BRITISH STANDARD

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1507:2006

Ventilation for buildings — Sheet metal air ducts with rectangular section — Requirements for strength and leakage

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ICS 91.140.30

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National foreword

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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, which has the responsibility to:

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Ventilation for buildings - Sheet metal air ducts with rectangular section - Requirements for strength and leakage

Ventilation des bâtiments - Conduits aérauliques rectangulaires en tôle - Prescriptions pour la résistance et l'étanchéité

Lüftung von Gebäuden - Rechteckige Luftleitungen aus Blech - Anforderungen an Festigkeit und Dichtheit

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Foreword

This European Standard (EN 1507:2006) 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of an identical text or by endorsement, at the latest by September 2006, and conflicting national standards shall be withdrawn at the latest by September 2006.

This European Standard is one of a series of standards for ductwork used for ventilation and air conditioning of buildings for human occupancy.

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

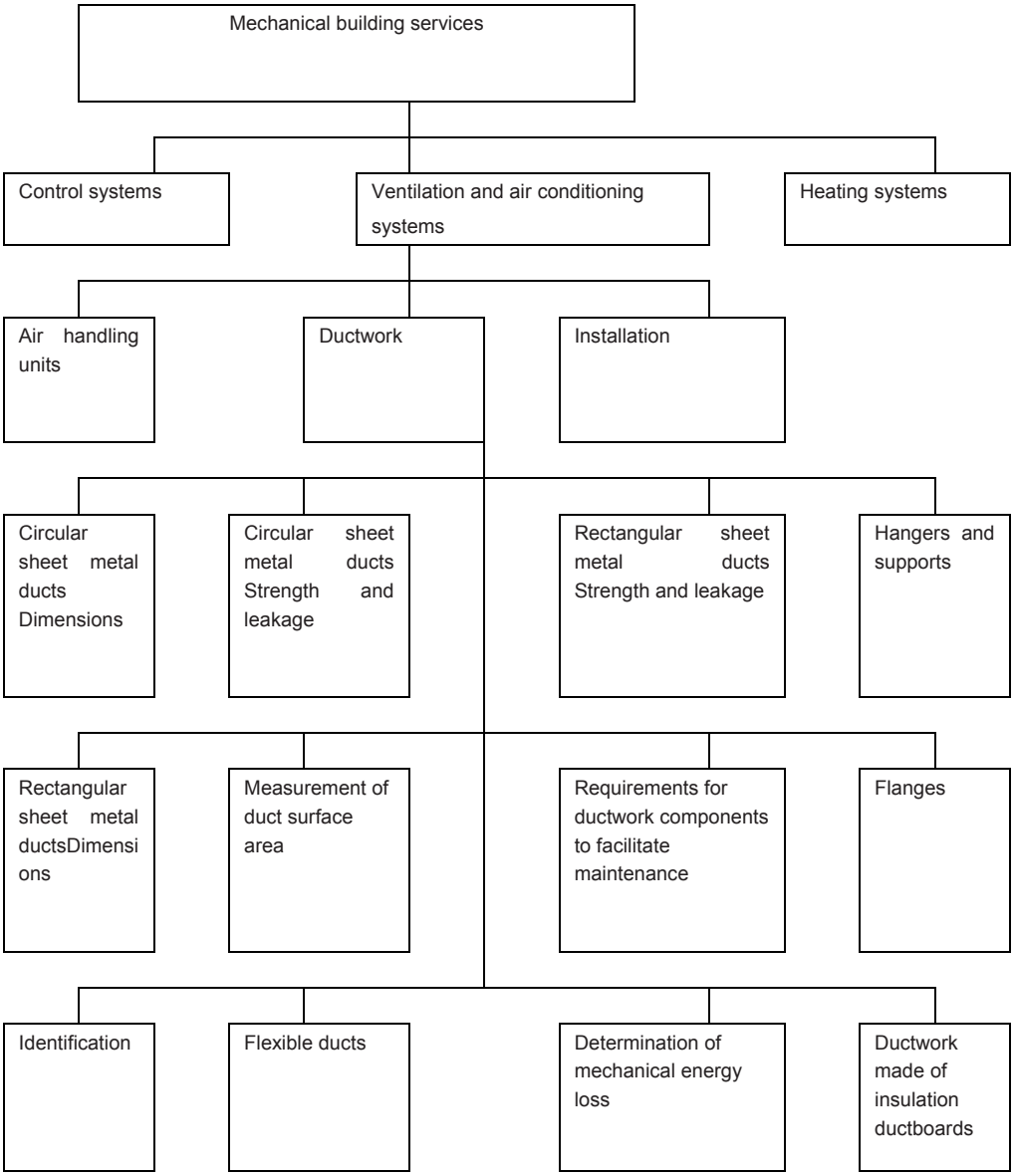


Figure 1 — Position of EN 1507 in the field of mechanical services

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 United Kingdom.

