SLOVENSKI STANDARD
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Particulate air filters for general ventilation - Requirements, testing, marking

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Partikel-Luftfilter für die allgemeine Raumlufttechnik - Anforderungen, Prüfung, Kennzeichnung

Filtres a air de ventilation générale pour l'élimination des particules - Exigences, essais, marquage

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This European Standard was approved by CEN on 1993-07-20. 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.

The European Standards exist 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.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Contents list

Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 195 "Air filters for general air cleaning", of which the secretariat is held by DIN.

As a result of a questionnaire procedure CEN has decided to accept EUROVENT 4/5 "Method of testing air filters used in general ventilation" as basic document for a European Standard. The test method in this document is taken from ASHRAE standard 52-76 "Method of testing air-cleaning filters used in general ventilation for removing particulate matter".

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of an identical text or by endorsement, at the latest by January 1994, and conflicting national standards shall be withdrawn at the latest by January 1994.

In accordance with the CEN/CENELEC Internal Regulations, following countries are bound to implement this European Standard: Belgium, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Switzerland and United Kingdom.

1 Scope

This European Standard refers to particulate air filters for general ventilation. These filters are classified according to their performance.

This European standard contains requirements to be met by particulate air filters. It describes testing methods and the test rig for measuring the filter performance.

The performance results obtained in accordance with this standard cannot by themselves be quantitatively applied to predict performance in service.

In order to obtain results for comparison and classification purposes, particulate air filters shall be tested against an atmospheric aerosol and a synthetic test aerosol.

This European standard applies to air filters which are to be tested between an air flow rate of 0;24 m^3/s (850 m^3/h)and 1,39 m^3/s (5000 m^3/h) and have an initial atmospheric dust spot efficiency lower than 98 %.

2 Normative reference

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the test and the publications are listed hereafter. For dated references, 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.

EUROVENT 4/4: Sodium chloride aerosol test for filters using flame photometric technique.

3 Definitions and units

For the purposes of this standard, the following definitions apply:

3.1 Filters

Air cleaning filters used in general ventilation for removing particulate matter and tested according to this European standard.

3.2 Test air

Outdoor air of the composition, temperature, pressure and atmospheric dust concentration prevailing at the time of the test in the plenum chamber. The relative humidity of the air shall be controlled as stated in clause 6.3. When determining the synthetic dust weight arrestance, room air may also be used as test air.

3.3 Rated air flow rate

The quantity of air the filter is designed to handle as specified by the manufacturer. Expressed in m^3/s (for a reference air density of 1,20 kg/m^3).

3.4 Face area

The area of the inside section of the test duct immediately up-stream of the filter (without transformation pieces : nominal values O,61 m x 0,61 m = 0,37 m²; with transformation pieces : nominal values W see figure D.3).

3.5 Face velocity

The air flow rate divided by the face area.
Expressed in m/s.

3.6 Net effective filtering area

The total filtering surface area of the filter in contact with the test air.
Expressed in m².

3.7 Media velocity

The air flow rate divided by the net effective filtering area.
Expressed in m/s.

3.8 Initial pressure drop

The pressure drop of the clean filter operating at its rated air flow rate.
Expressed in Pa. (Δp_O).

3.9 Final pressure drop

The pressure drop up to which the filtration performance is measured for classification purposes (see 5.4.2).
Expressed in Pa. (Δp_f).

3.10 Atmospheric dust spot efficiency

A measure of the ability of the filter to remove atmospheric dust from the test air.
This efficiency is measured on a light transmission basis.
Expressed as a % (E).

3.11 Initial atmospheric dust spot efficiency

The first determined dust spot efficiency value before any synthetic dust is fed to the filter.
Expressed as a % (E_A).

3.12 Average atmospheric dust spot efficiency

The average of the dust spot efficiency values (see 6.5.2.1).
Expressed as a % (E_m).

3.13 Synthetic dust weight arrestance

A measure of the ability of the filter to remove injected synthetic dust from the test air. This arrestance is calculated on a weight basis.
Expressed as a % (A).

