



**A clean future:
Systems for reducing diesel engine emissions**



A clear case:

Less emissions, a better future

Around the world the statutory requirements designed to protect the environment and our health are increasing. This means that effective and efficient filtration technology with a wide range of products is becoming increasingly important for diesel-powered vehicles and machines.

Severe laws? You just need the right partner.

MANN+HUMMEL is your competent system partner for reliable and future-proof filter technology in order to protect the environment and our health, to meet current regulations and to minimize the lifetime costs of your diesel equipment. We are a leading filtration specialist for industrial diesel applications such as construction machines and forklifts and we use technology proven thousands of times in the field of on-highway applications – for OEM products and also for the retrofit market.

New challenges? A question of the right system.

Your real advantage is that with MANN+HUMMEL you have an extensive range of filters at your disposal. We can complement your diesel particulate filter with other system components such as air cleaners, oil filters, fuel filters and CCV (crankcase ventilation) solutions. In this way we can considerably lengthen the lifetime of your diesel engine with minor investments in filtration technology. Our whole product range makes an additional contribution towards reducing engine emissions. This fact transforms filtration from a cost factor into an astute investment resulting in lower running costs.

Economy? It's the filter technology that counts.

MANN+HUMMEL diesel particulate filters already satisfy

the emission limits planned for tomorrow worldwide. This guarantees the usefulness of your investment. The diesel particulate filter technology of MANN+HUMMEL is based on sintered metal technology. This technology offers substantial advantages over conventional filter solutions which enable easy cleaning of the filter as required, a long product life, a robust product suitable for use under extreme conditions, and a high ash holding capacity resulting in very long service intervals. In 2003, these advantages were recognized with the German Environmental Award.

Worried about downtimes? Innovative products allow continuous operation.

MANN+HUMMEL offers active and passive systems which regenerate during normal operation and therefore do not require costly downtimes.

Incidentally, the air cleaners, oil filters, fuel filters and CCV solutions of the MANN+HUMMEL product range reduce engine wear and make an additional contribution to the reduction of emissions.



**At a glance:
Examples of international regulations governing particulate matter**

The equipping of industrial diesel machines with filtration technology to reduce emissions is becoming a selection criterion for project tenders. The following mandatory regulations governing particulate matter are already in place:

Europe

The EU directive 1999/30/EU stipulates that in EU member states an emission limit of $50\mu\text{g}/\text{m}^3$ particulate matter (PM10)* must not be exceeded for more than 35 days in the year. As a result many local and regional authorities have drawn up plans to control air pollution with the aim of reducing emissions

of particulate matter (PM10). In many cases these plans also affect industrial diesel applications.

Germany

Over and above the prevailing EU directives Germany has defined additional maximum occupational exposure limits at workplaces (TRGS 554).

Switzerland

Since 1998 construction machines in Switzerland have to be fitted with a VERT** approved diesel particulate filter according to the BUWAL-BauRLL (mandatory regulations for construction sites issued by the Swiss Federal Office for the Environment).

Austria

Since 2005 in Tyrol construction machines (>18 kW) in air pollu-

tion control areas may only be operate if fitted with diesel particulate filters (particulate matter regulation based on IG-L, the Federal Emission Control Act).

Italy

In South Tyrol since 2007 all building sites operated by the public authorities have to use construction machines equipped with diesel particulate filters. There are incentives for construction companies to equip their machines with filters.

UK – London

Since 2007 a number of building sites in London have only been allowed to use construction machines fitted with diesel particulate filters, according to the Best Practice Guidance – The Control of Dust and Emissions from Con-

struction and Demolition. This serves as a model for all construction machines in Greater London.

USA – California

The Environmental Protection Agency (EPA) in the USA has initiated the National Clean Diesel Campaign with a number of programs for on-road and off-road applications. The Risk Reduction Plan from the Californian EPA plans an 80% reduction of all particulate matter (PM10) emissions in California by 2010.

New York

Since 2005 construction machines (> 50 PS) in New York City have to be equipped with diesel particulate filters (Local Law 77 – New York City).

* PM10 = particulate matter particles with a diameter < $10\mu\text{m}$ ** VERT is a suitability and quality test for diesel particulate filters

Good news:

No limits for the environment – but for emissions

By the way – after 2011 the OEM market will also be subject to stricter controls. After that the use of diesel particulate filters in Europe and the US will become standard for the reduction of emissions in new industrial diesel applications.