Introduction

This European Standard specifies requirements and test methods for strength and air leakage of rectangular ductwork. The objective is to establish the mechanical strength and leakage necessary to verify the fitness for the intended service as installed ductwork.

Testing of leakage can be done on site, but testing of strength (deflection, bulging and caving) is confined to laboratories and manufacturers premises.

1 Scope

The European Standard applies to rectangular ductwork of sheet metal used in air conditioning and ventilation systems defined in the principal scope of CEN/TC 156.

2 Normative references

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

EN 14239, *Ventilation for buildings — Ductwork — Measurement of ductwork surface area*

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

3 Terms, definition and symbols

For the purposes of this European Standard, the following terms, definitions and symbols apply.

3.1
ductwork surface area
A
surface area (m^2) of the ductwork determined according to EN 14239

3.2
total joint length
L
length (m) of joints resulting from the installation of the ductwork

3.3
test pressure
p_{test}
static air pressure difference (Pa) between the ductwork to be tested and the surrounding air

3.4
design operating pressure
p_{design}
maximum static pressure difference (Pa) for which the installed ductwork is designed to operate under normal conditions

3.5
static gauge pressure limit
ps
maximum design operating pressure (Pa) for the ductwork according to its air tightness class. The pressure classes and corresponding static pressure limits, positive and negative, are defined in Table 1

3.6
leakage flow rate
qv air leakage flow rate of the ductwork ($m^3 \cdot s^{-1}$) at a given test pressure,

$Q_{measured}$ air leakage flow rate before correction

3.7
air temperature
t
air temperature (°C)

3.8
air barometric pressure
p
air barometric pressure (Pa)

3.9
leakage factor
f=qv/A leakage flow rate per unit duct surface area ($m^3 \cdot s^{-1} \cdot m^{-2}$)

3.10
air leakage limit
f_{max}
maximum permitted leakage factor for the ductwork according to its air tightness class. The air tightness classes are defined in Table 1

Table 1 — Ductwork classification

Air tightness class	Air leakage limit (f_{max}) $m^3 \cdot s^{-1} \cdot m^{-2}$	Static gauge pressure limits (ps) Pa			
		Negative at 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 [a]	$0{,}001 \times p_{test}{}^{0{,}65} \times 10^{-3}$	750	400	1 000	2 000
[a] Ductwork for special application.					

3.11
deflection of a duct (c_d)
shortest distance from the reference level to the lowest point of the duct wall before and under test (see Figure 2)

3.12
deflection of a joint (c_j)
largest deformation of a joint when subjected to the appropriate static air pressure. The shortest distance from the reference level, with the actual position of the duct corner as a base, to the lowest point of the joint under test (see Figure 3)

3.13
bulging, caving (s)
largest deformation of the sides of a duct when subjected to a negative (caving) or positive (bulging) pressure. It is given as the measured difference in distance between a reference plane outside the duct and the external surface with and without test pressure (see Figure 4)

4 Requirements

4.1 Leakage

The leakage factor f shall be lower than the air leakage limit f_{max} according to Table 1 for any test pressure p_{test} lower than or equal to the design operating pressure p_{design}. The requirement shall be fulfilled for positive and negative pressures.

4.2 Deformation

The ductwork shall withstand the static pressure limits ps according to Table 1 without permanent deformation or sudden change in leakage flow rate or test pressure.

4.3 Deflection of a duct

The deflection of a duct (cd) shall not exceed 0,4 % of lp or 20 mm, whichever is the smaller value.

4.4 Deflection of a joint

The joint under test according to Table 1 shall not deflect (c_j) by more than 1/250 of its longest side when subjected to maximum pressure rating for the duct classification or.

4.5 Bulging and/or caving

No wall of the duct under test according to Table 1 shall bulge and/or cave(s) by more than 3 % of its width or 30 mm, whichever is the smaller value.

5 Testing

5.1 Test rig specification

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

In any case the test rig shall comprise a pressure gauge and variable air flow supply. When strength is tested the rig shall also comprise two supports which are at the same height as the reference level.

