Product Range

Diesel Particulate Filters

Modular SMF® and SMF®-AR Systems

Mobile Machinery

Stationary Applications

John Ratcliffe

HJS Emission Technology

Content

Clean Solution with Diesel Particulate Filters

1. Challenge: Clean Diesel Emissions for Mobile Machinery and Stationary Applications

Reducing diesel pollutant emissions

Diesel engines are powerful, long-lasting and offer low fuel consumption. These are precisely the reasons why they are to be found on small and large-scale construction sites, usually in continuous service. However, when diesel is combusted in a diesel engine, the process gives rise to pollutants such as soot particles. The smaller these soot particles are, the easier it is for them to pass through our lungs and on into our bloodstream and other vital organs. Soot particles from diesel engines, then, are known to represent a significant health hazard.

For this reason, numerous measures for reducing pollutant emissions are gradually coming into force at European and national levels. These measures include, for example, EU Directive 2008/50/EC on ambient air quality, which came into force at the beginning of 2005. The declared objective of this directive, its derivative directives and the implementations in national law by the member states (in Germany, the Federal Pollution Control Act, 'Bundesimmissionsschutzgesetz' or BImSchG for short) is to maintain ambient-air quality where it is good and improve it in other cases, and precisely this principle is applied with particular vigour in the case of Europe's major cities and conurbations.

• Low emission zones in Germany

Appreciable reduction in air pollution

The regulations oblige city and local authorities to take action against the increasing pollution levels in inner-city areas. Among the measures already taken is the setting-up of low emission zones in Germany and other European countries and the so-called "filter obligation" for construction machinery in Switzerland.

	Average over	PM_{10} limit (Particulate Matter)
since 01.01.2005	**24 h**	**50 µg/m³** No more than **35** violations p. a. permissible/year
	1 year	**40 µg/m³**

• EU Directive 2008/50/EC

Germany

Currently, the driving restrictions in force in low emission zones apply only to passenger cars, light- and heavy-duty trucks and buses. Depending on stipulations for each given LEZ, vehicles must have a red, yellow or green sticker affixed to the inside of their windscreen before they can access the zone.

In 2012, the World Health Organization (WHO) reclassified diesel exhausts as carcinogenic and reassigned them to the same class of hazardous materials as asbestos, arsenic and mustard gas.

Furthermore, some medical studies have identified that construction workers who work in the vicinity of diesel-engined machinery suffer from higher rates of cancer. To protect construction workers, Germany's BG BAU employers' liability insurance association for the construction industry and IG BAU union are demanding the use of "cleaner" construction machinery and consequently the retrofitting of filters to existing older machines as well. As a result, we can soon expect to see invitations to tender for public-sector civil engineering projects insist upon the use of filters in all machinery used on site. Deutsche Bahn (German Rail) is also going down this route, demanding a commitment on the part of engineering companies to use cleaner machinery before it considers awarding them a contract.

Over and above the EU directives that apply, other laws apply in Germany, such as **TRGS 554 (Technical Rules on Hazard Substances – Diesel Engine Emissions)**. This protection regulation covers activities in work areas that can be subject to diesel engines emitting exhaust gases into the ambient air. This includes, for instance, workshops, production shops, construction works below ground, tunnels and truck cargo spaces that are at least partially enclosed. The TRGS rules make the use of diesel particulate filters mandatory, with filtration efficiency rates of at least 90%.

Switzerland

Switzerland is benchmark when it comes to combatting diesel soot, a primary contributor to airborne particulate matter: particulate filters have been compulsory in construction machinery for a long time now. Since as long ago as 1983, numerous laws have been passed with respect to reducing emissions levels. Within the scope of the "VERT" project (Verminderung der Emissionen von Real-Dieselmotoren im Tunnelbau, or in English, "Reduction of Diesel Emissions in Tunnelling"), a quality test was defined specifically for diesel particulate filters. This test method has since become the internationally recognised standard for testing pollutant-reducing systems. Filters that meet the technically demanding criteria are listed by the Swiss Federal Office for the Environment (FOEN, or BAFU from the German).

Particulate Filter		Conformity Certification			
Manufacturer	Filter Family/Type Classification	Assessment Dept.	Certification No.	Date of Certification	Valid Until
HJS	SMF®-AR	BAFU	B195/12.06	11.2014	30. 6.2016*
HJS	SMF®-CRT	BAFU	B159/03.05	11.2014	31.12.2015
HJS	SMF®-FBC	BAFU	B195/12.06	11.2014	30. 6.2016*

*= Extension until 31.12.2020 in preparation

• BAFU filter list (extract)

Appreciable reduction in air pollution

Only VERT-certified systems that achieve a filtration efficiency rate of at least 97% are allowed to be used in Switzerland. Above all, this applies to particularly harmful ultra-fine particulate matter (particulates with a diameter < 0.1 µm).

Since January 2009, the diesel PM emissions of mobile machinery on construction sites are subject to more stringent regulations. The new provisions laid down in the Air Quality Control Regulation (LRV) are for the most part oriented to the VERT method and stipulate the use of diesel particulate filters for mobile machinery with a power output from as low as 18 kW.

BAFU filter list (extract)

HJS systems are VERT-certified and included on the BAFU filter list. As such, they meet the tough Swiss specifications for diesel particulate filters (More information: www.umwelt-schweiz.ch).

Tried-and-tested particulate filter systems for fitting to diesel engines

WORLDWIDE – Selection

Austria: In Tyrol and the redevelopment area of Vienna, construction machinery with a power output of 18 kW or more are only approved for use when fitted with a diesel particulate filter with a filtration rate of at least 95%.

UK: On selected construction sites in London, only construction machinery fitted with exhaust-gas aftertreatment systems are allowed to be used.

Italy: Particulate filters are mandatory for construction machinery deployed on public construction sites in South Tyrol.

USA: A range of different measures are being taken in the USA to reduce the level of pollutants emitted by construction machinery. The "Diesel Risk Reduction Plan" of the California Air Resources Board (CARB) envisages a reduction in particulate emissions in California of 85% by 2020. Other measures include the use of diesel particulate filters on construction sites in cities such as New York, Washington DC, Houston and Boston.

Well equipped for making bids

A step ahead with environmental protection technologies: Having particulate filters installed is increasingly becoming a crucial criterion if you are to win new contracts.

2. HJS Exhaust-gas Aftertreatment Systems

In order to cut the pollutant emissions of mobile machinery, HJS offers modular diesel particulate filter systems specifically developed for such applications. Our economical and environmentally sound solutions have proven themselves many times over.

