BOSCH
Invented for life

FILTERS

Product Information Automotive

PIA

Contents

Bosch filters: **P**roduct **I**nformation **A**utomotive

Bosch filters protect important and expensive components on and inside your vehicle. They keep dirt, abrasive and fine particles – in case of diesel engines even water – away from injection systems, engines and occupants. What's more, Bosch provides a comprehensive product range to suit nearly every car and commercial vehicle – which is constantly updated and extended. Retailers and workshops relying on Bosch filters, i.e. filters from the global filter specialist, will thus always receive state-of-the-art filters.

Bodyguards for the engine
Bosch filters protect engines, especially in vehicles with modern gasoline and diesel injection systems featuring lower tolerance levels. State-of-the-art technology is used to produce Bosch filters. As a result, they provide highly reliable protection of engine components against smallest dirt particles, abrasive particles and water.

System expertise
The home of knowledge: As pioneer and a global leader concerning injection and engine management systems, Bosch is specialist for components perfectly matching one another.

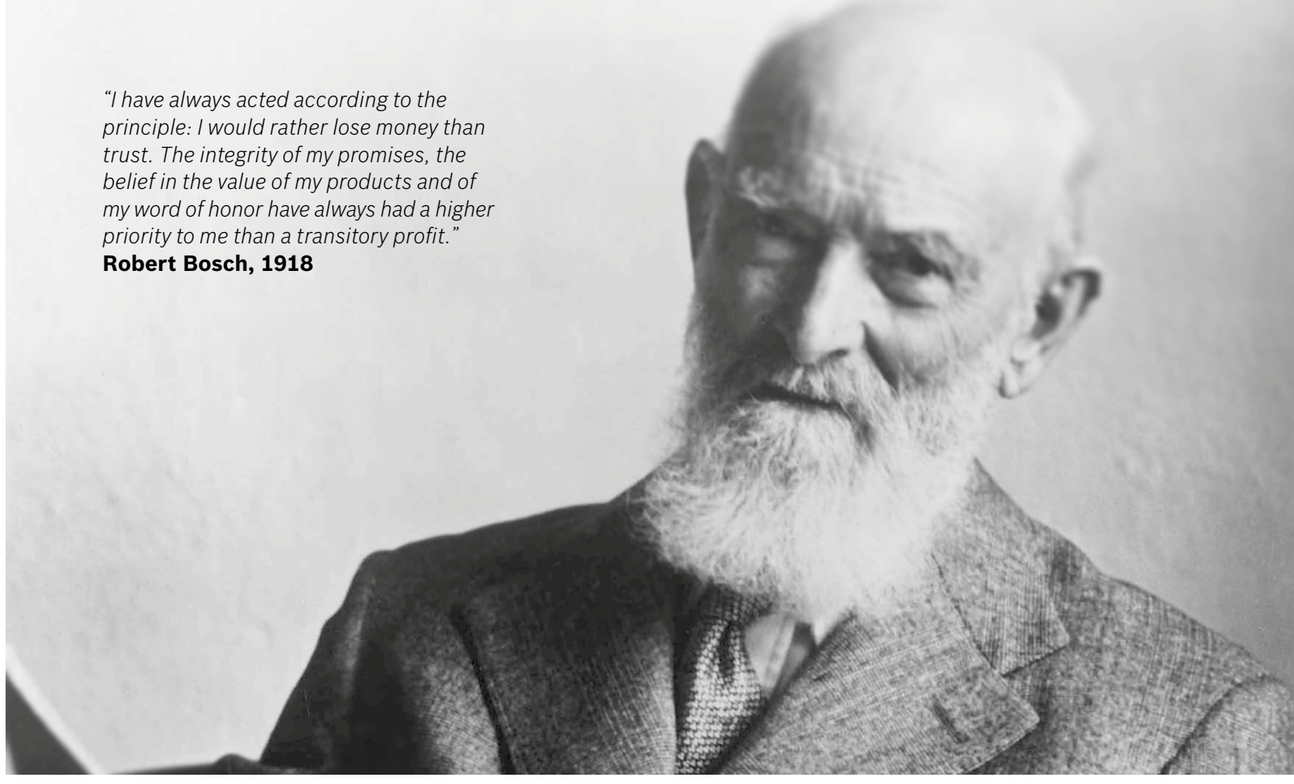
Sustainable further development
Development of vehicles and engines does not stand still. Bosch thus develops filters meeting special requirements, for instance, those of biofuels and hybrid vehicles. Environmental protection and conservation of resources play key roles at both development and production of Bosch filters.

Filter circle of quality:
good reasons for relying on Bosch filters

Bosch filters protect important and expensive vehicle components. In return, no compromises can be made concerning their product quality. Every Bosch filter features high-quality materials, top processing and technical know-how.

Five steps to top quality:

- **Development:** Developing new filters, the Simultaneous Engineering Team sticks to an elaborate procedure with precisely defined milestones.
- **Production:** High-quality materials, neat and accurate processing, and well-defined quality checks ensure consistently high quality of Bosch filters.
- **Release:** Only those new Bosch filters the product manager released once they passed the final technical tests, are made available for sale.
- **Checks:** Each new Bosch filter is subjected to random-sample tests before being stocked.
- **Field observation:** If so and once a mistake occurs, it is taken as a basis to learn from mistakes thus optimizing the series production.



“I have always acted according to the principle: I would rather lose money than trust. The integrity of my promises, the belief in the value of my products and of my word of honor have always had a higher priority to me than a transitory profit.”
Robert Bosch, 1918

At the Bosch filter production, a major focus is placed on environmental protection:

- Environmentally friendly development complying with the most stringent legal standards, use of recycled materials and avoidance of harmful ingredients
- Environmental protection throughout production due to Bosch‘s own environmental standard, being even stricter than legal guidelines
- Sustainable products and waste reduction by replaceable filter inserts

Did you know?

More than

80 years

ago, Robert Bosch first used a special paper for fuel filters – a material constantly improved ever since and still used today.

Filter development:
constantly focused on future requirements

Modern vehicle powertrains such as start/stop systems and hybrid drives, little space in engine compartments, biofuels and both current and future emission standards are the main forces driving filter innovations. Bosch thus promotes research and development of

- resilient sealing and housing materials coping better and longer with aggressive components of biodiesel and E10
- improved filter media allowing smaller and more individual filter designs
- new technologies for water separation improving the separation of even finer solubilized water particles

Common system know-how
This happens only at Bosch: Closely cooperating with developers of gasoline and diesel systems, the filter developers gain first-hand knowledge about specific system requirements.

Optical particle counting when testing filter efficiency

Microscopic analysis of filter-media characteristics

Bosch filters:
worldwide presence

Development:
Aranjuez, Spain
Bangalore, India

Production:
Aranjuez, Spain
Nalagarh, India
Nelamangala, India

Product management, purchasing department and quality management:
Bangalore, India
Belgrade, Serbia
Campinas, Brazil
Chicago, USA
Karlsruhe, Germany
Shanghai, China
Singapore

Did you know?

Filter tests at the laboratory are performed with Arizona test dust. Its composition and purity complies with the

SAE J726

test standard.

Plant in Aranjuez: filter production and plastics know-how under a single roof

Ever since 1978, Bosch has been producing filters in Spain. Nowadays, the plant in Aranjuez produces fuel filters, oil filter elements and Denoxtronic filters. In addition, it is also specialized on plastics. It produces complex plastic components, some of them with integrated electronic components – for example, housing modules for Denoxtronic 2.2 supply modules.

Due to installation space restrictions and energy efficiency requirements, future filters also ought to be „small and light“ with individual designs and modular concepts. Combining filter know-how and a high expertise concerning plastic technologies, the plant in Aranjuez is perfectly set for current and future customer requirements.

Gasoline-filter assembly line

Production portfolio

Illustration	Product	for Bosch business division
	Diesel filters	AA
	Gasoline filters	AA
	Oil filter elements	AA
	Denoxtronic filters for commercial vehicles	AA, DS
	Denoxtronic filters for passenger cars	DS
	Denoxtronic 2.2 supply-module components	DS
	Gasoline filters for Bosch in-tank units	AA, GS
	Electric components of Bosch sensors	AE

Air-helium leakproofness test

Did you know?

Each and every fuel filter is subject to a leakproofness test performed with

helium

at a vacuum chamber.

