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Guide

ENVIRONMENTAL PRODUCT DECLARATIONS FOR AIR FILTERS

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CORE MEMBERS OF THE EUROVENT PRODUCT GROUP 'AIR FILTERS'

In a nutshell
This document discusses the environmental impact of air filters for general ventilation used in the construction sector. It explains the product features that influence their environmental performance and provides guidance on the interpretation of Environmental Product Declarations (EPDs) for air filters.

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This document was published by Eurovent and was prepared in a joint effort by participants of the Product Group 'Air Filters' (PG-FIL), which represents a vast majority of manufacturers of these products active on the EMEA market. A particularly important contribution was provided by (in alphabetical order) Karsten Howe, Merete Lyngbye, Marc Schmidt, Yanbin Zhuo, and Tobias Zimmer. The key editorial team also included Thomas Caesar, Nils Juttner, Denis Osmancevic, Peter Ruiter and Igor Sikonczyk.

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List of abbreviations used:

EPD	Environmental Product Declaration
IAQ	Indoor Air Quality
LCA	Life Cycle Assessment
PM	Particulate matter

01 INTRODUCTION

Sustainable development is essential to meet present needs without compromising the ability of future generations to meet their own needs. This encompasses environmental protection, social aspects and economic growth. The United Nations (UN) translated this high-level objective into a number of specific goals in the 2030 Sustainable Development Agenda. The goals include, inter alia, good health and well-being, and quality education.

Air filters, which may appear to be simple and similar to other products, play an important role in achieving these goals. Filters are essential to provide good indoor air quality (IAQ), which in turn is crucial for the health and well-being of people who spend on average 90% of their time indoors. IAQ is also vital for high learning performance, necessary for ensuring quality education.

However, filters, like any product, have an impact on the environment due to their production and the energy consumption associated with their use and their disposal. That is why it is very important to consciously choose and use filters that have a low environmental impact and contribute to sustainability. It may not seem so obvious and tangible, but given the vast amount of air filters that are used all around us, our informed decisions in this regard really matter.

According to the European Environment Agency, buildings account for more than 30% of the EU's environmental footprint[1]. Air filters are indispensable in all ventilation and air conditioning systems that supply air to the building, which nowadays is standard for most buildings, especially new ones.

Contrary to other durable and non-energy-related building elements that affect the environmental impact (such as steel or concrete structures), filters are mass-produced consumables with a much shorter service life therefore the approach to assessing their impact needs to take into, account additional aspects compared to typical construction products.

Further to impacts related to the production stage (natural resources and raw materials depletion, transport, manufacturing), packing and distribution, air filter specific impacts should be considered.

These aspects are explained in the text boxes.

Reduction of airborne fine particles (PM) concentration indoors
and consequently a decrease in the associated health risks.

Impact on electricity consumption:
Filters do not consume energy but their average air flow resistance over the service life has a direct impact on electricity consumption by fan's. As in modern systems the pressure drop attributable to air filters accounts for a significant part of the fan total pressure increase. With high greenhouse gas emission intensity of electricity generation, this aspect can have a considerable impact on the carbon footprint of the system.

Low-impact disposal and potential for reuse and recycling of the materials that make up filters:
For air filters, which are consumables, the end-of-life stage occurs much more frequently than for other building elements, thus low impacts associated with this stage are important.

Actual length of service life:
For hygiene reasons, air filters are usually changed every year. However, not every filter can guarantee such a long service life and must be replaced earlier due to exceeding the limit air resistance. The need for more frequent replacement of filters during the lifetime of a building means a higher environmental impact associated with the production, distribution and disposal of filters.

The tools to assess the environmental impact of air filters are the Environmental Product Declaration (EPD) and Life Cycle Assessment (LCA). Both tools are explained in Chapter 1, while Chapters 2 and 3 discuss their application in the context of air filters, and Chapter 4 provides guidance on the use and interpretation of information contained in EPDs.

1.1 Benefits of using high environmental performance filters

The results of the following case study[2] illustrate the potential reduction in environmental impacts attributable to air filters, resulting from the use of the best air filters available on the market, as well as the overall health benefits of using filters.

The case study is based on an example office building complex located in Krakow, Poland, with a total office space of 69.000 m², which accommodates approximately 7.000 employees. The total outdoor air flow supplied by the ventilation system is 138 m³/s (496.800 m³/h), which corresponds to Category I of design ventilation rates according to EN 16798-1. The number of the installed ePM1 50% filters (592 x 592 mm) for supply air in air handling units amounts to 247. The ventilation system operates for 3.380 hours per year (from 7:00 to 20:00, Monday to Friday).

