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BSI Standards Publication

Ventilation for buildings — Ducts and ductwork components, leakage classification and testing

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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.

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May 2010

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English Version

Ventilation for buildings - Ducts and ductwork components, leakage classification and testing

Ventilation des bâtiments - Composants de réseaux,
classification de l'étanchéité et essais

Lüftung von Gebäuden - Luftleitungen und
Luftleitungsbauteile, Klassifizierung entsprechend der
Luftdichtheit und Prüfung

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Foreword

This document (EN 15727:2010) 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of an identical text or by endorsement, at the latest by November 2010, and conflicting national standards shall be withdrawn at the latest by November 2010.

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Introduction

The position of this standard in the field of mechanical services is shown in Figure 1.

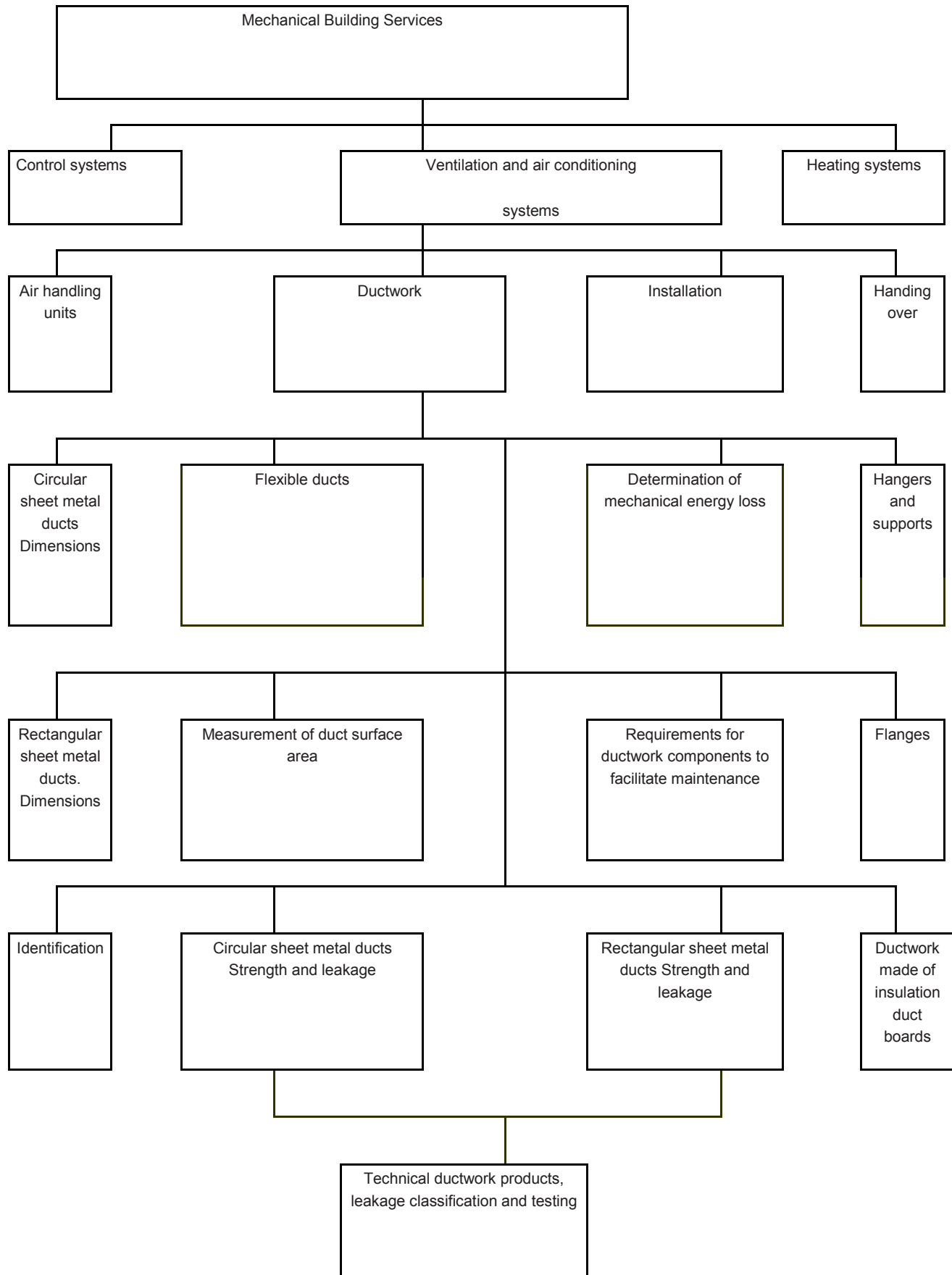


Figure 1 — Position of this standard in the field of mechanical services

1 Scope

This European Standard applies to technical ductwork products, intended for installation in ductwork conforming to EN 1505 and EN 1506, used in air conditioning and ventilation systems defined in the scope of CEN/TC 156. This document specifies the leakage requirements for technical ductwork products, i.e. components in the ductwork that has more functions than conveying air, such as sound attenuators, filter boxes and duct fans, etc.

The following products are not within the scope of this document:

- ductwork components like bends, reducers, ducts and T-pieces. EN 12237 and EN 1507 apply;
- flexible ducts according to EN 13180;
- ducts made of insulation ductboards according to EN 13403;
- dampers according to EN 1751;
- air handling units according to EN 1886.

This document is a parallel standard to EN 12237, EN 1507 and EN 1751, based on the same leakage classification.

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 1505, *Ventilation for buildings — Sheet metal air ducts and fittings with rectangular cross section — Dimensions*

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

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