SMF®-Sintered Metal Filter

The centrepiece of all HJS exhaust treatment systems is the Sintered Metal Filter (SMF®), with which the company sets new standards in the global marketplace. In 2003, HJS was awarded the 'Deutscher Umweltpreis' (German Environmental Award) for its development of the SMF®. This closed 100% filter reduces the emissions of soot particles, including fine particulate matter, down to the limit of detection, with a filter efficiency of over 99%.

Reliable and low on maintenance

The SMF® and the systems based on it are exceptionally reliable in operation, low-maintenance and also benefit from a long service life. HJS systems have proved their worth over many years in more than 250,000 cars, buses, trucks and construction machines.

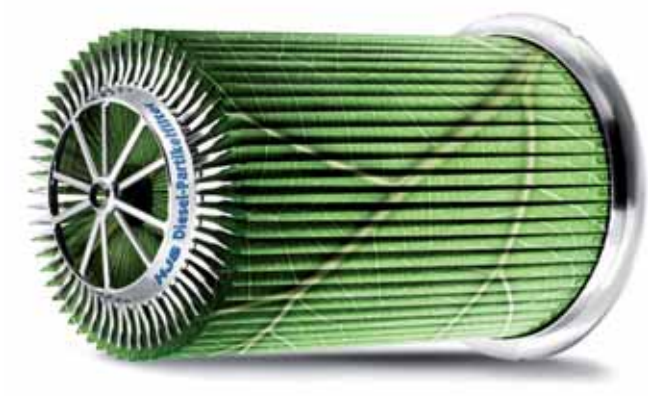
The advantages offered by the SMF® technology result from its special design as well as its use of sintered metal. Exhaust backpressure is minimised by the fact that there is an unrestricted inflow of gas into the filter pockets from outside. What's more, the ash holding capacity of the SMF® is considerably higher compared with that of a conventional wall-flow (honeycomb) filter. This significantly increases the mileage before an HJS filter requires cleaning, including in the case of older construction machinery and stationary applications that suffer from particularly high oil consumption. The costs for servicing and maintenance as well as the associated downtime costs fall accordingly.

Thanks to their modular construction, HJS Sintered Metal Filters can be adapted to create a range of different versions to suit different applications. They are suitable both as original equipment (OE) and also for retrofitting in mobile machinery and stationary applications.

Flexible solutions for different applications

SMF® advantages at a glance

- Reduction of soot particles and fine particulate matter by more than 99% (Based on particle number)
- Suitable for OE and retrofitting applications
- Proven system already installed in more than 20,000 construction machines
- High ash holding capacity and low exhaust backpressure
- Low-maintenance and economical
- Reliable with long service life
- Easy DIY cleaning



• SMF®-Sintered Metal Filter – 100% soot-free

HJS diesel particulate filters satisfy global requirements

Servicing and maintenance

Automatic monitoring and maintenance indicator

The **HJS Service Unit** monitors a filter automatically by measuring the backpressure and temperature of the exhaust gases. Both pieces of information are displayed by the **HJS "ServiceCheck" display module**, which means the status of the filter is immediately visible at all times. The Service Unit is included in the scope of delivery and ensures the filter functions at optimum efficiency.

Benefits

- Constant monitoring of the exhaust backpressure and temperature
- Overload detection for the particulate filter
- Automatic indication that the filter needs to be cleaned
- Lower maintenance costs

• Automatic monitoring with the electronic Service-Check

The HJS Service Unit complies with the LRV/VERT specifications

Maintenance

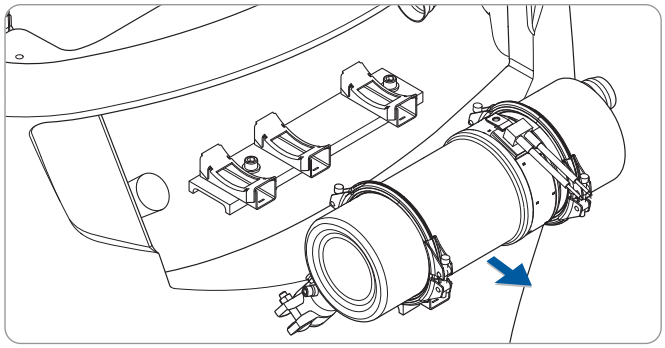
In addition to combustible soot particles, filter systems also remove all other solid particulate matter from the exhaust gases, above all ash from engine oils and additives. These residues must be removed from the filter at specific intervals by cleaning.

Cleaning intervals

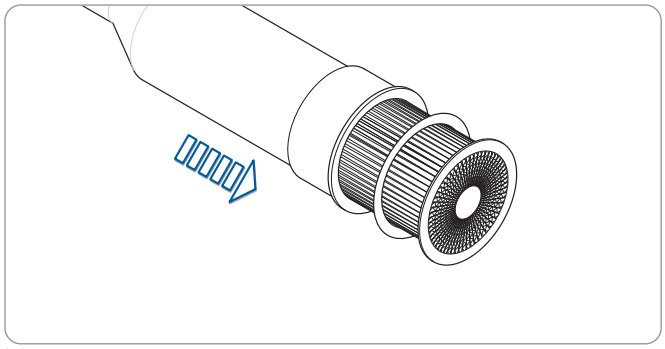
Thanks to the high ash holding capacity of the SMF®, the mileage it can cover before needing to be cleaned is considerably higher compared with that of a conventional wall-flow (honeycomb) filter. Experience shows that many machines can operate for longer than 2.000 hours before the first servicing work needs to be carried out. This makes it possible to keep the running costs for servicing and maintenance as well as the associated downtime costs to a minimum.

SMF® filter modules

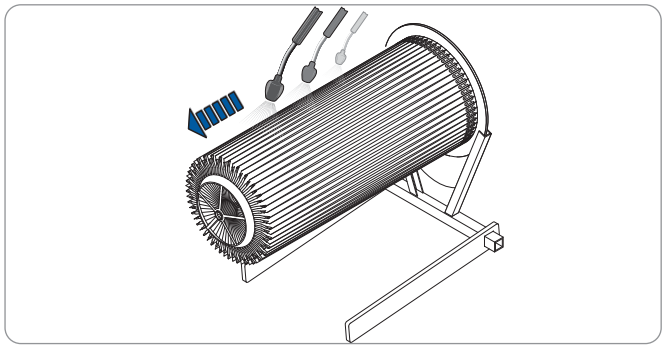
Cleaning a Sintered Metal Filter (SMF®) with a high-pressure cleaner results in a mixture of water, soot and ash. HJS recommends complete regeneration of the particulate filter before you start cleaning it, in order to degrade the soot particles that are collected in the filter.