-70%
PM2.5 concentration in indoor air compared to outdoor concentration on average per year

1 https://www.eea.europa.eu/en/topics/in-depth/buildings-and-construction
2 The background and calculations for the case study are included in a supplementary report available on request.

Figure 1: High5ive office buildings complex *©Colliers*

Reduction of PM concentration in the indoor air and decrease in the associated health risks

The annual mean concentration of harmful PM2.5 particles in outdoor air at the location in question was 17 µg/m³ in 2023[3], which is more than three times higher than the WHO recommended limit of 5 µg/m³. Thanks to the installed supply air filters, the average annual PM2.5 concentration in the indoor air, compared to the concentration outdoors was reduced by around 70%, which led to meeting the WHO recommended limit.

As regards the amount of PM2.5 particles collected by air filters that were **not inhaled** into the lungs of building users, it can be estimated at 20 kg per year, which translates into 1t of PM2.5 dust over the assumed 50-year lifetime of the building.

Reduction of electricity consumption and greenhouse gas emissions from its generation

A rough estimation can be based on the Eurovent energy classification for air filters[4]. Assuming that the Eurovent certified A+ class supply air filters are used instead of D class filters, the following electricity savings and related environmental benefits can be estimated at:

Savings	Annually	Over building's lifetime (50 years)
Electricity	**34.000 kWh**	**1.725 MWh**
Greenhouse gas emission[5]	**7.140 kg CO_2e**	**357 tons CO_2e**

3 *https://www.eea.europa.eu/en/analysis/maps-and-charts/air-quality-statistics-dashboards*
4 *For more information refer to Eurovent 4/21 and the Eurovent Certification programme for Air filters*
5 *For EU27 overage greenhouse gas emission intensity of electricity generation in 2023 = 207 gCO_2e/kWh (https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emission-intensity-of-1/greenhouse-gas-emission-intensity-of)*
6 *https://ourworldindata.org/travel-carbon-footprint*
7 *https://www.natureunited.ca/what-we-do/our-priorities/innovating-for-climate-change/forest-carbon-boreal-forest/*

Accordingly, over the typical building's lifetime of 50 years, these savings are equivalent to:

2,063,555
less kilometres
by petrol car[5]

1,451,199
less kilometres by passenger aircraft (domestic flight)[6]

1 hectare
of old forest to absorb emissions[7]

02 WHAT IS AN 'EPD' AND 'LCA' AND WHAT ARE THEY USED FOR?

2.1 Understanding Environmental Product Declarations (EPD) and Life Cycle Assessments (LCA)

In today's environmentally conscious marketplace, environmental tools such as Environmental Product Declarations (EPDs) and Life Cycle Assessments (LCAs) have become increasingly important. This document provides a simple explanation of these concepts for air filter customers.

2.2 Environmental Product Declaration (EPD)

An Environmental Product Declaration (EPD) is a standardised document that provides transparent, verified information about a product's environmental impact throughout its entire life cycle. Similar to a nutrition label, which lists ingredients and caloric content, an EPD (Environmental Product Declaration) reports a number of environmental impacts, such as carbon footprint, particulate matter filtration impact, water usage and resource consumption, in a clear and consistent format (Figure 2).

The category 'Particulate Matter' assesses the quantity of harmful particles a product and its manufacturing process emit into the atmosphere. Fine airborne particles pose health risks because they can penetrate deeply into the lungs and even enter the bloodstream, potentially leading to infections, respiratory and cardiovascular illnesses. They also have a negative effect on overall well-being, concentration and learning ability. According to the SETAC-UNEP Global Guidance for Life Cycle Impact Assessment Indicators, the positive impact of air filters on the category ‚Particulate Matter' is modelled (Fantke et al., 2016, p. 76 ff).

You can find **more information on the impact categories here**.

EPDs are created following international standards (ISO 14025) and must be verified by an independent third party to ensure accuracy and reliability. This verification process gives customers confidence in the environmental information being presented and allows for fair comparisons between similar products in the marketplace.

For air filter products, an EPD would typically include information about the raw materials used in manufacturing, energy consumption during production, transportation impacts, performance during use, and end-of-life considerations. It's important to understand that an EPD itself doesn't indicate whether a product is environmentally superior – it simply provides the factual data in a standardised format so you can make informed decisions. Many building certification programs like LEED and BREEAM now recognise or require EPDs, making them increasingly valuable for suppliers and customers in the building products industry.

