Spigots
Type KSFSSP

For filter unit systems with horizontal air entry and discharge

Spigot for assembling filter unit systems in ductwork

- Spigots made of sheet steel with decontaminable powder coating RAL 9010
- Air deflection plate in the air outlet spigot ensure a uniform airflow through the system, reduce the total differential pressure, and lower energy costs
- For filter unit systems of up to 6 filter casings in a row
- Leakage test for the entire filter unit system

Optional equipment and accessories

- Stainless steel construction

Filter unit system with KSFS.../-PM and spigot KSFSSP

Description

Spigot,
type KSFSSP

Application
- Spigot type KSFSSP for assembling a filter unit system with ducted particulate filters type KSFS for critical requirements

Construction
- M: Casing without prefilter
- PM: Casing with prefilter
- SPC: Steel, powder-coated RAL 9010, pure white
- STA: Stainless steel
- Number of casings: 1 – 6
- MD: Casing with service board
- TLBR: Air entry at top left, air outlet at bottom right
- TRBL: Air entry at top right, air outlet at bottom left
- TRBR: Air entry at top right, air outlet at bottom right
- TLBL: Air entry at top left, air outlet at bottom left
- SPM: Casing and spigot factory assembled
- SPP: Casing and spigot separate

Nominal sizes [mm]
- B × H × T

Useful additions
- Suitable filter elements to be ordered separately
- Mini Pleat filter panels (MFP)
- Mini Pleat filter cells (MFC)
- Activated carbon filter cells (ACF)
- Other filter elements upon request
- Ducted particulate filter (KSFS)

Construction features
- Spigot with support legs, for horizontal air entry or air outlet, available for systems with up to six filters units in a row
- Air deflection plate in the air ou tlet spigot ensure a uniform airflow through the system, reduce the total differential pressure, and lower energy costs
- For filter unit systems consisting of four or more filter units in a row, the unit systems are devided into smaller packages for transport reasons

Materials and surfaces
- Spigot made of either sheet steel, powder-coated RAL 9010, pure white, or of stainless steel

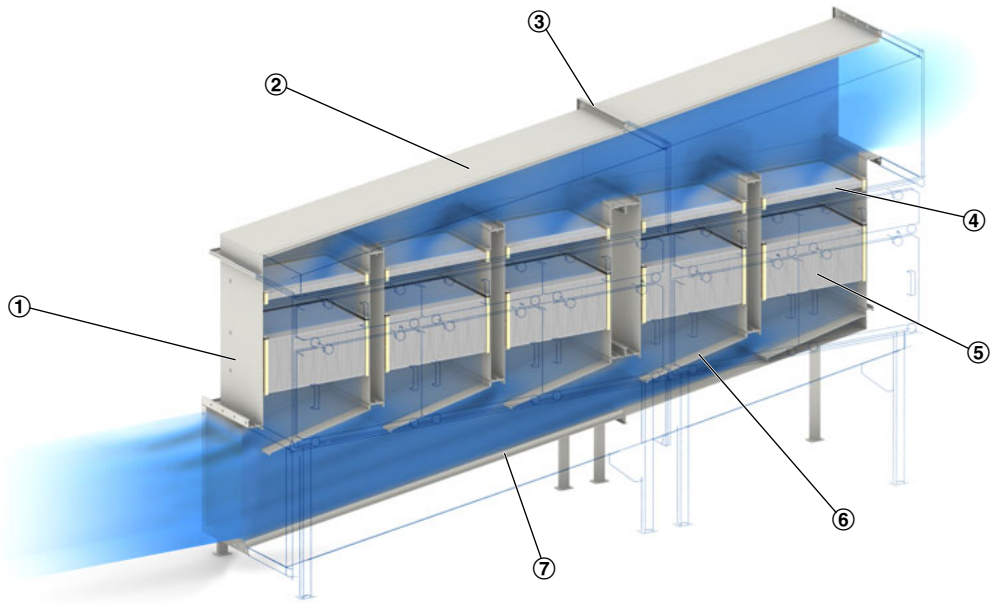
Maintenance
- Maintenance-free as construction and materials are not subject to wear

Function

Spigot type KSFSSP with support legs, for horizontal air entry and air outlet. Up to six ducted particulate filters can be arranged in a row to create a filter unit system. The air outlet spigot is fitted with Air deflection plate that ensure a uniform airflow through the system.

For filter unit systems consisting of four or more filter units in a row, the unit systems are devided into smaller packages for transport reasons.

Schematic illustration of KSFSSP



① Ducted particulate filter
② Air entry spigot
③ Separating point for transport
④ Fine dust filter as prefilter
⑤ Particulate filter as main filter
⑥ Air deflection plate for flow optimisation
⑦ Air outlet spigot with support legs

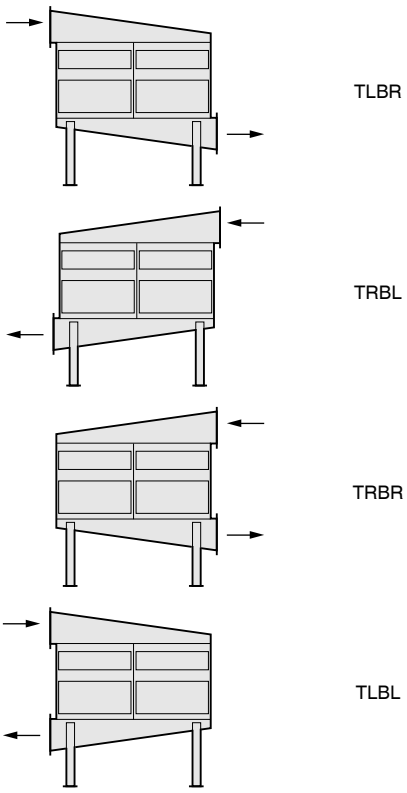
Spigot arrangement KSFSSP

TLBR:
Air entry at top left, air outlet at bottom right

TRBL:
Air entry at top right, air outlet at bottom left

TRBR:
Air entry at top right, air outlet at bottom right

TLBL:
Air entry at top left, air outlet at bottom left



Order code

KSFSSP

KSFSSP – PM – SPC / 710 × 794 × 710 × 4 / MD / TLBR / SPP
1 2 3 4 5 6 7 8

1 Type
KSFSSP Spigot

2 Construction
M Casing without prefilter
PM Casing with prefilter

3 Material
SPC Steel, powder-coated RAL 9010, pure white
STA Stainless steel

4 Nominal size of KSFS [mm]
B × H × T

5 Number of casings
1
2
3
4
5
6

6 Service board
No entry: none
MD Casing with service board

7 Spigot arrangement
TLBR Air entry at top left, air outlet at bottom right
TRBL Air entry at top right, air outlet at bottom left
TRBR Air entry at top right, air outlet at bottom right
TLBL Air entry at top left, air outlet at bottom left

8 Standard construction
SPM Casing and spigot factory assembled
SPP Casing and spigot separate

Order example

KSFSSP–PM–SPC/710×794×710×4/MD/TLBR/SPP

Construction	casing with prefilter
Material	steel, powder-coated RAL 9010, pure white
Nominal size of KSFS	710 × 794 × 710 mm
Number of casings	4
Service board	casing with service board
Spigot arrangement	air entry at top left, air outlet at bottom right
Standard construction	casing and spigot separate

Description

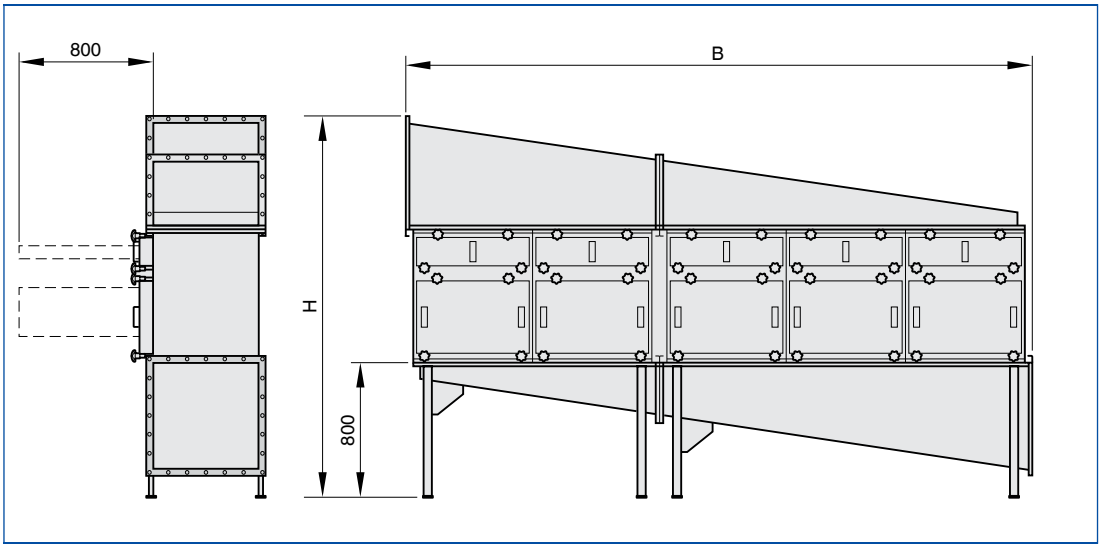
Spigot,
type KSFSSP

Application

– Spigot type KSFSSP for assembling a filter unit system with ducted particulate filters type KSFS for critical requirements

Dimensions

Dimensional drawing of KSFSSP



Standard construction

All weights are net, without packaging.

