Clean logistics – how environmental protection can pay for itself

100% Diesel Particulate Filter Systems for Commercial Vehicles

SMF®-Sintered Metal Filter

SMF®-CRT®

HJS
Abgas-Systeme • Exhaust Systems

Clean logistics - Environmental protection pays for itself!

Unrestricted mobility in low-emission zones

Focus on mobility, health and environmental protection

Environmental protection, people and innovative driven technologies are main areas that will significantly impact future mobility. The problem of ever-increasing traffic volumes, allied to the associated risks to humans and the environment from exhaust emissions, represents a major challenge both today and for the future.

The main demands on the internal combustion engines (diesel) relate to the need for low pollution and efficiency. Thanks to its outstanding characteristics and its benefits in terms of CO_2, the diesel engine will continue to be deployed around the world as the most important engine-type for many areas of application. As far as environmental considerations are concerned, there is a critical debate focused especially on emissions of soot particles and nitrogen oxides.

The consistent use of diesel exhaust-gas aftertreatment systems makes it possible for such pollutants to be eliminated and for vehicles and machines alike to be operated cleanly and efficiently.
This is where HJS technologies play a important role.

Diesel emissions

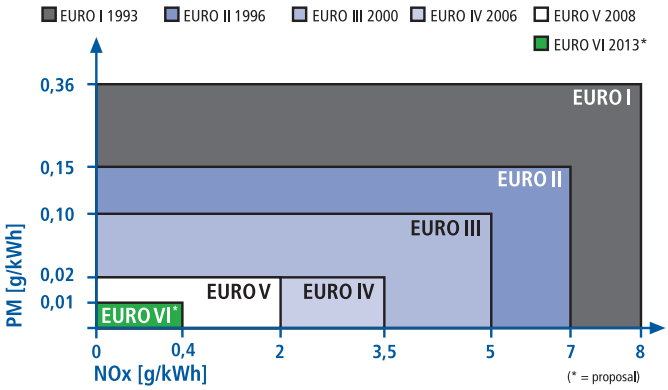
When fuel is combusted in a diesel engines, not only gaseous emissions are emitted, but especially also soot particles. The smaller these soot particles are, the easier it is for them to pass through our lungs and into our bloodstream and other organs. Soot particles from diesel engines are known to represent a particular health hazard. According to studies carried out on behalf of the EU Commission, every year over 280,000 people in Europe – 65,000 in Germany alone – die prematurely from the consequences of particulate matter exposure. Moreover, high levels of particulate matter result in an average shortening of life expectancy by around six months. This means that lowering the emissions of particulate matter is an extremely important goal in terms of human health. Any measure aimed at reducing such pollution must, therefore, be viewed positively.

The most important and effective measure for improving the air quality is the use of diesel particulate filters (DPF®). Particulate emissions can be almost entirely eliminated by means of 100-percent filter systems.

European exhaust emissions standards

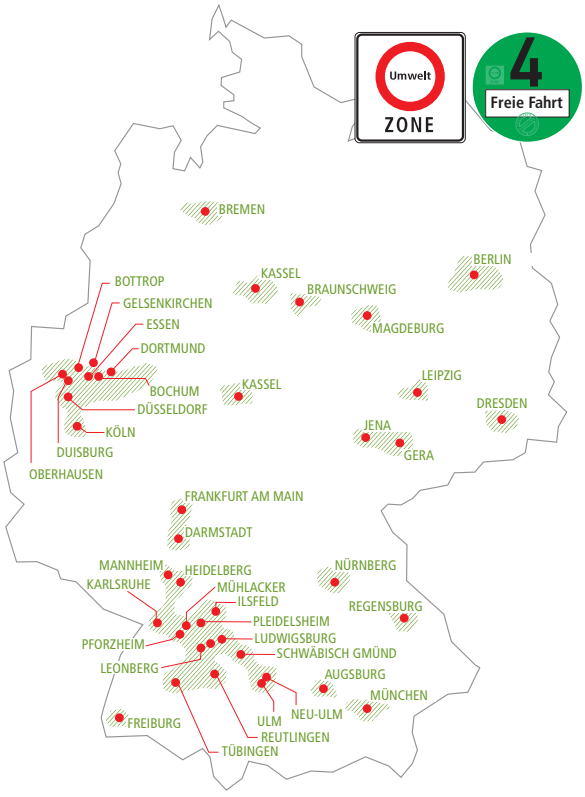
A reduction of the pollution caused by commercial vehicles has been achieved in the past 15 years exclusively through in-engine measures. The further tightening of emissions limits, which will be introduced with the EURO V standard and, above all, the EURO VI standard, calls for the use of exhaust-gas aftertreatment systems.