3.14 Initial synthetic dust weight arrestance

The first dust weight arrestance obtained from a dust feed increment of 30 g.
Expressed as a % (A_1).

3.15 Average synthetic dust weight arrestance

The average of the values of synthetic dust weight arrestance (see 6.5.2.2).
Expressed as a % (A_m).

3.16 Final air filter

The air filter used to collect the synthetic dust passing the filter.

3.17 Light transmission

The proportion of incident light passed by a translucent material as compared with the incident flux.
Expressed as a %.

3.18 Relative light transmission

The light transmission of a sampling target relative to the light transmission of a translucent standard.
Expressed as a %.

3.19 Dust spot opacity

The decrease in relative light transmission of a dust spot sampling target resulting from the build-up of atmospheric dust on the target.
Expressed as a %.

3.20 Dust holding capacity
(Static dust holding capacity)

The amount of synthetic dust fed to a disposable or non self-renewable filter multiplied by its average arrestance until one of the limiting conditions occurs.
Expressed in g.

4 Classification

According to their filtration performances, filters are classified in groups and classes.

4.1 Group of filters

According to this standard filters are contained in one of the following groups :

- group G : coarse dust filters;
- group F : fine dust filters.

4.2 Classes of filters

Filters of groups G and F are classified according to their performances (average synthetic dust weight arrestance or average atmospheric dust spot efficiency). See 5.5.

Group G filters are subdivided in four classes :

- G 1;
- G 2;
- G 3;
- G 4.

Group F filters are subdivided in five classes :

- F 5;
- F 6;
- F 7;
- F 8;
- F 9.

5 Requirements

5.1 Generalities

The filter shall be designed or marked so as to prevent incorrect mounting.

The filter shall be designed so that when correctly mounted in the ventilation duct, no leak occurs at the sealing edge.

If, for any reason, dimensions do not allow testing of a filter under standard test conditions, assembly of two or more filters of the same type or model is permitted, provided no leaks occur in the resulting filter.

5.2 Materials

The complete filter (filter and frame) shall be made of suitable material to withstand normal usage and exposures to those temperatures, humidities and corrosive environments that are likely to be encountered.

The complete filter shall be designed so that it will withstand mechanical constraints that are likely to be encountered during normal use.

Dust or fibres released from the filter media by the air flow through the filter shall not constitute a

hazard or nuisance for the people (or devices) exposed to filtered air.

5.3 Rated air flow rate

The filter(s) shall be tested at its rated air flow rate for which the filter has been designed by the manufacturer.(If the manufacturer does not notify any rated air flow rate, testing will be conducted at 0,94 m^3/s (3400 m^3/h.) In no circumstances shall tests be made for air flows lower than 0.24 m^3/s or higher than 1.39 m^3/s.

Measurement according to 6.1, 6.2.

5.4 Pressure drop

5.4.1 Initial pressure drop

The initial pressure drop of the filter is recorded at a minimum of four air flow rates (e.g. 50, 75, 100 and 125 % of the rated air flow rate).

Measurement according to 6.2.

5.4.2 Final Pressure drop

For classification purposes only the filtration performance is measured up to a final pressure drop of:

- 250 Pa for group G filters and
- 450 Pa for group F filters.

If, for technical reasons, these values cannot be achieved the manufacturer can reduce the final pressure drop accordingly.

5.5 Filtration performance

Testing shall be carried out at the rated air flow rate.

Filters having an initial atmospheric dust spot efficiency greater than 98 % are not relevant to this standard.

If the initial atmospheric dust spot efficiency is lower than 20 % the filter is a group G filter and no further efficiency test shall be carried out. Only arrestance tests are continued.

After testing in accordance with clause 6., filters are classified according to table 1.