The total height of the filter unit system depends on the height of the selected ducted particulate filters type KSFS.

Dimensions [mm] and weight [kg]

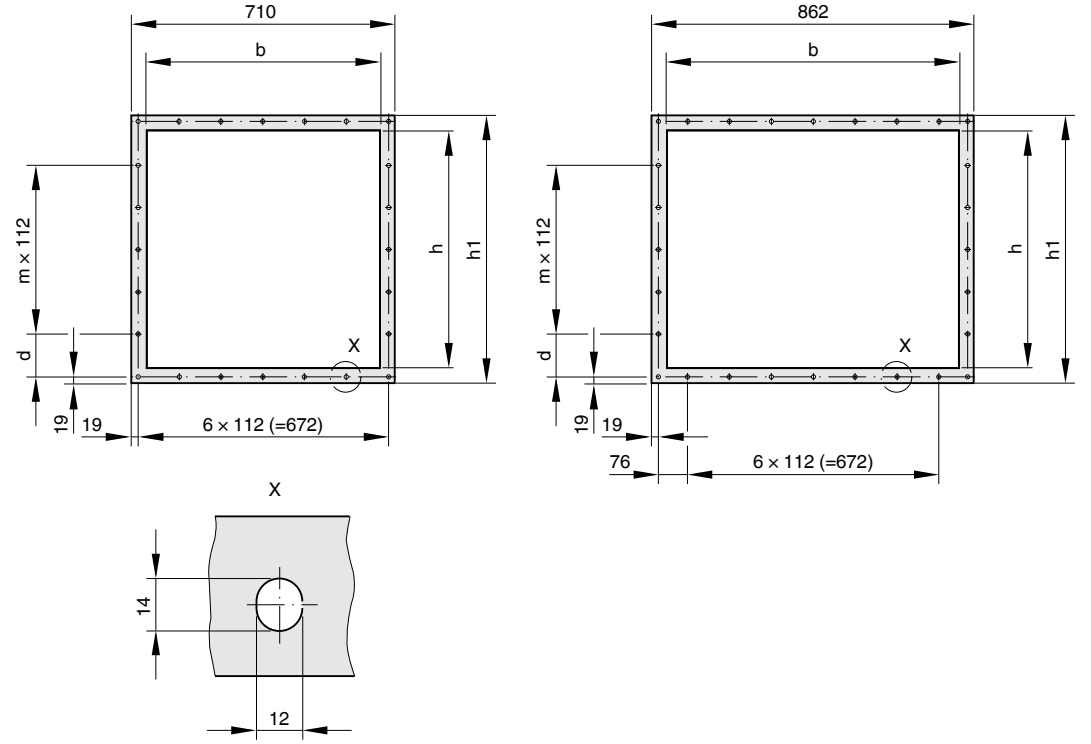
Number of casings	Casing depth T	Total width B	Total height in combination with				Weight
	KSFS	KSFSSP	KSFS-M		KSFS-PM		
			H = 411	H = 553	H = 652	H = 794	
	mm						~ kg
1	710	800	1456	1598	1697	1839	45
2	710	1510	1571	1713	1812	1954	60
3	710	2220	1656	1798	1897	2039	80
4	710	3020	1756	1898	1997	2139	120
5	710	3730	1886	2028	2127	2269	145
6	710	4440	1966	2108	2207	2349	180

Dimensions [mm] and weight [kg]

Number of casings	Casing depth T	Total width B	Total height in combination with		Weight
	KSFS	KSFSSP	KSFS-M	KSFS-PM	
			H = 553	H = 794	
	mm				~ kg
1	862	800	1598	1839	50
2	862	1510	1713	1954	65
3	862	2220	1798	2039	85
4	862	3020	1898	2139	125
5	862	3730	2028	2269	155
6	862	4440	2108	2349	190

2

KSFSSP flange dimensions



Flange dimensions

Number of casings	Casing depth T KSFS	b	h	h1	m x 112	d
	mm					mm
1	710	625	200	285	1 x 112	67.5
2	710	625	315	400	2 x 112	69.0
3	710	625	400	485	3 x 112	115.5
4	710	625	500	585	4 x 112	105.5
5	710	625	630	715	5 x 112	114.5
6	710	625	710	795	6 x 112	98.5

Flange dimensions

Number of casings	Casing depth T KSFS	b	h	h1	m x 112	d
	mm					mm
1	862	777	200	285	1 x 112	67.5
2	862	777	315	400	2 x 112	69.0
3	862	777	400	485	3 x 112	115.5
4	862	777	500	585	4 x 112	105.5
5	862	777	630	715	5 x 112	114.5
6	862	777	710	795	6 x 112	98.5

Standard text

This specification text describes the general properties of the product. Texts for other variants can be generated with our Easy Product Finder design programme.

Spigots type KSFSSP for assembling a filter unit system with ducted particulate filters type KSFS for critical requirements
Filter unit system consisting of a ducted particulate filter type KSFS with support legs, for horizontal air entry and air outlet.
Spigot available for systems of up to six filter units in a row, factory assembled
The arrangement of the spigots can be selected.
The discharge spigot is fitted with Air deflection plate that ensure a uniform airflow through the system and reduce the total differential pressure.
Leakage test for the entire filter unit system.

Materials and surfaces

- Spigot made of either sheet steel, powder-coated RAL 9010, pure white, or of stainless steel

Construction

- M: Casing without prefilter
- PM: Casing with prefilter
- SPC: Steel, powder-coated RAL 9010, pure white
- STA: Stainless steel
- Number of casings: 1 – 6
- MD: Casing with service board
- TLBR: Air entry at top left, air outlet at bottom right
- TRBL: Air entry at top right, air outlet at bottom left
- TRBR: Air entry at top right, air outlet at bottom right
- TLBL: Air entry at top left, air outlet at bottom left
- SPM: Casing and spigot factory assembled
- SPP: Casing and spigot separate

2

Order options

1 Type
KSFSSP Spigot

2 Construction
☐ **M** Casing without prefilter
☐ **PM** Casing with prefilter

3 Material
☐ **SPC** Steel, powder-coated RAL 9010, pure white
☐ **STA** Stainless steel

4 Nominal size of KSFS [mm]
B × H × T

5 Number of casings
☐ **1**
☐ **2**
☐ **3**
☐ **4**
☐ **5**
☐ **6**

6 Service board
No entry: none
☐ **MD** Casing with service board

7 Spigot arrangement
☐ **TLBR** Air entry at top left, air outlet at bottom right
☐ **TRBL** Air entry at top right, air outlet at bottom left
☐ **TRBR** Air entry at top right, air outlet at bottom right
☐ **TLBL** Air entry at top left, air outlet at bottom left

8 Standard construction
☐ **SPM** Casing and spigot factory assembled
☐ **SPP** Casing and spigot separate

Filter units and filter elements

Basic information and nomenclature

- Selection of filter elements
- Test method according to EN 779
- Eurovent certification
- Energy efficiency according to Eurovent document 4/11
- Test method according to EN 1822
- Easy Product Finder
- New product names

