EUROVENT
EUROPE'S INDUSTRY ASSOCIATION FOR **INDOOR CLIMATE, PROCESS COOLING,** AND **FOOD COLD CHAIN** TECHNOLOGIES

Eurovent 4/22 - 2015

Industry Recommendation for Residential Air Filter Performance Measurements

First Edition

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Eurovent, 80 Bd. A. Reyers Ln, 1030 Brussels, Belgium
secretariat@eurovent-association.eu

Eurovent - The European Committee of HVAC&R Manufacturers
AISBL / IVZW / INPA

Diamant Building
80 Bd. A. Reyers Ln
1030 Brussels
BELGIUM

Phone: +32 (0)466 90 04 01
Fax: +32 (0)2 70 67 966
secretariat@eurovent-association.eu
Follow us on LinkedIn!

Fortis Bank
IBAN: BE 31 210043999555
BIC: GEBABEBB
VAT: not applicable

Document history

This marks the first edition of Eurovent 4/22. No prior versions of this Industry Recommendation exist.

Preface

In a nutshell

- Eurovent 4/22 refers to particulate air filters for residential application having an efficiency ePM_1 of less than 99 %.
- Describes the technical specifications, requirements and an efficiency classification system based upon fractional efficiency measurement and a Particulate Matter reporting system.
- Method is applicable for filters having rated maximum air flow from 70 to 1000 m^3/h.

Authors

This document was published by the EUROVENT association and was prepared in a joint effort by participants of the Product Group 'Air Filters' (PG-FIL) and the responsible Technical Subcommittee.

The more than 20 manufacturers participating within this working group hold a market share on the EMEA market of more than 90 % as independently assessed by Eurovent Market Intelligence.

A list of all participants to this Product Group is available on request.

Adoption

The document has been approved and adopted through a formal voting procedure by Eurovent's national member associations from across Europe. This ensures a wide-ranging representativeness based on democratic decision-making procedures. More information on these members can be found at the end of this document.

Note: The EUROVENT Association does not grant any certification based on this document. All certification-related issues are managed by the association's independent subunit EUROVENT CERTITA CERTIFICATION in Paris.

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1. Introduction

This Recommendation refers to particulate air filters for residential application having an efficiency ePM_1 of less than 99 %. It describes the technical specifications, requirements and an efficiency classification system based upon fractional efficiency measurement and a Particulate Matter reporting system. The method is applicable for filters having rated maximum air flow from 70 to 1000 m^3/h.

Particulate Matter in the context of this Recommendation describes a size fraction of the natural aerosol (liquid and solid particles) suspended in ambient air. The symbol ePM_x describes the efficiency of an air cleaning device to particles with an optical diameter between 0,3 µm and x µm. Filters according to this Recommendation are rated by their efficiency values ePM_1, $ePM_{2.5}$ and ePM_{10}.The particle efficiency of the filter element is measured as a function of the particle size in the range of 0.3 to 10 µm of the new and unconditioned filter element.

In a second step, a full filter element shall be conditioned (discharged) in an artificial aging step to provide information about the intensity of the electrostatic removal mechanism. The results from these two steps are used to calculate the average efficiency curve. From this average efficiency curve the ePM_x efficiency values are calculated by weighting the fractional efficiency values with a standardised and normalised particle size distribution. This standardised and normalised particle size distribution is defined in ISO 16890. The performance results obtained in accordance with this Recommendation shall not by themselves be quantitatively applied to predict performance in service with regard to efficiency and lifetime.

Coarse filter mats can be classified directly according to the ISO 16890 series. Filters which are falling out of the scope of the ISO 16890 series due to their size and their maximum rated air flow can be classified according to their ePM_x efficiency by using this Eurovent Recommendation and by following the steps described below.

2. Definitions

Rated maximum air flow (in m^3/h)

The rated maximum air flow is defined as the maximum operational air flow for the filter as recommended by the manufacturer.

Other terms and definitions

For other terms and definition refer to ISO 29464, which establishes a terminology for the air filtration industry and comprises terms and definitions together with, in some cases, symbols and units.

3. Test rig and equipment

The test rig shall be based on ISO/TS 11155-1.

If a test rig is used which deviates from the specifications in terms of dimensions and/or air flow rate, it has to be validated according to ISO/TS 11155-1 chapter 4.4 and annex E. As there is no dust loading within this recommendation, the test rig can be either in vertical or horizontal position.

4. Conditioning method

The conditioning shall be based on the isopropanol vapour method as described in ISO 16890-4, or ISO 29461-1 adapted to test the full filter element.

5. Test procedure

1. Measure the initial pressure drop curve at 75, 100 and 125 % of the rated maximum air flow and correct it to the standard condition of 23 °C and 101.3 kPa according to ISO/TS 11155-1 annex C. If 75 % of the max. rated airflow of the filter is below 70 m^3/h, then start with 100 % of the max. rated airflow of the filter.
2. Measure a fractional efficiency curve in the particle size range from 0.3 to 10 µm using a test rig according to the ISO/TS 11155-1 and using a test aerosol as defined in ISO 16890-2 at the rated maximum air flow (as defined in Section 2 of this document).
3. Condition the filter element according to ISO 16890-4 for minimum efficiency determination.
4. Calculate the ePM efficiencies according to ISO 16890-1 chapter 7 using the 2 fractional efficiency curves previously measured at the rated maximum air flow.