Car filters: product range

Bosch – a strong partner for filter businesses

Satisfied customers, low warehousing and ordering efforts, always using the latest technologies – Bosch filters stand out for numerous convincing USP:

- Safety thanks to first-class product quality
- Complete range consiting of more than 2 500 filters from a single source
- Market coverage of 95 %
- Updated product range with more than 200 new releases each year
- High availability of goods – in more than 100 countries worldwide
- Strategic partner for the future offering training courses and seminars
- Strong brand trusted by its customers

LESERWAHL
BEST BRAND 2017
KATEGORIE Filter
auto motor und sport

A strong brand
12 times in a row, the readers of the German automobile magazine “auto, motor und sport” voted Bosch the best brand in the Filters category.

Fuel filters

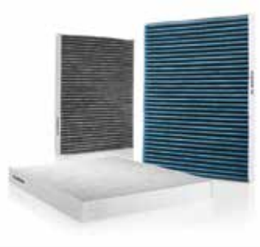
Bosch fuel filters protect the injection system. They reliably separate particles and water from fuel and contribute to optimum engine performance.

Oil filters

Bosch oil filters protect the engine. They reliably remove soot and metal particles from engine oil.

Air filters

Bosch air filters protect the engine. They reliably remove particles from the intake air thus contributing to optimum engine performance.



Cabin filters

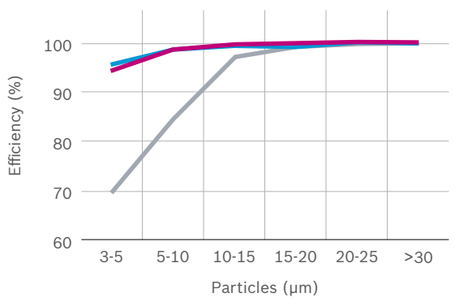
Bosch cabin filters protect the vehicle occupants against pollen, fine dusts as well as harmful and foul-smelling gases. The new FILTER^{+} provides additional health protection inside the car – especially for allergy sufferers.

Bosch fuel filters in comparison:
quality pays off

Bosch filters are not available at bargain prices because they combine high-quality materials, meticulous processing and high development efforts. Tests at the laboratory reveal the differences between Bosch quality filters and cheap filters.

Efficiency

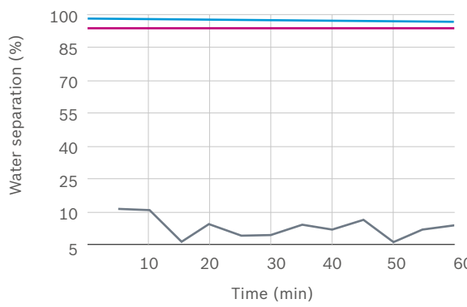
Lower efficiency of cheap filters
➔6 times more particles get into the injection system!



▶ Standard (ISO TR 13353)
▶ High-quality filter, e.g. Bosch ▶ Low-quality filter

Water separation

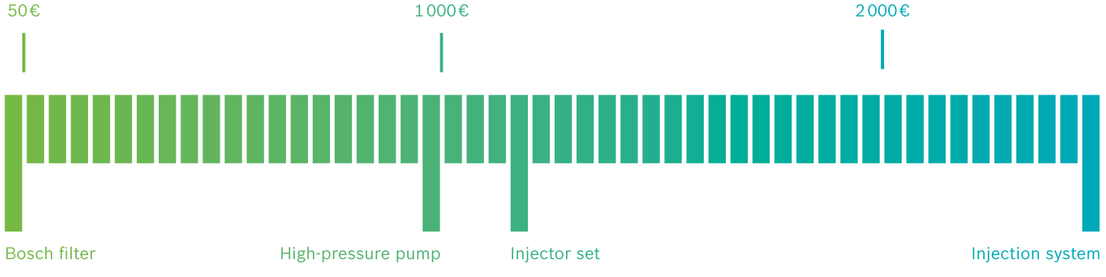
Water separation does not fulfill the standard requirements
➔Risk of corrosion within fuel injection system!

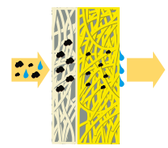
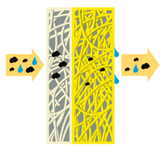
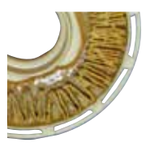
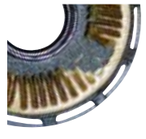
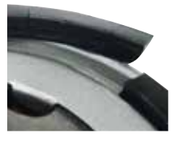


▶ Standard requirements (ISO / TR 16332)
▶ High-quality filter, e.g. Bosch ▶ Low-quality filter

Cheap today, expensive tomorrow
With respect to fuel filters, those willing to save on the wrong things risk expensive damage, for example to nozzles or the high-pressure pump. Only quality filters are worth their price. They keep their promises.

Cost relations



On the safe side with Bosch filters		Cheap filters – expensive consequences!
High particle separation rate thanks to micro-porous multilayer filter medium		 Low-quality filter medium ▶ Increased engine wear ▶ Injector clogging ▶ Corrosion
Large dust-holding capacity through high number of pleats		 Lower number of pleats ▶ Increased engine wear due to particles ▶ Reduced service life
Reliable filtration thanks to stable pleat geometry		 Unstable pleat geometry ▶ Insufficient fuel filtration ▶ Increased engine wear
Corrosion-resistant housing prevents fuel leakages		 Corrosion caused by spray water ▶ Hazards caused by leaking fuel ▶ Environmental pollution ▶ Increased engine wear
Robust connection of the end pleats		 Bypass of unfiltered fuel caused by missing connection of end pleats ▶ Increased engine wear
High-quality seal made out of a special rubber prevents any fuel leakage		 Damaged, porous seal ▶ Hazards caused by leaking fuel ▶ Environmental pollution
Protection cap on the clean side (outlet) of the filter to prevent any soiling during transport and storage		 Missing protection cap facilitates filter soiling ▶ Increased engine wear caused by dirt particles ▶ Reduced filter service life

Bosch fuel filters:
FAQs about quality

Which types of filter media are used most commonly?
Depending on the individual specifications, the filter media used consist of

- cellulose-based paper with a special impregnation: Cellulose is a natural product. Its fibers can vary in shape and size. The impregnation ensures a high mechanical, thermal and chemical resilience of the filter medium. This kind of filter medium is primarily used for gasoline filters.

- multilayer filter media: At a sophisticated procedure, the cellulose with special impregnation is coated with a plastic layer. This combination increases the separation rate in comparison with pure paper media. These filter media are primarily used for diesel filters.

- fiberglass / synthetic fibers: These filter media meet even tougher demands – such as e.g. the demands of common rail systems requiring maximum fuel purity. Synthetic fibers can be produced extremely thin and homogeneously. This results in high separation rates without any influence on the differential pressure.

Why are there yellow and white filter media?
The color of the filter medium makes no reference to the filter quality. It rather depends on its specifications. The base material – cellulose – is white. It is coated with a yellow melt-blown layer. Depending on the filter application, it is then cured at a furnace intensifying the yellow color even further.

Diesel filter with support ring

What does the pressure-pulsation test indicate and why is it so important?
At this test, the filter durability is checked. The filter is tested subjecting it to specific pressure ranges and routines at a test bench. These cycles are used to simulate the operation in start/stop systems – for instance – causing increased pressure pulsations within the fuel lining due to the increased start-up frequency.

Which types of connections are used to connect filter elements and end caps?
Besides simple gluing, there are two welding procedures used to combine the filter element with the end caps:

- Infrared welding: The plastic cover is heated by infrared lamps. The plastic is thus softened and the element is pressed into it. As the plastic cools down, both components are connected firmly – this is known as “plasticizing”

- Ultrasonic welding: At this procedure, the heat required for plasticizing is generated by ultrasonic waves turned into mechanical vibrations.

Why did the star shape of filter media prevail?
The star shape is extremely sturdy, it increases the dirt and water separation capacity of the filter medium and features a lower flow resistance. In addition, a larger filter surface can be installed on a smaller space using star pleats.

Why is a sturdy connection between end pleats and filter media so important?
The end pleats of the filter medium need to be connected lastingly in order to ensure internal integrity. Otherwise, the clean and the dirty side of the filter wouldn’t be separated from each other. Consequently, unfiltered fuel could get into the injection system.

Why is it, some diesel filters come with support ring?
At these filters, the support ring provides the required stability as the direction of flow of fuel is inverted. That is, with these filters, the fuel flows inside out.

Glossary of specialist terms

External integrity
No fuel must leave the filter housing in an uncontrolled manner – important safety feature!

Operating pressure
Pressure inside a vehicle’s fuel lining under normal operating conditions.

Differential pressure
The difference in fuel pressure between filter inlet and filter outlet – is to be as low as possible.

Double beading
Special sealing method for fuel-filter steel housings. For this purpose, a double-folded fringe is created between the housing and the rubberized lid.