	Filter class	Construction	Area of application	Examples
Coarse dust filter, particle size > 10 µm				
Insects, textile threads, sand, flue ash, pollen, spores, cement dust, carbon dust	G3 G4	Type FMC (Automatic roll filter media) Type FMR (roll media made of glass fibres or chemical fibres) Type FMP (filter medium as roll media or cut-to-size pads) Type ZL (Z-line filters) Type PFC (pocket filters made of non-woven chemical fibres)	Prefilters and recirculated air filters	Civilian shelters
			Extract air	Paint spray booths and kitchen extract air
			Used to protect air handling units and compact units from contamination	Room air conditioners, fans
			Prefilters	For filter classes M5 to F9
Fine dust filters, particle size 1 – 10 µm				
Pollen, spores, cement dust, bacteria and germs Aerosol insecticides	M5 M6 F7	Type FMR (roll media made of chemical fibres) Type FMP (filter medium as roll media or cut-to-size pads) Type ZL (Z-line filters) Type PFC (pocket filters made of non-woven chemical fibres) Type PFS (pocket filters made of non-woven synthetic fibres) Type PFG (pocket filters made of non-woven glass fibres) Type PFN (pocket filters made of NanoWave® medium) Type MFI (Mini Pleat filter inserts) Type MFE (Mini Pleat filter elements) Type MFC (Mini Pleat filter cells) Type MFP (Mini Pleat filter panels) Type DFF (Deep Pleat compact fine dust filter)	Fresh air filters for rooms with low requirements	Factory buildings, storage rooms, and garages
			Prefilters and recirculated air filters	Ventilation plant rooms
			Final filters in air conditioning systems	Sales rooms, department stores, offices
Oil spray and accumulated soot, tobacco smoke, metal oxide smoke	F7 F8 F9		Prefilters in air conditioning systems	For filter classes F7 to F9
			Final filters in air conditioning systems	Offices, production rooms, central control rooms, hospitals, computer centres
			Prefilters	For filter classes E11, E12 and H13
Particulate filters, particle size < 1 µm				
Bacteria and viruses tobacco smoke metal oxide smoke asbestos dust	E10 E11 H13	Type MFI (Mini Pleat filter inserts) Type MFE (Mini Pleat filter elements) Type MFC (Mini Pleat filter cells) Type MFP (Mini Pleat filter panels) Type DFH (Deep Pleat particulate filter cells)	Final filters for the most critical requirements	Laboratories, production rooms in the food processing and pharmaceutical industries
				Fine-mechanical, optical, and electronic industries
				Medicine
Particulate filters for clean room technology				
Particle size < 1 µm see Particulate filters	H13	Type MFI (Mini Pleat filter inserts) Type MFE (Mini Pleat filter elements) Type MFC (Mini Pleat filter cells) Type MFP (Mini Pleat filter panels) Type DFH (Deep Pleat particulate filter cells)	Final filters	For rooms rated to an ISO class between 7 and 9, or class 10000 or 100000 according to Federal Standard
Various stages of oil vapour and soot suspended radioactive particles	H14	Type MFI (Mini Pleat filter inserts) Type MFC (Mini Pleat filter cells) Type MFP (Mini Pleat filter panels)		For rooms rated to an ISO class between 5 and 7, or class 100, 1000 or 10000 according to Federal Standard
Aerosols	H14 U15 U16	Type MFPCR (Mini Pleat filter panels for clean room technology)		For rooms rated to an ISO class between 1 and 4, or class 1 or 10 according to Federal Standard

Test method

Pocket filter, type PFG

Mini Pleat filter insert type MFI, costruction PLA

Mini Pleat filter panel type MFP

EN 779 – test method

Coarse and fine dust filters are used for separating contaminants from the atmospheric air for general use in ventilation and air conditioning systems as well as in process engineering.
For the testing of coarse and fine dust filters, European standard EN 779, 'Particulate air filters for general ventilation', describes a uniform, reproducible test method, the requirements for particulate filters, and the test rig for measurement.

Measurement of the initial differential pressure

The initial differential pressure is the differential pressure of the clean sample. It is measured at least at 50 %, 75 %, 100 %, and 125 % of the nominal volume flow rate to which the filter is subjected. The measurement results are used to create a curve of the differential pressure as a function of the volume flow rate.

Measurement of the arrestance

For the determination of the arrestance, synthetic dust (ASHRAE dust) is fed at increments at nominal volume flow rate. The composition of the synthetic test dust is based on weight percentages of the following:

- 72 weight percent of 'fine' test dust to ISO 12103-1 A2
- 23 weight percent of black carbon
- 5 weight percent of lint cotton

Downstream of the sample, a final filter takes up the dust that has not been arrested by the sample. From the weight gain of the final filter and the amount of dust fed, the arrestance is determined gravimetrically, i.e. by weighing the final filter after every dust feed procedure.
Every dust feed results in an increase of the differential pressure of the filter. The test is continued until the final differential pressure defined in the standard is reached.
The maximum final differential pressure is 250 Pa for coarse dust filters, and 450 Pa for fine dust filters.
Then the average arrestance for the entire duration of the test is calculated.

Calculation of the dust holding capacity

The dust holding capacity is the product of the total mass of dust fed and the average arrestance.

Measurement of the efficiency

For fine dust filters, the efficiency is measured together with the arrestance.
First, the initial efficiency of the clean filter is determined. The efficiency is then measured again after each measurement of the arrestance.
To determine the efficiency, the sample is treated with a test aerosol made of DEHS (di-ethyl-hexyl sebacate). The efficiency is determined at the beginning and directly after each dust feed (ASHRAE test dust) by counting particles. The particle counter used can count particles as small as 0.1 µm.
For the test, an aerosol made of DEHS and with a particle size of 0.2 – 3.0 µm is mixed with the test air. Upstream and downstream of the filter, partial airflows are sampled and fed to the particle counter. The test is stopped at a final differential pressure of 450 Pa. Finally, the average efficiency for the entire duration of the test is calculated.
The classifying particle size is 0.4 µm.

Efficiency after electrostatic discharge

Certain synthetic filter media rely on electrostatic effects to achieve a high efficiency. Since electrostatic charges can be neutralised by some contaminants in the air, the efficiency of a filter is also determined after a complete discharge.
For this purpose, the IPA test method (isopropanol treatment) is described in detail in the EN 779:2012 standard. The process is such that representative samples from the filter to be tested are dipped in isopropanol, dried, and then the efficiency is measured with a particle size of 0.4 µm.

EN779:2012 AIR FILTER RESULTS

① GENERAL

Test no.: SP201103101	Date of test: 08/03/2011 - 11/03/2011	Supervisor: CM/TEr
Test requested by: TROX GmbH		Device receiving date
Device delivered by: TROX GmbH		07/03/2011

② DEVICE TESTED

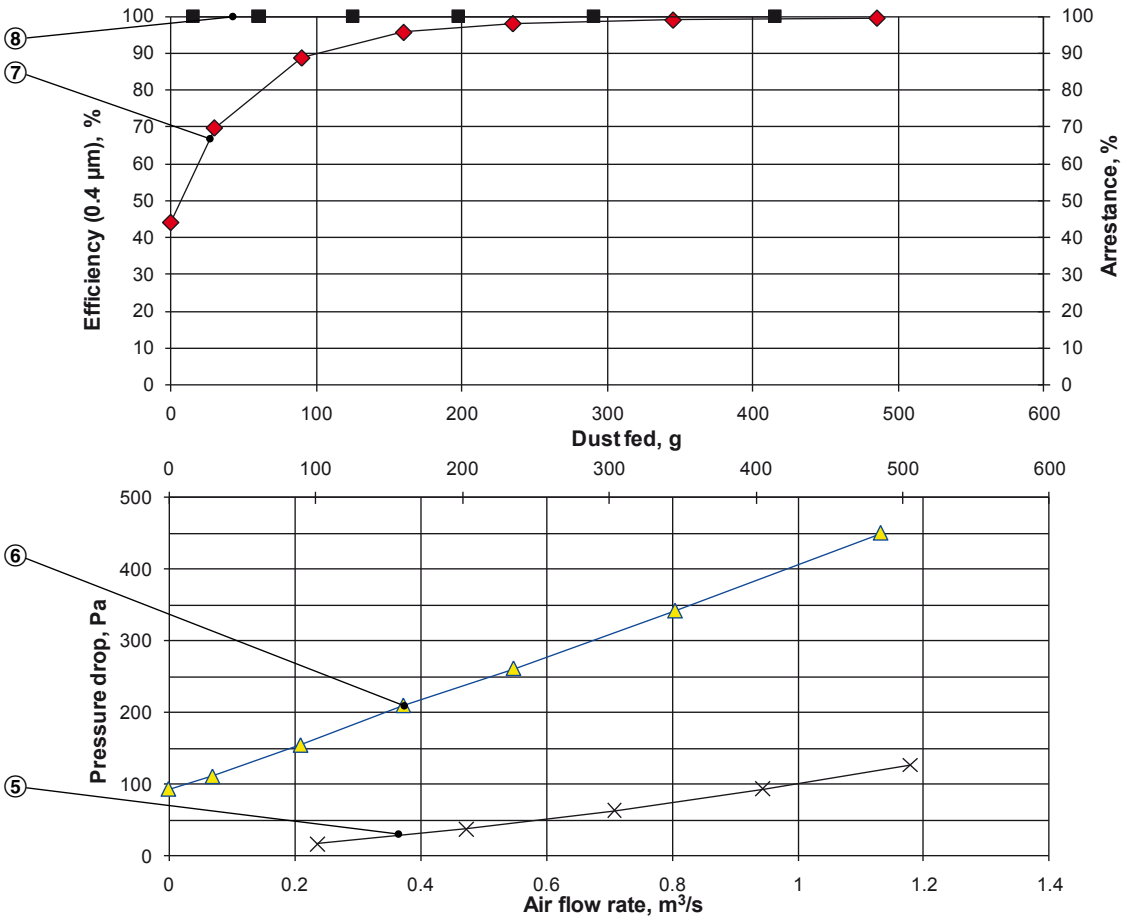
Model: PFN-F7-GAL-25	Manufacturer: TROX GmbH	Construction: Pocket filter, 8 pockets
Type of media: Synthetic	Net effective filtering area: 6.4 m²	Filter dimensions (width x height x depth): 592 mm x 592 mm x 600 mm