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1 nominal diameter

d_n
nominal diameter according to EN 1506 for ductwork of circular cross-section

3.1.2 side lengths a and b

side lengths according to EN 1505 for a ductwork of rectangular cross-section

3.1.3
total joint length

L
total length of the periphery of the joints of the connections of the technical products

3.1.4
product surface area

A_p
actual external envelope surface area for the technical ductwork product under test, excluding possible flanges and insertion parts

3.1.5
virtual product surface area

A_c
quantity used for calculation of the permitted leakage for the product under test according to this document

NOTE A_c may deviate from the product surface area.

3.1.6
test pressure

p_{test}
static pressure difference between the pressure within the product to be tested and the pressure of the ambient air

3.1.7
static pressure limit

p_s
maximum design operating pressure for the ductwork according to its air tightness class

NOTE The static pressure limits, positive and negative, for the appropriate air tightness class are specified in Table 3 and Table 4.

3.1.8
air leakage rate

q_{vl}
air leakage flow rate of the product under test

3.1.9
measured air leakage rate

$q_{\text{vlmeasured}}$
air leakage flow rate before correction of temperature and atmospheric pressure (see 7.4)

3.1.10
air temperature

t
temperature of the ambient air during the test

3.1.11
atmospheric pressure

p_a
barometric pressure of ambient air during the test

3.1.12
tightness factor

f_c
leakage flow rate per unit surface area of the product

3.1.13 air leakage limit

f_{\max}
maximum permitted leakage factor for the product according to its air tightness class

3.1.14 technical ductwork product

component, including its connection pieces, installed in the ductwork that has one or more functions more than conveying air

NOTE 1 Sound attenuators, filter boxes and duct fans are typical examples of technical ductwork products and can be tested separately according to this standard. These technical ductwork products are also a part of the ductwork and can be included in the tests in duct systems according to EN 12237 and EN 1507.

NOTE 2 Ductwork components like bends, reducers, ducts and T-pieces are not within the scope of this standard. EN 12237 and EN 1507 apply.

3.2 Symbols

The nomenclature shown in Table 1 is used throughout this document.