• 1. Remove filter module



• 2. Remove SMF® filter from casing



• 3. Clean SMF® filter with high-pressure cleaner

NOTE: Observe all health and safety and environmental protection laws, directives and legal requirements applicable in your country.

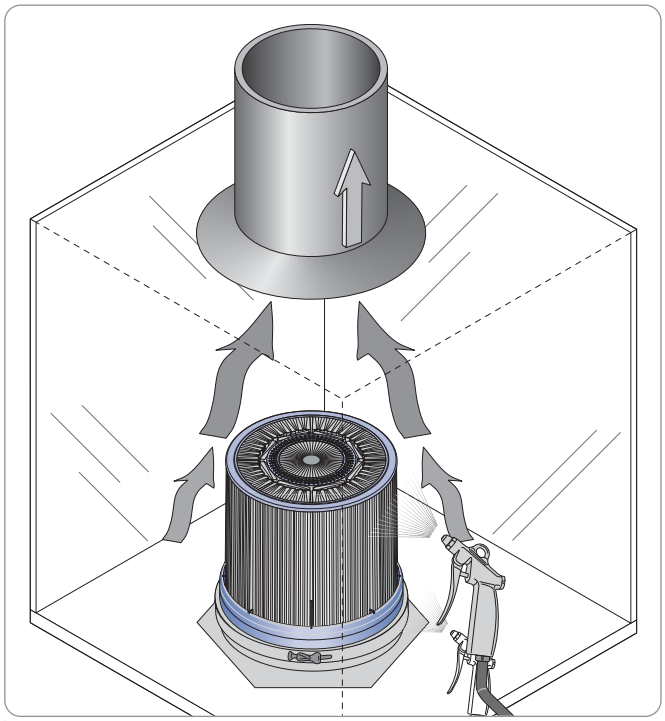
Disposing of soot and ash:

Aqueous solutions from particulate filters must be disposed of in accordance with waste disposal **code 190106** as listed in the European Waste Catalogue (EWC).

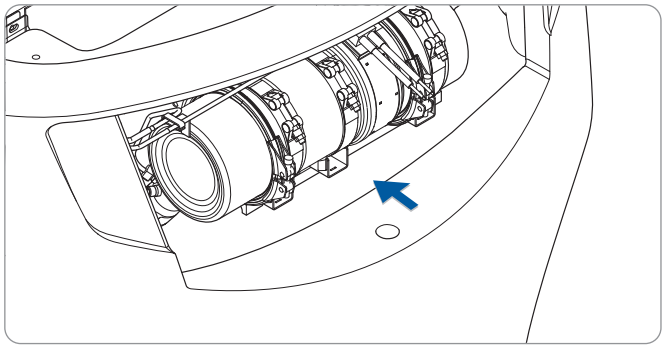
Solid matter from particulate filters must be disposed of in accordance with waste disposal **code 100118** as listed in the European Waste Catalogue (EWC).

CSMF filter modules

Coated Sintered Metal Filter modules (CSMF) may only be cleaned using compressed air. Manual or automatic cleaning equipment with an extractor unit is required.



• 3b. Clean CSMF with compressed air



• 4. Reinstall filter module

DPF® refurbishing – Made by HJS

HJS has its very own state-of-the-art system – designed and developed by our own engineers and technicians – for industrially refurbishing your used diesel particulate filters. The cleaning process is performed in a closed loop, so that no pollutants can escape into the environment.

Certification

HJS diesel particular filters for mobile machinery and stationary applications …

… are certified in accordance with the **internationally recognised VERT criteria**

… are included on the **Swiss BAFU filter** list and as such satisfy the tough specifications laid down by the national **Air Quality Control Regulation (LRV)**

…. are approved by the US **Mine Safety and Health Administration (MSHA)**

… meet requirements of the Germany's **TRGS 554 2(4)**

On the safe side with HJS

Practical experience

HJS diesel particulate filter systems are suited for original equipment as well as retrofitting of mobile machinery and stationary applications. Many engine and machinery manufacturers are already convinced – and more than 20.000 applications, such as industrial fork-lift trucks and construction machines, have already been equipped with tailor-made HJS solutions. We see ourselves as a cost- and quality-oriented partner who supplies its customers – you – with effective systems and components.

• Application example – dependant on the available installation space HJS Systems fitted accordingly

3. Equipping of Diesel Engines with Particulate Filter Systems

The following procedures must be followed when installing an exhaust-gas aftertreatment system for mobile machinery and stationary applications:

Application of the Machinery

Exhaust-gas temperature 250 °C to 450 °C

SMF® system

Determine size of filter taking into account maximum permissible exhaust backpressure

Determine size of catalytic converter in line with machinery power rating and emissions standard

Check temperature profile

barely sufficient

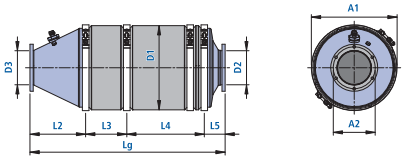
CSMF system (coated filter)

sufficient

SMF® system (uncoated filter)

Take insulation into account

Take installation space into account



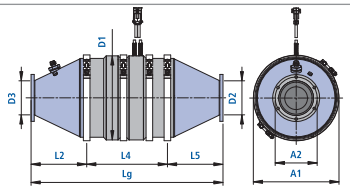
Exhaust-gas temperature from 150 °C

SMF®-AR system

Determine size of filter taking into account maximum permissible exhaust backpressure

Take insulation into account

Take installation space into account



All application specifications, installation guidelines and maintenance manuals provided by HJS Emission Technology GmbH & Co. KG must be complied with.

4. Modular SMF® System

SMF® technology has been developed specifically for applications in the medium to high power range. As a rule, the systems replace the original silencer, and they can be customised as required to match specific machines and stationary applications.

The modular SMF® systems require no extra regeneration aids, additives or intervention in the engine management system. The HJS Service Unit constantly displays the system's instantaneous operating state and indicates when the filter is in need of cleaning.

Catalytic coating

For low-temperature applications, the Sintered Metal Filter can be given a special coating in order to promote the regeneration process (CSMF = Coated Sintered Metal Filter).