③ TEST DATA

Test air flow rate: 0.944 m^3/s	Test air temperature: 28 to 33 °C	Test air relative humidity: 11 to 18 %	Test aerosol: DEHS	Loading dust: ASHRAE 52/76

④ RESULTS

Initial pressure drop: 93 Pa	Initial arrestance: >99 %	Initial efficiency (0.4 µm): 44 %	Test dust capacity: 217 / 353 / 480 g	Untreated/ discharged efficiency of media (0.4 µm): 46.5 % / 39,8 %
Final test pressure drop: 250 / 350 / 450 Pa	Average arrestance: >99% / >99% / >99%	Average efficiency (0.4 µm): 85% / 90% / 93%	Filter class (450 Pa): F7	Remarks:
Note: The performance results are only valid for the tested item and cannot by themselves be quantitatively applied to predict efficiency and lifetime in service				



① General information
② Information on the tested filter
③ Test data
④ Test results
⑤ Differential pressure as a function of the volume flow rate (clean sample)
⑥ Differential pressure as a function of the dust fed at the test volume flow rate
⑦ Efficiency (0.4µm) as a function of the dust fed at the test volume flow rate
⑧ Filtration efficiency as a function of the dust fed at the test volume flow rate

Classification

The new EN 779:2012 standard now requires specific minimum efficiencies for filter classes F7 to F9.
No minimum efficiency is required for filter classes F5 and F6. To differentiate them from filter classes F7, F8 and F9, the new filter group M has been created. The filters continue to be classified based on the average efficiency.

Group	Filter class	Final differential pressure	Average arrestance (Am) of the synthetic test dust	Average efficiency (Em) for particles of 0.4 µm	Minimum efficiency for particles of 0.4 µm
		Pa	%		
Coarse	G1	250	50 ≤ Am < 65	–	–
Coarse	G2	250	65 ≤ Am < 80	–	–
Coarse	G3	250	80 ≤ Am < 90	–	–
Coarse	G4	250	90 ≤ Am	–	–
Medium	M5	450	–	40 ≤ Em < 60	–
Medium	M6	450	–	60 ≤ Em < 80	–
Fine	F7	450	–	80 ≤ Em < 90	35
Fine	F8	450	–	90 ≤ Em < 95	55
Fine	F9	450	–	95 ≤ Em	70

Eurovent certification

Objective and contents

The objective of the certification programme is the creation of shared databases with data on the technical properties of air filters that are tested by independent organisations. These independent organisations check whether the data given in a manufacturer's catalogue corresponds to the actual results of filter tests.
Once a sample product has been successfully tested by an independent organisation, the resulting certification applies to the defined product range and applications.
Certification is officially performed by the Eurovent Certification Company.
In addition to the certification number, the EUROVENT logo may be used.
Usually filters of classes M5 to F9 are tested. The tests are performed by independent, accredited testing institutes. For filters, these are VTT in Finland and SP in Sweden.

Quality management as a prerequisite for participation

Participation in the Eurovent certification programme is voluntary. Manufacturers who want to have their filter portfolio certified must have a quality management system such as ISO 9001.

Random selection of samples

Once a year, Eurovent selects one filter to be tested from four different product groups for each manufacturer. Product groups and the respective filters are selected at random.

The certificate

If all four filters have successfully passed the test, Eurovent provides the manufacturer with a certificate that is valid for one year. The certificate applies to all fine dust filters of the manufacturer (the 'certify all' principle). The tests are repeated every year.

EUROVENT CERTIFICATION

EUROVENT CERTIFICATION COMPANY SCRL
53 rue Turbigo 75003 Paris FRANCE - RCS Paris B 393 363 460 - Code APE : 748K

Accreditation #5-0527 Products and Services Certification according to EN 45011 :1998 - Scope available on www.cofrac.fr. COFRAC is signatory of EA MLA, list of EA members is available in http://www.european-accreditation.org/ea-members

Certification Diploma N° : 07.01.336

EUROVENT Certification Company certifies that

M5-F9 Air Filters

from

TROX GmbH

Located at

Heinrich-Trox-Platz, 47504 NEUKIRCHEN-VLUYN, Germany

Trade name

TROX

have been assessed according the requirements of following standard

OM-11-2013

The list of certified products is displayed at :

http://www.eurovent-certification.com

TROX GmbH

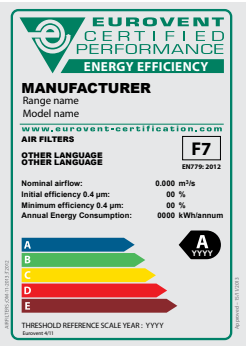
is authorised to use the EUROVENT Certification mark in accordance with the rules specified in the Operational Manual

OM-11-2013

Erick MELQUIOND
Managing Director

Approval date : 2007/01/31
Re-checked on : 2013/03/13
Valid until : 2014/05/31

Energy efficiency according to Eurovent document 4/11



The energy label makes the decision easy

The energy consumption of ventilation systems is decisive for the economic efficiency of the entire building. Filters have a great influence on the energy consumption of ventilation systems since they generate differential pressures that have to be compensated by an increase in the energy supply. Up to 80% of the costs for air filtration are energy costs. This is why every facilities manager would like to know about the energy efficiency of filters.
Eurovent document 4/11 describes a uniform method to evaluate the energy efficiency of filter classes G4, M5, M6, and F7 to F9.

Practical calculation of the average differential pressure

The average differential pressure is calculated according to EN 779 as a function of the dust feed at the test volume flow rate.
Based on the measuring results, the average differential pressure is calculated using the following formula: fit fourth degree polynomial.
In the process, filter group G filters are fed with 350 g of ASHRAE dust, group M filters with 250 g, and group F filters with 100 g. This corresponds to the average dust load of the filter in one year of operation.

What do the energy classes mean?

There are seven energy classes (A to G). Class A filters are particularly energy-efficient. Class G filters, on the other hand, have a comparatively high energy consumption.

Which filters may carry the energy label?

The Eurovent energy label applies to filters of classes G4 to F9 which are tested to the EN 779:2012 standard. It can only be used by manufacturers whose filters are certified by Eurovent.

Environmental protection and economic efficiency

The energy classification according to Eurovent is a reliable method for realistically estimating the energy consumption of filters in all kinds of systems. It is recognised by all important European manufacturers and represents an important contribution to the reduction of energy consumption and CO2 emissions.

10

Calculation of the average differential pressure

$$\overline{\Delta p} = \frac{1}{M}\int_0^M \Delta p(m) \times d(m) = \frac{1}{5}a \times M^4 + \frac{1}{4}b \times M^3 + \frac{1}{3}c \times M^2 + \frac{1}{2}d \times M + \Delta p_i$$

Calculation of the energy consumption for a filter

$$W = \frac{q_v \times \overline{\Delta p} \times t}{\eta \times 1000}$$

W: Energy consumption
q_v: Volume flow rate
Δp: Average differential pressure
t: Operating time
η: Fan efficiency
Given data
$q_v = 0.944\ m^3/s$
t = 6000 h
η = 0.50