According to a report concerning “Diesel Fuel and Exhaust Emissions” written in 1996, the World Health Organization (WHO) classifies particulate matter as harmful to health. Legislators in many countries have since reacted and introduced measures to stop operators using industrial diesel applications without reduced engine emissions.

**The pure truth:
MANN+HUMMEL is fit
for the future**

It's good to know that when you retrofit a filter system from us you will have nothing to fear from the environmental protection regulations. The following is an overview of the most important current and imminent laws and regulations:

- The EU directive 1999/30/EU stipulates that an emission limit of $50\mu\text{g}$ particulate matter (PM10)* per cubic meter of air must not be exceeded for more than 35 days in the year.
- Air pollution control plans for local and regional authorities are currently being drawn up all over the world.
- In Germany the labor protection legislation has defined additional maximum occupational exposure limits (TRGS 554).
- In the Italian region of South Tyrol and in Austria there are various incentive programs to encourage retrofitting.

Forwards with retrofitting

Around the world there are numerous incentive programs

offering financial assistance for the retrofitting of diesel particulate filters. MANN+HUMMEL assists customers to select the right program. At the latest by 2011 diesel particulate filters will be standard for OEM producers and the incentive programs will most likely end. A decision to retrofit your industrial diesel applications now means you are sure to benefit from the incentives currently on offer. Where tenders today already stipulate diesel particulate filters, you will have a competitive advantage. This is also valid for cross-border operations, e.g. in Switzerland, where today operators already have to retrofit. And another important consideration is the safeguarding of the health of your employees.





Your first choice:

Filtration expertise for OEM and retrofitting

There are good reasons why MANN+HUMMEL has a leading position in the field of filtration technology for OEM and retrofitting solutions. The company employs more than 10,000 people worldwide at more than 41 locations and is today a leading supplier to the automotive industry and mechanical engineering industry.

Powered by partnership

MANN+HUMMEL stands for global partnership with a local

presence. We meet the requirements of our customers with innovative solutions and top quality and we are continuously striving to offer the best value for money and thus set new standards.

Winner of awards, certified and motivated

Those who wish to set standards have to be judged by their achievements. The numerous awards and certificates awarded to MANN+HUMMEL every

year is clear evidence that we are able to more than satisfy the requirements of today. The company also has a proud record for certificates issued on a country and location basis. All MANN+HUMMEL locations are or will be certified according to the standards ISO 9001:2000 and ISO TS 16949:2002.

Advanced engineering

As a leading development partner to industry MANN+HUMMEL works closely together with international machine producers on a long-term basis in the development of filters for industrial diesel applications. Customers very much appreciate the development work and design solutions we are able to offer as a system supplier. In cooperation with international automobile and machine producers around 500 employees use modern engineering equipment and tool and testing methods to research and develop innovative products with an improved economic performance. Each

one of our products and customers is able to benefit from the knowledge gained in this process, made possible by

the substantial investment in engineering MANN+HUMMEL makes every year amounting to 6% of the company turnover.





**Full provider:
System solutions to reduce emissions**

SMF®-AR diesel particulate filters:

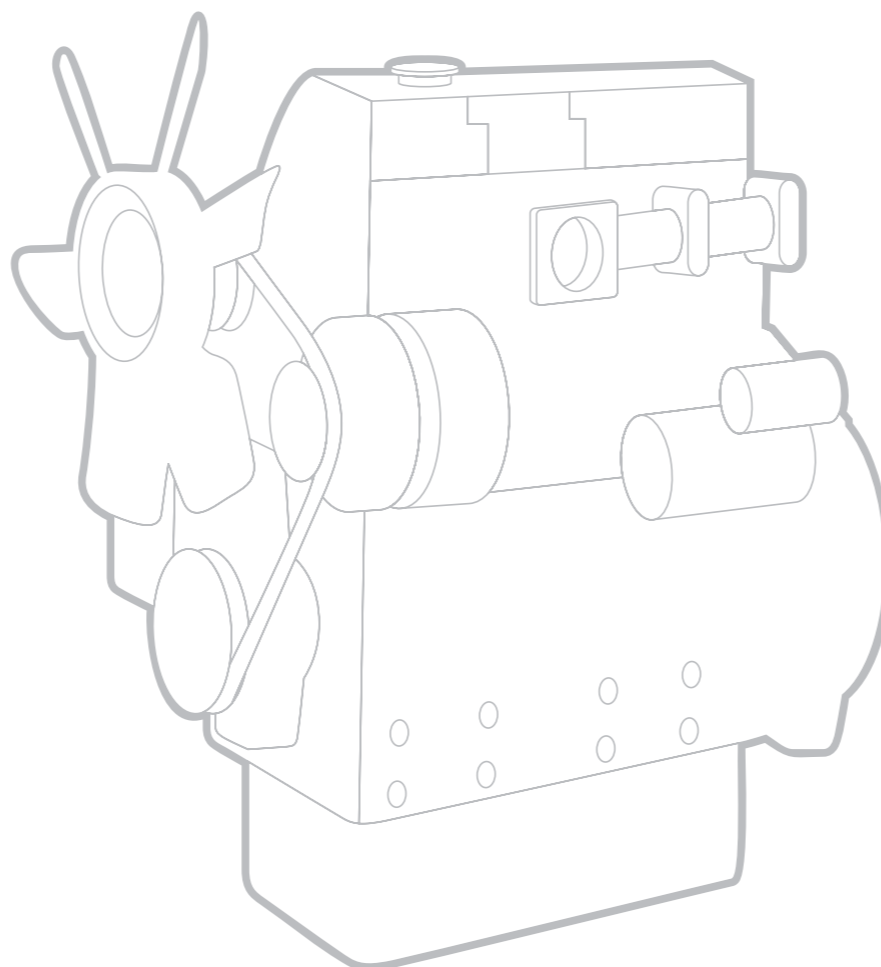
This product available worldwide eliminates the discharge of particles from engines up to 130 kW and therefore satisfies the requirements of today and tomorrow. Special features are the VERT approval, the durability of the sintered metal design, the high ash holding capacity and the considerably lower running costs in comparison to conventional diesel particulate filters.

CRT® diesel particulate filters:

This easy and robust system is designed for high output engines (up to 560 kW) and also has VERT approval. The user has the same product advantages as with the branded product SMF®-AR.

Preliminary fuel filter:

Higher injection pressure increases the demands placed on fuel filtration with regard to the separation of water and particles. Producers of injection pumps have therefore formulated a set of requirements. MANN+HUMMEL offers the PreLine® preliminary fuel filter which separates water with an efficiency of at least of 93% according to ISO 4020. Preliminary fuel filtration protects modern injection systems against damage from corrosion and abrasion. This reduction in wear prolongs engine life and also reduces emissions.



Centrifuges:

This branded product from MANN+HUMMEL is for the filtration of oil and efficiently separates contaminants such as soot and fine metal particles present in the lube oils of diesel engines. This lengthens the service life of the oil, lowers running costs and simultaneously ensures the maximum lifetime for diesel applications with reduced downtimes. In addition, centrifuges prevent unnecessary engine wear and therefore make an important contribution towards the reduction of diesel engine emissions.

Crankcase ventilation:

The MANN+HUMMEL ProVent® series for open and closed crankcase ventilation enjoys worldwide acclaim. The reasons for this are the highly efficient oil separation of the system, the flexibility of use offered by its compact design and the low running costs achieved through reduced oil consumption. Additional features are high operational reliability through protection against excessive crankcase pressure and easy servicing.

Air cleaners:

MANN+HUMMEL air cleaners are characterized by a high separation efficiency, a long service life and a high dirt holding capacity. The flexibility of use enabled by their compact design is another advantage together with the low running costs achieved through low pressure drop and high operational reliability, made possible by reliable sealing. A further efficient side effect is the easy disposal and recycling of the metal-free filter elements..



SMF®-AR – the powerful solution up to 130 kW

SMF®-AR diesel particulate filters are designed for applications in the lower to medium power output range with low or dynamically changing power consumption. The high performance of the SMF®-AR is based on the decades of experience MANN+HUMMEL has in the field of filtration technology. This self-contained system consists of a filter plus software, electronics and sensors and has a fully automatic operation. The SMF®-AR functions on the principle of active regeneration which means that the soot burn-off is initiated as soon as the filter is fully loaded with soot.

Companies and the environment benefit equally from the advantages of this innovative know-how.