Table 1 — Symbols

Symbol	Quantity	Units
A_p	Product surface area	m ²
a and b	Side lengths	m
d_n	Nominal diameter	m
L	Total joint length	m
A_c	Virtual product surface area	m ²
f_c	Product Tightness factor	m ³ ·s ⁻¹ ·m ⁻²
f_{\max}	Air leakage limit	m ³ ·s ⁻¹ ·m ⁻²
p_a	Atmospheric pressure	Pa
p_s	Static pressure limit ($p - p_a$)	Pa
p_{test}	Test pressure	Pa
$q_{v\text{measured}}$	Measured air leakage rate	m ³ ·s ⁻¹
$q_{v\text{l}}$	Air leakage rate	m ³ ·s ⁻¹
t	Air temperature	°C

4 Instrumentation

4.1 Calibration

Periodic calibration of the measurement system used in this test method according to manufacturer specifications or to standardized quality systems is required.

4.2 Air flow rate measurement

Leakage air flow meters shall have a minimum indicated accuracy according to the ranges in Table 2.

Table 2 — Accuracy of leakage air flow meters

Range $\text{m}^3\cdot\text{s}^{-1}$	Accuracy of measurement
Up to and including $1,8 \times 10^{-5}$	$\pm 9 \times 10^{-7} \text{ m}^3\cdot\text{s}^{-1}$
More than $1,8 \times 10^{-5}$	$\pm 5 \%$

4.3 Pressure measurement

Manometers for pressure measurement shall have an indicated accuracy not greater than $\pm 2 \%$.

4.4 Temperature measurement

Measurement of temperature is carried out, for example by means of mercury-in-glass thermometers, resistance thermometers or thermo-couples. Instruments shall be graduated, or give readings in intervals not greater than 0,5 K, and calibrated to an accuracy not greater than 0,25 K.

5 Leakage

The leakage factor (f_c) shall be lower than the air leakage limit (f_{\max}), corresponding to the required air tightness class, specified in Table 3, for all test pressures (p_{test}) between the static pressure limit (p_s).

The air tightness classes are specified in Table 3 and Table 4. The classes correspond to EN 12237:2003 and EN 1507:2006 but there will always be a difference between system and technical product classifications.

Explanation: a number of technical ductwork products classified in air tightness class C will not automatically fill the demands for air tightness class C in systems.

Table 3 — Air tightness classification for technical ductwork products with circular cross section connections

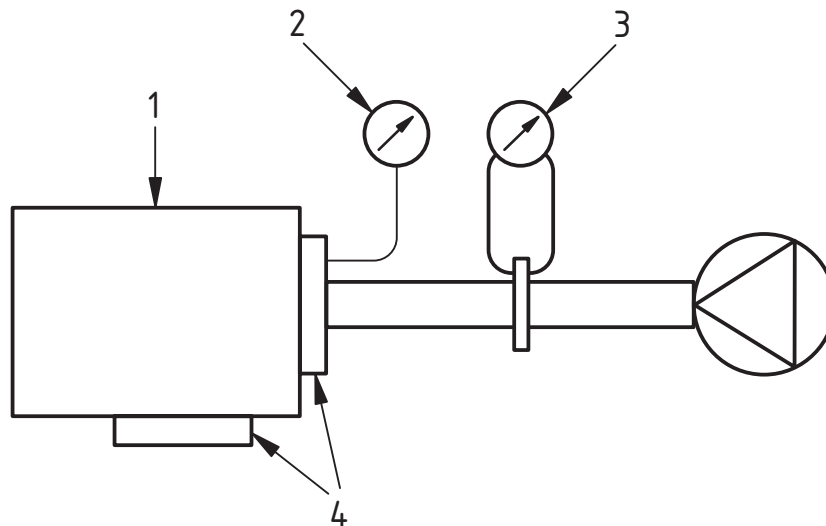
Air tightness class	Static pressure limit (p_s) Pa		Air leakage limit (f_{max}) $m^3 \cdot s^{-1} \cdot m^{-2}$
	Positive	Negative	
A	500	500	$0,027 \times p_{test}^{0,65} \times 10^{-3}$
B	1 000	750	$0,009 \times p_{test}^{0,65} \times 10^{-3}$
C	2 000	750	$0,003 \times p_{test}^{0,65} \times 10^{-3}$
D	2 000	750	$0,001 \times p_{test}^{0,65} \times 10^{-3}$