• Modular SMF® system

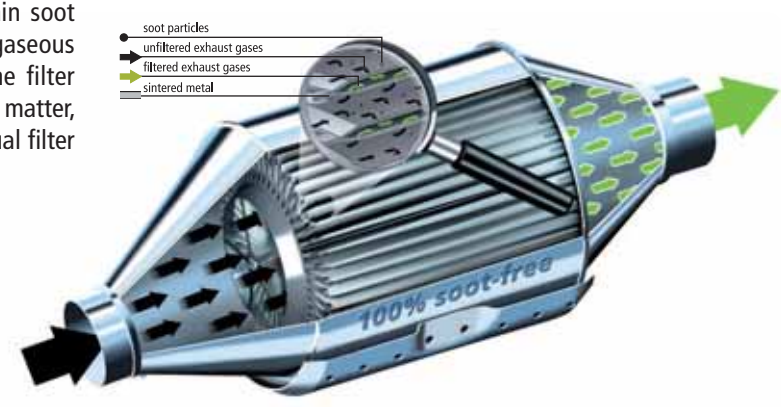
Application examples for SMF® systems:

Construction machinery, construction vehicles and construction equipment, such as industrial forklift trucks, wheel loaders, backhoe loaders, track loaders, special vehicles, power generating sets and district heating plants

The right system for your specific requirement

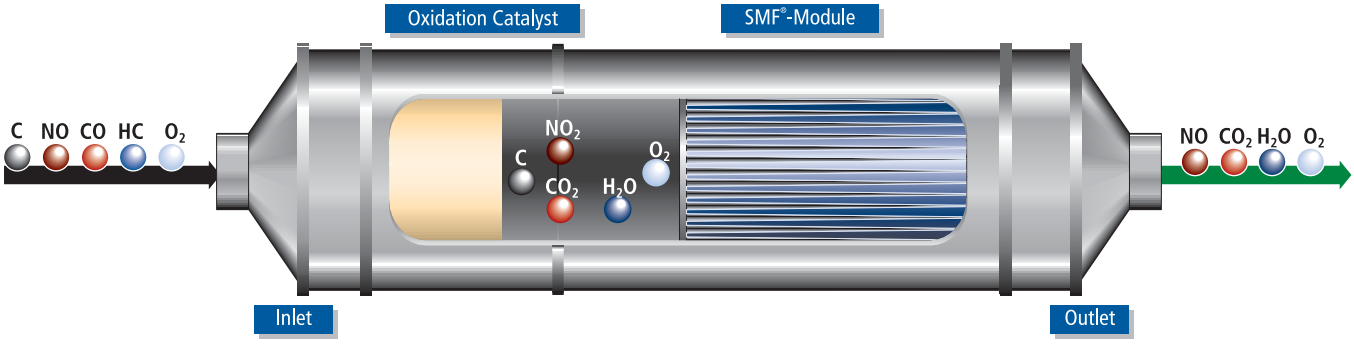
Functional description

The hot exhaust-gases from the engine – which contain soot particles – are fed into the housing of the SMF®. The gaseous components flow through the microscopic pores of the filter pockets; the soot particles, including the fine particulate matter, are trapped on the surface and deposited on the individual filter pockets.



HJS's proven SMF® technology with passive regeneration is used to break down the soot that collects in the SMF®. The HJS system combines a highly efficient, upstream diesel oxidation catalyst (DOC) with an SMF®.

Optimised tuning of the system results in the filter being continuously and effectively freed from the deposited soot.



• The proven HJS SMF® system with passive regeneration technology continuously frees the filter from the soot deposited

Benefits

- No need for time-consuming and costly replacement of mobile machinery and stationary applications
- Reduction of soot particles and fine particulate matter by more than 99% (Based on particle number)
- Catalytic coating provides extended temperature window
- Flexible adaptation to different machines and engine power outputs

SMF® system for retrofitting

4. Modular SMF® System

Technical data and requirements

Max. safe temperature operation for SMF®*: 650 °C exhaust-gas temperature

Max. safe temperature operation for CSMF:** 450 °C (max. 3% of operating time 450 °C < T < 500 °C)

Filter material: high-temperature-resistant chrome-nickel steel

Filter housing material: 1.4301

Filtration efficiency rate: (number concentration in range from 20 – 300 nm) > 99%

Filtration efficiency rate: (in relation to soot mass) > 95%

* SMF®: uncoated Sintered Metal Filter

** CSMF: coated Sintered Metal Filter

Application and operating conditions

The following application and operating conditions must be complied with in order to ensure the modular SMF®/CSMF systems from HJS function optimally:

> Engine fulfils Stage II, Stage III A/III B or Stage IV in Europe, Tiers II, III and IV in the USA

> Fuels used comply with DIN EN 590 (max. 50 ppm sulphur), DIN 51628 or DIN 14214 with a maximum phosphor concentration of 2 ppm and a maximum alkali concentration of 1 ppm

> Low-ash engine oils

> Exhaust-gas temperatures between 250 °C and 450 °C for > 35% of operating time for regeneration

> Strain-free, vibration-isolated installation of the systems and secure, gas-tight connection to the existing exhaust system

> Systems never mounted on the engine-gearbox unit

> Only components approved and released by the system supplier are fitted

Perfect connection of the system pipework ensures low exhaust backpressure. HJS offers insulating components for all its systems to reduce their surface temperature.

The systems must only ever be operated in conjunction with the HJS Service Unit and HJS insulation (included in the scope of delivery).

In order to ensure the systems operate as intended, HJS and its authorised partners offer a temperature-measurement service and one-on-one application consulting.

All application specifications, installation guidelines and maintenance manuals provided by HJS Emission Technology GmbH & Co. KG must be complied with.