The consistent application of advanced exhaust treatment systems not only allows new vehicles to meet these high standards, but also older vehicles can be brought into line with the state of the art.



Particulate matter, low-emission zones and driving bans

According to the German federal environmental agency, road traffic – predominantly diesel-engined vehicles – is one of the principal sources of pollution. The particulate matter pollution caused by soot emissions from these engines accounts for around half of all particulate matter pollution. Consequently, various measures have and are being introduced to reduce the release of pollutants at both



• Over 40 low-emission zones will be implemented in Germany

| Emission-dependent TOLL charges planed from the 1st of January 2009

European and also German national levels. Such measures include the EU air quality directive, which sets limits for air pollution from particulate matter and other pollutants such as nitrogen dioxide; the establishment of low-pollution zones with driving bans for vehicles with high exhaust emissions; as well as an emissions-dependent system of TOLL charges for heavy duty commercial vehicles.

Clean logistics – the competitive advantage from retrofitting with DPF®

Retrofitting with a DPF® makes both environmental and economic sense, because investing now in low-pollution exhaust emission technologies not only means making a substantial contribution to human health and environmental protection, but also the use of 100% filter systems will help businesses and freight carriers to cut costs, maintain the value of their vehicle fleets and guarantee their long-term mobility. For example, a truck equipped with an HJS filter system will easily qualify for a green particulate emission sticker allowing it to enter low-pollution zones while at the same time reducing the vehicle's toll charges.

From both an environmental and also increasingly an economic perspective, it makes sense to retrofit commercial vehicles. Retrofitting trucks with DPF®-Systems is a genuine alternative to purchasing a new vehicle.

Emission-dependent TOLL charges

At present, trucks belonging to the emission classes EURO II and EURO III are responsible for almost 90 per cent of the soot particles from heavy goods traffic on German motorways. According to a decision taken by the German government on the 18th of June 2008, the toll charges for such vehicles will increase with effect from January 2009. By installing diesel particulate filters (DPF®), however, fleet operators can enable their vehicles to fall into a lower emission class, thereby reducing their toll charges considerably. This applies to German vehicle operators as well as foreign vehicles operators alike.

Key points of the German government's decision

The planned toll charge amendment, which will take effect on January 1st, 2009, includes the introduction of a fourth toll charge category as well as an emissions-dependent two-tier charge for vehicles retrofitted with a DPF®. This means that, starting from day one, the operator has a financial advantage from retrofitting thanks to the reduction of the toll charges for trucks equipped with a DPF®-system.

Sample calculation of toll charge savings

(100,000 km annual mileage of a truck with a gross vehicle weight of 12 tonnes or over)

TOLL SAVINGS

EURO III Truck + SMF® = € 4,200 per year
EURO II Truck + SMF® = € 6,300 per year

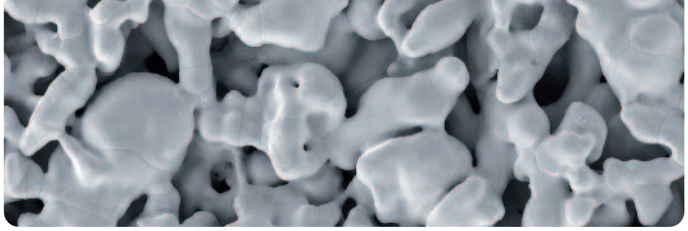
Assuming retrofitting costs of around € 6,000 for an HJS 100% filter system for a truck with the emission class EURO II or EURO III, the investment can pay for itself within one year depending on the mileage travelled. In addition, retrofitting considerably increases the resale value of commercial vehicles.