Figure 5, gives an illustration of the test rig used for strength.

5.2 Leakage testing

5.2.1 Test object

Before commencing the test, the section to be tested shall be sealed off from the rest of the system. In either case the area to be tested shall normally be at least 10 m^2.

NOTE A normal ratio between the total joint length (L) and area (A) is L/A = 1 – 1,5 m^{-1}.

The test object shall, whenever possible, contain a representative variety of duct dimensions and fittings.

5.2.2 Test procedure

The section to be tested shall be subjected to test pressures, positive and negative, not lower than its design operating pressure p_{design}. The test pressure shall be maintained within ± 5 % of the specified value for 5 min.

For laboratory testing, or when more information on ductwork performance is needed, the testing shall be extended to several test pressures, at least 5 positive and 5 negative within a range of test pressures up to and including the static pressure limits. In this case the time for stable pressure at each measuring point may be lowered to 1 min.

5.2.3 Correction of leakage test result

The measured leakage flow rates shall be corrected if the temperature (t) and/or barometric pressure (p) are different from standard conditions (+20 °C and 101 325 Pa) as follows:

$$\mathrm{qv} = \mathrm{q\ measured\ x}\ \frac{293}{273+\mathrm{t}} \times \frac{p}{101325}$$

5.3 Strength testing

5.3.1 Test object

The test object shall consist of two sections of straight ductwork. The two section shall have a total length of minimum 3,0 m. The ducts shall be placed with one joint halfway between the supports.

5.3.2 Test procedure

The section to be tested shall be subjected to a negative pressure not lower than its static pressure limit (negative) according to Table 1. The test pressure shall be maintained within ±5 % of the specified value for 5 min.

Measure the length of the duct to be tested and place the supports at the distances specified in 5.1 and Figure 5. Tighten the ends of the duct and connect the test fan and the pressure gauge.

5.3.3 Determination of deflection of a duct

Connect the duct to a test rig in accordance with 5.1 Figure 5. Start the air supply and regulate the pressure to the test pressure appropriate to the tightness class (see Table 1). When steady state is reached, measure the deflection (c_d) (see 3.11).

5.3.4 Determination of deflection of a joint

Connect the duct to a test rig in accordance with 5.1 and Figure 5. Start the air supply and regulate the pressure to the test pressure appropriate to the tightness class (see Table 1). When steady state is reached, measure the deflection cj (see 3.12) by measuring the distance from the joint to the corresponding reference plane, with and without pressure. Record the highest value of deflection.

5.3.5 Determination of bulging and/or caving

Connect the duct to a test rig in accordance with 5.1 and Figure 5. Apply the stated test pressure and determine the bulging and caving (see 3.13) from evenness of each side of the duct by measuring the distance from the external duct surface to the corresponding parallel reference plane based on the position of the duct corner. The difference between the distances, with and without pressure, is the bulging/caving of the side. Record the highest value of bulging/caving.

6 Measurement accuracy and test reports

6.1 Measurement accuracy requirements

6.1.1 General requirements

The test rig shall be inspected by the user before use on site. Periodic calibration of the measurement system used in this test method according to manufacturer specifications or to standardized quality insurance systems is required.

6.1.2 Air flow measurement

The air flow rate shall be measured using instruments in accordance with ISO 5221. The air flow rate shall be measured with a maximum uncertainty of 2,5 % of reading or 0,000 012 $m^3 \cdot s^{-1}$, whichever is the greatest.

6.1.3 Differential pressure measurement

Differential pressure shall be measured using instruments having a maximum measurement uncertainty of 2,5 % of reading or 3,0 Pa, whichever is the greatest.

6.1.4 Barometric pressure

The barometric pressure shall be measured with a maximum measurement uncertainty of 200 Pa.

NOTE Using measurement equipment operating on the mass-flow-principle, the aforementioned correction of the atmospheric pressure is not necessary.

6.1.5 Temperature measurement

Temperature shall be measured using instruments having a maximum measurement uncertainty of 0,5 K.

NOTE Using measurement equipment operating on the mass-flow-principle, the aforementioned correction of the temperature is not necessary.

6.1.6 Deflection, bulging or carving

Measurement of bulging or carving shall be measured using instruments having a maximum measurement uncertainty of 1 mm.