Flow resistance
Pressure loss within the fuel pipe once the fuel passed the filter – must be as low as possible.

Internal integrity
The clean side of the filter must not get in contact with the contaminated one – i.e. leakage of unfiltered fuel is to be avoided.

Filter service life
The amount of dirt the filter medium is able to absorb until reaching a specified maximum differential pressure.

Meltblowing technique
Used to produce very fine high-separation filter media. For this purpose, plastic is melted and sprayed by a hot air stream. The extremely fine fibers thus created are then applied onto cellulose.

Dust separation capacity (efficiency)
Is determined by pore size and distribution; the distribution of pores must be as even as possible.

Measurement of the maximum pore size

Did you know?

The fineness of filter pores is tested with a special

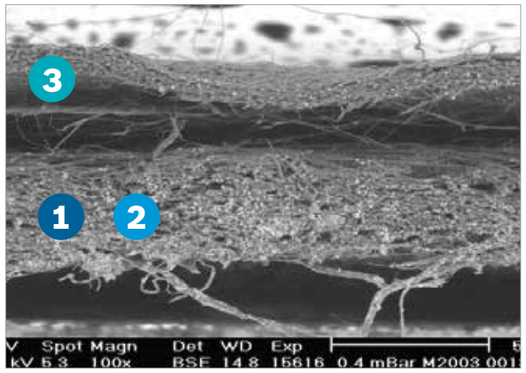
DIN ISO 2942

test using compressed air.

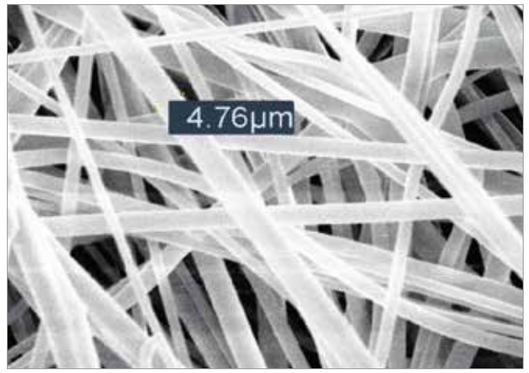
The core of fuel filters:
an effective filter medium

Multilayer structure of the filter medium

1. Cellulose layer: acts as carrier material
2. Special resin impregnation: is applied to the cellulose layer and cured at a special furnace
3. Polyester fiber layer: The plastic is melted and then sprayed by a hot air stream; the resulting fibers are applied to the cellulose via lamination



Multilayer structure



Microscopically small: finest polyester fibers

Main task of the filter medium: removal of particles from fuel

Type of contamination	Material	Origin	Damage
Heavy particles	Mineral materials (sand)	▶ Dust from the atmosphere ▶ Dirt from the tank ▶ Supply pipes	Wear and tear
	Rust	Corrosion inside the fuel tank	
	Metal particles	Mechanical grinding	
Light particles	Fibers	Environment	Clogging of injection nozzles
	Small plastic particles	Fragments of system components:	
Microparticles		From the tank system	Clogging of both filter and injectors

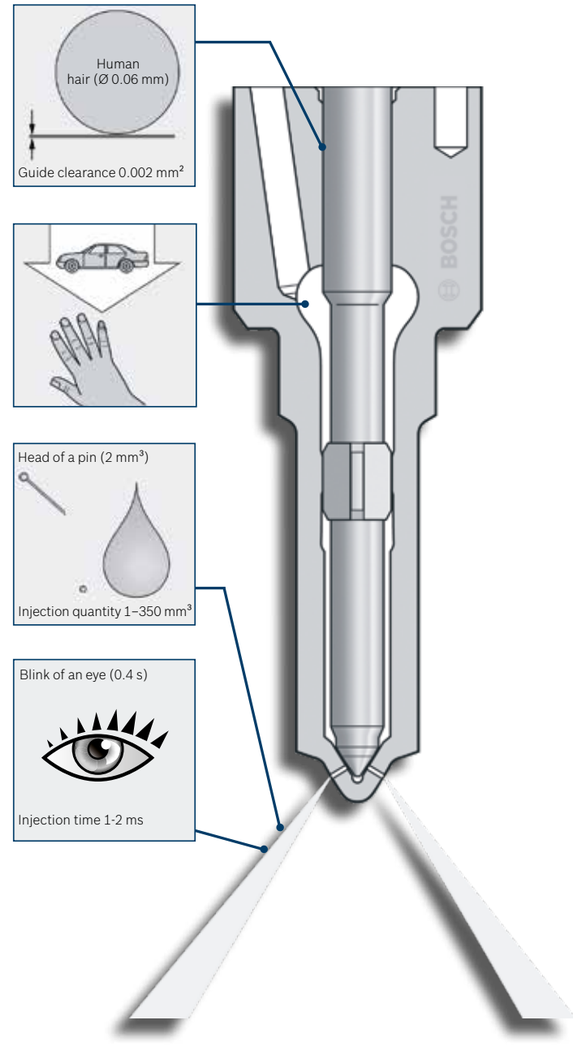
Bosch fuel injection: a world of superlatives

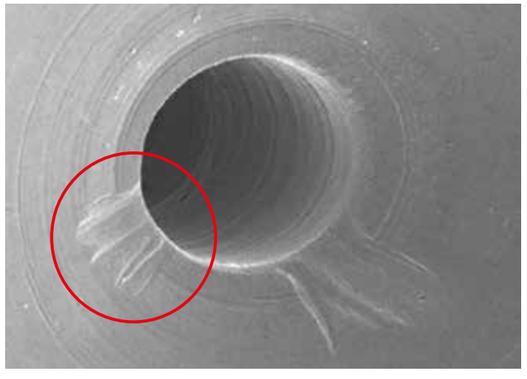
The guide clearance of moving parts amounts to 0.002 mm. In comparison, a human hair is 30 times as thick.

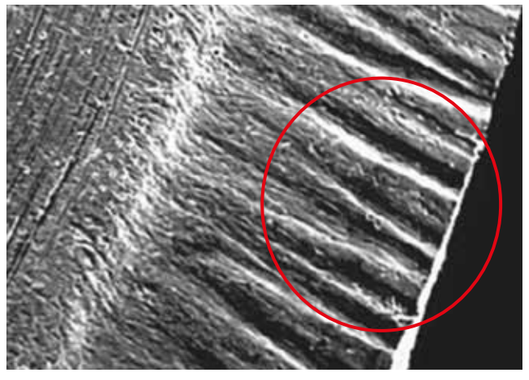
The fuel is injected into the combustion chamber with a pressure of up to 2 200 bar. This corresponds to the weight of an upper-class car placed on one square centimeter.

The injection quantity varies between 1 mm³ and 350 mm³. This quantity is pressed through an 0.25 mm hole at a speed of 2 000 km/h.

Much faster than the blink of an eye.
The injection time amounts to 1-2 milliseconds. A blink lasts longer than 200 injections.




Material abrasion on the injector


Scoring on a piston

Bosch diesel filters:
customized solutions to suit every need

Purpose of diesel filters:

- Protection of both injection system and engine against particles, water, and other residues in fuel

Change diesel filters regularly as specified by the vehicle manufacturer!

Consequences of clogged filters:

- Loss of engine power or even engine standstill
- Impairment or interruption of the fuel supply
- Impairments to the output of the fuel pump or even a short-circuit
- Internal corrosion of engine components

Also ideal for biodiesel: Bosch diesel filters
Produced according to EU standard, biodiesel (FAME = fatty acid methyl ester) is based on vegetable oil or animal fat and is then added to conventional mineral diesel fuel. In Europe, this additive may represent up to 7 % of the fuel (according to EN590). The special characteristics of biodiesel:

- Aggressive to sealing materials
- "Saponification" of the fuel through reactions with certain materials: clogging of injection nozzles
- Higher solubility of water in fuel:
  Reduced water separation by conventional diesel filters and risk of corrosion of injection-system components
- Increased growth of microorganisms

Thanks to resistant materials for seals and housing, ideal filter media, and improved water separation, Bosch diesel filters are the ideal solution – even when using biodiesel.