Eurovent limits for the energy classification of filters

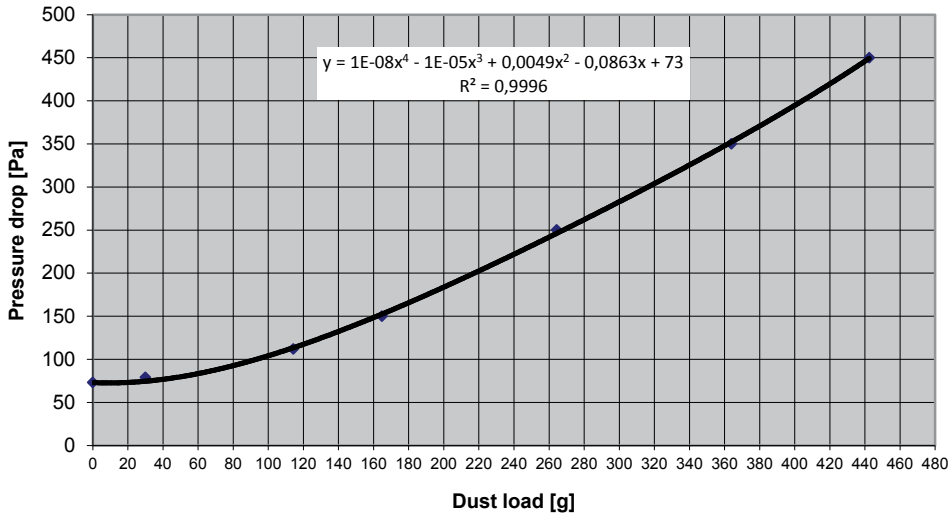
Filter class	G4	M5	M6	F7	F8	F9
MTE	–			MTE ≥ 35 %	MTE ≥ 55 %	MTE ≥ 70 %
	M_G = 350 g ASHRAE	M_M = 250 g ASHRAE		M_F = 100 g ASHRAE		
	kWh					
A	0 – 600	0 – 650	0 – 800	0 – 1200	0 – 1600	0 – 2000
B	>600 – 700	>650 – 780	>800 – 950	>1200 – 1450	>1600 – 1950	>2000 – 2500
C	>700 – 800	>780 – 910	>950 – 1100	>1,450 – 1700	>1950 – 2300	>2500 – 3000
D	>800 – 900	>910 – 1040	>1100 – 1250	>1700 – 1950	>2300 – 2650	>3000 – 3500
E	>900 – 1000	>1040 – 1170	>1250 – 1400	>1950 – 2200	>2650 – 3000	>3500 – 4000
F	>1000 – 1100	>1170 – 1300	>1400 – 1550	>2200 – 2450	>3000 – 3350	>4000 – 4500
G	>1100	>1300	>1550	>2450	>3350	>4500

MTE: Minimum test efficiency

Calculation of the average differential pressure

$$\overline{\Delta p} = \frac{1}{M}\int_0^M \Delta p(m) \times d(m) = \frac{1}{5}a \times M^4 + \frac{1}{4}b \times M^3 + \frac{1}{3}c \times M^2 + \frac{1}{2}d \times M + \Delta p_i$$

Example: Calculation of average differential pressure and energy consumption



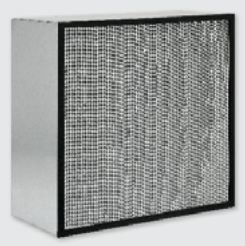
a ___1.00E-08
b ___ -1.00E-05
c ___ 4.90E-03
d ___ -0.0863
Δp_i ___ 73
M ___ 100
Δp ___ 83 Pa

q_v ___ 0.944 m^3/s
t ___ 6000 h
η ___ 0.5
W ___ 973 kWh

Energy class ___ A

Mini Pleat filter panels for clean room technology, type MFPCR

Mini Pleat filter cells, type MFC



Deep Pleat particulate filter cells, type DFH

EN 1822 – test method

The EN 1822 standard applies to tests for the filtration performance of efficient particulate air filters (EPA), high-efficiency particulate air filters (HEPA) and ultra low penetration air filters (ULPA) in the manufacturer's production facility.
The European EN 1822 standard was first published in 1998 and last revised in 2011. The standard consists of five parts.
It defines a method for testing the efficiency by counting particles using a liquid or solid test aerosol. The test aims at determining the particle size at which the filter shows its minimum filtration efficiency.
This particle size is called the 'most penetrating particle size, or MPPS'. As a rule, particulate filters with glass fibre papers can separate particles as small as 0.1 to 0.25 µm.

Part 1 – Classification, performance test, and labelling

Part 1 of the standard deals with the classification, performance testing, and labelling of particulate filters. On the basis of the values for local efficiency and overall efficiency, the filter is assigned to a filter class according to the table below.

Filter class	Overall		Local	
	Efficiency	Penetration	Local efficiency	Local penetration
	%			
E10	≥ 85	≤ 15	–	–
E11	≥ 95	≤ 5	–	–
E12	≥ 99.5	≤ 0.5	–	–
H13	≥ 99.95	≤ 0.05	≥ 99.75	≤ 0.25
H14	≥ 99.995	≤ 0.005	≥ 99.975	≤ 0.025
U15	≥ 99.9995	≤ 0.0005	≥ 99.9975	≤ 0.0025
U16	≥ 99.99995	≤ 0.00005	≥ 99.99975	≤ 0.00025
U17	≥ 99.999995	≤ 0.000005	≥ 99.9999	≤ 0.0001

Part 2 – Measuring devices and aerosol generators

Part 2 of the standard describes the measuring devices and aerosol generators used for the test. It also explains the statistical basis for particle counting in cases where the testing equipment registers only very few counts.

Part 3 – Determination of fractional efficiency and MPPS

Part 3 of the standard describes how the fractional efficiency and the MPPS are determined.
The flat sheet filter medium is fixed in a frame and subjected to the test air flow. The test air flow contains a test aerosol. Upstream and downstream of the filter, partial air flows are sampled in order to determine the concentration of particles of various sizes. The results of the measurement are shown as a fractional efficiency curve. The particle size with the highest penetration is known as MPPS.


Test rig EN 1822-4

Part 4 – Leakage test, determination of local efficiency and overall efficiency

Part 4 of the standard is dedicated to the leakage testing of filter elements using a scan test.
With a test aerosol whose average particle size equals the MPPS, the filter element is checked for leakage. The overall efficiency is calculated from the measured local filtration efficiencies.
The leakage test serves to test the filter element for local penetration values that exceed the permissible levels.
For the leakage test, the test filter is fixed in a mounting assembly and subjected to a test air flow that is equal to the nominal volume flow rate.
After the measurement of the differential pressure at the nominal volume flow rate, the filter is purged and the test aerosol produced by the aerosol generator is mixed with the prepared test air along a mixing duct such that it is spread homogeneously over the cross-section of the duct.
The particle flow rate on the downstream side of the tested filter is smaller than the particle flow rate on the upstream side by the factor mean penetration.
Downstream of the filter, the manufacturing irregularities of the filter material or leaks in the filter material lead to a variation of the particle flow rate over the filter cross section. In addition, leaks at the edges of the filter or within the components of the test filter (sealant, filter frame, seal of the filter mounting assembly) may lead locally to an increase in the particle flow rate on the downstream side of the test filter.
During the leakage test, the particle flow distribution on the downstream side of the filter is determined to check if and where the limit values are exceeded. For this purpose a measuring probe is connected to the downstream particle counters.
When the filter is leak-free and fulfils the criteria of the overall efficiency, a test report is created. The test report contains the test number, the target data for the filter, and the actual data of the sample. The leak-free state of the filter is confirmed, and the filter is assigned a number .

Test rig EN 1822-4

Repair of leakage points

If the specified signal value is not exceeded during the probe run, the filter is free of leaks. If the signal value is exceeded, then this is an indication that the limit value for locally permissible penetration has been exceeded at this position. Should it be necessary to check the local penetration, then the probe is returned to the coordinates at which the signal values were reached in the scan test. The aim is to find the point with the maximum count rate.
At that point the count rate is measured with a stationary probe. At the same time the concentration of the aerosol on the upstream side is also measured continuously or intermittently.
The filter may be repaired when the following parameters apply. The filter shall be retested after repair.
» All repairs in total (including those made by the filter manufacturer) must neither block nor restrict more than 0.5 % of the filter face area (not including the frame).
» The maximum length of each repair point must not exceed 3.0 cm.

Part 5 Efficiency test of the filter element

The last part of the standard deals with the efficiency test of filter elements that could not be tested according to Part 4 due to their design.
The downstream sampling to determine the overall efficiency takes place using stationary sampling probes.