Table 1: Classification according to the filtration performances

Initial dust spot efficiency (E_A)		$E_A<20\%$	$E_A\geq20\%$
Characteristics		Average arrestance $A_m(\%)$	Average efficiency $E_m(\%)$
Filter group	Filter class	Class limits	
Coarse (G)	G 1	$A_m<65$	-
	G 2	$65\leq A_m<80$	-
	G 3	$80\leq A_m<90$	-
	G4	$90\leq A_m$	-
Fine (F)	F 5	-	$40\leq E_m<60$
	F 6	-	$60\leq E_m<80$
	F 7	-	$80\leq E_m<90$
	F 8	-	$90\leq E_m<95$
	F 9	-	$95\leq E_m$

6 Test methods

6.1 Test rig

The test rig, see figure D.1, comprises 6 duct parts. The nominal dimensions of duct parts 1, 3, 4, 5 and 6 are 610 x 610 mm. Duct part 2 where the filter is installed has a nominal dimension of 622 x 622 mm. The length of this duct part shall be 1,1 times the length of the filter and have a minimum length of 1 m. If the filter to be tested is of a size different from the cross-section of the test duct, transformation pieces with dimensions as shown in figure D.3 are to be used.

Duct part 1 which is situated upstream of the filter, consists of a mixing orifice on the air intake side, upstream of which is positioned the dust feeder and downstream of which is a perforated plate to spread the dust uniformly in the duct.The upstream sampling head is placed in the last third of this duct.Downstream is duct part 3.It contains the downstream pressure tappings for measuring the pressure drop of the filter and is connected to duct part 4 or 5 dependent upon the part of the test being undertaken. For the arrestance test, duct part 4 which contains the final filter will be used. For the efficiency test, duct part 5 containing the downstream sampling head will be used.

Duct part 4 and duct part 5 have the same dimensions. If duct part 4 is not available, duct part 5 may be used both for dust spot efficiency and arrestance determination. When measuring with the final filter in position, the downstream sampler must be blanked-off or the complete downstream sampling assembly removed from the duct and the opening blanked-off with a flat plate in such a manner as to avoid leakage.

Duct part 6 is fitted with a standardized air flow measuring device.

If an alternative air flow measurement device is used, ductpart 6 can be shortened if it is made conical with dimensions not shorter than the standardized flow measuring device.

The dimensions of the test rig and the positions of the pressure taps are shown in figure D.2.

The test duct shall be isolated from vibrations caused by the main fan or any other equipment producing vibrations in the area where the test rig is installed. The test rig shall be exhausted as far as possible from the air intake.

6.1.1 Preparation of the filter

6.1.1.1 The filter shall be prepared in accordance with the manufacturer's recommendations. The filter shall be weighed to the nearest gram. Filters which require external accessories shall be operated during the test with accessories having characteristics equivalent to those used in actual practice. The operating conditions of such accessory equipment shall be recorded.

6.1.1.2 The filter including any normal mounting frame shall be sealed into the duct part 2 in a manner that prevents leakage between duct parts 1 and 2.

6.1.1.3 After the installation of the filter in the test duct, the movable downstream sections, duct parts 3 and 5, shall be so positioned as to obtain accurate measurement.

6.2 Measurement of air flow and the determination of the initial pressure drop of the filter

6.2.1 The air flow shall be measured according to a standard method. It is mandatory that the dimensions of the test rig as shown in figure D.2 are maintained.

6.2.2 Measure and record pressure drop of the filter at a minimum of four air flow rates of e.g. 50, 75, 100 and 125 % of rated air flow rate to establish a curve of pressure drop as a function of air flow rate. Pressure drop shall be measured between static pressure taps located as shown in figure D.2. Pressure taps are to be provided at 4 points, distributed over the periphery of the duct and connected together by a ring line.

The pressure drop readings shall be corrected for an air density of 1,20kg/m³.

6.3 Atmospheric dust spot efficiency

6.3.1 Summary of test procedures

Samples of test air are drawn at equal mass flow rates from the upstream and downstream sides of the filters tested. Equal flow rates through the samples are established by means of critical flow nozzles. The downstream test air is sampled intermittently as controlled by a percentage timer.

The elapsed time meter is provided to record the total "on" time. These data plus the flow rate (0,94 dm^3/s) established by the critical flow nozzles allow verification of the gas meter readings.

Dust from the sampled air upstream and downstream of the filter is captured on equal area targets of filter paper. The percentage of "on" time for the upstream sample is adjusted by previous experiments so that the upstream and downstream targets are of approximately equal opacity at the end of the test.