Sales arguments at a glance

Customer benefits	Product features
High particle separation rate, reliable water separation	Microporous, multilayer filter medium
High dust retention capacity, low flow resistance	Large filter surface
Moisture resistance and tensile strength	Filter medium with special impregnation
100% internal and external integrity	High-quality processing, use of highly resistant materials

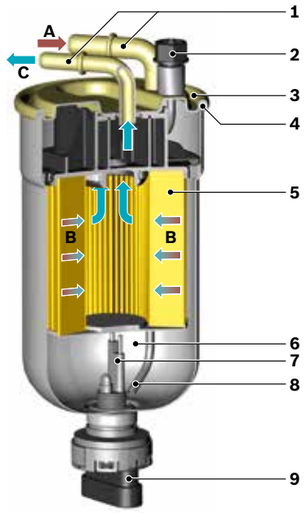
Diesel-filter designs

Illustration	Product
	**Line filter** Line filters are installed into the fuel lining.
	**Filter exchange box** Filter exchange boxes are spare parts for so-called assembly filters. When replaced, they are screwed right onto the assembly head. The assembly head is permanently attached to the engine or the chassis of the vehicle. It contains all parts not having to be changed regularly – e.g. temperature sensor, pressure regulator, and heating.
	**Filter insert with seal ring** In modern vehicles, environmentally friendly line filters with a replaceable filter insert are becoming more and more common. When changing the filter, only the filter element and the seal ring need to be replaced.
	**Common rail diesel filters – the upper class of line filters** Bosch common rail diesel filters protect even the most sensitive injection systems. The high pressures of over 2 200 bar and the low production tolerances of the components demand the ultimate in terms of purity of diesel fuel: ▶ Because of the high pressure, any water that is not separated can expand explosively and damage the injection nozzles. Corrosion and wear caused by insufficient lubrication may be other consequences. ▶ At such a high pressure, particles not separated become extremely destructive increasing the wear on injection nozzles.

The advantages of Bosch diesel filters

- Protection of the injection system
- Long filter service life
- Contribute to optimum engine performance

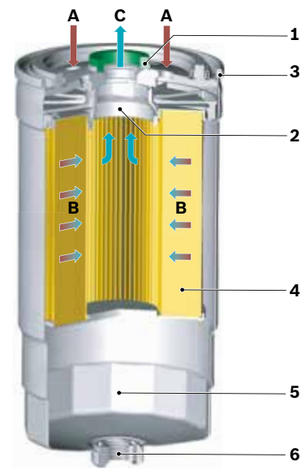
Impressive technology:
inner values of Bosch diesel filters



Design and operation of line filters

1 Hose connection
2 Water drain
3 Filter cover
4 Double beading
5 Multilayer filter medium
6 Water accumulation chamber
7 Water sensor
8 Water drain tube
9 Electrical connector for water sensor

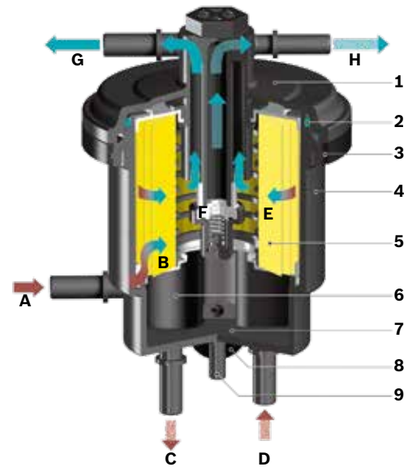
A Inflow of contaminated diesel
B Dirt and water filtration of diesel
C Cleaned diesel is conducted to the engine



Design and operation of filter exchange boxes

1 Seal
2 Threaded connection
3 Double beading
4 Multilayer filter medium
5 Water accumulation chamber
6 Water drain screw

A Inflow of contaminated diesel
B Dirt and water filtration of diesel
C Cleaned diesel is conducted to the engine



Design and operation of common rail diesel filters

1 Filter cover
2 Seal ring
3 Metal ring
4 Housing
5 Filter medium
6 Bimetal valve
7 Water accumulation chamber
8 Water drain screw
9 Drain tube

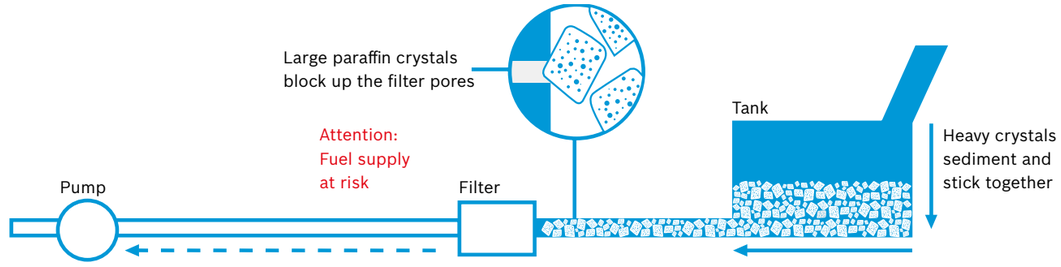
A Inflow of contaminated diesel
B Bimetal valve controls warm return flow from engine
C Fuel return flow to tank
D Fuel return flow from engine
E Dirt and water filtration of the diesel
F Overflow valve opens at 1 to 1.5 bar
G Clean diesel is conducted to engine
H Excess of diesel is returned to tank

Heated filters protect against:

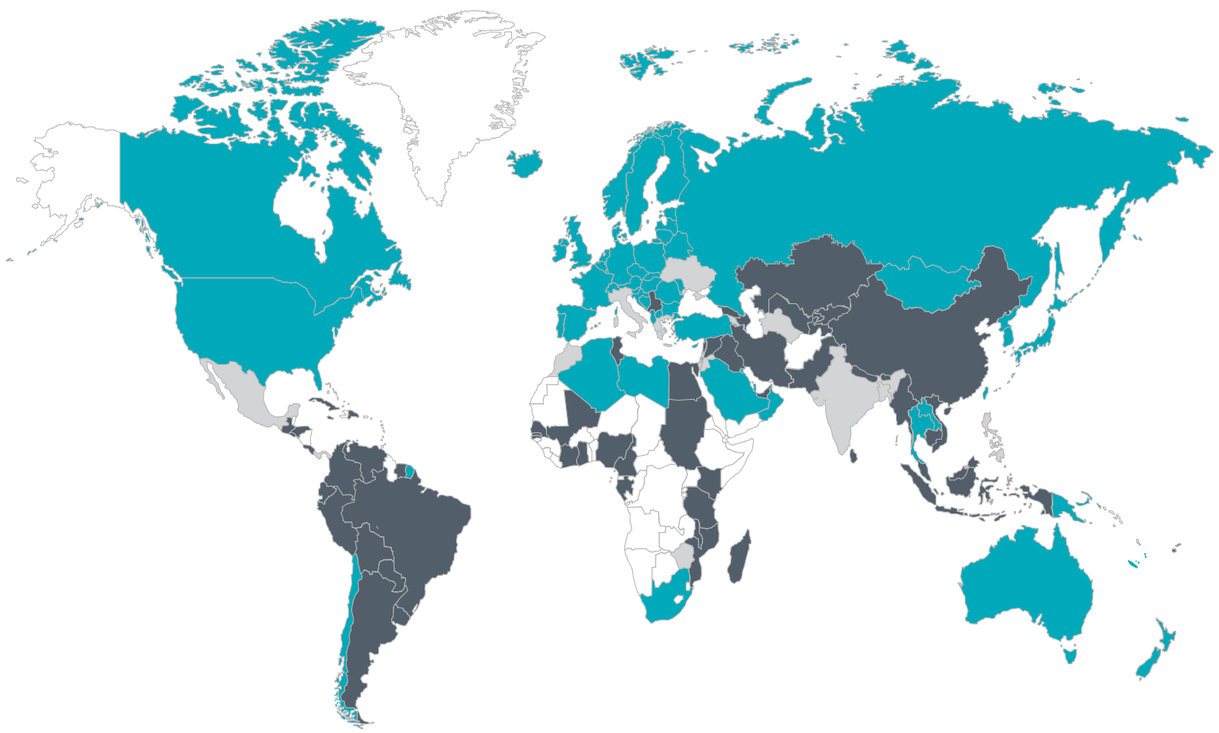
- Filter clogging
- Increase in flow resistance
- Increased strains on the fuel pump
- Engine standstill

- Passive heating: the regulator element makes sure preheated fuel is returned to the filter
- Active heating: a temperature sensor regulates constant and precisely controlled electrical heating via heating element
- The heating system can either be part of the filter itself or of the assembly head

At low temperatures, paraffins crystallize



Because of varying diesel quality:
perfectly set for sophisticated tasks



Source: SGS World Wide Fuel Surveys summer 2006 to winter 2010/2011

≤ 19 Established diesel markets
= 20
≥ 21
} Increased impurity due to particles

A suitable filter for any diesel quality
In global terms, the quality of diesel varies considerably. Depending on the region and the climatic conditions, the concentration of water and dust may be extremely high. Bosch thus provides various diesel filters perfectly geared to the individual diesel qualities of the respective country.

