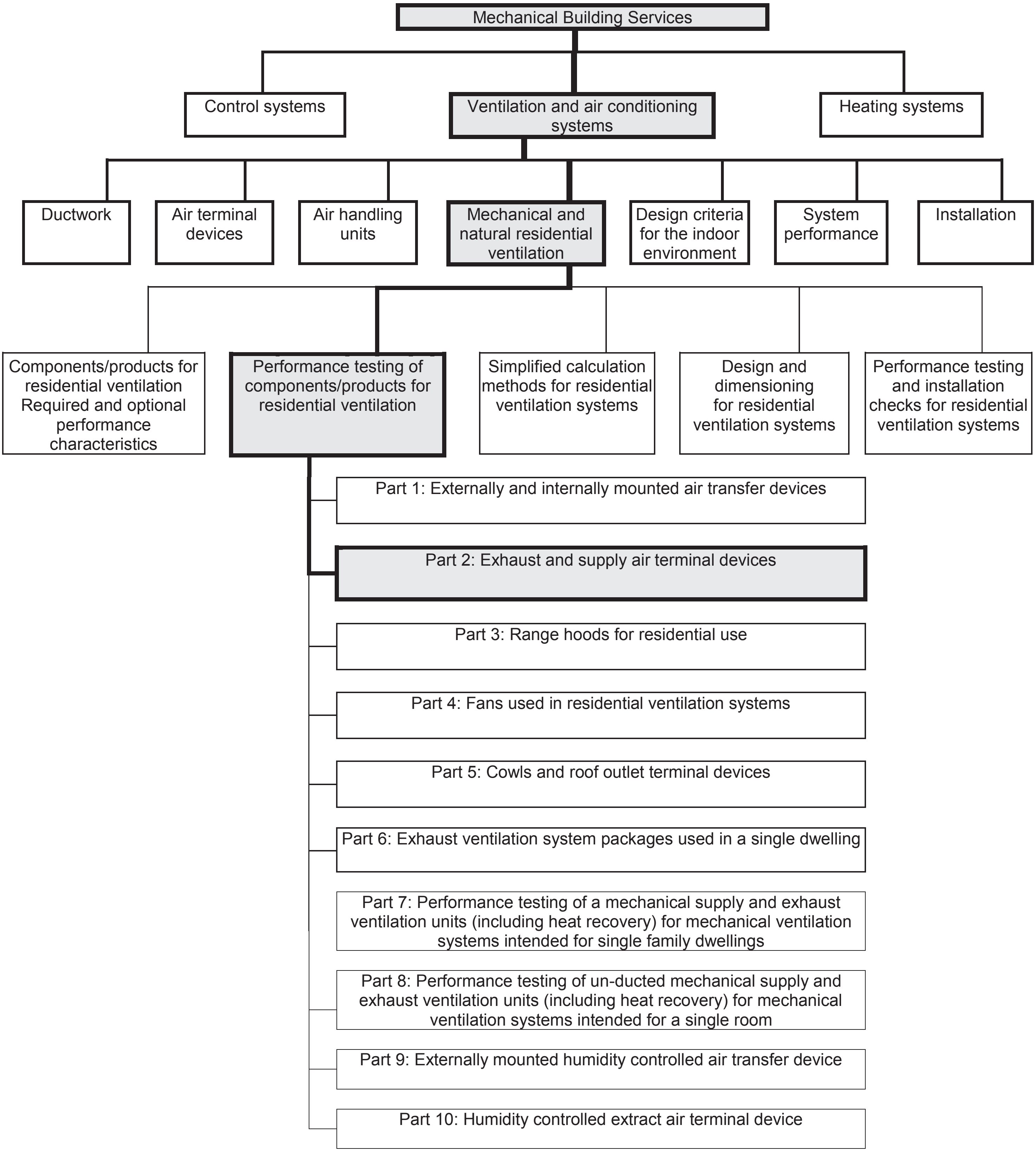


Figure 1 — Position of EN 13141-2 in the field of the mechanical building services

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

1 Scope

This European Standard specifies laboratory methods for testing exhaust and supply air terminal devices operating under pressure differences.

It applies to devices used in mechanical and natural residential ventilation systems, of the following types:

— device with a manually adjustable opening; or

— device with a fixed opening; or

— pressure difference controlled device.

It describes tests intended to characterize:

— flow rate/pressure;

— air diffusion characteristics (for supply air terminal devices);

— noise production for components of systems;

— insertion loss of component of systems;

— sound insulation.

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 1506, *Ventilation for buildings — Sheet metal air ducts and fittings with circular cross-section — Dimensions*

EN 12238, *Ventilation for buildings — Air terminal devices — Aerodynamic testing and rating for mixed flow application*

EN 12792:2003, *Ventilation for buildings — Symbols, terminology and graphical symbols*

EN 13141-1:2004, *Ventilation for buildings — Performance testing of components/products for residential ventilation — Part 1: Externally and internally mounted air transfer devices*

EN ISO 140-3, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 3: Laboratory measurements of airborne sound insulation of building elements (ISO 140-3:1995)*

EN ISO 3741, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms (ISO 3741:1999, including Cor 1:2001)*

EN ISO 5135, *Acoustics — Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room (ISO 5135:1997)*

EN ISO 11691:2009, *Acoustics — Measurement of insertion loss of ducted silencers without flow — Laboratory survey method (ISO 11691:1995)*

EN ISO 7235:2009, *Acoustics — Laboratory measurement procedures for ducted silencers and air-terminal units — Insertion loss, flow noise and total pressure loss (ISO 7235:2003)*

ISO 5221, *Air distribution and air diffusion — Rules to methods of measuring air flow rate in an air handling duct*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12792:2003 and the following apply.