Environmental protection pays for itself!

The benefits of retrofitting at a glance

- ✔ Active protection of health and the environment
- ✔ Clean logistics with 100% diesel particulate filter
- ✔ Retrofitting of EURO II and EURO III trucks
- ✔ Significant toll charge savings
- ✔ Amortisation of investment within one year (depending on annual mileage and EURO standard)
- ✔ Unrestricted access to low-pollution zones with the green emissions sticker

Emission class	Toll charge category NEW	Retrofitting	Toll charge category NEW with retrofitting	Cost per km (3 axles)	Cost per km (4 axles)	Saving per km	Saving after 100.000 km	Saving after 150.000 km
EURO 0	D		D	27.3 cents	28.7 cents			
EURO I								
EURO II		with SMF®	C			6.3 cents	6.300 €	9.450 €
EURO III	C	with SMF®	B	21.0 cents	22.4 cents	4.2 cents	4.200 €	6.300 €
EURO IV	B		B	16.8 cents	18.2 cents			
EURO V / EEV	A		A	14.0 cents	15.4 cents			



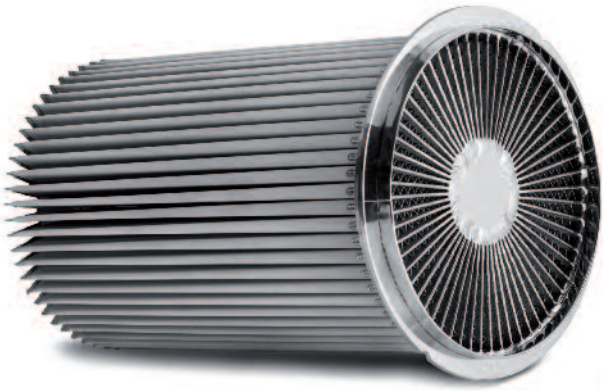
Sintered Metal through an electron microscope

HJS Exhaust-Aftertreatment-Systems

SMF®- Sintered Metal Filter

100% soot-free

The centrepiece of all HJS exhaust treatment systems is the sintered metal filter (SMF®), with which HJS sets new standards in the global marketplace and for which HJS was awarded the 2003 German Environment Prize. This enclosed 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%. The HJS SMF® complies with the limits laid down not only in the EURO V-, but also in the EEV-standard.



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

Reliable, low maintenance and cost effective

The SMF® and the systems based on it are exceptionally reliable in operation, low on maintenance and also benefit from a long service life. HJS systems have proved their worth over many years in thousands of bus and truck applications. The advantages offered by an SMF® result from its special design as well as the use of the material sintered metal. The clogging known from conventional ceramic filters with their honeycomb structure is made impossible by the pocket-type construction of the SMF®. Exhaust backpressure is minimised through the unrestricted inflow of exhaust gas into the filter pockets from the outside. In addition, the ash storage capacity of an SMF® is three to four times as high as that of a conventional ceramic filter system, which significantly increases the mileage before an HJS filter requires cleaning. This includes older trucks with their particularly high oil consumption. Whereas a ceramic filter requires cleaning after just a short period of operation, an SMF® is capable of several years of operation before maintenance is needed. This makes it possible to minimise the running costs for service and maintenance as well as the associated downtime costs, which in turn allows considerable cost savings for the operator over the life of a vehicle.

Flexible solutions for different applications

Thanks to their modular construction, sintered metal filters can be used in various systems and versions to suit different applications. They are suitable both for original equipment (OE) applications and also for retrofitting in trucks.

