SLOVENSKI STANDARD
oSIST prEN 1751:2011

01-april-2011

Prezračevanje stavb - Naprave za razvod zraka - Aerodinamično preskušanje dušilnikov in loput

Ventilation for buildings - Air terminal devices - Aerodynamic testing of damper and valves

Lüftung von Gebäuden - Komponenten des Luftverteilersystems - Aerodynamische Prüfung von Drossel- und Absperrelementen

Ventilation des batiments - Bouches d'air - Essais aérodynamiques des registres et clapets

Ta slovenski standard je istoveten z: **prEN 1751**

ICS:

91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning

oSIST prEN 1751:2011 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1751

February 2011

ICS 91.140.30

Will supersede EN 1751:1998

English Version

Ventilation for buildings - Air terminal devices - Aerodynamic testing of damper and valves

Ventilation des batiments - Bouches d'air - Essais aérodynamiques des registres et clapets

Lüftung von Gebäuden - Komponenten des Luftverteilersystems - Aerodynamische Prüfung von Drossel- und Absperrelementen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 156.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. prEN 1751:2011: E

Contents

Page

Foreword ... 3
1 Scope ... 3
2 Normative references ... 4
3 Definitions and symbols ... 4
4 Instrumentation ... 6
5 Leakage tests ... 7
6 Flow rate and pressure tests ... 9
Annex A (normative) Mechanical testing of dampers and valves ... 20
Annex B (informative) Thermal transmittance through dampers and valves ... 24
Annex C (normative) Classification of a damper or valve leakage ... 28
Annex D (informative) ... 31

Foreword

This document (prEN 1751:2011) has been prepared by Technical Committee CEN/TC 156 “Ventilation for buildings”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1751:1998.

1 Scope

This European Standard specifies methods for the testing and rating of dampers and valves used in air distribution systems with pressure differences up to 2000 Pa.

The tests incorporated in this European Standard are:

a) leakage past a closed damper or valve (for classification see annex C);

b) casing leakage (for classification see annex C);

c) flow rate/pressure requirement characteristics;

d) torque: (see annex A);

e) thermal transmittance: (see annex B).

The acoustic testing of dampers and valves is not included in this standard.

The tests specified above apply to the following:

a) measurement of leakage past a closed damper or valve;

b) measurement of casing leakage;

c) determination of flow rate and pressure requirements;

d) measurement of torque characteristics (see annex A);

e) measurement of thermal transfer characteristics to determine insulation properties (see annex B).

NOTE: Certain aspects of the dynamic performance of dampers or valves are dependent upon the air distribution system to which they are connected and are, therefore, difficult to measure in isolation. Such considerations have led to the omission of these aspects of the dynamic performance measurements from this European Standard. Also, in common with other air distribution components, the results from tests carried out in accordance with this European Standard may not be directly applicable if the damper or valve is situated in an area of non-uniform flow.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references the subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

CR 12792 Ventilation for buildings - Symbols and terminology

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

ISO 7244 Air distribution and air diffusion - Aerodynamic testing of dampers and valves

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices. Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full.*

ISO 5167-2 *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full-Part 2: Oriface plates*

ISO 5167-3 *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full-Part 3: Nozzles and Venturi nozzles*

ISO 5167-4 *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full-Part 4: Venturi tubes*

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

3 Definitions and symbols

For the purposes of this standard, the definitions given in CR 12792 apply.

3.1 Symbols

The symbols used in this standard are given in table 1.

Table 1: Symbols

Symbol	Quantity	Unit
A	Internal cross-sectional area of duct	m^2
C_D	Coefficient of discharge	-
D_e	Equivalent diameter Circular ducts: $\sqrt{\frac{4A}{\pi}}$ Square/Rectangular ducts: $\frac{2ab}{a+b}$	m
p	Absolute pressure	Pa
pa	Atmospheric pressure	Pa
p_d	Velocity pressure ½ ρv^2	Pa
p_t	Stagnation or absolute total pressure	Pa
p_s	Static gauge pressure (p - p_a)	Pa
Δp_s	Pressure differential across the damper or valve under test	Pa
Δp	Flow meter pressure difference	Pa
Δp_t	Conventional total pressure differential for an air density of 1,2 $kg{\cdot}m^{-3}$ at the inlet to the damper or valve under test	Pa
q_v	Volume rate or air flow at the flow meter	$l{\cdot}s^{-1}{\cdot}m^{-2}$
q_{vL}	Leakage volume rate of air flow	$l{\cdot}s^{-1}{\cdot}m^{-2}$
q_{vLBA}	Closed blade leakage volume rate of air flow per unit duct cross sectional area	$l{\cdot}s^{-1}{\cdot}m^{-2}$
q_{vLCA}	Case leakage volume rate of air flow per unit duct cross sectional area	$l{\cdot}s^{-1}{\cdot}m^{-2}$
v	Velocity	$m{\cdot}s^{-1}$
s	Position of damper setting	%, α or m
T	Torque	N·m
U	Thermal transmittance coefficient	$W{\cdot}K^{-1}{\cdot}m^{-2}$
q	Temperature	°C
ρ	Air density	$kg{\cdot}m^{-3}$
ξ	Loss coefficient	-

3.2 Suffixes

The following suffixes shall be used with the symbols given in table 1.