3.1
insertion loss
reduction in sound pressure level in the reverberation room due to the mounting of the air terminal device

3.2
test duct
straight, rigid hard-walled duct of constant cross section between sound source and air terminal device

3.3
reverberation room
room specially designed to facilitate the production of approximately diffuse sound fields

3.4
background noise
noise emitted by the whole sources other than the source under testing

4 Performance testing of aerodynamic characteristics

4.1 Flow rate/pressure

4.1.1 Principle

This test consists of measuring several volume flow rates induced through a device by the applied static pressure difference to define the flow rate/pressure characteristic curve in the operating range specified by the manufacturer. In the case of manually adjustable devices this test shall be carried out at maximum and minimum opening conditions specified by the manufacturer.

Some exhaust ATD are of the bi-function type, i.e. they are designed to work under both natural and mechanical ventilation system. In that case the manufacturer may have to specify two operational ranges, and the device shall be tested for each of them according the standard procedure.

4.1.2 Test installation, conditions and uncertainty of measurement

4.1.2.1 Test installation and conditions

The device to be tested shall be installed in accordance with Figure 2a) for exhaust air terminal device or Figure 2b) for supply air terminal device.

The test installation shown in Figure 2a) and Figure 2b) comprises:

— a test duct with an airflow meter, a static pressure gauge and an airflow straightener in accordance with ISO 5221. Other measurement devices may be used, provided they allow measurements with an uncertainty in accordance with 4.1.2.2;

— a fan with means to vary the pressure difference across the device, covering the range of Table 1 given in 4.1.3.

NOTE In order to avoid pumping effect, an adequate device may be added after the airflow meter.

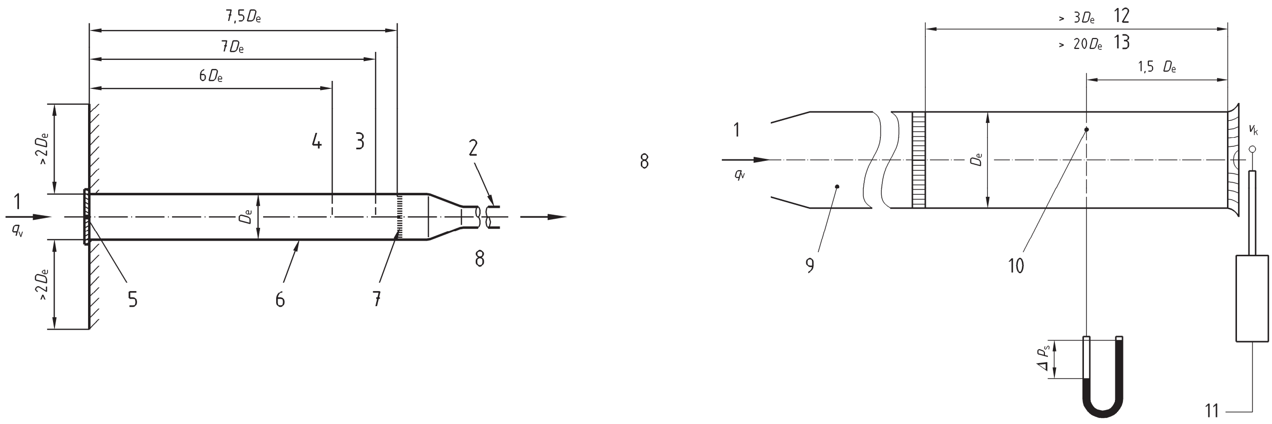
The test facilities shall have a range:

— for extraction: – 300 Pa to 0 Pa;

— for supply: 0 Pa to + 300 Pa.

The air terminal device shall be mounted in a test duct with cross-sectional dimensions equal to the nominal size of the device or to the duct dimensions normally recommended by the manufacturer.

For supply only, the duct shall be straight and at least 20 D_e long to guarantee a uniform velocity profile or shall include an efficient flow straightener located at a position at least 3 D_e from any part of the air terminal device. It is recommended that straightener cells have an axial length at least equal to six times the hydraulic diameter of their cross-section.



a) For exhaust air terminal device

b) For supply air terminal device

Key

1 airflow
2 airflow meter
3 plane of temperature measurement
4 plane of pressure measurement
5 air terminal device
6 test duct, diameter D_e
7 flow straightener
8 connection to fan, flowrate control and airflow meter
9 transition to test duct size
10 plane of pressure measurement
11 signal to display or computer
12 with flow straightener
13 without flow straightener

Figure 2 — Test installation for exhaust air terminal device (Figure 2a)) and supply air terminal device (Figure 2b))

4.1.2.2 Uncertainty of measurement

In the case of air terminal devices with pressure difference controlled openings:

— the pressure shall be measured with an uncertainty lower than:

$$0{,}2 + 0{,}03 \times (\text{measured value}) \qquad (\text{Pa}) \qquad (1)$$

— the volume flow rate shall be measured with an uncertainty lower than:

$$0{,}3 + 0{,}03 \times (\text{measured value}) \qquad (1 \cdot s^{-1}) \qquad (2)$$

For other air terminal devices:

— the pressure shall be measured with an uncertainty lower than:

$$0{,}5 + 0{,}03 \times (\text{measured value}) \qquad (\text{Pa}) \qquad (3)$$

— the volume flow rate shall be measured with an uncertainty lower than:

$$0{,}3 + 0{,}03 \times (\text{measured value}) \qquad (1 \cdot s^{-1}) \qquad (4)$$

NOTE The combined uncertainties of measurement will result in a total accuracy of the test method in the range of 3 % to 5 %.