Sizing example

Mini Pleat filter panels for clean room technology, type MFPCR

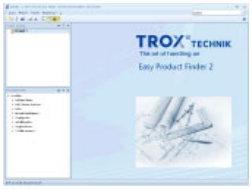
Sizing data

- Filter class _____ H14
- Volume flow rate _____ 1205 [m³/h]
- Initial differential pressure _____ 85 [Pa]
- Nominal size _____ 1220 x 610 [mm]
- Pleat depth _____ 70 [mm]

Construction

- ALG: Frame made of extruded aluminium profile (depth 90 mm)

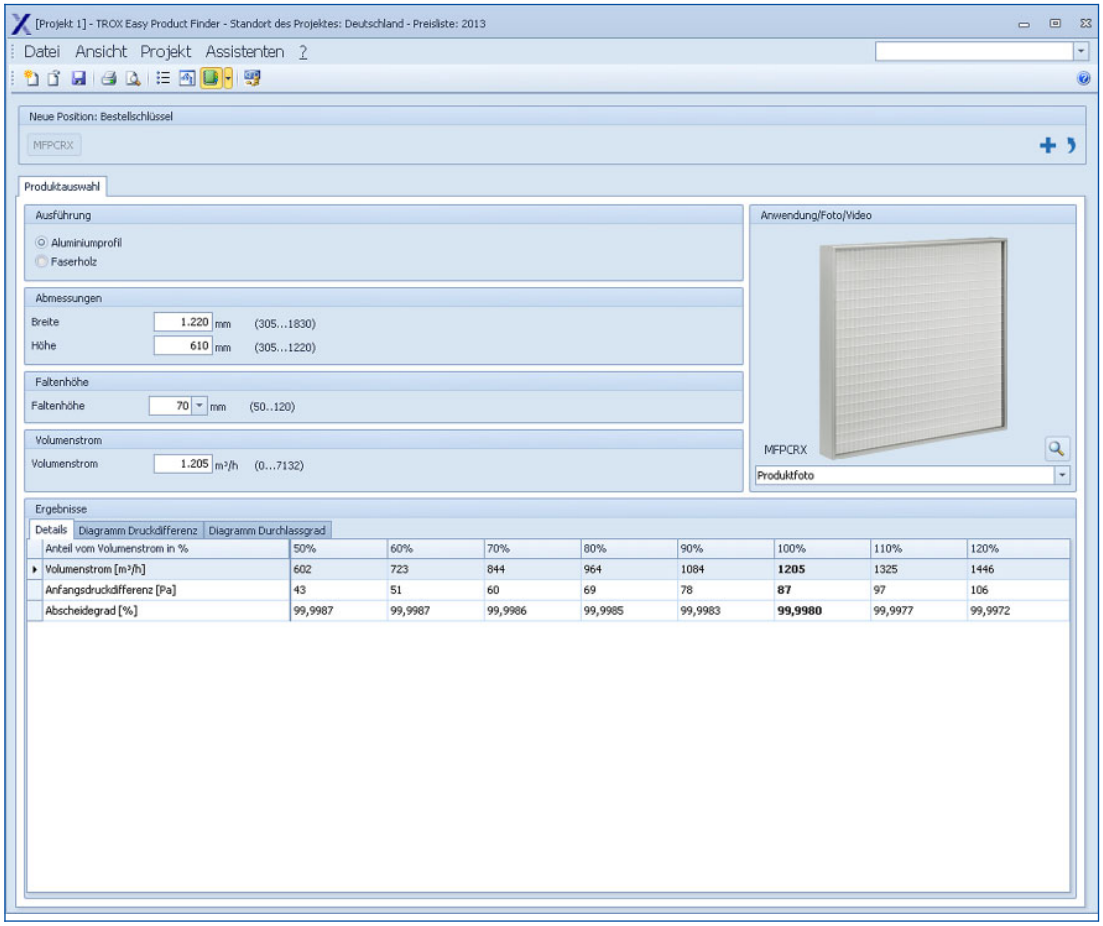
Easy Product Finder



The Easy Product Finder allows you to size products using your project-specific data.

You will find the Easy Product Finder on our website.

MFPCR_EasyProductFinder



Sizing results

- Initial differential pressure: _____ 87 [Pa]
- Overall efficiency: _____ 99.9980 [%]

- Requirement for filter class H14:
- Overall efficiency: _____ >99.995 [%]

Sizing example

Ceiling mounted particulate filters, type TFC

Sizing data

- Variant _____ SC
- Material _____ Casing SPC
- Air terminal device _____ VDW
- Nominal size _____ 600 × 24
- Spigot diameter _____ 248 mm
- Casing height _____ 344 mm
- Damper blade _____ M
- Fixing points _____ 2
- Suspension/measurement points _____ S
- Flange width _____ 15 mm
- Volume flow rate _____ 600 m^3/h
- Required sound power level _____ 40 dB(A)

Selection of Mini Pleat filter panel

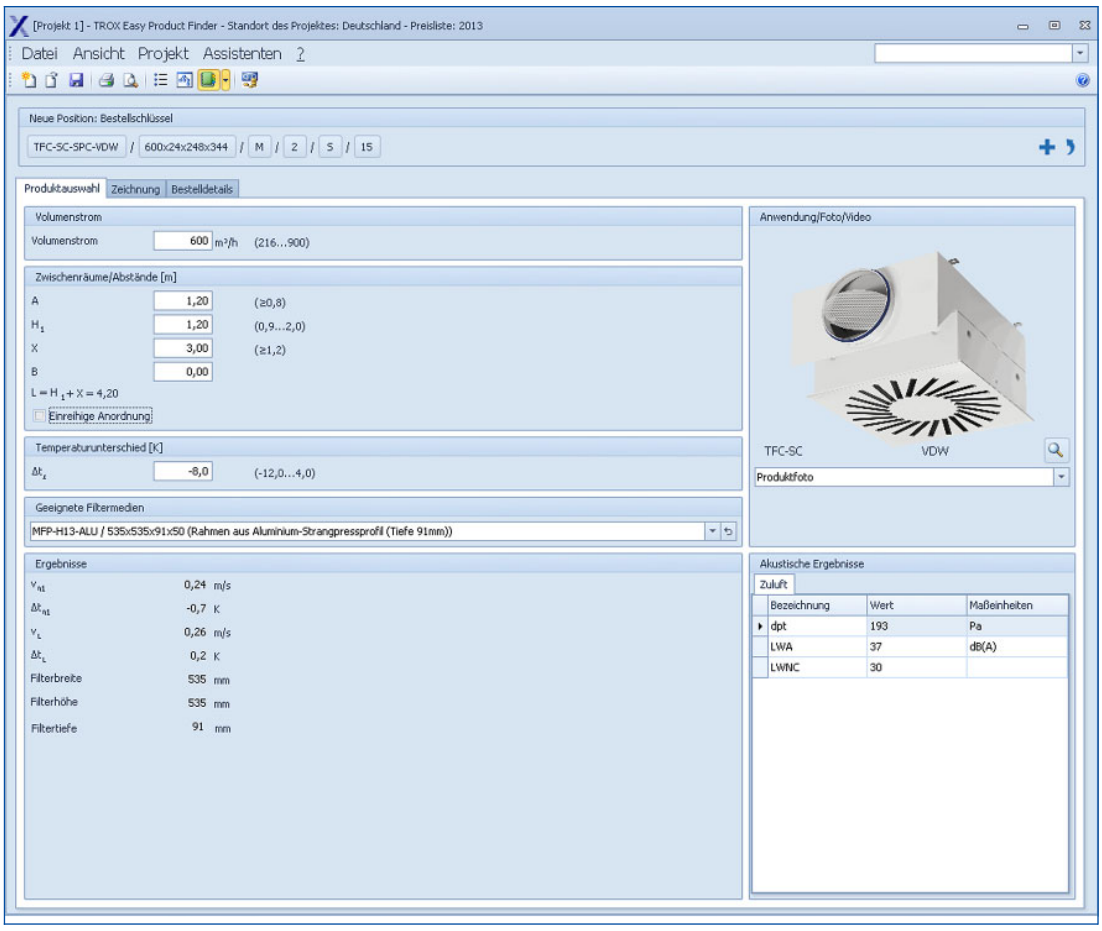
- MFP-H13-ALU/535×535×91×50

Easy Product Finder

The Easy Product Finder allows you to size products using your project-specific data.

You will find the Easy Product Finder on our website.