1 is the inlet of the damper or valve under test

2 is the outlet of the damper or valve under test

u is the measuring point upstream of the flow meter

n is the value at a selected point of the flow rate/static pressure curve

4 Instrumentation

4.1 Air flow rate measurement

4.1.1 The air flow rate shall be measured using instruments in accordance with ISO 5167-1to4, ISO 5221 or other instruments which will have equivalent calibrated performance.

4.1.2 Air flow meters shall have a minimum calibration accuracy of ± 2,5 % over the whole range.

NOTE: If necessary, flow meters can be calibrated in situ by means of the Pitot static tube traverse technique described in ISO 3966.

4.1.3 Flow meters shall be checked at intervals as appropriate but not exceeding 12 months. This check can take the form of one of the following:

a) a dimensional check for all flow meters not requiring calibration;

b) a calibration over their full range using the original method employed for the initial calibration of meters calibrated in situ;

c) a check against a flow meter which meets flow meter specifications according to ISO 5221.and ISO 5167-1-2-3-4 as appropriate

4.1.4 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 $l{\cdot}s^{-1}{\cdot}m^{-2}$	Accuracy of calibration
Up to and including 0,018	± 0,0009 $l{\cdot}s^{-1}{\cdot}m^{-2}$
More than 0,018	± 5 %

NOTE: Alternatively, other devices such as variable area, flow-rate meters or integrating air flow meters of the positive displacement type can be used if calibrated in accordance with 4.1.3 c).

4.2 Pressure measurement

4.2.1 Pressure in the duct shall be measured by means of a liquid filled, calibrated manometer or any other device conforming to 4.2.2

4.2.2 The resolution shall not be greater than the characteristics listed for the accompanying range of manometers, given in Table 3.

Table 3: Resolution for the ranges of manometers

Range Pa	Resolution Pa
Up to and including 50	0,1
From 50 to 250	1
From 250 to 500	5,0
Above 500	25,0

4.2.3 The measured value of differential pressure should be greater than 10% of the range of the measurement device used.

Note: Example : with a micromanometer in the range 0…1000 Pa the minimum differential pressure to be measured is 100 Pa.

4.2.4 The uncertainty of calibration standards shall be:

a) for instruments with the range up to 100 Pa, equal or better than ± 0,5 Pa

for instruments with the range over 100 Pa, equal or better than ± 0,5% of reading

4.3 Temperature measurement

Measurement of temperature shall be, for example, by means of mercury-in-glass thermometers, resistance thermometers or thermo-couples. Instruments shall have a resolution better than 0,5 K and be calibrated to an accuracy of ± 0,25 K.

5 Leakage tests

5.1 General

Damper leakage performance could vary depending on whether the damper is subjected to positive or negative pressure. The manufacturer shall specify the pressure conditions for test.

5.2 Damper and valve leakage

5.2.1 Measurement of damper and/or valve leakage in the shut-off position shall be made under conditions of actual operation with the damper or valve closing against the maximum recommended static pressure conditions. Since small flow rates exist during the closed damper or valve condition, the method used to measure these small flow rates will introduce a high pressure loss when the damper or valve is open. This precludes a high pressure difference in the inlet duct until the damper or valve approaches the closed position. As the valve is closed and the flow rate decreases, the inlet static pressure difference will increase to approximately the recommended inlet pressure.

5.2.2 The damper or valve shall be cycled 10 times between the fully open and fully closed positions of the actuator at the start of each test (before starting the fan of the air supply system) concluding with the damper or valve in the fully closed position.

NOTE: In all cases in the closed position, the damper drive is subject to a torque rating recommended by the manufacturer.

5.2.3 The damper or valve under test shall be connected to a test installation similar to that shown in figure 1a) or figure 1b). A suitable air supply shall be connected to the duct.