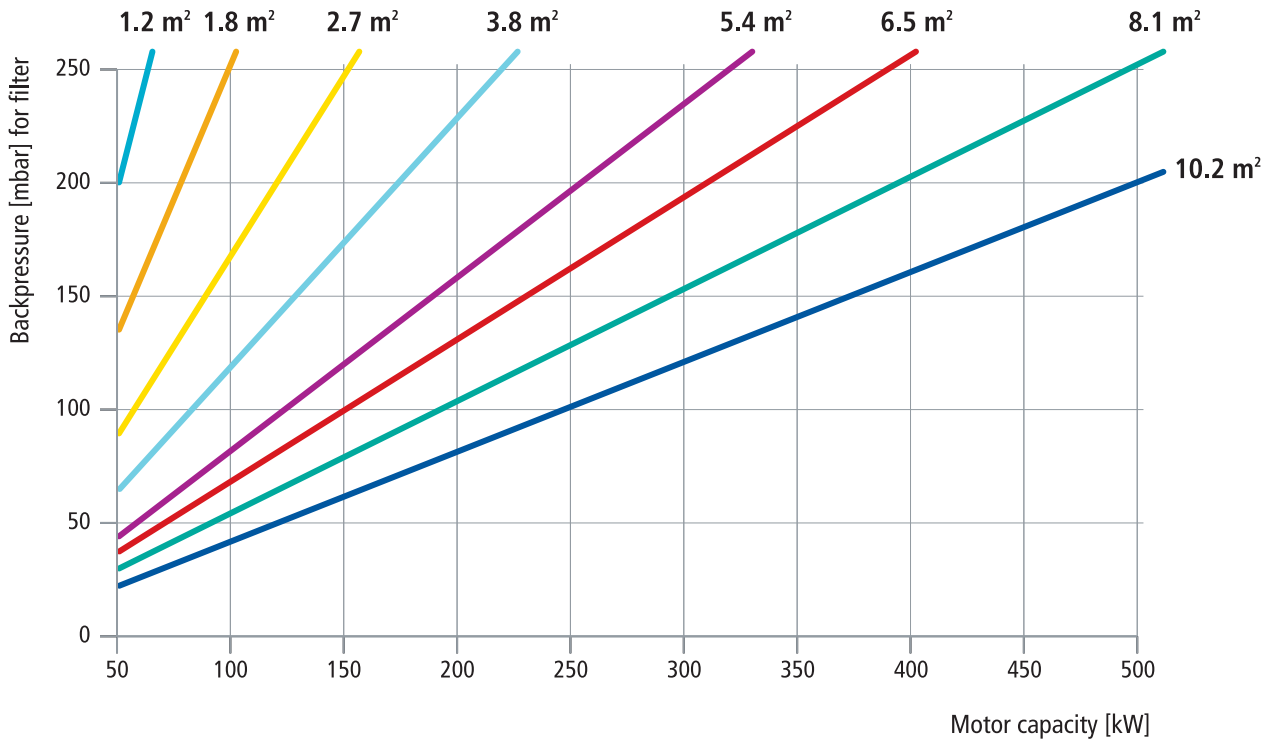
Dimensioning the filter

HJS offers modular SMF®/CSMF systems with filter surface areas ranging from 1.2 m² to 10.2 m².

To help you choose the right size of filter, the diagram below shows the exhaust backpressure generated by each size of filter (not taking the inlet and outlet modules into account).

• SMF®-Sintered Metal Filter – 100% soot-free

Filter surface areas* from 1.2 m² to 10.2 m²



* Refers to a filter module with a maximum temperature upstream of the DPF® of 450°C

• Backpressure of the individual filter units

Example calculation

In the case of a construction machine with a power output of e.g. 250 kW and a maximum permissible exhaust backpressure of 200 mbar (as specified by the engine manufacturer), a filter with a surface area of 5.4 m² can be installed. In this simplified example, it should be noted that the backpressure flow of the inlet and outlet modules is not taken into account. The modules tend to result in a slightly higher backpressure. Further technical data are required if the filter is to be dimensioned more precisely (see Enquiry Forms).

Dimensioning the catalytic converter

The vehicle and engine data (plus some other data) are required in order to determine the size of catalytic converter (3-inch or 6-inch cat) required. In order to ensure catalytic converters operate as intended, HJS and its authorised partners offer one-on-one assistance (see section HJS Enquiry Form).

4. Modular SMF® System

Considering the installation space available

After determining the size of the filter and catalytic converter, it's time to see how much space is available for installing them.

As a rule, the filter system replaces the original silencer. Alternatively, the particulate filter system can be installed at a different position in the exhaust system. In this case, note that the filter must be installed upstream of a silencer.

When selecting the installation position, make sure that there is sufficient clearance between the filter and other components and that the filter can be removed easily for servicing and maintenance work.

The filter unit can be installed horizontally or vertically. The matching inlet and outlet modules must be selected in line with the amount of installation space available in the machine (AXIAL-AXIAL, AXIAL-RADIAL, RADIAL-AXIAL, RADIAL-RADIAL).

To secure the filter, system mounts must be used.

Content of dimension tables

> Inlet module
> 3-inch or 6-inch cat module
> SMF® (uncoated filter) or CSMF (coated filter)
> Outlet module

Scope of delivery

The item numbers listed describe fully assembled filter units with inlet and outlet module, system clamp, gasket set and HJS Service Unit. In addition, all relevant technical documentations, such as the installation guidelines and maintenance manual, are included in the scope of delivery.

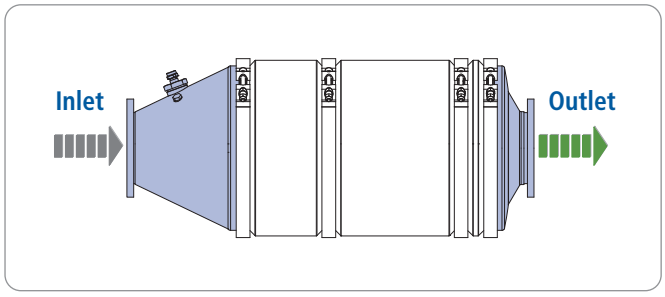
The system mounts and insulation set must be ordered separately. (see Section Individual components)

Dimension tables

The dimension tables contain all dimensions of relevance to installation. All dimensions are stated in millimetres (mm).

This section describes and illustrates the different versions of filter systems with a surface area of 1.2 m² to 10.2 m².

AXIAL - AXIAL



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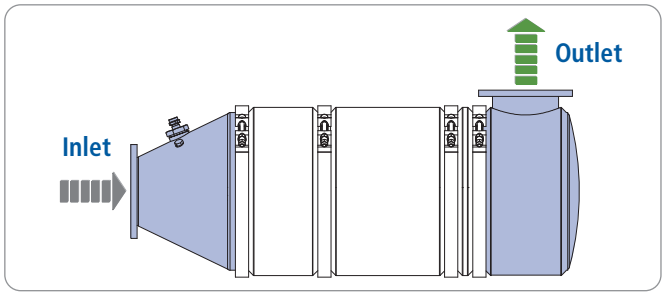

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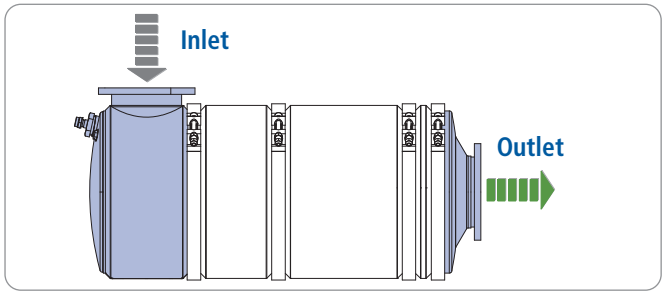