6.2 Leakage test report

6.2.1 General data

The test report shall give the following general information on the performed test:

— date and place of test;

— test personnel and witnesses;

— test equipment, including pressuring means and measuring instruments;

— air temperature and barometric pressure during the test;

NOTE Measurement only necessary if needed for the correction of the measured values by the used measurement equipment

— building or project reference;

— design of installed ductwork including dimensions, thickness of materials, type of stiffening, length, type of ducts/tubes and fittings, assembly method, and type and distance of hangers/supports;

— required air tightness class and design operating pressure of the installed ductwork;

— installer of ductwork;

— manufacturer of ductwork.

6.2.2 Test result

The test report shall present:

1) measured values of:

a) ductwork surface area (A);

b) total joint length (L);

c) test pressure (p_{test});

d) leakage flow rate (qv) corrected for temperature and barometric pressure;

2) calculated values of:

a) leakage factor (f);

b) air leakage limit (f_{max}) (according to the formulas given in Table 1) at the measured test pressure (p_{test});

c) air tightness class achieved.

For tests including several test pressures it is recommended to plot the leakage factors as a function of test pressure in a diagram together with the air leakage limit curve.

6.3 Strength test report

6.3.1 General data

As in 6.2.

6.3.2 Test result

The test report shall present:

1) calculated values of:

   a) ductwork surface area (A);

   b) total joint length (L);

   c) test pressure (p_{test});

d) pressurising time;

e) deflection of a duct (cd);

f) deflection of a joint (cj);

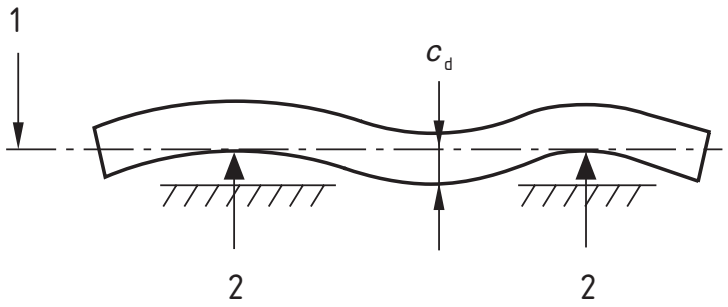
g) bulging and/or caving (s);

h) distance between supports (lp);

2) inspection statement concerning:

a) observed deformation of the ductwork during the test;

b) sudden changes in test pressure (p_{test}) or leakage flow rate (qv) if applicable.