Indispensable: effective water separation
Water is the main enemy of any injection system, especially of diesel high-pressure pumps and injection nozzles (injectors). Therefore all Bosch diesel filters feature a particularly reliable water separation function. A prerequisite for this function is the star-shaped folding of the filter medium and a special, water-resistant resin coating.

How does water get into the diesel?

- It is present within the fuel itself
- By condensation inside the tank

Causes of insufficient water separation

- Non-compliance with replacement intervals
- Use of cheap filters

Expensive consequences

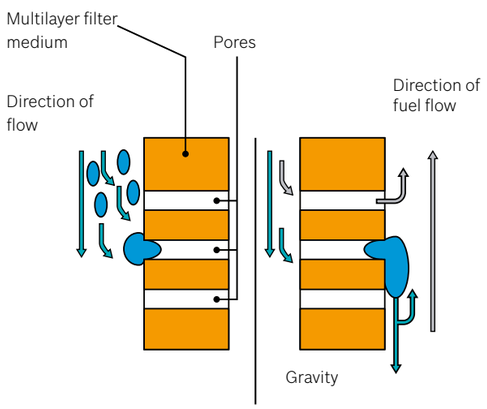
- Corrosion damage to injection system, engine, and pump
- Wear damage due to rust particles

Corrosion at the high-pressure pump housing

Corrosion at the injector

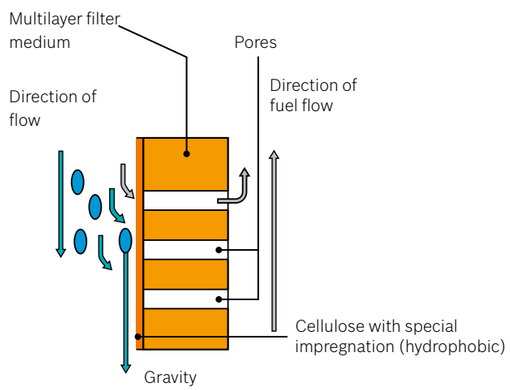
Principles of water separation

Coalescence effect



Water separation on the clean side of the filter, small water droplets combine into larger water drops as they flow through the pores (= coalescence effect). These larger drops then drop down.

Hydrophobic effect



Water separation on the dirty side of the filter thanks to a filter medium coated with a water-repellent (hydrophobic) special resin.

Bosch gasoline filters:
effective filtration of smallest particles

Purpose of gasoline filters:

- Protection of injection system and engine against particles and other residue within fuel

Change gasoline filters regularly as specified by the vehicle manufacturer!

Consequences of clogged filters:

- Loss of engine power or even engine standstill
- Impairment or interruption of the fuel supply
- Impairments to the output of the fuel pump or even a short-circuit

Sales arguments at a glance

Customer benefits	Product features
Long service life, high particle separation rate	Microporous, multilayer filter medium
High dust retention capacity, low flow resistance	Large filter surface
Moisture resistance and tensile strength	Filter medium with special impregnation
100% internal and external integrity	High-quality processing, use of highly resistant materials

E10 fuel – on the safe side with Bosch gasoline filters

E10 consists of 10 % bioethanol and 90 % gasoline. Due to its chemical composition, bioethanol may corrode certain materials.
Possible consequences:

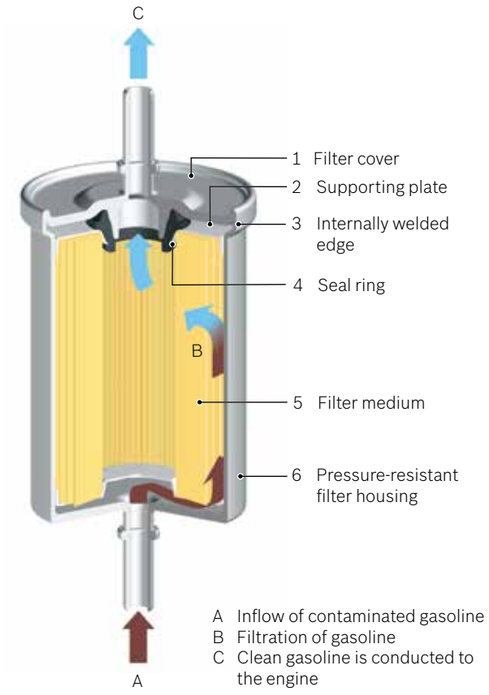
- Porosity of seals and elastomers
- Corrosion on aluminum parts

Thanks to resistant sealing and housing materials and optimized filter media, Bosch gasoline filters are perfectly suited for use with E10.

Going strong as original equipment

In modern vehicles, fuel supply modules are installed into the fuel tank more and more often. The permanently integrated fuel filter in such modules lasts for the vehicle's entire service life and is no wearing part. Several vehicle manufacturers use Bosch fuel supply modules with an integrated Bosch gasoline filter as original equipment for their vehicles.

Design and operation of gasoline filters



A Inflow of contaminated gasoline
B Filtration of gasoline
C Clean gasoline is conducted to the engine

The advantages of Bosch gasoline filters

- Protection of the injection systems
- Long filter service life
- Contribute to optimum engine performance

Bosch oil filters:
for the engine to run smoothly

Purpose of oil

- Minimization of wear and friction
- Heat dissipation
- Precision sealing and protection against corrosion
- Cleans the combustion chamber removing combustion residues

Task of oil filters:

- Protects the engine against impurities in oil such as dust, metal particles, combustion residues or soot particles

Urban traffic means stress for oil

Short-distance trips and frequent cold starts can cause an excess of fuel within the combustion mixture and increased condensation.
That is, ...

- the oil is soiled by unburnt hydrocarbons and condensation causing premature aging of oil
- at high engine temperatures, these components evaporate inside the oil circuit thus reducing the lubrication quality even further

Therefore: Use high-quality engine oil combined with Bosch quality filters in order to prevent premature oil aging.

Change oil filters regularly as specified by the vehicle manufacturer!

Consequences of clogged filters:

- Premature engine wear or even engine damage
- Reduced engine performance
- Increased oil consumption

Sales arguments at a glance

Customer benefits	Product features
Long service life of both filter and engine oil	Microporous, specially impregnated filter medium
High dust retention capacity	Large filter surface
High particle separation rate	Specifically designed and perfectly matched components
Reliable engine lubrication at all temperatures and oil pressures	Integrated bypass valve and backstop
No oil leaks	Seals made of a special rubber,corrosion-resistant housing materials

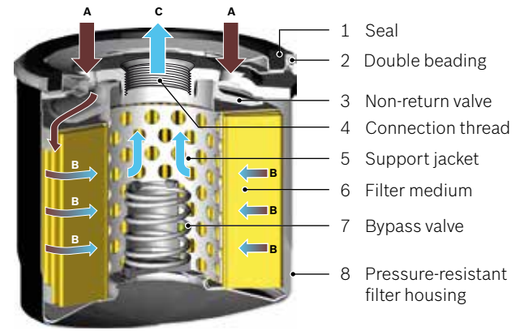
Non-return valve

- Prevents idling of the oil filter after switching off the engine
- Immediate lubrication at restarts thanks to quick buildup of pressure

Bypass valve

- Guarantees continuous oil supply for the engine at low ambient temperatures and protection when the filter is clogged at the end of service life through brief bypassing of the filter
- Less damage caused by impurities than by interrupted oil supply and cooling

Oil filters – design and operation



A Inflow of contaminated oil
B Filtration of oil
C Clean oil is conducted to the engine

Oil filter designs

Oil filter insert
The oil filter housing is permanently connected to the engine block. When changing the filter, only the filter insert and the seals are replaced.

Oil filter exchange box
When changing the filter, the entire oil filter is replaced and screwed right onto the engine block using a connector flange.