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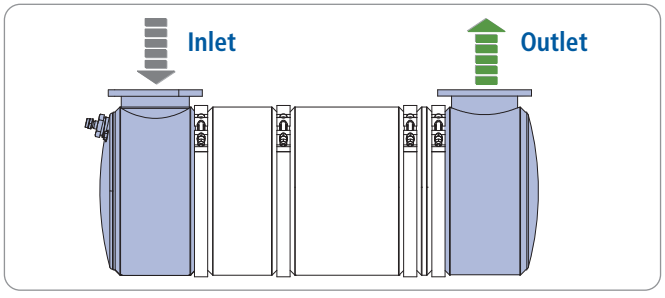
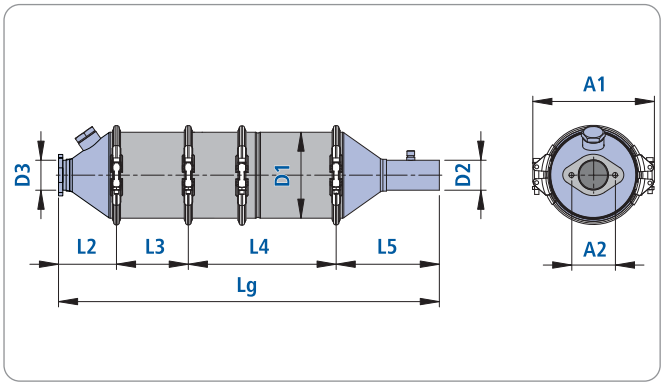
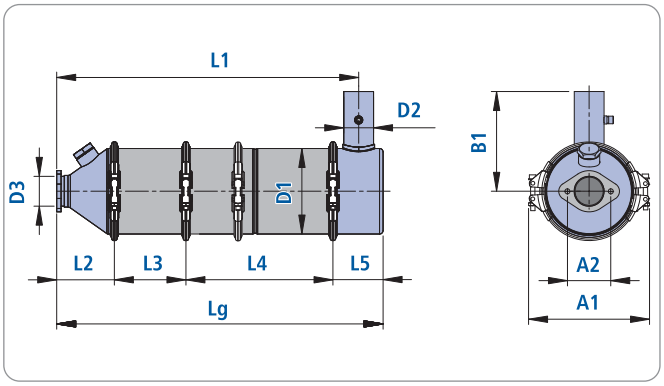


SMF® – 1.8 m²

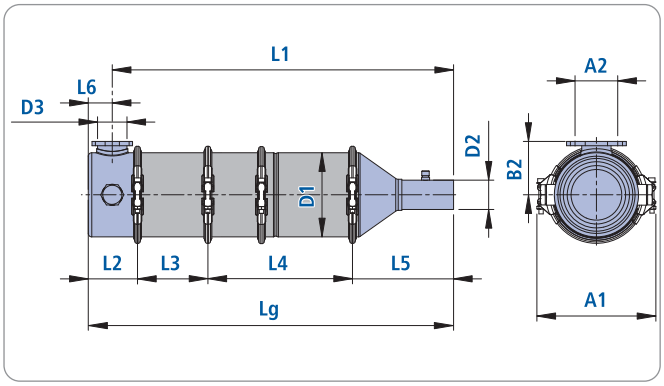
AXIAL - AXIAL



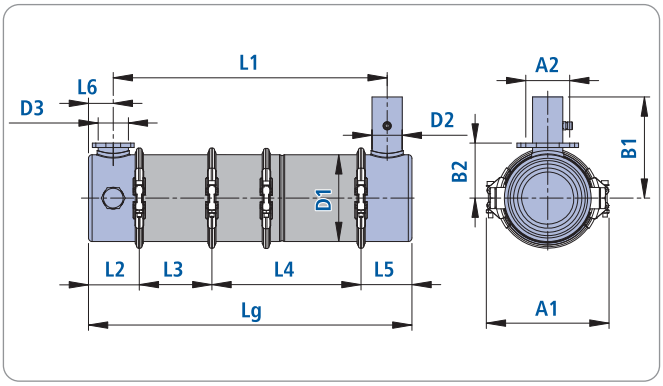
AXIAL - RADIAL



RADIAL - AXIAL



RADIAL - RADIAL



Measurement Table SMF® – 1.8 m²

HJS Item No.*1	System*2	Confi-guration	Lg Cat 3-inch	Lg Cat 6-inch	L1 Cat 3-inch	L1 Cat 6-inch	L2	L3 Cat 3-inch	L3 Cat 6-inch	L4	L5	L6	A1	A2	B1	B2	ø D1	ø D2	ø D3
93 72 0109	SMF® 1.8 m²	AX - AX	699	-	-	-	106	132	-	272	189	-	220	80	-	-	158	55	55
93 72 0110	SMF® 1.8 m²	AX - AX	-	758	-	-	106	-	191	272	189	-	220	80	-	-	158	55	55
93 76 0109	CSMF 1.8 m²	AX - AX	699	-	-	-	106	132	-	272	189	-	220	80	-	-	158	55	55
93 76 0110	CSMF 1.8 m²	AX - AX	-	758	-	-	106	-	191	272	189	-	220	80	-	-	158	55	55
93 72 0111	SMF® 1.8 m²	AX - RAD	602	-	557	-	106	132	-	272	92	-	220	80	184	-	158	55	55
93 72 0112	SMF® 1.8 m²	AX - RAD	-	661	-	616	106	-	191	272	92	-	220	80	184	-	158	55	55
93 76 0111	CSMF 1.8 m²	AX - RAD	602	-	557	-	106	132	-	272	92	-	220	80	184	-	158	55	55
93 76 0112	CSMF 1.8 m²	AX - RAD	-	661	-	616	106	-	191	272	92	-	220	80	184	-	158	55	55
93 72 0113	SMF® 1.8 m²	RAD - AX	685	-	640	-	92	132	-	272	189	45	220	80	-	100	158	55	55
93 72 0114	SMF® 1.8 m²	RAD - AX	-	744	-	699	92	-	191	272	189	45	220	80	-	100	158	55	55
93 76 0113	CSMF 1.8 m²	RAD - AX	685	-	640	-	92	132	-	272	189	45	220	80	-	100	158	55	55
93 76 0114	CSMF 1.8 m²	RAD - AX	-	744	-	699	92	-	191	272	189	45	220	80	-	100	158	55	55
93 72 0115	SMF® 1.8 m²	RAD - RAD	588	-	498	-	92	132	-	272	92	45	220	80	184	100	158	55	55
93 72 0116	SMF® 1.8 m²	RAD - RAD	-	647	-	557	92	-	191	272	92	45	220	80	184	100	158	55	55
93 76 0115	CSMF 1.8 m²	RAD - RAD	588	-	498	-	92	132	-	272	92	45	220	80	184	100	158	55	55
93 76 0116	CSMF 1.8 m²	RAD - RAD	-	647	-	557	92	-	191	272	92	45	220	80	184	100	158	55	55