4.1.3 Test procedure

The measurements shall be taken for six points, each taken within one of the pressure difference ranges (bands) given in Table 1 so as to match with / cover the operational range of the device as stated by the manufacturer.

Table 1 — Pressure difference ranges

Pressure difference Δp Pa
3 to 4
4 to 6
6 to 8
8 to 10
13 to 18
18 to 24
24 to 32
32 to 42
42 to 55
55 to75
75 to 100
100 to 130
130 to 170
170 to 225
225 to 300

The environmental conditions existing during the tests such as temperature, barometric pressure shall be recorded.

Air temperature θ_a shall be (20 ± 5) °C. During the test, temperature θ_a shall not vary more than ± 2 °C.

The test shall be carried out by continuously increasing the pressure difference across the device.

For pressure difference controlled devices, a first series of measurement shall be made with continuously increasing the pressure difference, then a second with continuously decreasing it.

At each point the couple (pressure difference Δp, volume flow rate $q_{\text{v meas}}$) shall be recorded when steady state conditions are achieved.

The volume flow rate $q_{\text{v meas}}$ may be directly measured or alternatively calculated from the measured value of mass flow rate q_{m}.

4.1.4 Analysis of results

Analysis of result shall be as specified in EN 13141-1:2004, 4.1.3.

4.1.5 Presentation of results

Presentation of result shall be as specified in EN 13141-1:2004, 4.1.3.

4.2 Air diffusion characteristics for supply air terminal devices

Tests shall be carried out and the results presented in accordance with EN 12238.

5 Performance testing of acoustic characteristics

5.1 Noise production for components of systems

5.1.1 General

Air passing through an air terminal device generates noise, some of which is radiated into the room. The method described below determines the acoustic power level of the noise thus emitted.

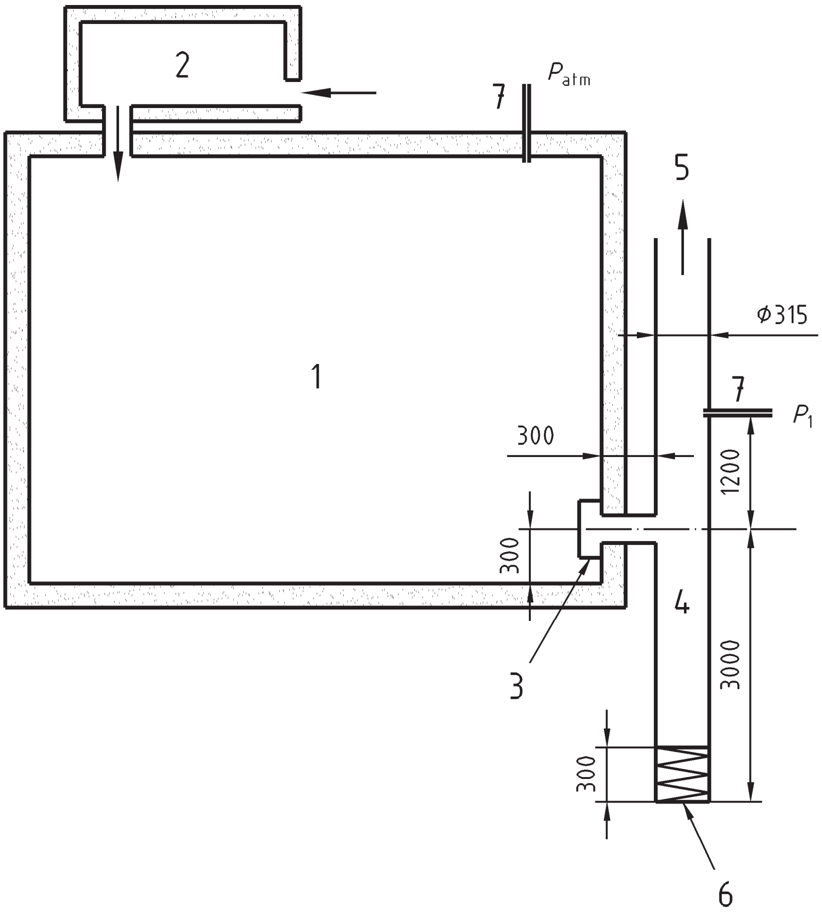
5.1.2 Test installation

5.1.2.1 Characteristics of reverberation room

The acoustics measurements shall be made in a reverberation room according to the EN ISO 3741.

The test installation shall be as shown in Figure 3. Dimensions are given in millimetres. Tolerances should be ± 10 mm, except for test duct, whose tolerance shall comply with EN 1506.

Dimensions in millimetres



Key

1 reverberation room
2 silencer (or silent air inlet)
3 air terminal device under test
4 test duct
5 to the exhaust fan and the flow rate measuring instrument
6 anechoic termination (300 mm of fibrous sound absorbent plug with a density close to 40 kg/m³ before the closed side of the duct)
7 pressure probes

Figure 3 — Test facility and test installation of the air terminal device on its test duct

5.1.2.2 Position of the air terminal device in reverberation room

The duct centreline should be placed at 300 mm from an edge of the test room and at least at 1 500 mm from any wall other than those forming the edge.