Figure 2: Environmental impact categories
(source: European Commission green-forum.ec.europa.eu)

2.3 Life Cycle Assessment (LCA)

A Life Cycle Assessment forms the foundation for creating an EPD and is a comprehensive scientific method for evaluating the environmental impacts of a product throughout its entire existence – from raw material extraction to final disposal or recycling. In essence, an LCA traces everything that goes into and comes out of a product system, including resources, energy, emissions, and waste across all stages of the product's life (Figure 3).

For air filters, this would include analysing the environmental impacts of all components, manufacturing processes, transportation, and disposal or recycling methods.

The following must be observed regarding the use phase:

Air filters themselves do not consume energy during the use phase; rather, energy is used by the fan that moves air through the filter. However, since the fan is not part of the air filter product, it is excluded from the Environmental Product Declaration (EPD) for the filter.

Furthermore, the energy consumption and environmental impact during the use phase can vary widely depending on factors such as system design, airflow rates, pressure drops, maintenance practices, and the type or function of the building. Due to this variability, it is not feasible to define a universally applicable use scenario. Therefore, EPDs for air filters omit use data from the main declaration and instead include it in a mandatory annex, where standadised use scenarios are provided..

This approach aligns with the EN 15804 standard. Even when use phase data is included, its reliance on assumed the scenarios limits its comparability across different products and applications. As a result, use phase information is generally more meaningful within the context of building-level life cycle assessments (LCAs), where operational energy use and maintenance can be evaluated more accurately.

LCAs follow a structured approach outlined in international standards (ISO 14040 and 14044) and typically involve four main phases: defining goals and scope, creating an inventory of inputs and outputs, assessing environmental impacts, and interpreting results.

The comprehensive nature of LCAs helps identify which stages of a product's life cycle contribute most significantly to its environmental footprint and which components of the product, enabling manufacturers to make targeted improvements where they matter most.

Figure 3: Life Cycle Stages *(source: European Commission green-forum.ec.europa.eu)*

2.4 Practical Applications for Air Filter Customers

For you as an air filter customer, EPDs and LCAs serve several practical purposes. They enable you to compare the environmental performance of different filter products on an equal basis, helping you select products that align with your sustainability goals and potentially meet green building certification requirements. These tools also demonstrate transparency in the supply chain, showing that manufacturers have nothing to hide about their products' environmental attributes.

Additionally, EPDs can help you respond to increasing environmental reporting requirements in many industries and provide documentation for your own sustainability initiatives. By choosing products with verified EPDs, you support companies that invest in understanding and improving their environmental performance while helping reduce your own carbon footprint and the overall environmental impact across the industry.

2.5 Conclusion

Environmental Product Declarations and Life Cycle Assessments provide objective, science-based information about products' environmental impacts. While LCAs are the comprehensive analytical process, EPDs are the standardised communication tool that makes this complex information accessible and comparable. For air filter customers, these tools offer valuable insights that support informed purchasing decisions and demonstrate a commitment to environmental responsibility.

03 ORIGIN AND DEVELOPMENT OF EPDs IN THE CONSTRUCTION SECTOR

Historically, EPDs were adopted by the building industry because the Construction Product Regulation of 2011 included the seventh basic requirement for the sustainable use of natural resources and indicated that EPDs should, wherever possible (on a voluntary basis), be used to assess the sustainable use of resources and the environmental impact of construction works.

Accordingly, the first EPDs were made for long-lasting building products such as concrete, bricks and other building materials. These materials are characterised by the fact that their environmental impact is created during the manufacturing and/or disposal phase. Furthermore, the use phase of these products is not related to energy.

These Materials have been captured in EPDs for some time to give the builders, architects and owners a better understanding of the environmental impact and support their decision making when selecting building materials. This has helped to better understand the building sector in terms of sustainability.

With the growing importance and awareness of sustainability, there is an increasing demand for EPDs for further products from other areas that are used in buildings. These include components whose environmental impact is directly or indirectly related to energy use, and which have a significantly different service life to that of structural building components. Air filters are a good example of such products.

The first EPDs were made for long-lasting building products

04 EPDs FOR FILTERS AS CONSUMABLES

In contrast to other long-lasting and permanent building components, air filters are mass-produced consumables with a much shorter service life compared to the lifetime of a building. The air filter has a typical service life of approximately one year, while other building components, like e.g. windows have a typical lifetime of decades. In addition, air filters are standardised components, and the actual application of an air filter is normally not known by the manufacturer and may differ a lot for the same type of air filter. For those reasons, the approach to assessment of filters' environmental impact needs to be different than for 'typical' construction products.