TFC_EasyProductFinder



Sizing results

- Total differential pressure: _____ 193 [Pa]
- Sound power level: _____ 37 [db(A)]

New product names for filter units

①	②	③	④	
F210	SCF	C	Filter frames for wall installation	Standard cell frames
F220	SCF	B	Filter frames for wall installation	Standard cell frames
F240	SCF	B	Filter frames for wall installation	Standard cell frames
F242	SCF	A	Filter frames for wall installation	Standard cell frames
F250	MF	-	Filter frames for wall installation	Mounting frames
F270	MP	-	Filter frames for wall installation	Mounting plate
F340	UCA	1SPF	Filter casings for duct installation	Universal casings
F341	UCA	1SAF	Filter casings for duct installation	Universal casings
F344	UCA	2SPF	Filter casings for duct installation	Universal casings
F345	UCA	2SAF	Filter casings for duct installation	Universal casings
F353	KSF	-	Filter casings for duct installation	Ducted particulate filters
F360	KSFS	M	Filter casings for duct installation	Ducted particulate filters for critical requirements
F370	KSFS	PM	Filter casings for duct installation	Ducted particulate filters for critical requirements
F352	KSF	-	Filter casings for duct installation	Ducted particulate filters
F383	DCA	-	Filter casings for duct installation	Duct casings for particulate filters
F620	TFP	TC	Particulate filter air terminal devices	Pharmaceutical clean room terminal filters
F622	TFP	SC	Particulate filter air terminal devices	Pharmaceutical clean room terminal filters
F624	TFP	SCR	Particulate filter air terminal devices	Pharmaceutical clean room terminal filters
F631	TFM	-	Particulate filter air terminal devices	Particulate filter modules for ceilings
F640	TFC	SC	Particulate filter air terminal devices	Ceiling mounted particulate filters
F650	TFC	SR	Particulate filter air terminal devices	Ceiling mounted particulate filters
F654	TFC	SC00H	Particulate filter air terminal devices	Ceiling mounted particulate filters
F655	TFC	SCTN0	Particulate filter air terminal devices	Ceiling mounted particulate filters
F656	TFC	SCBR0	Particulate filter air terminal devices	Ceiling mounted particulate filters
F659	TFC	SCVFL	Particulate filter air terminal devices	Ceiling mounted particulate filters
F660	TFC	TC	Particulate filter air terminal devices	Ceiling mounted particulate filters
F670	TFW	-	Particulate filter air terminal devices	Wall mounted particulate filter
M536AB3	MD	DPC/230	Measuring devices	Pressure measuring devices
M536AB4	MD	DPC/24	Measuring devices	Pressure measuring devices
M536AC4	MD	APC	Measuring devices	Pressure measuring devices
M536AD4	MD	UT	Measuring devices	Pressure measuring devices
New type	SIF	B	Filter frames for wall installation	Filter wall
	KSFSSP	-	Filter casings for duct installation	Spigots
New variant	TFC	SRKSR	Particulate filter air terminal devices	Ceiling mounted particulate filters

① Previous name ② New name ③ Variant ④ Product

New product names for filter elements

①	②	③	④	⑤	
F702A…	**FMC**	**G02-CAS**	G3	Automatic roll filter media	Filter media
F702B…	**FMR**	**G02**	G3	Roll media	Filter media
F702B…	**FMP**	**G02-ROL**	G3	Cut-to-size pads	Filter media
F702C…	**FMC**	**G02-RFMS/RFMA**	G3	Automatic roll filter media	Filter media
F702D…	**FMP**	**G02-PAD**	G3	Cut-to-size pads	Filter media
F702N…	**FMC**	**G02-CASN**	G3	Automatic roll filter media	Filter media
F703B…	**FMP**	**C03-ROL**	G3	Cut-to-size pads	Filter media
F703B…	**FMR**	**C03**	G3	Roll media	Filter media
F703D…	**FMP**	**C03-PAD**	G3	Cut-to-size pads	Filter media
F704B…	**FMR**	**C04**	G3	Roll media	Filter media
F704B…	**FMP**	**C04-ROL**	G3	Cut-to-size pads	Filter media
F704D…	**FMP**	**C04-PAD**	G3	Cut-to-size pads	Filter media
F706B…	**FMR**	**C06**	M5	Roll media	Filter media
F706B…	**FMP**	**C06-ROL**	M5	Cut-to-size pads	Filter media
F706D…	**FMP**	**C06-PAD**	M5	Cut-to-size pads	Filter media
F711B…	**FMR**	**C11**	G4	Roll media	Filter media
F711B…	**FMP**	**C11-ROL**	G4	Cut-to-size pads	Filter media
F711D…	**FMP**	**C11-PAD**	G4	Cut-to-size pads	Filter media
F715B…	**FMR**	**C15**	G4	Roll media	Filter media
F715B…	**FMP**	**C15-ROL**	G4	Cut-to-size pads	Filter media
F715D…	**FMP**	**C15-PAD**	G4	Cut-to-size pads	Filter media
F718E…	**ZL**	**NWO**	G4	Z-Line filters	Filter media
F718K…	**ZL**	**PLA**	G4	Z-Line filters	Filter media
F719E…	**ZL**	**NWO**	M5	Z-Line filters	Filter media
F719K…	**ZL**	**PLA**	M5	Z-Line filters	Filter media
F721A…	**FMC**	**C21-CAS**	G3	Automatic roll filter media	Filter media
F721C…	**FMC**	**C21-RFMA/RFMD**	G3	Automatic roll filter media	Filter media
F725…	**PFS**	**PLA, GAL**	M5	Pocket filters made of non-woven synthetic fibres	Pocket filter
F726…	**PFS**	**PLA, GAL**	M6	Pocket filters made of non-woven synthetic fibres	Pocket filter
F728…	**PFS**	**PLA, GAL**	F7	Pocket filters made of non-woven synthetic fibres	Pocket filter
F736G…	**DFF**	**GALSF/SMG/HMG**	M6	Compact fine dust filters	Deep Pleat filters
F736M…	**DFF**	**GALSF**	M6	Compact fine dust filters	Deep Pleat filters
F736W…	**DFF**	**MDF**	M6	Compact fine dust filters	Deep Pleat filters
F736X…	**DFF**	**GALDF/SMG/HMG**	M6	Compact fine dust filters	Deep Pleat filters
F736Y…	**DFF**	**GAL**	M6	Compact fine dust filters	Deep Pleat filters
F737M…	**DFF**	**GALSF**	F7	Compact fine dust filters	Deep Pleat filters
F737W…	**DFF**	**MDF**	F7	Compact fine dust filters	Deep Pleat filters
F737Y…	**DFF**	**GAL**	F7	Compact fine dust filters	Deep Pleat filters
F739G…	**DFF**	**GALSF/SMG/HMG**	F9	Compact fine dust filters	Deep Pleat filters
F739M…	**DFF**	**GALSF**	F9	Compact fine dust filters	Deep Pleat filters
F739W…	**DFF**	**MDF**	F9	Compact fine dust filters	Deep Pleat filters
F739X…	**DFF**	**GALDF/SMG/HMG**	F9	Compact fine dust filters	Deep Pleat filters
F739Y…	**DFF**	**GAL**	F9	Compact fine dust filters	Deep Pleat filters