5.2.4 The supply air pressure shall be increased to the maximum recommended inlet pressure difference in accordance with the appropriate classification from figure C.1 and figure C.2. The damper or valve is then modulated to the open position, without any additional adjustment of the supply air system flow rate, and then returned to the closed position either manually or by the means provided by the manufacturer. The supply air pressure shall be adjusted, as the damper or valve nears closure, to maintain the recommended inlet static gauge pressure difference within ± 5%.

5.2.5 Report the damper or valve leakage volume rate of air flow as a function of test pressure difference in the closed position. Also include classification, see annex C.

5.3 Casing leakage

5.3.1 The test installation shall be similar to that shown in figure 2 a) or figure 2 b). The damper or valve casing outlet shall be sealed and the damper or valve shall be set to the open position.

5.3.2 The test of the casing shall be carried out by subjecting the casing to its maximum recommended pressure in accordance with 5.2.4. The pressure shall be maintained for 60s before the measurement of leakage commences.

5.3.3 Report the test results as casing leakage volume flow rate of air flow as a function of test pressure. Also include classification, see annex C.

6 Flow rate and pressure tests

6.1 Ducted Method

This method apply for dampers or valves mounted within a duct.

6.1.1 The damper or valve under test shall be mounted in a system comprising a fan, a means of controlling air flow rate, a flow rate measuring system and test ducts (see figure 3).

6.1.2 The test ducts shall have cross-sectional dimensions equal to the nominal size of the unit under test or to the manufacturer's instructions. The upstream test duct shall be straight for a minimum length of $5D_{e1}$. The downstream test duct shall be straight for a minimum length of $5D_{e2}$ or 2 m, whichever is the greatest.

6.1.3 Flow straighteners shall be fitted in the upstream test duct at a position $3D_{e1}$ from the connection to the damper or valve under test or, alternatively a straight duct shall be used without a flow straightener if in accordance with ISO 5221.

6.1.4 The velocity profile near the upstream connection to the damper or valve under test shall be uniform to 10 % of the mean value over the test duct cross section, excluding the area within 15 mm of the duct walls. Carry out a velocity survey at 10 equally spaced intervals along a pair of mutually perpendicular axes to confirm that the velocity profile is within these limits. Wire mesh screens located no closer than $2,5D_{e1}$ to the upstream connection to the damper or valve under test can, if necessary, be incorporated to achieve a suitably uniform velocity profile.

6.1.5 The upstream duct static gauge pressure (p_{s1}) shall be measured by means of four static pressure tappings $1,5D_{e1}$ from the upstream connection to the damper or valve under test. For a rectangular duct, these pressure taps shall be at the centre of each side and, for a circular duct, equally spaced around the circumference. Connect the pressure taps to form a piezometric ring. Alternatively, use a single Pitot static probe.

6.1.6 The air temperature shall be measured at the flow meter and at a position $2,5D_{e1}$ upstream of the damper or valve under test, and, during the test the temperature variation at the same station shall not be greater than 3K.

6.1.7 The damper or valve shall be set in its fully open position and tests shall be carried out as follows:

6.1.7.1 Use a minimum of five air flow rates distributed evenly throughout the total flow range, and choose the lowest air flow rate so that the test duct static pressure is not less than 10 Pa.

6.1.7.2 Remove the damper or valve from the test installation and connect the upstream test duct directly to the downstream test duct. Repeat the procedure in 6.7.1 at five air flow rates covering the same flow rate range used in 6.7.1.

6.1.8 If required, repeat the procedure described in 6.7.1 with the damper or valve other than in the open position.

6.1.9 Record the data given in table 4.

Table 4: Flow rate and pressure test data

Symbol	Quantity	Unit	Uncertainty of measurement
$p_{s1(a)}$	Inlet duct static gauge pressure with the damper or valve installed	Pa	3%
$p_{s1(b)}$	Inlet duct static gauge pressure with the damper or valve removed	Pa	3%
Pa	Atmospheric pressure	Pa	1%
θ_1	Air temperature at inlet to the damper or valve under test	°C	3 %
Δp 1)	Flow meter pressure difference	Pa	3 %
p_{su}	Static gauge pressure immediately upstream of the flow meter	Pa	3 %
θ_u	Air temperature immediately upstream of the flow meter	°C	3 %
S	Position of damper setting	%, α or m	2°
1) Or the appropriate parameter which relates to q_v.			

6.2 Chamber method

This method applies for dampers and valves with free inlet and discharge

6.2.1 Size Relationship.

The size relationship of test setup apparatus for determination of flow rate and static pressure differential of the device shall be limited to the following:

- The chamber cross-sectional area shall be at least 7 times the internal cross sectional area of duct (A) of the device being tested;
- Other dimensions shall respect indications of figure 4.