*1 Scope of delivery does not include brackets and insulation

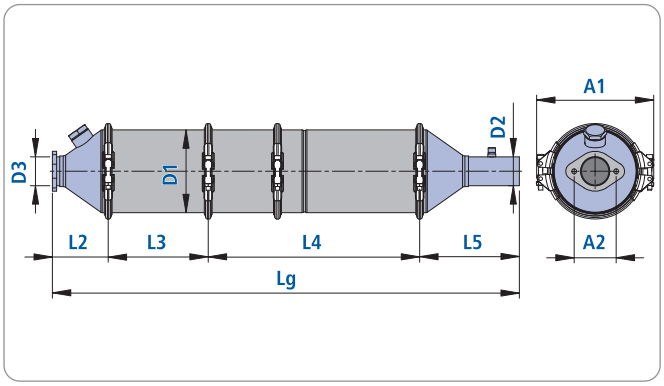
*2 SMF® = uncoated filter; CSMF = coated filter

Comment: The specified dimensions [in mm] are subject to tolerances. Precise dimensions on request.

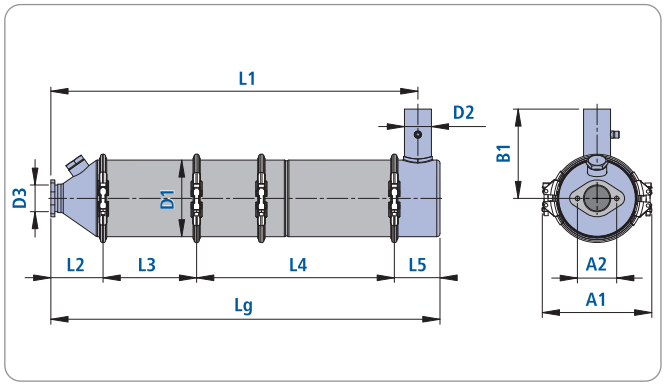
4. Modular SMF® System

SMF® – 2.7 m²

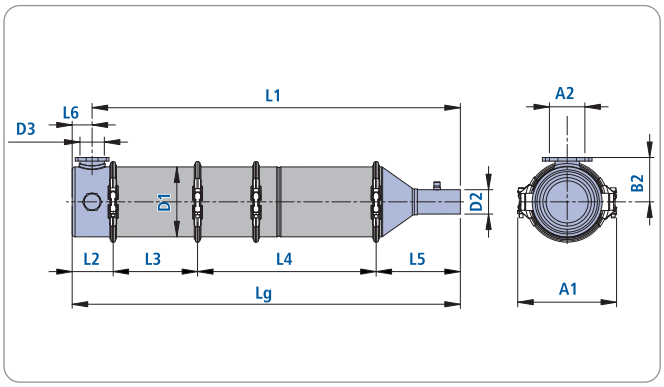
AXIAL - AXIAL



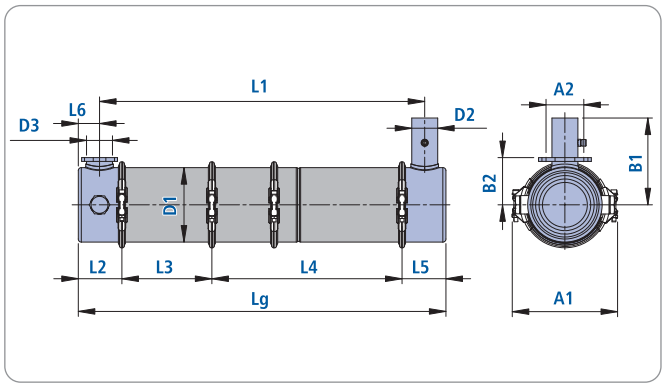
AXIAL - RADIAL



RADIAL - AXIAL



RADIAL - RADIAL



Measurement Table SMF® – 2.7 m²

HJS Item No.*1	System*2	Confi-guration	Lg		L1		L2	L3		L4	L5	L6	A1	A2	B1	B2	ø D1	ø D2	ø D3
			Cat 3-inch	Cat 6-inch	Cat 3-inch	Cat 6-inch		Cat 3-inch	Cat 6-inch										
93 72 0117	SMF® 2.7 m²	AX - AX	831	-	-	-	106	132	-	404	189	-	220	80	-	-	158	55	55
93 72 0118	SMF® 2.7 m²	AX - AX	-	890	-	-	106	-	191	404	189	-	220	80	-	-	158	55	55
93 76 0117	CSMF 2.7 m²	AX - AX	831	-	-	-	106	132	-	404	189	-	220	80	-	-	158	55	55
93 76 0118	CSMF 2.7 m²	AX - AX	-	890	-	-	106	-	191	404	189	-	220	80	-	-	158	55	55
93 72 0119	SMF® 2.7 m²	AX - RAD	734	-	689	-	106	132	-	404	92	-	220	80	184	-	158	55	55
93 72 0120	SMF® 2.7 m²	AX - RAD	-	793	-	748	106	-	191	404	92	-	220	80	184	-	158	55	55
93 76 0119	CSMF 2.7 m²	AX - RAD	734	-	689	-	106	132	-	404	92	-	220	80	184	-	158	55	55
93 76 0120	CSMF 2.7 m²	AX - RAD	-	793	-	748	106	-	191	404	92	-	220	80	184	-	158	55	55
93 72 0121	SMF® 2.7 m²	RAD - AX	817	-	772	-	92	132	-	404	189	45	220	80	-	100	158	55	55
93 72 0122	SMF® 2.7 m²	RAD - AX	-	876	-	831	92	-	191	404	189	45	220	80	-	100	158	55	55
93 76 0121	CSMF 2.7 m²	RAD - AX	817	-	772	-	92	132	-	404	189	45	220	80	-	100	158	55	55
93 76 0122	CSMF 2.7 m²	RAD - AX	-	876	-	831	92	-	191	404	189	45	220	80	-	100	158	55	55
93 72 0123	SMF® 2.7 m²	RAD - RAD	720	-	630	-	92	132	-	404	92	45	220	80	184	100	158	55	55
93 72 0124	SMF® 2.7 m²	RAD - RAD	-	779	-	689	92	-	191	404	92	45	220	80	184	100	158	55	55
93 76 0123	CSMF 2.7 m²	RAD - RAD	720	-	630	-	92	132	-	404	92	45	220	80	184	100	158	55	55
93 76 0124	CSMF 2.7 m²	RAD - RAD	-	779	-	689	92	-	191	404	92	45	220	80	184	100	158	55	55