Oil filters – types

Main flow filter

- With each cycle, all of the oil passes the filter

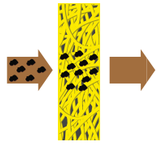
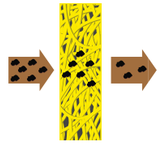
Combined main-flow/bypass filter

- 100 % of the oil is filtered by the main flow filter
- In addition, 10 % of the oil are subject to a fine filtration at the bypass filter – slowing down oil aging

The advantages of Bosch oil filters

- Protection of the engine from wear
- Extends the service life of oil filter and engine oil
- Contribute to optimum engine performance

Bosch oil filters in comparison:
quality pays off

On the safe side with Bosch filters		Cheap filters – expensive consequences!
High particle separation rate thanks to microporous filter medium with special impregnation		 Low-quality filter medium ▶ Increased engine wear ▶ Possible increase in fuel consumption
Large dust-holding capacity through large number of pleats		 Low number of pleats ▶ Poor filtration ▶ Increased wear or even engine damage ▶ Reduced service life
Reliable filtration thanks to meticulous processing and stable pleat geometry		 Unstable pleat geometry, excess of adhesives ▶ Increased engine wear ▶ Possible increase in fuel consumption
Corrosion-resistant housing prevents oil leakages		 Corrosion caused by spray water ▶ Increased wear or even engine damage ▶ Environmental pollution caused by leaking oil
Robust felt ring prevents oil leakages		 Poorly fitting felt ring ▶ Loss of internal integrity, poor filtration of oils ▶ Increased wear up to engine damage
High-quality seal made of a special rubber prevents oil leakages		 Damaged, porous seal ▶ Increased wear or even engine damage ▶ Environmental pollution caused by leaking oil
Accurately set valve-opening pressure ensures reliable engine lubrication – even under cold conditions and in case of a clogged filter.		 Poor functioning of the bypass valve ▶ Increased wear or even engine damage ▶ Bursting of the oil filter

FAQs about quality

How important is the country of origin, and how does it affect the filter quality?
The country of origin of Bosch filters does not matter at all since Bosch filters always feature quality "made by Bosch". The same ISO standards and Bosch guidelines concerning filter development and production are applied at all facilities worldwide.

Which are the most commonly used filter media?
Oil filters are made of cellulose-based filter media with a special impregnation. Cellulose is a natural product. Its fibers can vary in shape and size. The impregnation ensures the high mechanical, thermal and chemical resilience of the filter medium.

Why did the star shape of filter media prevail?
The star shape is extremely sturdy, it increases the dirt separation capacity of the filter medium and features a lower flow resistance. In addition, a larger filter surface can be installed on a smaller space using star pleats.

Why is a sturdy connection between end pleats and filter media so important?
The end pleats of the filter medium need to be connected lastingly in order to ensure internal integrity. Otherwise, the filter's clean and dirty sides would not be separated from each other. As a result, unfiltered fuel could get into the injection system.

What does "opening pressure of the bypass valve" mean?
In case of low ambient temperatures or very soiled oil, the bypass valve makes sure the engine is constantly supplied with oil by passing it by the filter for short instants. Such viscous oil requires an increased pressure to be pushed through the filter. Once the pressure level reaches a predefined limit (= opening pressure), the bypass valve is opened. The accurate design and version of these bypass valves is an important quality feature.

Why are there both filter exchange boxes and filter inserts?
Shape and specifications of oil filters are set by the vehicle manufacturers. Basically, filter exchange boxes and filter inserts have the same function. In addition, filter exchange boxes are equipped with a bypass valve and a non-return valve. In case of filter inserts, this job is performed by a firmly integrated filter housing.
Throughout the last years, a clear trend towards filter inserts could be seen among car manufacturers. As they don't require any metal housing, they are easier on the environment and help saving resources.

Measurement of the pleat depth

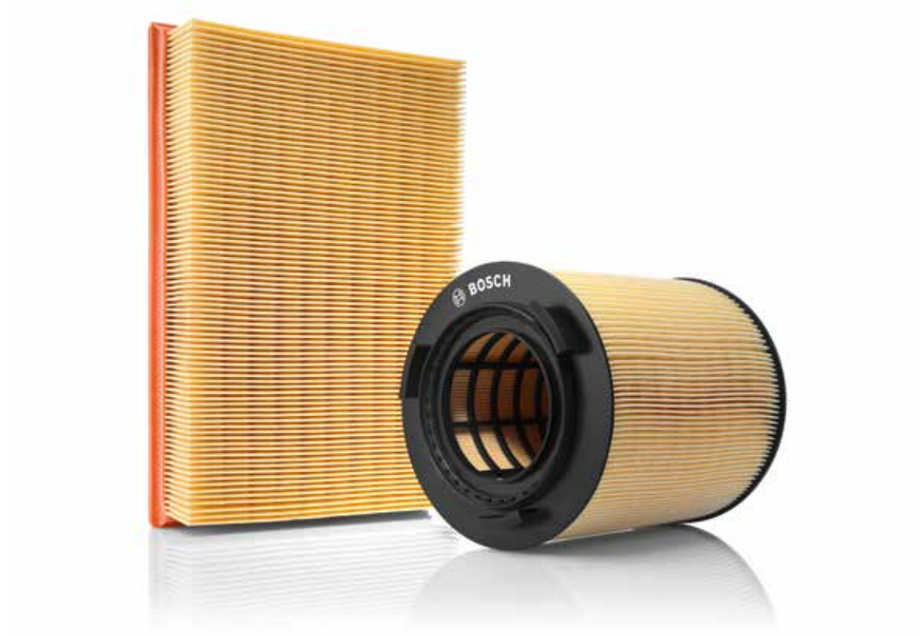
Did you know?

The filter surface is calculated as follows:

2 x

pleat depth x pleat width x amount of pleats
= surface of the filter medium

Bosch air filters:
final stop for dirt particles of all kinds



Purpose of air filters

- Protection of the engine against dirt particles within the intake air
- Protection of the engine against wear
- Safeguarding of the air supply for the mixture preparation

Change air filters regularly as specified by the vehicle manufacturer!

Consequences of clogged filters:

- Insufficient air supply, thus reduced engine performance and increased pollutant emissions
- Increased fuel consumption
- Problems when starting the engine
- Premature contamination of oil

Sales arguments at a glance

Customer benefits	Product features
Long service life, high particle separation rate, moisture resistance and tensile strength	Microporous, specially impregnated filter medium
High dust retention capacity and low flow resistance	Large filter surface
Robust pleat geometry	Filter medium with special embossing
Perfect fit	Accurate fit and high-quality sealing materials

Why air filters must not be cleaned

To burn 1 liter of fuel, you need 10 000 liters of air. That makes it all the more important that air filters work perfectly and are changed regularly. If you try to extend the service life of an air filter by cleaning the filter medium with compressed air, you are making a false economy.
The risks are as follows:

- Compressed air destroys the pleats of the filter medium thus impeding the proper operation of air filters
- Impurities enclosed within the filter medium are released again
- Dirt and other particles penetrate into the engine causing a loss of power and, in the worst case, damaging the engine

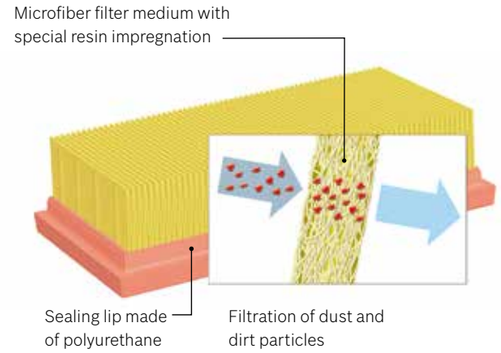
Hot-film air mass meter for precise mixture preparation

Hot-film air-mass meters are sensors measuring the mass of intake air. They send this information to the engine control unit for optimum mixture preparation. They are usually fitted into the intake duct right behind the air filter. For flawless operation, they need

- clean air
- a constant airflow without any disruptive turbulences

In this regard, air filters play an extremely important role.

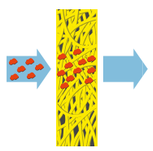
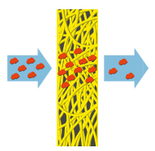
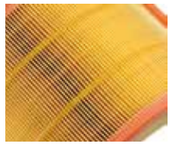
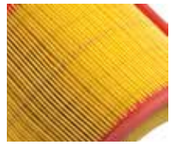
Design and operation of air filters



The advantages of Bosch air filters

- Protection of the engine
- Long filter service life
- Contribute to optimum engine performance

Bosch air filters in comparison:
quality pays off

On the safe side with Bosch filters		Cheap filters – expensive consequences!	
High particle separation rate thanks to microporous filter medium			Low-quality filter medium ▶ Increased wear at the engine ▶ Accumulation of dirt on the air-mass meter
Large dust-holding capacity thanks to high number of pleats			Low number of pleats ▶ Reduced service life
Moisture resistance thanks to impregnation with special resin			Conglomeration of pleats due to moisture ▶ Decreased engine performance ▶ Increased fuel consumption
Inflammation protection tanks to special coating			Fire hazard caused by aspirated cigarette stubs or backfire ▶ Vehicle fire
Permanently stable pleat geometry thanks to sufficiently dimensioned glue beads			Unstable pleat geometry ▶ Reduced service life ▶ Reduced engine performance ▶ Increased fuel consumption
No bypass of unfiltered air thanks to high-quality polyurethane seal			Poor processing, low-quality sealing material ▶ Increased engine wear ▶ Accumulation of dirt on the air-mass meter
No loss of filter surface thanks to careful processing of the sealing material			Excessive use of sealing material ▶ Short service life ▶ Reduced engine performance ▶ Increased fuel consumption

FAQs about quality

Which types of filter media are most commonly used?
Depending on the individual specifications, the filter media used consist of

- cellulose-based paper with a special impregnation: Cellulose is a natural product. Its fibers can vary in shape and size. The impregnation ensures the high mechanical resilience of the filter medium as well as its resistance to moisture.
- synthetic fibers: Synthetic fibers can be produced extremely thin and homogeneously. This results in a high dust retention capacity concomitant with small construction sizes and unaltered replacement intervals.
  Prefilters are also made of synthetic fibers. They are often used in dusty areas to increase the filter service life.