Catalytic coating

For OE applications or in the case of vehicles that are operated at low temperatures, the SMF® can be provided with a specially developed catalytic coating to support the process of filter regeneration.

SMF® advantages at a glance

- ✔ Suitable for OE and retrofitting applications
- ✔ Over 99% Reduction of soot emissions, incl. fine particulate matter
- ✔ Low exhaust backpressure
- ✔ High ash storage capacity
- ✔ Catalytic coating provides extended temperature window for optimized regeneration
- ✔ Low-maintenance and economical
- ✔ Reliable with a long service life
- ✔ 100% recyclable

Operating principle

The CRT® effect 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 allows the SMF® to be effectively and continuously freed from the deposited soot.

The modular SMF®-CRT® system requires neither extra regeneration aids nor additives or any intervention in the engine management system. Electronic monitoring constantly guarantees the full operability of the filter system.

Sintered Metal Filter-pocket

TOLL-fee savings of 4,200 € per year (100,000 km)

Modular SMF®-CRT®-System

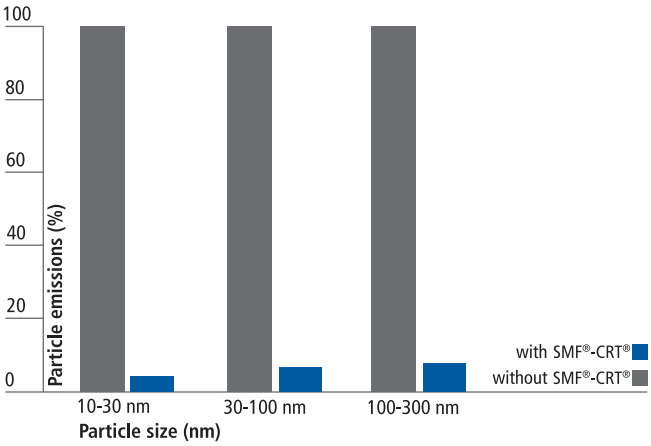
The proven SMF®-CRT® system (**C**ontinuously **R**egenerating **T**echnology) is suitable for trucks that cover long distances on motorways and which therefore generate continuously high exhaust gas temperatures.

Efficiency

Different studies conducted on engine test stands, by various vehicle manufacturers and also by the TÜV-Nord technical inspection agency in Essen/Germany have confirmed the exemplary operating efficiency of the HJS SMF®-CRT® system.

- ✔ Over 95% reduction of gaseous pollutant emissions (CO / HC)
- ✔ Over 99% reduction of particulate emissions, including fine particulate matter

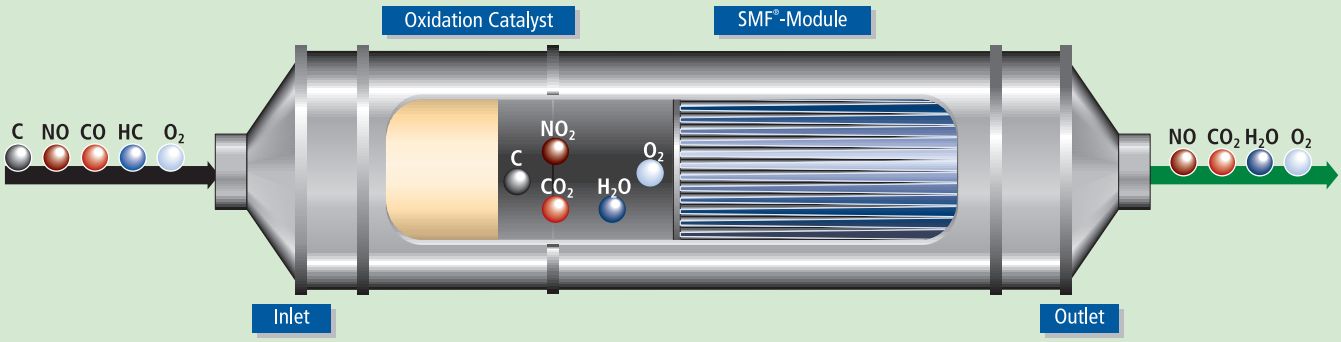
Impact of the SMF®-CRT®-System on the particulate size distribution



