SLOVENSKI STANDARD
SIST EN 1751:1999

01-september-1999

Prezraļevanje stavbï Naprave za razvod zrakaï Aerodinamiļno preskuġanje duġilnikov in loput

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

Lüftung von Gebäuden - Geräte des Luftverteilersystems - Aerodynamische Prüfungen von Drossel- und Absperrelementen

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

Ta slovenski standard je istoveten z: **EN 1751:1998**

ICS:

91.140.30	Prezraļevalni in klimatski sistemi	Ventilation and air-conditioning

SIST EN 1751:1999 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1751

October 1998

ICS 91.140.30

Descriptors: buildings, ventilation, air distribution, air diffusion, air terminal devices, dampers, flow measurements, pressure measurements, measuring instruments, accuracy, air performance tests, leak tests, pressure tests

English version

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

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

Lüftung von Gebäuden - Geräte des Luftverteilungssystems - Aerodynamische Prüfungen von Drossel- und Absperrelementen

This European Standard was approved by CEN on 2 October 1998.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents **Page**

Foreword

This European Standard 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 April 1999, and conflicting national standards shall be withdrawn at the latest by April 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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

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 $½ \rho v^2$	Pa
p_t	Stagnation or absolute total pressure	Pa
p_s	Static gauge pressure ($p - p_a$)	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 5221.

4.1.2 Air flow meters shall have a minimum accuracy according to the ranges in table 2.

Table 2 : Ranges and accuracies of air flow meters

Range $l \cdot s^{-1} \cdot m^{-2}$	Accuracy of measurement
From 0,07 to 7	± 2,5 %
From 0,007 to 0,07	± 5 %

NOTE: Flow meters can be calibrated in situ by means of the Pitot static tube traverse techniques described in ISO 5221.

4.1.3 Leakage air flow meters shall have a minimum indicated accuracy according to the ranges in table 3.

Table 3 : Accuracy of leakage air flow meters

Range $l \cdot s^{-1} \cdot m^{-2}$	Accuracy of measurement
Up to and including 0,018	$\pm$ 0,0009 $l \cdot s^{-1} \cdot m^{-2}$
More than 0,018	$\pm$ 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 4.1.4 c).

4.1.4 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 check calibration over their full range using the original method employed for the initial calibration or for flow meters calibrated in situ;

c) a check against a flow meter which meets flow meter specifications according to ISO 5221.

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 maximum scale interval shall not be greater than the characteristics listed for the accompanying range of manometer given in table 4.

Table 4 : Maximum scale interval according to range of the manometer

Range Pa	Maximum scale interval Pa
Up to and including 25	1,0
From 25 to 250	2,5
From 250 to 500	5,0
Above 500	25,0

4.2.3 For air flow rate measurements, the minimum pressure differentials shall be:

a) 25 Pa with an inclined tube manometer or micro-manometer;

b) 500 Pa with a vertical tube manometer.

4.2.4 Calibration standards shall be:

a) For instruments within the range ≤ 25 Pa, a micro-manometer accurate to ± 0,5 Pa;

NOTE: In practice, difficulty can be experienced in verifying these accuracies.

b) For instruments within the range > 25 Pa ≤ 500 Pa, a manometer accurate to ± 2,5 Pa (hook gauge or micro-manometer);

c) For instruments within the range > 500 Pa, a manometer accurate to ± 25 Pa (vertical manometer).

4.3 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 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 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).

6.2 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.

6.3 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.