If the edge is not at 300 mm from the duct centreline, it shall be simulated by using a baffle of particle board, thickness 22 mm, minimum density 500 kg/m³ and minimum area 1 500 mm × 1 500 mm.

5.1.2.3 Air handling circuit

The air circuit shall be designed as shown in Figure 3.

An extraction fan shall be mounted in the air circuit and fitted with regulation devices and a silencer. The measured background noise of the test room when the air terminal device is removed should remain at least 6 dB lower than the noise measured with the device.

The inlet through which air enters the test room shall have a sufficiently large cross-section to maintain low pressure difference in the test room and not induce any noise which might contribute to the background noise.

5.1.2.4 Flow noise measuring conditions

Air shall be extracted from to the air terminal device by means of the test duct specified in 3.2 and 5.1.2.1 and the air handling circuit specified in 5.1.2.3.

The airflow rate shall be determined from an airflow measuring instrument in accordance with ISO 5221, or using an instrument of at least the same accuracy, and fitted in the air handling circuit.

The pressure drop through the air terminal device shall be measured as:

$$\Delta p = \left| p_{\mathrm{atm}} - p_1 \right| \quad (5)$$

where

p_{atm} is the atmospheric pressure in the room;

p_1 is the static pressure measured in the duct at the position indicated in Figure 3.

The static pressure shall be measured according to 4.1.

The air terminal device shall be mounted such that no air leakage can occur between the device and the air duct, to avoid the generation of narrow-band noise which can affect the results.

The setting of any positioning parameter indicated on the adjustable terminal devices shall be recorded.

5.1.2.5 Background noise measuring conditions

Background noise shall be measured in the test room, the air terminal device being removed, according to 5.1.2.3 and 5.1.2.4 with an airflow rate equal (± 5 %) to the one existing when the air terminal device installed. This implies the preliminary measurement of the airflow rate with the air terminal device installed.

5.1.3 Test procedure

This procedure shall be carried out for each mounting specified by the manufacturer and each operational range specified by the manufacturer if the device is of the bi-function type.

The pressure difference to be applied during the sound level measurement shall be the maximal value declared by the manufacturer.

Additional operating conditions can be used to achieve acoustic measurements:

- the minimal pressure difference value declared by the manufacturer and three intermediate values equally distributed among the bands between mini and maxi values, to be taken in Table 2;
- any other value of pressure difference (to be chosen in the table) required by the applicant or local regulation/certification.

Table 2 — Pressure difference ranges

Pressure difference Δp Pa
3 to 4
4 to 6
6 to 8
8 to 10
13 to 18
18 to 24
24 to 32
32 to 42
42 to 55
55 to 75
75 to 100
100 to 130
130 to 170
170 to 225
225 to 300

5.1.4 Acoustic measurement

The determination of the sound power level from the sound pressure level shall be made according to EN ISO 3741.

The frequency shall cover the range 100 Hz to 5 000 Hz in one-third octave band presentation.

The measured sound pressure levels, in frequency bands, shall be corrected for the influence of background noise by subtracting a value K_1 which is calculated for each band according to the following equation:

$$K_1 = -10 \lg (1 - 10^{-0,1\Delta L}) \text{ dB} \quad (6)$$

where

K_1 is the correction for background noise, expressed in decibels (dB);

$\Delta L = \overline{L'_p} - \overline{L''_p}$

where

L'_p is the level of the mean-square sound pressure, in a given frequency band, averaged over the microphone positions or traverse, with the source under test in operation, expressed in decibels (dB);

L''_p is the level of the mean-square background sound pressure, in a given frequency band, measured immediately after the measurement of the source under test, averaged over the microphone positions or traverse, expressed in decibels (dB).

For values of 6 dB ≤ ΔL ≤ 15 dB, corrections shall be made according to Equation (6).

5.1.5 Presentation of results

For each pressure difference, the sound power level results shall be presented in tables, including the one-third octave bands spectra, expressed in decibels (dB) with the associated overall values in dB and dB(A). The operating conditions shall be specified, so that the values for which background noise does not fulfil the lower limit requirement.

A graph presenting the dB spectrum shall be included.

5.2 Insertion loss of component of systems

5.2.1 General

The aim of the method is to determine the insertion loss for the ATD (Air Terminal Device), generally without airflow except if the geometry of the device is significantly changed by the air.

In a reverberation room the noise level, L_{p1}, from a loudspeaker unit propagating through a test duct is measured.

Then the noise level with the ATD mounted on the test duct, L_{p2}, is measured. The insertion loss, D, is calculated as the difference between the measured values.

5.2.2 Test procedure

5.2.2.1 Test room

The preferred measurement room is a reverberation room complying with the requirements of EN ISO 3741. Other environments complying with EN ISO 11691 are allowed.

5.2.2.2 Sound measuring

The instrumentation system shall meet the requirements for a type 1 instrument as described in EN ISO 11691:2009.

The measurements shall be taken in 1/3-octave bands.

5.2.2.3 Sound source equipment

A noise generator with an amplifier shall be connected to the loudspeaker. White or pink noise shall be generated.

The link between the sound source and the test duct should be elastic to reduce the transmissions of undesired vibrations.