SMF®-CRT® for a Mercedes-Benz Actros EURO III

Quick and simple installation

The catalyst- and SMF®-modules for trucks are integrated in a stainless-steel silencer housing, which allows easy installation in the existing exhaust system without the need for any interface modifications. The original silencer system is simply and quickly replaced by the identically dimensioned HJS system.



Mercedes-Benz Actros EURO III – 100% soot-free

TOLL-fee savings with Sintered Metal Filter – kilometre for kilometre

Market coverage and product range

The majority of trucks affected by the new German toll charge scheme can be retrofitted with an HJS particulate filter system. The present HJS SMF®-CRT® product range already covers over 65 per cent of the entire population of EURO III trucks in Germany. Systems are available for various models of trucks made by Mercedes-Benz, MAN, DAF and IVECO and are already being successfully used in various countries outside Germany. The existing HJS product range is subject to ongoing review and expansion, which means that there will be constant additions of new vehicle models, especially EURO III and EURO II vehicles.

SMF®-CRT® advantages at a glance

- ✔ Suitable for OE and retrofitting applications
- ✔ Over 99% Reduction of soot emissions, incl. fine particulate matter
- ✔ Over 95% Reduction of gaseous pollutant emissions (CO / HC)
- ✔ Extended CRT® temperature window for filter regeneration
- ✔ Modular construction
- ✔ Simple installation – replaces the original silencer
- ✔ Over 65% of the EURO III truck market covered by existing product range

HJS Product Range 2008

Vehicle	Year	EURO Standard	Engine	Displacement ltr.	Performance kW	System	Article-Nr.
DAF							
LF 45	01 2001 -	III	BE 99 C0	3,9	99	CRT® 65 SMF®	93 64 5568
LF 45 / FA 45.150	01 2001 -	III	BE 99 C	3,9	99	CRT® 65 SMF®	93 64 5568
LF 45	01 2001 -	III	BE 110 C0	3,9	110	CRT® 65 SMF®	93 64 5568
LF 45 / FA 45.150	01 2001 -	III	BE 110 C	3,9	110	CRT® 65 SMF®	93 64 5568
LF 45	01 2001 -	III	BE 123 C0	3,9	123	CRT® 65 SMF®	93 64 5568
LF 45 / FA 45.170	01 2001 -	III	BE 123 C	3,9	123	CRT® 65 SMF®	93 64 5568
LF 55 / FA 55.170	01 2001 -	III	BE 123 C	3,9	123	CRT® 65 SMF®	93 64 5568
LF 45 / FA 45.170	01 2001 -	III	BE 123 C	3,9	123	CRT® 65 SMF®	93 64 5568
LF 45 / FA 45.180	01 2001 -	III	CE 136 C	5,9	136	CRT® 65 SMF®	93 64 5568
LF 55 / FA 55.180	01 2001 -	III	CE 136 C	5,9	136	CRT® 65 SMF®	93 64 5568
LF 55 / FAN 55.180	01 2001 -	III	CE 136 C	5,9	136	CRT® 65 SMF®	93 64 5568
LF 55 / FT 55.180	01 2001 -	III	CE 136 C	5,9	136	CRT® 65 SMF®	93 64 5568
LF 45	01 2001 -	III	CE 136 C0	5,9	136	CRT® 65 SMF®	93 64 5568
LF 55	01 2001 -	III	CE 136 C0	5,9	136	CRT® 65 SMF®	93 64 5568
LF 55 / FA 55.220	01 2001 -	III	CE 162 C	5,9	162	CRT® 81 SMF®	93 64 5570
LF 55 / FAN 55.220	01 2001 -	III	CE 162 C	5,9	162	CRT® 81 SMF®	93 64 5570
LF 45 / FA 45.220	01 2001 -	III	CE 162 C	5,9	162	CRT® 81 SMF®	93 64 5570
LF 55 / FT 55.220	01 2001 -	III	CE 162 C	5,9	162	CRT® 81 SMF®	93 64 5570
LF 45	01 2001 -	III	CE 162 C0	5,9	162	CRT® 81 SMF®	93 64 5570
LF 55	01 2001 -	III	CE 162 C0	5,9	162	CRT® 81 SMF®	93 64 5570
LF 55 / FA 55.250	01 2001 -	III	CE 184 C	5,9	184	CRT® 81 SMF®	93 64 5570
LF 55 / FAN 55.250	01 2001 -	III	CE 184 C	5,9	184	CRT® 81 SMF®	93 64 5570
LF 55 / FT 55.250	01 2001 -	III	CE 184 C	5,9	184	CRT® 81 SMF®	93 64 5570
LF 55	01 2001 -	III	CE 184 C0	5,9	184	CRT® 81 SMF®	93 64 5570
CF 65 / FA 65.180	01 2001 -	III	CE 136 C	5,9	136	CRT® 65 SMF®	93 64 5568
CF 65 / FA 65.220	01 2001 -	III	CE 162 C	5,9	162	CRT® 81 SMF®	93 64 5570
CF 65 / FA 65.220	01 2001 -	III	CE 184 C	5,9	184	CRT® 81 SMF®	93 64 5570