What does the initial restriction test show?
This test makes sure that the air flow at the intake is not slowed too much by a new air filter.

Why is the dust retention capacity so important and how is it measured?
This quality feature decides upon the filter service life. It indicates the amount of dirt the filter is able to collect before having to be replaced.
At the same time, compliance with the specified differential pressure is to be ensured. Bosch measures this by means of ISO 5011 simulation tests.

How important is the filter surface and how does Bosch compare to others in this regard?
The filter surface is an important criterion for optimum filter performance, but it's not the only one. A perfectly matched combination and coordination of several different components of the filter medium – that is, e.g. pleats, grammage (thickness) and surface finish (embossing, coating) – are decisive factors. In this regard, Bosch applies the same standards for functional and quality tests as for original equipment.

How is the filter medium connected to the filter frame?
A lasting and robust connection between filter medium and filter frame is of major importance in order to prevent any bypass of unfiltered – or unmetered – air into the engine. For this purpose and depending on the individual specifications, gluing or welding procedures are performed. Nonetheless, the procedure used has no influence on the quality of the connection.

Paper burst strength test

Did you know?

In order to check the mechanical stability of filter media, the amount of

newton meters

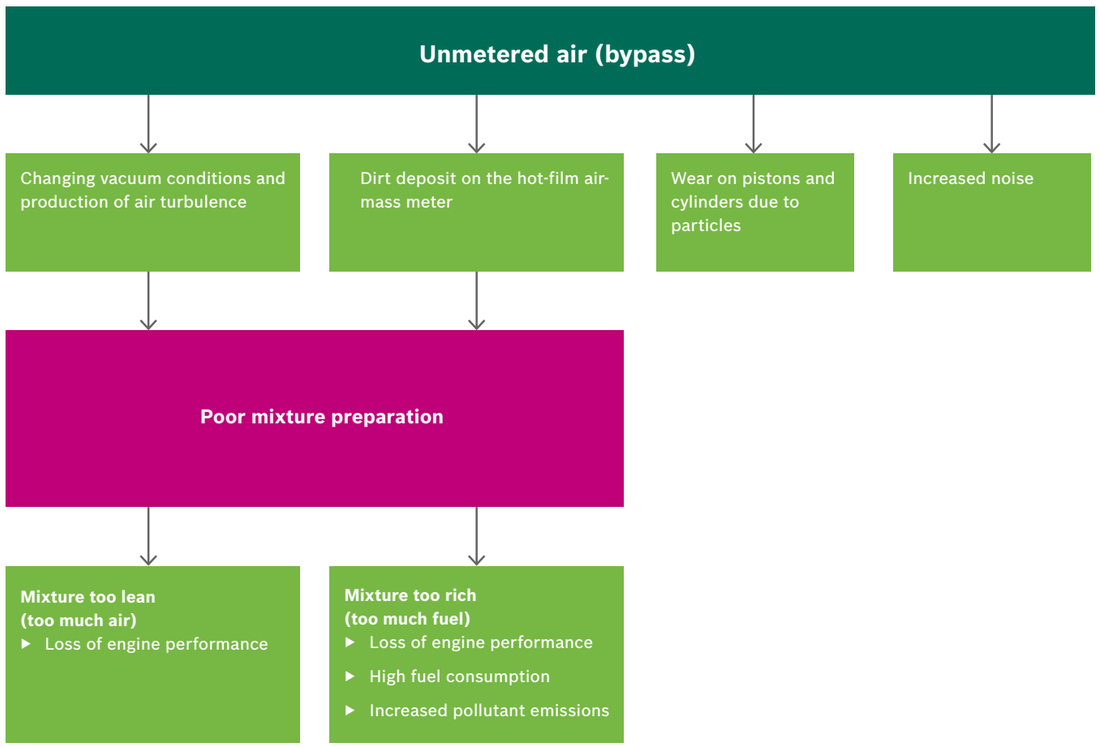
required to tear apart a wet piece of the tested filter medium is measured.

Prevents unmetered air:
the seal of air filters

The prerequisite for flawless operation: leakproofness
Without a reliable seal, any air filter would be useless as leakages and porosity cause a bypass of unfiltered (unmetered) air into the intake duct. Bosch air filters are equipped with a particularly lasting seal made of polyurethane:

- Precise fit matched to the housing shapes
- Unevenness at the housing is compensated
- Flexibility and suppleness in the seal throughout the entire filter service life

The consequences of a leaking air filter



Filter replacement:
tips and tricks for workshops

Fuel filters

- Clean the connections and surroundings before removing the old filter.
- Observe the vehicle manufacturer specifications concerning bleeding or preliminary filling of new filters.
- Changing line filters: pay attention to the correct disassembly of the mounts (in accordance with the vehicle manufacturer specifications), e.g. with vehicle-specific quick-action locks.
- When changing filters: Beware of released gasoline fumes. They are extremely flammable! A single spark caused by an electrostatic discharge when touching a metal housing can ignite the gasoline-air mixture.

Cabin filters

- Change the filter once a year at the start of the pollen season.
- Check the correct fit as otherwise noises may come up and effectiveness may be lost.

Oil filters

- When changing oil filter inserts:
  Pay attention to the tightening torque for housing covers according to the vehicle manufacturer specifications
- After changing oil and oil filter: Start the engine, wait at idling speed until the oil pressure check lamp turns off, then switch off the engine, check the oil filter for external integrity, check the oil level again, and, if necessary, top up oil (pay attention to the vehicle manufacturer specifications)

Air filters

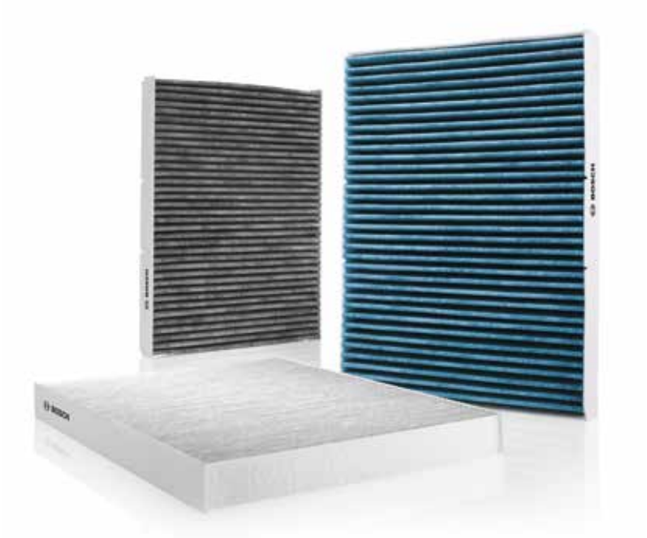
- After removing the old filter, clean the filter housing.
- If available: check filters for crankcase ventilation and replace if necessary.
- During the assembly, check the correct fit of the filter element to avoid any bypass of air into the intake duct and noise generation.
- After changing the hot-film air-mass meter, please replace the air filter as well. The hot-film air-mass meter requires a clean and turbulence-free air flow to ensure a correct measurement.

Bosch cabin filters:
the right filter for any requirement

Purpose of cabin filters:

- Protects passengers against pollen, dust, and pollutants
- Additional protection against harmful and foul-smelling gases with activated-carbon filters.
- Additional anti-allergic and anti-bacterial effect in case of FILTER^{+}
- Protects the air conditioning system

Change cabin filters every 15 000 km or once a year!