Even if air filters are passive components without a direct consumption of electrical energy, their resistance to the airflow often has a significant impact on the overall energy consumption and carbon footprint of a ventilation system. In many applications of air filters in buildings, the electrical energy consumption attributable to their use is a significant contributor to the filter's overall carbon footprint.

A good indication of the energy consumption of a specific air filter is given by the calculation model in Eurovent 4/21, which provides an estimate of the annual energy consumption in kWh of a filter under standardised conditions. For a more specific calculation of the energy consumption of air filters on the building level, the calculation models of Eurovent 4/24 could be used.

One of the main functions of an air filter is to improve the indoor air quality (IAQ) to protect the people in the building from harmful pollutants like particulate matter (e.g. PM2.5). Therefore, the PM2.5 removal efficiency of an air filter and its resulting positive impact on the health of the people in the building should be considered, when evaluating its environmental impact.

Download the Eurovent 4/24 calculation model **here:**

EUROVENT 4/24

Use the Eurovent 4/24 calculation model to calculate the energy consumption of air filters at the building level.

05 WHAT INFORMATION CAN BE FOUND IN THE FILTER EPD AND HOW CAN IT BE USED?

The environmental product declaration of a filter contains detailed information about its environmental impact. It includes a product description, LCA results and third-party verification details.

The EPD describes a product type, intended application, scope and conditions of LCA, resource consumption, waste and emissions and end of life information. The LCA result will present a table of at least mandatory environmental impact indicators in separate product life cycle phases, for example the Global Warming Potential-GWP typically expressed in kg CO_2 equivalents, Acidification Potential-AP and Eutrophication Potential-EP. To ensure that the EPD is compliant with ISO14025, ISO14040, ISO14044, EN15804 and product category rules (PCR), it is verified by an independent third-party.

5.1 Informed assessment of the EPD for different applications

The following guidelines for evaluating filter EPDs facilitate more sustainable and informed choices for various applications.

Step 1: Define your needs

- Are you looking for the most environmentally friendly option?
- What is your need regarding particle matter removal and indoor air quality?
- Do you need a low-carbon footprint product for sustainability goals?
- Is recyclability or durability important for long-term use?

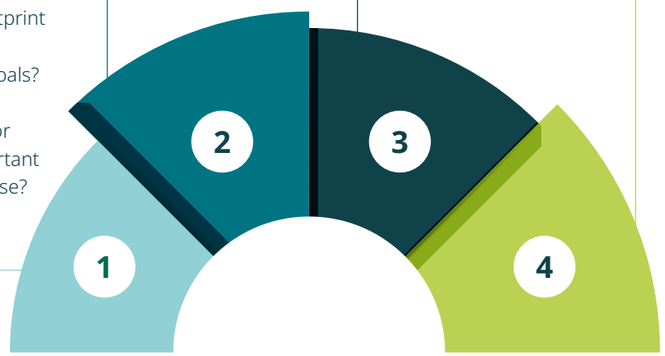
Step 2: Review key metrics

- Weight of raw materials
- Values of environmental impact indicators

Step 3: Check third-party verification

Step 4: Consider the full life cycle

Example: A filter with low production impact but high energy use might not be the best choice. Recyclability and material sourcing matter for long-term sustainability.



5.2 Avoiding misuse and misinterpretation of EPDs

EPDs are valuable tools for assessing the environmental impact of products, but they can be misused or misinterpreted. The following practices are to facilitate proper use and avoid misleading conclusions:

- **EPDs are not the EU Ecolabel**. Unlike certifications such as Energy Star or Cradle-to-Cradle, EPDs do not indicate that a product is 'green' or 'sustainable'. They provide neutral, quantitative environmental data.
- **When comparing EPDs for air filters, ensure that all of them are based on the same Product Category Rules,** defining, for example, the same declared unit and annual operating time. Otherwise, the data may be misleading.
- **Pay attention to all claimed environmental impacts and take your local legislation into account.** Do not focus only on GWP, ignoring other critical impact categories, like water use, ozone depletion or toxic emissions.

It is important to understand the limitations of EPDs, ensure reliable comparisons, verify credibility, and use EPDs as part of a broader sustainability assessment. It is a powerful tool, but only when interpreted correctly.

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IAQmatters
Yes to a better Indoor Air Quality

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