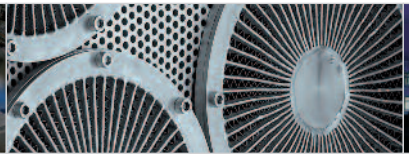
MAN TGA EURO III – 100% soot-free

Vehicle	Year	EURO Standard	Engine	Displacement ltr.	Performance kW	System	Article-Nr.
IVECO							
Eurocargo 60 E	2000 - 2006	III	Tector F4A E13	3,9	95	CRT® 65 SMF®	93 64 5568
Eurocargo 65 E	2000 - 2006	III	Tector F4A E15	3,9	110	CRT® 65 SMF®	93 64 5568
Eurocargo 75 E	2000 - 2006	III	Tector F4A E17	3,9	125	CRT® 65 SMF®	93 64 5568
Eurocargo 80 E	2000 - 2006	III	Tector F4A E17	3,9	125	CRT® 65 SMF®	93 64 5568
Eurocargo 110 EL	2000 - 2006	III	Tector F4A E17	3,9	125	CRT® 65 SMF®	93 64 5568
Eurocargo 80 EL	2000 - 2006	III	Tector F4A E18	5,9	134	CRT® 65 SMF®	93 64 5568
Eurocargo 90 E	2000 - 2006	III	Tector F4A E18	5,9	134	CRT® 65 SMF®	93 64 5568
Eurocargo 100 E	2000 - 2006	III	Tector F4A E21	5,9	154	CRT® 65 SMF®	93 64 5568
Eurocargo 120 EL	2000 - 2006	III	Tector F4A E21	5,9	154	CRT® 65 SMF®	93 64 5568
MAN							
F 2000	1994 - 2000	III	D 2866 LF	10,5	250, 294, 338	SMF® F2000 97	i.p.
TGA	2001 - 2006	III	D 2866 LF	10,5	228, 257,287, 316	SMF® TGA 96	i.p.
TGA	2001 - 2006	III	D 20	12,8	338, 353, 375, 390	SMF® TGA 96	i.p.
Mercedes Benz							
Econic/Axor	2001 - 2006	III	OM 906 LA	6,3	170, 205	CRT® 72 SMF®	93 64 3861
Econic/Axor	2001 - 2006	III	OM 906 LA	6,3	170, 205	CRT® 72 CSMF®	93 75 3861
Econic/Axor	2001 - 2006	III	OM 906 LA	6,3	170, 205	CRT® 72 SMF®	93 64 3053
Econic/Axor	2001 - 2006	III	OM 906 LA	6,3	170, 205	CRT® 72 CSMF®	93 75 3053
Econic/Axor	2001 - 2006	III	OM 906 LA	6,3	170, 205	CRT® 72 CSMF®	93 75 3536
Atego	ab 1998	III	OM 906 LA	6,3	170, 205	CRT® 80-B SMF®	93 64 3768
Atego	ab 1998	III	OM 906 LA	6,3	170, 205	CRT® 80 CSMF®	93 75 3768
Atego	ab 1998	III	OM 906 LA	6,3	170, 205	CRT® 80-A SMF®	93 64 3535
Atego	ab 1998	III	OM 906 LA	6,3	170, 205	CRT® 80 CSMF®	93 75 3535
Atego	ab 1998	III	OM 904 LA	4,2	110	CRT® 81 SMF®	93 64 3821
Atego	ab 1998	III	OM 904 LA	4,2	110	CRT® 81 CSMF®	93 75 3821
Atego	ab 1998	III	OM 906 LA	6,3	170, 205	CRT® 81 SMF®	93 64 3605
Atego	ab 1998	III	OM 906 LA	6,3	170, 205	CRT® 81 CSMF®	93 75 3605
Atego	ab 1998	III	OM 904 LA	4,2	110	CRT® 82-A SMF®	93 64 3590