The sound source equipment shall be made of one loudspeaker mounted in a box-source as described in 5.2.2.2 and Figure A.2 of Annex A of EN ISO 7235:2009. The section of the box-source shall be five times bigger than the duct work to ensure homogeneous airflow in the test duct inlet. The loudspeaker shall be located face to the inlet of the test duct, at 0,6 L of the inlet (where L is the length of the source-box).

The three dimensions of the box-source shall not be the same.

The source box is connected to the test duct and to duct leading to the fan. In case of ATD test without airflow, the opening of the fan duct shall be closed using a panel with a density bigger or equal to the other wall of the box.

The connection between the source-box and the test duct shall necessitate a junction element to adapt the section and shape of the source-box opening and the test duct. Without airflow, this element shall only reduce the section of source-box opening to fit the test duct section. With airflow, the junction element shall be made according to following requirement:

— the angle of transition element should be lower than 15°;

— the minimum length (in metres) of the element is the ratio of biggest section over smallest section minus one:

$$L_{\text{min}} = (S_{\text{max}} / S_{\text{min}}) - 1 \tag{7}$$

The rectangular – circular transition can be done within these elements.

5.2.2.4 Generating and measuring airflow and pressure drop

Some ATDs are controlled by airflow or a pressure drop. Whatever the case, a fan is necessary. The method consisting in its connection to the source-box as described in this standard (see Figure 4) is preferred but any other setup allowing the generation and measurement of airflow is accepted.

In case of airflow, the test device shall include a duct (called fan duct) upstream the source-box, consisting in:

— a fan, with adapted vibratory insulating elements between the fan and the duct;

— a silencer, inserted in the duct between the fan and the box-source to reduce the fan noise. It should be conceived to not generate noticeable vortex. A straightener may be necessary.

Moreover, devices to adjust and to measure airflow rates shall be inserted in the test device, in the fan duct (for example, an orifice plate device is convenient).

The pressure drop of the ATD is characterised by the difference of static pressures. The first one P_0 is measured in the reverberation room; the second one P_1 is measured in the test duct, five times the test duct diameter from the ATD, i.e. 5 d_2.

5.2.2.5 Test duct

The test duct shall be exactly 3,50 m long. Test duct cross-dimension shall be as close as possible to the connection of the ATD, less than ± 10 % for the equivalent diameter. To reduce bypass transmission an elastic joint with steel on the outside can be mounted between the sound source and the test duct. The test duct length shall be measured from the transition element of the sound source. The same test duct shall be used when measuring without and with ATD.

NOTE The specified dimensions in 5.2.3 and 5.2.4 have been standardised in detail in order to reduce reproducibility errors between different laboratories.

5.2.2.6 Block for testing the limiting insertion loss

The limiting insertion loss assesses the maximum insertion loss of the test rig. It shall be measured by blanking off the test duct with a block at the end of the duct. One way of doing this is to make a 1 m long "block" made of the same duct type and dimension as the test duct. In the room end of the block two heavy plates are mounted with 0,2 m distance with mineral wool between and well sealed. The other end is filled up with mineral wool and connected to the test duct with a standard fitting. If measurements show insufficient limiting insertion loss, the block may be improved with heavy outside lining.

However, it may be necessary to improve airborne insulation or vibratory decoupling.

5.2.3 Preparation and mounting of the test samples

The ATD shall be mounted in a position representative of normal usage: ATD intended for free mounting in a room or in an acoustical open ceiling shall be mounted on a test duct that terminates minimum 1,0 m from any surface in the test room. ATD intended for mounting in a tight ceiling or wall shall be mounted flush with a surface in the test room, as explained in EN ISO 5135. If correct mounting is difficult, the reflecting room surfaces may be simulated by panels with a weight greater than 7 kg/m^2 as explained in EN ISO 5135.

The opening of the test duct shall not be positioned on any axial symmetry of the reverberation room.

If the test object includes a damper, the damper shall be set fully open before the test.

When testing without ATD (free duct), the duct shall terminate in free space minimum 1,0 m from any test room surface or flush with a wall.

5.2.4 Procedure

5.2.4.1 Measurements without airflow

Carry out the measurements in 1/3-octave bands in the frequency range 100 Hz to 5 000 Hz. If the measurement environment is not qualified for the whole frequency range, the results may still be reported as long as frequencies outside the range of qualification are clearly indicated in the test report.

Three measurement series shall be carried out, sound source under running:

— background sound pressure level L_b with the end of the test duct blocked in accordance with 5.2.2.6;

— sound pressure level L_{p2} without ATD;

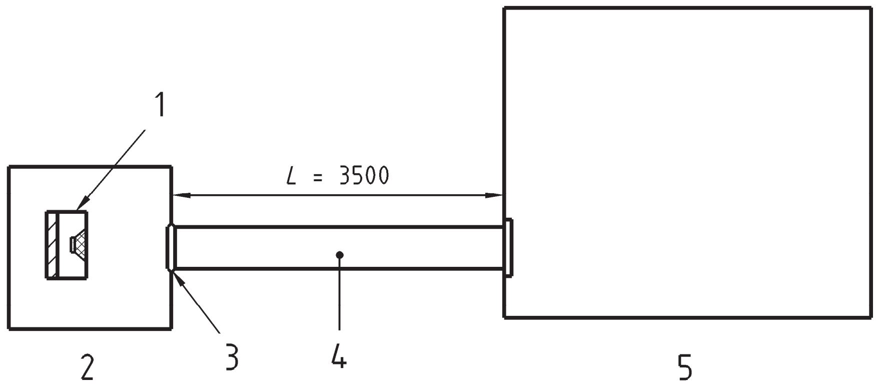
— sound pressure level L_{p1} with ATD.