6. Filter classification based on ePM

The filter classification is based on ISO 16890-1. Particulate Matter in the context of this Recommendation describes a size fraction of the natural aerosol (liquid and solid particles) suspended in ambient air. The symbol ePM_x describes the efficiency of an air cleaning device to particles with an optical diameter between 0,3 µm and x µm. The following particle size ranges are used in this standard for the listed efficiency values:

Table 1: Particle size fractions

Fraction	Size range
ePM_{10} (thoracic fraction)	≤ 10 µm
$ePM_{2.5}$ (respirable fraction)	≤ 2.5 µm
ePM_1	≤ 1 µm

Table 2: Filter groups

Group name	Requirement			Class reporting value
	$ePM_{1,\ min}$	$ePM_{2,5,\ min}$	ePM_{10}	
ISO Coarse	—	—	< 50%	Initial grav. Arrestance
ISO ePM_{10}	—	—	≥ 50%	ePM_{10}
ISO $ePM_{2,5}$	—	≥ 50%		$ePM_{2,5}$
ISO ePM1	≥ 50%	—	—	ePM_1

The filter classes are reported as class reporting value in conjunction with the group name. For the reporting of the ePM classes, the class values shall be rounded downwards to the nearest multiple of 5 percentage points. Values larger than 95 % are reported as '>95%'. Examples of reporting classes are ISO Coarse 60%, ISO ePM_{10} 60%, ISO $ePM_{2,5}$ 80%, ISO ePM_1 85%, or ISO ePM_1 >95%. Coarse filter mats can be classified directly according to the ISO 16890 series including a dust loading to ISO 16890-3 to determine the initial gravimetric arrestance. In this case, the filter class can be reported as the group name 'ISO Coarse' in conjunction with the initial gravimetric arrestance (rounded downwards to the next multiple of 5 percentage points) such as, for instance, 'ISO coarse 60%'. As this Eurovent Recommendation does not describe a dust loading procedure, all other coarse filters (not filter mats) with an ePM_{10} efficiency of less than 50 % which are used in residential applications and which are out of the scope of the ISO 16890 series, shall be classified by their group name 'ISO Coarse' only, without reporting an initial gravimetric arrestance.

7. Labelling

Filters tested and classified according to this guideline shall be labelled with the following information as minimum:

- Name, trade mark or other means of identification of the manufacturer
- Filter type, designation and reference number
- Dimensions (width, length and depth)
- Reference to this guideline
- Rated maximum air flow
- Pressure drop at rated maximum air flow
- Group name and efficiency or arrestance at rated maximum air flow

8. Reporting

The test report according to this Recommendation shall fulfil the minimum requirements defined in ISO 16890-1 chapter 8.3.

9. Reference documents

[1] ISO/DIS 16890-1:2014 – Air filters for general ventilation — Part 1: Technical specifications, requirements and efficiency classification system based upon Particulate Matter (ePM)

[2] ISO/DIS 16890-2:2014 – Air filters for general ventilation — Part 2: Measurement of fractional efficiency and air flow resistance

[3] ISO/DIS 16890-4:2014 – Air filters for general ventilation — Part 4: Conditioning method to determine the minimum fractional test efficiency

[4] ISO/TS 11155-1:2001 – Road vehicles — Air filters for passenger compartments — Part 1: Test for particulate filtration

[5] ISO 29461-1:2013 – Air intake filter systems for rotary machinery — Test methods — Part 1: Static filter elements

[6] ISO 29464:2011 – Cleaning equipment for air and other gases — Terminology

About Eurovent

We are Europe's Industry Association for Indoor Climate, Process Cooling, and Food Cold Chain Technologies – thinking beyond 'HVAC&R'

Eurovent is Europe's Industry Association for Indoor Climate, Process Cooling, and Food Cold Chain Technologies. Its members from throughout Europe, the Middle East and Africa represent more than 1.000 companies, the majority small and medium-sized manufacturers. Based on objective and verifiable data, these account for a combined annual turnover of more than 30bn Euros, employing around 150.000 people within the association's geographic area. This makes Eurovent one of the largest cross-regional industry committees of its kind. The organisation's activities are based on highly valued democratic decision-making principles, ensuring a level-playing field for the entire industry independent from organisation sizes or membership fees.

Eurovent's roots date back to 1958. Over the years, the Brussels-based organisation has become a well-respected and known stakeholder that builds bridges between manufacturers it represents, associations, legislators and standardisation bodies on a national, regional and international level. While Eurovent strongly supports energy-efficient and sustainable technologies, it advocates a holistic approach that also integrates health, life and work quality as well as safety aspects. Eurovent holds in-depth relations with partner associations around the globe. It is a founding member of the ICARHMA network, supporter of REHVA, and contributor to various EU and UN initiatives.

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Our Members are national associations from Europe, the Middle East and Africa that are representing manufacturers in the area of Indoor Climate, Process Cooling, and Food Cold Chain technologies.

Spain · Spain · Belgium · Russia · Italy · Italy

Denmark · Finland · Turkey · Netherlands · Sweden · Slovenia

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The more than 1000 companies within their networks (Eurovent 'Affiliated Manufacturers') can directly participate in Eurovent activities in a democratic and transparent manner.

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