① Previous name ② New name ③ Construction ④ Filter class ⑤ Product

New product names for filter elements

①	②	③	④	⑤	
F743…	**PFC**	**PLA, GAL**	G4	Pocket filters made of non-woven chemical fibres	Pocket filter
F744…	**PFG**	**PLA, GAL**	M5	Pocket filters made of non-woven glass fibres	Pocket filter
F746…	**PFG**	**PLA, GAL**	M6	Pocket filters made of non-woven glass fibres	Pocket filter
F748…	**PFG**	**PLA, GAL**	F7	Pocket filters made of non-woven glass fibres	Pocket filter
F749…	**PFG**	**PLA, GAL**	F9	Pocket filters made of non-woven glass fibres	Pocket filter
F755F…	**MFI**	**PLA**	M5	Filter inserts	Mini Pleat filters
F755K…	**MFP**	**PLA**	M5	Filter panels	Mini Pleat filters
F755M…	**MFI**	**SPC**	M5	Filter inserts	Mini Pleat filters
F755S…	**MFI**	**SPC**	M5	Filter inserts	Mini Pleat filters
F756E…	**MFC**	**STA**	M6	Filter cells	Mini Pleat filters
F756E…	**MFP**	**STA**	M6	Filter panels	Mini Pleat filters
F756F…	**MFI**	**PLA**	M6	Filter inserts	Mini Pleat filters
F756K…	**MFP**	**PLA**	M6	Filter panels	Mini Pleat filters
F756M…	**MFI**	**SPC**	M6	Filter inserts	Mini Pleat filters
F756M…	**MFC**	**GAL**	M6	Filter cells	Mini Pleat filters
F756M…	**MFP**	**GAL**	M6	Filter panels	Mini Pleat filters
F756S…	**MFI**	**SPC**	M6	Filter inserts	Mini Pleat filters
F756W…	**MFC**	**MDF**	M6	Filter cells	Mini Pleat filters
F756W…	**MFP**	**MDF/MDFF**	M6	Filter panels	Mini Pleat filters
F757E…	**MFC**	**STA**	F7	Filter cells	Mini Pleat filters
F757E…	**MFP**	**STA**	F7	Filter panels	Mini Pleat filters
F757F…	**MFI**	**PLA**	F7	Filter inserts	Mini Pleat filters
F757K…	**MFP**	**PLA**	F7	Filter panels	Mini Pleat filters
F757M…	**MFI**	**SPC**	F7	Filter inserts	Mini Pleat filters
F757M…	**MFC**	**GAL**	F7	Filter cells	Mini Pleat filters
F757M…	**MFP**	**GAL**	F7	Filter panels	Mini Pleat filters
F757S…	**MFI**	**SPC**	F7	Filter inserts	Mini Pleat filters
F757W…	**MFC**	**MDF**	F7	Filter cells	Mini Pleat filters
F757W…	**MFP**	**MDF/MDFF**	F7	Filter panels	Mini Pleat filters
F759A…	**MFE**	**AL**	F9	Filter elements	Mini Pleat filters
F759E…	**MFC**	**STA**	F9	Filter cells	Mini Pleat filters
F759E…	**MFP**	**STA**	F9	Filter panels	Mini Pleat filters
F759F…	**MFI**	**PLA**	F9	Filter inserts	Mini Pleat filters
F759K…	**MFP**	**PLA**	F9	Filter panels	Mini Pleat filters
F759M…	**MFI**	**SPC**	F9	Filter inserts	Mini Pleat filters
F759M…	**MFE**	**GAL**	F9	Filter elements	Mini Pleat filters
F759M…	**MFC**	**GAL**	F9	Filter cells	Mini Pleat filters
F759M…	**MFP**	**GAL**	F9	Filter panels	Mini Pleat filters
F759S…	**MFI**	**SPC**	F9	Filter inserts	Mini Pleat filters
F759W…	**MFC**	**MDF**	F9	Filter cells	Mini Pleat filters
F759W…	**MFP**	**MDF/MDFF**	F9	Filter panels	Mini Pleat filters
F760E…	**ACFC**	**STA**		Filter cartridges	Activated carbon filters
F760F…	**ACFI**	**PLA**	-	Filter inserts	Activated carbon filters
F760J…	**ACF**			Filter cells	Activated carbon filters
F760K…	**ACFC**	**PLA**		Filter cartridges	Activated carbon filters
F760M…	**ACFC**	**GAL**		Filter cartridges	Activated carbon filters
F766…	**PFN**	**PLA, GAL**	M6	Pocket filters made of NanoWave® medium	Pocket filter
F768…	**PFN**	**PLA, GAL**	F7	Pocket filters made of NanoWave® medium	Pocket filter
F769…	**PFN**	**PLA, GAL**	F9	Pocket filters made of NanoWave® medium	Pocket filter

① Previous name ② New name ③ Construction ④ Filter class ⑤ Product

New product names for filter elements

①	②	③	④	⑤	
F770E...	**DFH**	**STA**	E11	Particulate filter cells	Deep Pleat filters
F770M...	**DFH**	**GAL**	E11	Particulate filter cells	Deep Pleat filters
F770W...	**DFH**	**MDF**	E11	Particulate filter cells	Deep Pleat filters
F771E...	**DFH**	**STA**	H13	Particulate filter cells	Deep Pleat filters
F771M...	**DFH**	**GAL**	H13	Particulate filter cells	Deep Pleat filters
F771W...	**DFH**	**MDF**	H13	Particulate filter cells	Deep Pleat filters
F779S...	**MFI**	**SPC**	E10	Filter inserts	Mini Pleat filters
F780A...	**MFE**	**AL**	E11	Filter elements	Mini Pleat filters
F780AR...	**MFCA**	**AL**	E11	Filter cartridges	Mini Pleat filters
F780E...	**MFC**	**STA**	E11	Filter cells	Mini Pleat filters
F780E...	**MFP**	**STA**	E11	Filter panels	Mini Pleat filters
F780M...	**MFE**	**GAL**	E11	Filter elements	Mini Pleat filters
F780M...	**MFC**	**GAL**	E11	Filter cells	Mini Pleat filters
F780M...	**MFP**	**GAL**	E11	Filter panels	Mini Pleat filters
F780N...	**MFP**	**ALN**	E11	Filter panels	Mini Pleat filters
F780S..	**MFI**	**SPC**	E11	Filter inserts	Mini Pleat filters
F780V...	**MFP**	**ALV**	E11	Filter panels	Mini Pleat filters
F780W...	**MFC**	**MDF**	E11	Filter cells	Mini Pleat filters
F780W...	**MFP**	**MDF**	E11	Filter panels	Mini Pleat filters
F780Y...	**MFP**	**ALY**	E11	Filter panels	Mini Pleat filters
F780Z...	**MFP**	**ALZ**	E11	Filter panels	Mini Pleat filters
F781A...	**MFE**	**AL**	H13	Filter elements	Mini Pleat filters
F781AR...	**MFCA**	**AL**	H13	Filter cartridges	Mini Pleat filters
F781E...	**MFP**	**STA**	H13	Filter panels	Mini Pleat filters
F781E...	**MFC**	**STA**	H13	Filter cells	Mini Pleat filters
F781M...	**MFE**	**GAL**	H13	Filter elements	Mini Pleat filters
F781M...	**MFC**	**GAL**	H13	Filter cells	Mini Pleat filters
F781M...	**MFP**	**GAL**	H13	Filter panels	Mini Pleat filters
F781N...	**MFP**	**ALN**	H13	Filter panels	Mini Pleat filters
F781S...	**MFI**	**SPC**	H13	Filter inserts	Mini Pleat filters
F781U...	**MFP**	**ALU**	H13	Filter panels	Mini Pleat filters
F781V...	**MFP**	**ALV**	H13	Filter panels	Mini Pleat filters
F781W...	**MFC**	**MDF**	H13	Filter cells	Mini Pleat filters
F781W...	**MFP**	**MDF**	H13	Filter panels	Mini Pleat filters
F781Y...	**MFP**	**ALY**	H13	Filter panels	Mini Pleat filters
F781Z...	**MFP**	**ALZ**	H13	Filter panels	Mini Pleat filters
F782B...	**MFPCR**	**ALB**	H14	Filter panels for clean room technology	Mini Pleat filters
F782C...	**MFPCR**	**ALC**	H14	Filter panels for clean room technology	Mini Pleat filters
F782E...	**MFC**	**STA**	H14	Filter cells	Mini Pleat filters
F782E...	**MFP**	**STA**	H14	Filter panels	Mini Pleat filters
F782G...	**MFPCR**	**ALG**	H14	Filter panels for clean room technology	Mini Pleat filters
F782M...	**MFC**	**GAL**	H14	Filter cells	Mini Pleat filters
F782M...	**MFP**	**GAL**	H14	Filter panels	Mini Pleat filters
F782S...	**MFI**	**SPC**	H14	Filter inserts	Mini Pleat filters
F782U...	**MFP**	**ALU**	H14	Filter panels	Mini Pleat filters
F782V...	**MFP**	**ALV**	H14	Filter panels	Mini Pleat filters
F782W...	**MFC**	**MDF**	H14	Filter cells	Mini Pleat filters
F782W...	**MFP**	**MDF**	H14	Filter panels	Mini Pleat filters
F782Y...	**MFP**	**ALY**	H14	Filter panels	Mini Pleat filters
F782Z...	**MFP**	**ALZ**	H14	Filter panels	Mini Pleat filters

① Previous name ② New name ③ Construction ④ Filter class ⑤ Product

New product names for filter elements

①	②	③	④	⑤	
F783B…	**MFPCR**	**ALB**	U15	Filter panels for clean room technology	Mini Pleat filters
F783C…	**MFPCR**	**ALC**	U15	Filter panels for clean room technology	Mini Pleat filters
F783G…	**MFPCR**	**ALG**	U15	Filter panels for clean room technology	Mini Pleat filters
F784C…	**MFPCR**	**ALC**	U16	Filter panels for clean room technology	Mini Pleat filters
F784G…	**MFPCR**	**ALG**	U16	Filter panels for clean room technology	Mini Pleat filters
New variant	**MFP**	**ALZ**	M6	Filter panels	Mini Pleat filters
New variant	**MFP**	**ALZ**	F7	Filter panels	Mini Pleat filters
New variant	**MFP**	**ALZ**	F9	Filter panels	Mini Pleat filters
New type	**FHD**	**D, R, V**	E11	Filter panels with hood	Mini Pleat filters
New type	**FHD**	**D, R, V**	H13	Filter panels with hood	Mini Pleat filters
New type	**FHD**	**D, R, V**	H14	Filter panels with hood	Mini Pleat filters
New type	**FHD**	**D, R, V**	U15	Filter panels with hood	Mini Pleat filters
New variant	**ACFI**	**PLA**	PF	Filter inserts	Activated carbon filters

① Previous name ② New name ③ Construction ④ Filter class ⑤ Product