NOTE It is sufficient to do test series 1 and 2 once for each test duct if more ATDs with the same inlet dimension are tested in the same series or if more positions of ATD are tested, provided that the test conditions are the same in all tests.

The sound pressure level shall be spatially averaged levels measured in identical points or paths in the reverberation room. The emitted sound power spectrum for the three test series should be the same. This shall be controlled by measuring the voltage across the loudspeaker and keeping it constant. The measurements and the averaging shall be in accordance with EN ISO 3741, or standard for the actual test environment.

Typical test set up is shown in Figure 4.

Dimensions in millimetres



Key

1 loudspeaker

2 box source

3 plastic joint

4 test duct, diameter d_2

5 reverberant room

L minimum length: 3 500 mm

Figure 4 — Typical test set up without airflow

5.2.4.2 Measurements with airflow

Carry out the measurements in 1/3-octave bands in the frequency range 100 Hz to 5 000 Hz. If the measurement environment is not qualified for the whole frequency range, the results may still be reported as long as frequencies outside the range of qualification are clearly indicated in the test report.

Three measurement series shall be carried out, sound source under running:

— background sound pressure level L_b with the end of the test duct blocked in accordance with 5.2.2.6;

— sound pressure level L_{p2} without ATD.

  L_{p2} shall be measured in the test room, the air terminal device being removed, with an airflow rate equal (± 5 %) to the one existing when the air terminal device installed;

— sound pressure level L_{p1} with ATD.

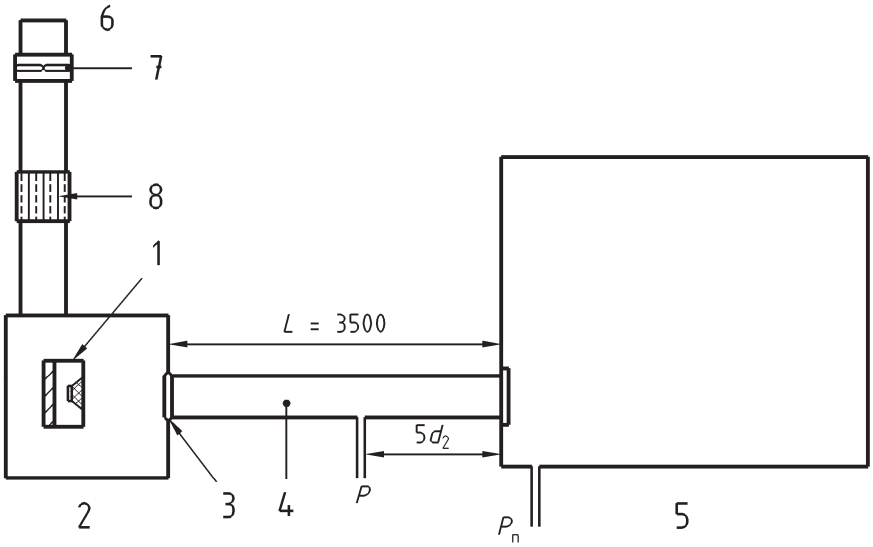
Special precaution shall be taken to ensure that the sound generated by the fan and the airflow are at least 10 dB below L_{p2}.

NOTE It is sufficient to do test series 1 and 2 once for each test duct if more ATDs with the same inlet dimension are tested in the same series or if more positions of ATD are tested, provided that the test conditions are the same in all tests.

The sound pressure level shall be spatially averaged levels measured in identical points or paths in the reverberation room. The emitted sound power spectrum for the three test series should be the same. This shall be controlled by measuring the voltage across the loudspeaker and keeping it constant. The measurements and the averaging shall be in accordance with EN ISO 3741, or standard for the actual test environment.

Typical test set up is shown in Figure 5.

Dimensions in millimetres



Key

1 loudspeaker
2 box source
3 plastic joint
4 test duct, diameter d_2
5 reverberant room
6 airflow measurement device
7 fan
8 silencer
L minimum length: 3 500 mm

Figure 5 — Typical test set up with airflow

5.2.5 Control of the limiting insertion loss

A difference between L_{p2} with ATD and the background level L_b less than 6 dB (preferably 10 dB) means that indirect sound transmissions occurs and radiates sound pressure into the receiving room. The sound insulation of the test device should be improved.

5.2.6 Calculations

Calculate the untreated insertion loss, D_u:

$$D_u = L_{p2} - L_{p1} \quad (8)$$

Calculate the limiting insertion loss, D_{lim}:

$$D_{lim} = L_{p2} - L_b \quad (9)$$

Corrections for insufficient limiting insertion loss:

If the difference between limiting insertion loss D_{lim} and the untreated insertion loss D_{u} of the ATD is less than 10 dB, but greater than 3 dB, then the measured insertion loss should be increased by a correction factor *K* depending on difference between D_{lim} and D_{u}:

$$\Delta D = D_{\text{lim}} - D_{\text{u}} \quad (10)$$

$$K = -10 \lg \left(1 - 10^{-\Delta D/10}\right) \quad (11)$$

The insertion loss of the considered ATD is then

$$D = D_{\text{u}} + K \quad (12)$$

For differences ΔD less than 3 dB, it shall be stated that D is outside measurable range.