Table 4 — Air tightness classification for technical ductwork products with rectangular cross section connections

Air tightness class	Air leakage limit (f_{max}) $m^3 \cdot s^{-1} \cdot m^{-2}$	Static pressure limits (p_s) Pa			
		Negative for all pressure classes	Positive at pressure class		
			1	2	3
A	$0,027 \times p_{test}^{0,65} \times 10^{-3}$	200	400		
B	$0,009 \times p_{test}^{0,65} \times 10^{-3}$	500	400	1 000	2 000
C	$0,003 \times p_{test}^{0,65} \times 10^{-3}$	750	400	1 000	2 000
D	$0,001 \times p_{test}^{0,65} \times 10^{-3}$	750	400	1 000	2 000

6 Test rig specifications

The product to be tested shall be sealed off before commencing the test with end caps and sealing of the joining system specified by the manufacturer. The end caps do not have to be attached with screws or rivets that will cause damage to the product under test. The test rig shall be equipped so that the product can be pressurized and the pressure p_{test} and the volume airflow q_{v1} can be measured, see example in Figure 2.



Key

- 1 Product under test
- 2 Pressure meter p_{test}
- 3 Air flow meter q_{v}
- 4 End caps

Figure 2 — Arrangement for leakage measurement in technical ductwork products

7 Test procedure

7.1 Method for testing a technical ductwork product

The test product shall be subjected to several test pressures, at least five positive and five negative, within a range of test pressures up to and including the static pressure limits (p_s). The leakage rate reading shall be recorded under stable conditions, i.e. when each test pressure has been maintained within $\pm 5\%$ of the specified value for 5 min.

7.2 Calculation of the total joint length (L)

The total joint length, in metres, for a product of circular cross-section is the sum of the joint perimeter of each connection (1 to n).

$$L = \pi \times (d_1 + d_2 + \dots d_n) \tag{1}$$

The total joint length, in metres, for a product of rectangular cross-section is the sum of each joint perimeter.

$$L = 2 \times (a_1 + b_1 + a_2 + b_2 + \dots a_n + b_n) \tag{2}$$

7.3 Calculation of the virtual product surface area (A_c)

The virtual product surface area A_c , in square metres, is:

$$A_c = L \times 0,5 \tag{3}$$

or

$$A_c = A_p \text{ (the product surface area)} \quad (4)$$

whichever is the larger.

7.4 Correction of leakage

The measured leakage flow rate, in cubic metres per second, shall be corrected if the temperature (t) and/or atmospheric pressure (p_a) are different from the standard conditions (+ 20 °C and 101 325 Pa) as follows:

$$q_{vl} = q_{vl\text{measured}} \times \frac{293}{273 + t} \times \frac{p_a}{101\,325} \quad (5)$$

7.5 Calculation of the product tightness factor (f_c)

$$f_c = \frac{q_{vl}}{A_c} \quad (6)$$

in cubic metres per second per square metre.

8 Test report

The test report shall include the following information on the tests:

- a) date and place of test according to EN 15727;
- b) test personnel and witnesses;
- c) a record of the test equipment, including the means of pressurising the sample and the measuring instruments with the appropriate calibration reference;
- d) air temperature and atmospheric pressure during the test;
- e) design of the product including jointing method, dimensions, angles, length, steel thickness;
- f) required air tightness class and design operating pressure of the product;
- g) identity of the manufacturer of product;
- h) calculated values of the Total joint length (L) including a report how the calculation is done;
- i) calculated value of product area (A_c) including a report how the calculation is done;
- j) test pressure (p_{test});
- k) air leakage rate (q_{vl}) corrected for temperature and barometric pressure;
- l) pressurising time;
- m) observed deformation of the ductwork components during the test;
- n) calculated values of tightness factor (f_c);
- o) calculated values of air leakage limit (f_{max}) at the measured test pressure (p_{test});
- p) calculated values of air tightness class achieved.

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