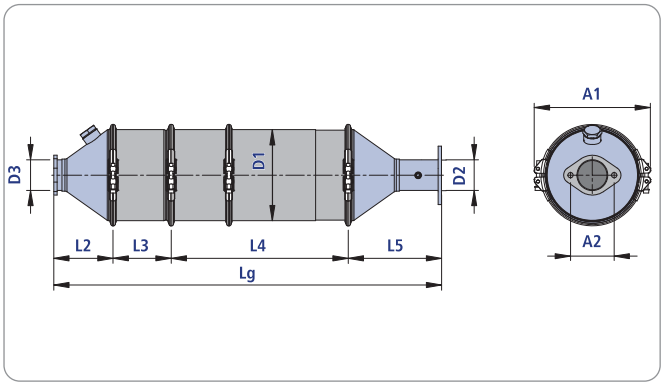
*1 Scope of delivery does not include brackets and insulation

*2 SMF® = uncoated filter; CSMF = coated filter

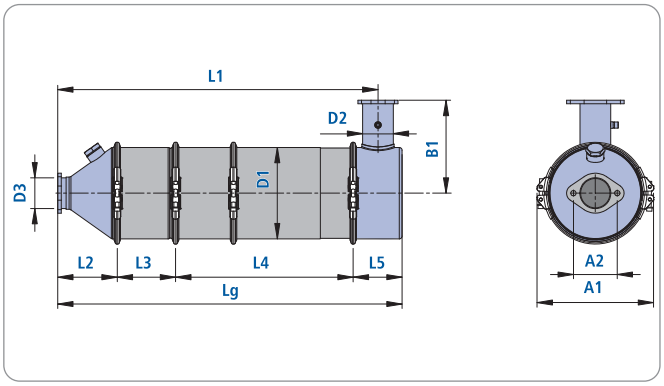
Comment: The specified dimensions [in mm] are subject to tolerances. Precise dimensions on request.

SMF® – 3.8 m²

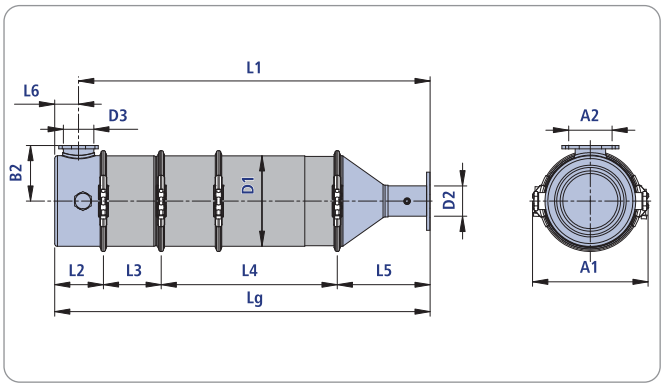
AXIAL - AXIAL



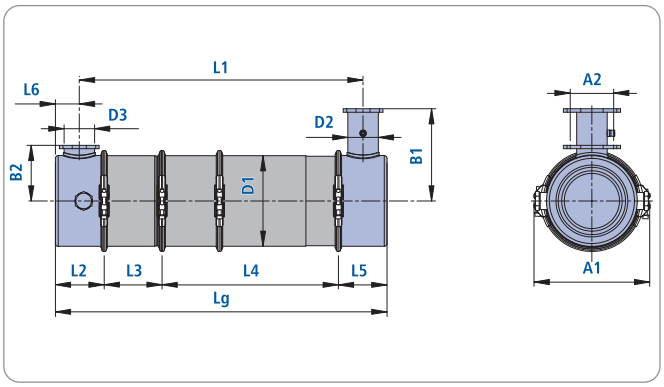
AXIAL - RADIAL



RADIAL - AXIAL



RADIAL - RADIAL



Measurement Table SMF® – 3.8 m²

HJS Item No.*1	System*2	Confi-guration	Lg		L1		L2	L3		L4	L5	L6	A1	A2	B1	B2	ø D1	ø D2	ø D3
			Cat 3-inch	Cat 6-inch	Cat 3-inch	Cat 6-inch		Cat 3-inch	Cat 6-inch										
93 72 0125	SMF® 3.8 m²	AX - AX	892	-	-	-	135	134	-	404	219	-	266	100	-	-	208	70	70
93 72 0126	SMF® 3.8 m²	AX - AX	-	966	-	-	135	-	208	404	219	-	266	100	-	-	208	70	70
93 76 0125	CSMF 3.8 m²	AX - AX	892	-	-	-	135	134	-	404	219	-	266	100	-	-	208	70	70
93 76 0126	CSMF 3.8 m²	AX - AX	-	966	-	-	135	-	208	404	219	-	266	100	-	-	208	70	70
93 72 0127	SMF® 3.8 m²	AX - RAD	786	-	731	-	135	134	-	404	113	-	266	100	216	-	208	70	70
93 72 0128	SMF® 3.8 m²	AX - RAD	-	860	-	805	135	-	208	404	113	-	266	100	216	-	208	70	70
93 76 0127	CSMF 3.8 m²	AX - RAD	786	-	731	-	135	134	-	404	113	-	266	100	216	-	208	70	70
93 76 0128	CSMF 3.8 m²	AX - RAD	-	860	-	805	135	-	208	404	113	-	266	100	216	-	208	70	70
93 72 0129	SMF® 3.8 m²	RAD - AX	868	-	813	-	111	134	-	404	219	55	266	100	-	127	208	70	70
93 72 0130	SMF® 3.8 m²	RAD - AX	-	943	-	888	111	-	208	404	219	55	266	100	-	127	208	70	70
93 76 0129	CSMF 3.8 m²	RAD - AX	868	-	813	-	111	134	-	404	219	55	266	100	-	127	208	70	70
93 76 0130	CSMF 3.8 m²	RAD - AX	-	943	-	888	111	-	208	404	219	55	266	100	-	127	208	70	70
93 72 0131	SMF® 3.8 m²	RAD - RAD	762	-	652	-	111	134	-	404	113	55	266	100	216	127	208	70	70
93 72 0132	SMF® 3.8 m²	RAD - RAD	-	836	-	726	111	-	208	404	113	55	266	100	216	127	208	70	70
93 76 0131	CSMF 3.8 m²	RAD - RAD	762	-	652	-	111	134	-	404	113	55	266	100	216	127	208	70	70
93 76 0132	CSMF 3.8 m²	RAD - RAD	-	836	-	726	111	-	208	404	113	55	266	100	216	127	208	70	70

*1 Scope of delivery does not include brackets and insulation

*2 SMF® = uncoated filter; CSMF = coated filter

Comment: The specified dimensions [in mm] are subject to tolerances. Precise dimensions on request.