5.2.7 Expression of results

The insertion loss in 1/3-octave bands, corrected for insufficient limiting insertion loss, shall be presented in tabular and preferably also in graphical form as a function of frequency, from 100 Hz to 5 000 Hz. All values outside measurable range should be marked in the table and commented.

In addition, the calculated insertion loss in octave bands may be presented in table and graph.

5.3 Sound insulation characteristics of a pair of air terminal devices

5.3.1 General

The air extraction circuit of a collective mechanical ventilation system joins up certain rooms in a same building by means of a common duct.

The capacity of the terminal devices to restrict the transmission of airborne sound from one room to another may, in certain conditions, and for a given configuration of terminal devices in each of the rooms and a specified drawing of the duct section common to both rooms, be characterised by a parameter given by Equation (12):

$$D_{n,e} = L_{p_1} - L_{p_2} + 10 \lg (A_0/A) \quad (13)$$

where

A_0 = 10 m²;

A is the equivalent absorption area of the receiving room;

L_{p1} and L_{p2} are the average sound pressure level in the emitting and receiving rooms respectively.

This section describes a method for determining the sound insulating capacity of a section of mechanical ventilation ductwork connecting the two rooms.

The method used to determine the sound insulation on a test facility comprising two adjoining reverberant rooms should be as described in EN ISO 140-1 regarding the "requirements for laboratory test facilities with suppressed flanking transmission", and EN ISO 140-3 and EN 20140-10 for the "measurement of sound insulation of building elements". These standards are completed by specific construction arrangements affecting:

— the positioning of the terminal devices in each of the test facility rooms;

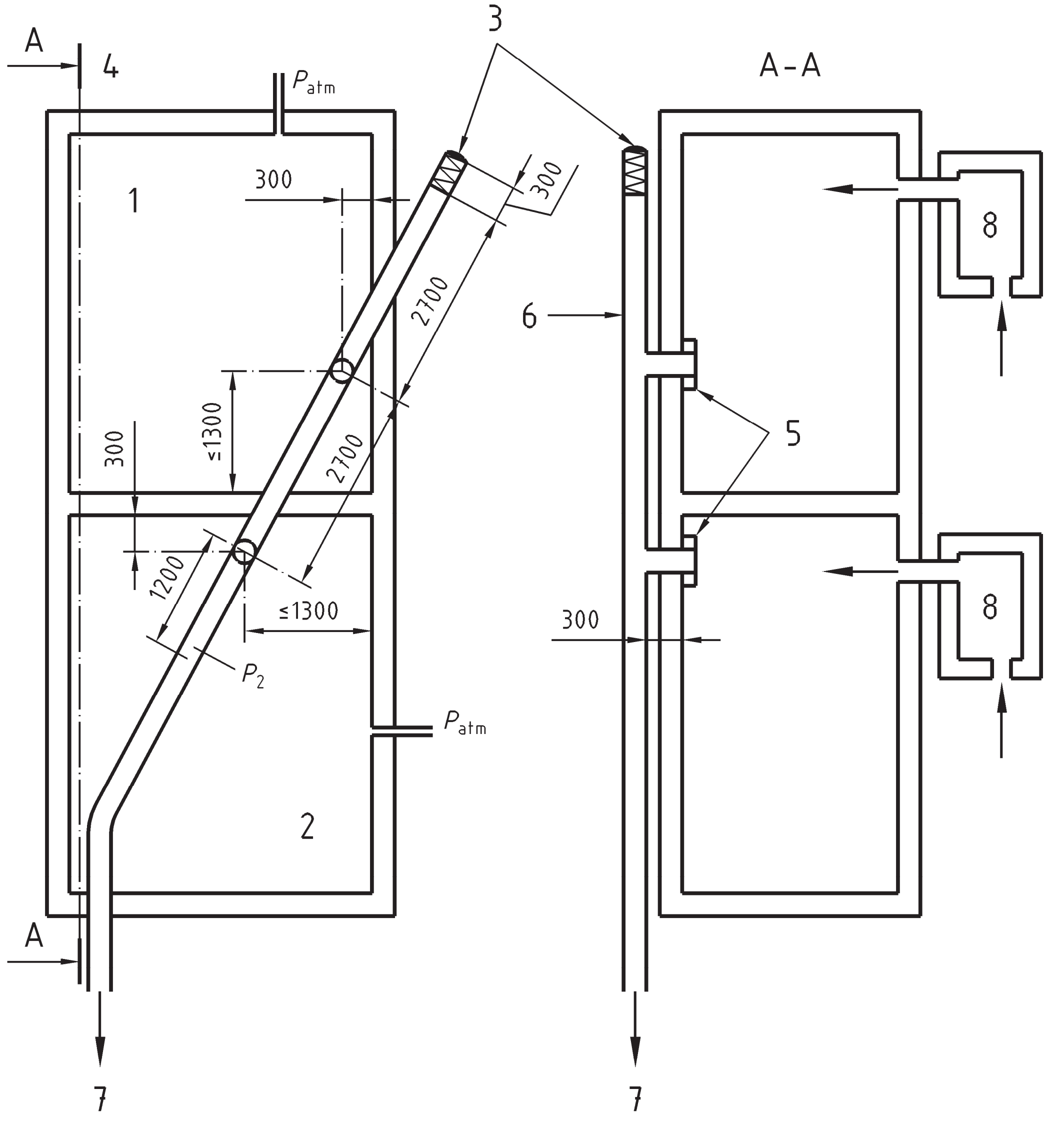
— the defining of the ductwork section common to the two terminal devices and, if necessary, the air system to be used when testing in the presence of a terminal device airflow;

— the conditions for measuring the background noise;

— the number of test points and their specification;

— the test installation shall comply with Figure 6.