Key

1 reference line

2 support

Figure 2 — Deflection of a duct

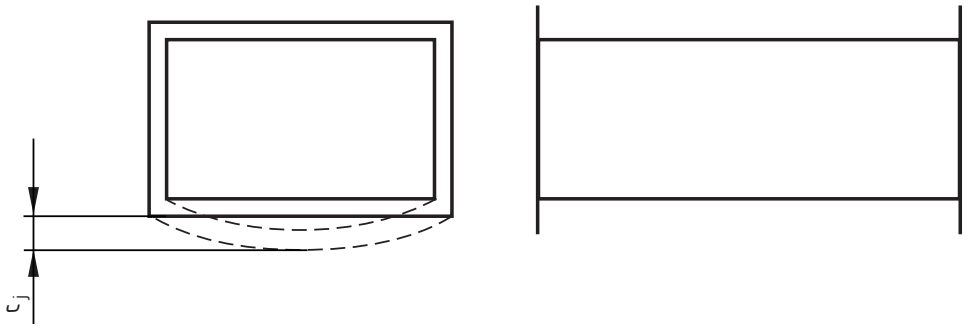


Figure 3 — Deflection of a joint

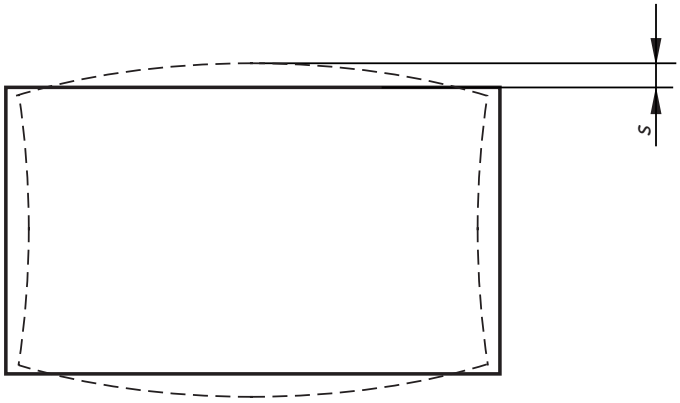
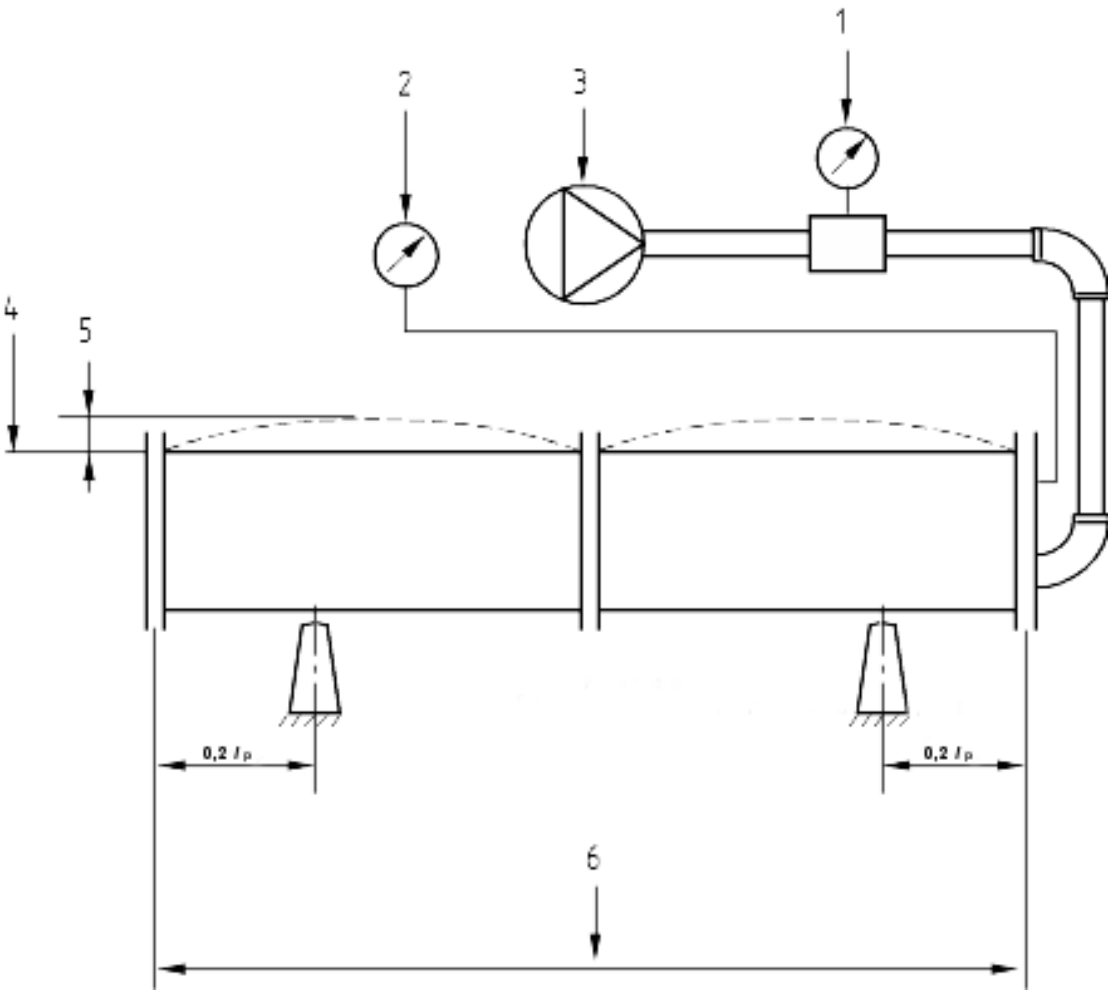


Figure 4 — Bulging/caving



The accuracy of the measurement of support distances shall be within ± 5 mm.

Key

1	air flow meter
2	pressure gauge
3	variable flow air supply
4	reference plane
5	distance to bulging duct surface
6	lp (total length of both ducts)

Figure 5 — Rig for testing of strength of ducts

Bibliography

[1] EN 1505, Ventilation for buildings — Sheet metal air ducts and fittings with rectangular cross section — Dimensions

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

[3] EN 12236, Ventilation for buildings — Ductwork hangers and supports — Requirements for strength

[4] EN 12237, Ventilation for buildings — Ductwork — Strength and leakage of circular sheet metal ducts

[5] EN 12792, Ventilation for buildings — Symbols, terminology and graphical symbols

[6] EN 12599, Ventilation for buildings – Test procedures and measuring methods for handing over installed ventilation and air conditioning systems

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