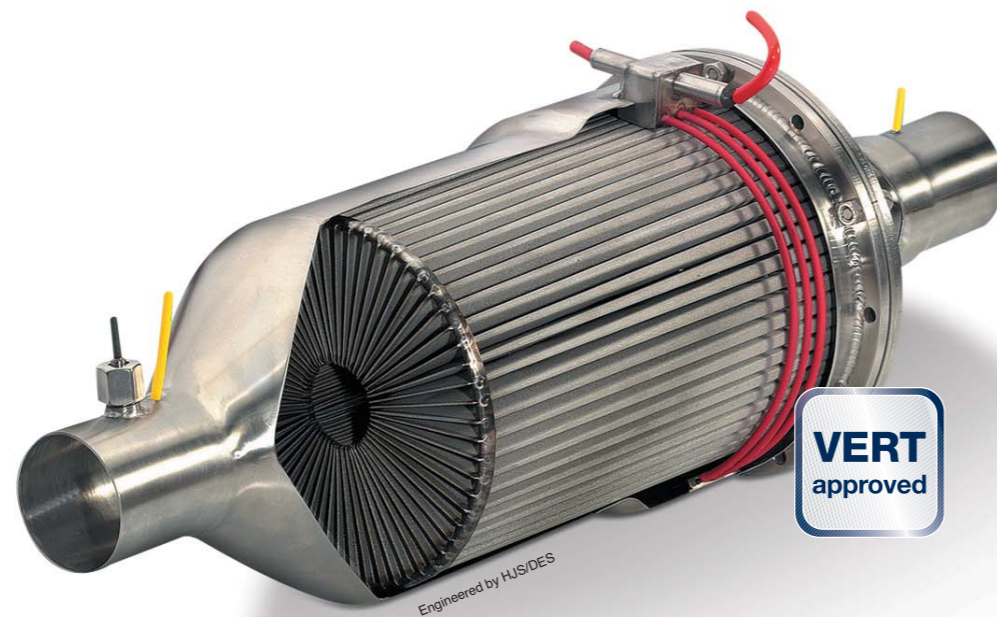
Costs under control

The SMF®-AR allows continuous machine operation without downtimes. Depending on the application, the very long service intervals of 2000 to 2500 operating hours are a further benefit. The sintered metal design of the filter with its minimal maintenance requirement offers a further contribution to the reduction of costs. The life of the filter corresponds to the life of the

engine. Replacement is therefore not necessary. The result is lower running costs.

The right performance profile

Sintered metal technology enables a long product life and also provides for a high separation efficiency considerably above 99%. The flexibility of use enabled by the compact design is also a clear advantage. Through use of an automatically dosed diesel additive the regeneration process remains NO₂ neutral. This makes your investment a safe one.



Example vehicles are forklifts, mini-excavators and wheel loaders up to 130 kW.

CRT® – the strong solution up to 560 kW

The CRT® diesel particulate filter benefits from the same advantages as its small brother, the SMF®-AR, which are a long life, high separation efficiency, flexibility of use, and a safe investment. Some aspects, however, such as low running costs through reduced downtimes and the very long service intervals for large machines are even more significant.

Fit for high power

CRT® diesel particulate filters are designed for diesel applications in the medium to high power output range with a high and constant power consumption. Continuous regeneration is made with an integrated oxidation catalytic converter provided the exhaust gas temperature for 25% of the operating time is

> 260°C. Application examples are dumper trucks, mobile excavators, wheel loaders and track vehicles.



VERT is a suitability and quality test for diesel particulate filter systems for the protection of people and the environment in Switzerland. VERT is recognized internationally. For example, in California VERT examinations are accepted by the registration authorities.

- MANN+HUMMEL company
- Joint venture company

MANN+HUMMEL Group

The MANN+HUMMEL Group is an international company with its headquarters in Ludwigsburg, Germany. The group employs more than 10,000 people worldwide at more than 41 locations.

The company develops, produces and sells technically complex components and systems for the automotive

industry and many other fields. A key area is high quality filtration products for vehicles, engines and industrial applications. The OEM business with global market leaders and producers of vehicles, machines and installations defines the quality and performance of the products. Filters for the international aftermarket are sold

under a variety of international brands as well as under the MANN-FILTER brand.

MANN+HUMMEL Industrial Filters

The Industrial Filters Business Unit has its headquarters in Speyer, Germany. The business unit is specialized in meeting the special require-

ments of off-highway vehicles and engine applications, compressed air and vacuum technology, mechanical engineering and plant construction.

MANN+HUMMEL Industrial Filters offers high performance for these fields and other fields which have a requirement for the filtration and separation of air, gas and liquids.



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