Dimensions in millimetres



Key

1	reverberation room	5	tested terminal devices
2	reverberation room	6	common duct, d_2 = 315 mm
3	anechoic duct end	7	to fan in case of measurement with airflow
4	pan view	8	silent air inlet in case of measurement with airflow

Figure 6 — Test installation for measuring the acoustic insulation of air terminal devices

5.3.2 Testing without airflow

The distance between a branch axis and the end of the nearest collective duct shall be at least 2 700 mm.

The ends of the collective duct shall be equipped with a fibrous sound absorbent plug with a density close to 40 kg/m^3 and thickness close to 300 mm.

5.3.3 Testing with airflow

When required by terminal device operation (geometry related to the flow or the differential pressure), or by the applicant, test readings shall be taken in the presence of terminal device airflow.

In this case, one of the ends of the collective duct shall be connected to an air extractor which fulfils the arrangements adopted for the airflow tests.

The collective duct shall be equipped with a sensor for measuring p2 downstream of each branch connection.

The value (p_{atm} - p_2) shall be used to determine the flow through each of the terminal devices.

In order to execute the test in these conditions, special precautions shall be taken to ensure that the sound generated by the fan and the terminal devices are less than the sound transmitted from one room to the other, and that the air entering each of the rooms does not disturb the insulation between them and with the outside.

Tests can be performed without airflow if the geometry of air terminal device is not affected at the current pressure level or if the geometry of air terminal device is blocked at the position equivalent to the one induced by the current pressure level and validated by aerodynamic test.

NOTE 1 The significant variations of ξ (coefficient of energy loss of the terminal device) in relation to the pressure difference (Δp) justify the choice a single Δp value for the tests.

NOTE 2 It is sufficient that the real airflow measured values during the acoustic test are between 95 % and 105 % of those noted during the airflow test.

5.3.4 Conditions for measuring background noise

5.3.4.1 General

Background noise is all the unwanted noise in the receiving room not resulting from the airborne sound transmitted through the mechanical ventilation ductwork. The background noise may have several sources. It may be:

— generated in the emitting room and penetrate the receiving room by means other than airborne transmission through the ventilation ductwork;

— external noise penetrating the receiving room through the room wall;

— external noise penetrating the receiving room through terminal device components; generated by the fan or the terminal devices and penetrate the receiving room when testing in the presence of a terminal device airflow.

5.3.4.2 Measuring of background noise

5.3.4.2.1 Testing without airflow

The background noise is the average acoustic pressure level measured in the receiving room when the sound sources in the emitting room are operating and the terminal device has been replaced by a plaster insulating plug measuring around 50 mm thick, or any other material with an equivalent weight per unit of surface area (19 kg/m²).

5.3.4.2.2 Testing with airflow

In addition to the measurement defined in 5.3.4.2.1 (fan stopped), the sound pressure level resulting from operation of the fan and the airflow in the ductwork is determined in the receiving room (the sound sources then being stopped in the emitting room).

5.3.4.3 Corrections due to background noise

The sound pressure levels due to background noise shall be low enough for any correction to be unnecessary.

In particular, when testing with an airflow, each of the sound pressure levels measured in the conditions defined in 5.3.4.2 shall be at least 10 dB less in each band to the one measured in the receiving room when determining the insulation.

If these conditions cannot be satisfied due to the requirement to measure particularly powerful sound insulations, the correction is authorised but shall be explicitly mentioned in the test report.

5.3.4.4 Selection of test pressure

The sound insulation shall be measured at the minimum pressure difference (p_{atm} - p_2) established by the applicant.

5.3.4.5 Calculation of sound insulation

Sound insulation values can be determined per frequency band based on the noted acoustic pressure levels in the noise emitting and receiving rooms using Equation (12) given in 5.3.1.

5.3.5 Presentation of the results

The values obtained in each frequency band for acoustic insulation shall be described in accordance with the indications given in EN ISO 140-3. Any corrections made due to the background noise shall be explicitly given.

An overall value for the sound insulation in decibels can also be calculated using the method proposed in EN ISO 717-1:1996, Annex A.

Bibliography

[1] EN 13142*, Ventilation for buildings — Components/products for residential ventilation — Required and optional performance characteristics*

[2] EN 13182, *Ventilation for buildings — Instrumentation requirements for air velocity measurements in ventilated spaces*

[3] EN 61260:1995, *Electroacoustics — Octave-band and fractional-octave-band filters (IEC 61260:1995)*

[4] EN 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications (IEC 61672-1:2002)*

[5] EN 61672-2, *Electroacoustics — Sound level meters — Part 2: Pattern evaluation tests (IEC 61672-2:2003)*

[6] EN ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements (ISO 5167-1:2003)*

[7] EN 20140-10, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 10: Laboratory measurement of airborne sound insulation of small building elements (ISO 140-10:1991)*

[8] EN ISO 140-1, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 1: Requirements for laboratory test facilities with suppressed flanking transmission (ISO 141-1:1997)*

[9] EN ISO 717-1:1996, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation (ISO 717-1:1996)*

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.

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 Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.

...making excellence a habit.™