Atego	ab 1998	III	OM 904 LA	4,2	110	CRT® 82-A CSMF®	93 75 3590
Actros/Axor	2002 - 2006	III	OM 457 LA	12,0	220, 260	CRT® 83-A SMF®	93 64 3580
Actros/Axor	2002 - 2006	III	OM 457 LA	12,0	220, 260	CRT® 83-A CSMF®	93 75 3580
Actros/Axor	2002 - 2006	III	OM 501 LA	12,0	235, 265, 300, 320, 335	CRT® 83-A SMF®	93 64 3580
Actros/Axor	2002 - 2006	III	OM 501 LA	12,0	235, 265, 300, 320, 335	CRT® 83-A CSMF®	93 75 3580
Actros/Axor	2002 - 2006	III	OM 502 LA	16,0	370, 395, 425, 450	CRT® 83-B SMF®	93 75 3457
Actros/Axor	2002 - 2006	III	OM 502 LA	16,0	370, 395, 425, 450	CRT® 83 CSMF®	93 75 3457

As a medium sized company based in Menden/Germany, HJS Fahrzeugtechnik GmbH & Co KG has more than 30 years experience and expertise in the field of exhaust-gas aftertreatment. Some 500 employees develop, produce and market modular systems for the reduction of pollutant emissions. These innovative environmental protection technologies can be used either for original equipment or for retrofitting in passenger cars, commercial vehicles and various non-road applications. In addition to systems for spark-ignition engines, HJS is particularly specialised in systems for diesel engines – especially for reducing soot particle and nitrogen oxide emissions. All systems meet the statutory requirements and are certified in accordance with the valid licensing regulations.

With its extensive range of patents for DPF® (Diesel Particulate Filter) and SCRT® (Selective Catalytic Reduction Technology), HJS sets benchmarks, both nationally and globally.






HJS Technology portfolio for OE- and Retrofit-Applications

> Oxidation Catalysts
> Diesel Particulate Filters (DPF®)
  - Sintered Metal Filters (SMF®)
  - Silicium Carbit Filters (SiC)
  - Cordierite Filters
> Modular CRT®-SMF®-Systems
> Modular CSMF®-Systems
> SMF®-AR-Systems – with active regeneration
> Fuel-Converter for DPF® regeneration
> SCR-Systems to eliminate nitrogen oxides
> SCRT®-Systems – reduction of soot-particle and nitrogen-oxide emissions

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