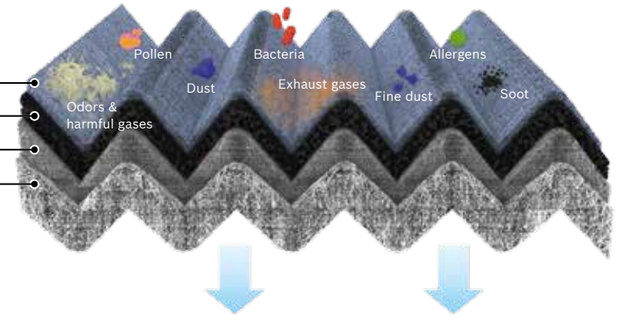
Consequences of clogged filters:

- Poor vision due to misted windows, and thus reduced safety
- Increased concentration of pollutants inside the vehicle
- Allergic reactions, e.g. sneezing
- Restricted operation of the air conditioning system due to deposits on the evaporator

Function	FILTER^{+}	Activated-carbon filter	Standard filter
Neutralizes allergens and bacteria	✔		
Separates fine dusts (up to 99 % of $PM_{2,5}$ µm)	✔		
Separates foul-smelling and harmful gases (ozone, smog, exhaust gases)	✔	✔	
Separates pollen and fine dusts (up to 100% of PM_{10} µm)	✔	✔	✔
Protects the air conditioning	✔	✔	✔
Reduces dazzling effects	✔	✔	✔

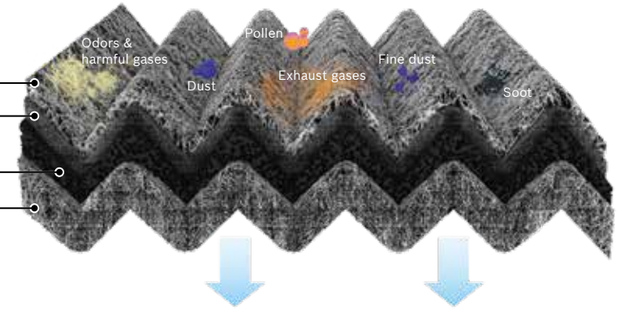
FILTER^{+}

1 Anti-allergy layer
2 Activated-carbon layer
3 Ultra-fine microfiber layer
4 Carrier fleece



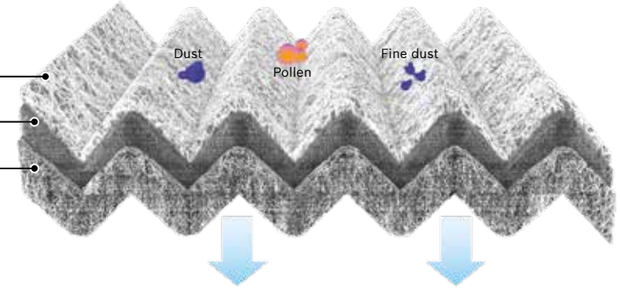
Activated-carbon filters

1 Prefilter
2 Microfiber layer
3 Activated-carbon layer
4 Carrier fleece



Standard filters

1 Prefilter
2 Microfiber layer
3 Carrier fleece



Did you know?

Activated carbon is made of coconut shells carbonized and crushed in a hermetically sealed environment. Water vapor with a temperature of

800°C

is used to create its sponge-like structure.

The new Bosch FILTER+:
a real relief for allergy sufferers

Increasing health consciousness and a risen awareness for topics such as fine dusts and allergies among car drivers highlight cabin filters ever more – a great chance for wholesalers and workshops to increase their revenues!

Health benefit for just 2 euro cents more a day*

Attractive packaging with product picture

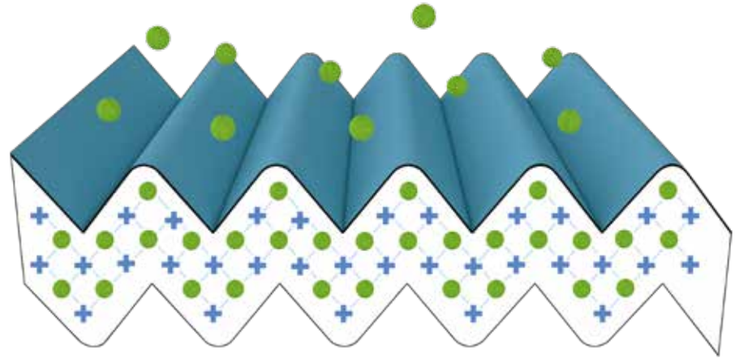
- FILTER+ function and benefits neatly explained for end consumers
- Incl. short code, part number, applications and EAN code
- Installation instructions included
- QR code for quick access to additional information
- High stability for a reliable protection of cabin filters during transport and warehousing

Sales arguments at a glance

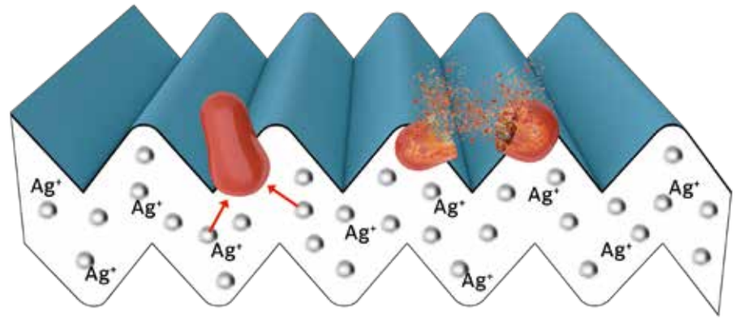
Customer benefits	Product features
Renders allergens permanently harmless and eliminates bacteria	Special anti-allergy layer
Neutralizes harmful and foul-smelling gases	Activated-carbon layer
Separates almost 100% of all fine dust particles (up to 2.5 µm), soot particles and pollen in a highly efficient manner	Ultra-fine microfiber layer
Protects the air conditioning, improves the visibility	Reduction of deposits
Easy to fit	Fitting instructions included

* comparing the higher price of a FILTER+ in EUR with the price of an activated-carbon filter and in case of its annual replacement. Bosch recommends replacing cabin filter once a year or every 15 000 km.

Operating principle of the anti-allergy layer



The FILTER+ anti-allergy layer lastingly separates allergens integrating them into a molecular grid structure and rendering them harmless.



Anti-bacterial: silver ions penetrate and kill bacteria.

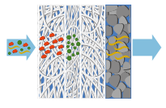
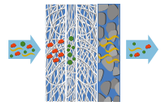
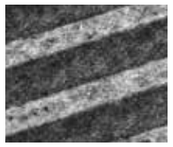
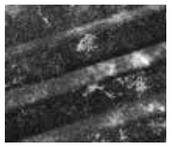
Movie clip on the Internet:

Film

The advantages of the new FILTER+

- Health benefit for just 2 euro cents more a day*
- Increased comfort
- Increased safety

Bosch cabin filters in comparison: quality pays off

On the safe side with Bosch filters		Cheap filters – unpleasant consequences!	
Pure air through several well-coordinated filter layers			Too thin and badly coordinated filter layers ▶ Particles and pollen get into the interior of the vehicle
Reliable filtration thanks to high-quality fibers			Insufficient fibers and low fiber quality ▶ Low filtration performance
Stability and increased filter surface through special embossing of the filter medium			Low-quality filter medium without embossing ▶ Reduced service life
Reliable adsorption of harmful gases and odors by ▶ Sufficient activated carbon ▶ with high quality			Insufficient and badly distributed low-quality activated carbon ▶ Harmful gases get into the vehicle interior
Stable pleat geometry – even when exposed to humidity			Unstable pleat geometry ▶ Unreliable filtration
Shape is perfectly geared to the installation space – and is still highly flexible in order to ease the installation under difficult circumstances			Incorrect fit and bad workmanship ▶ Bypass of unfiltered air and accumulation of dirt on the air conditioning
Practice-approved installation instructions ease the filter replacement			Missing installation instructions ▶ Loss of time during filter replacement

FAQs about quality

What does high cabin-filter efficiency mean?
A high particle separation rate combined with a decrease in pressure being as low as possible – over the complete cabin-filter service life. The decrease in pressure is the difference in air pressure before and after the filtration.

What does an efficiency of 99 % mean?
The filter efficiency is measured with particles of different sizes. The bigger the particles, the higher the separation rate.
The new FILTER^{+}, for instance, separates more than 99 % of all particles featuring the most respirable size of 2.5 micrometers.

What does the pressure-pulsation test indicate and why is it so important?
The separation rate is an important quality criterion for vehicle manufacturers. A special DIN test measures the amount of fine dust particles of a certain size retained by a new cabin filter subject to a specific air pressure over a defined period of time. Each Bosch cabin filter has to pass this quality test.

Why is the decrease in pressure such an important criterion for vehicle manufacturers?
For optimum functionality of all of the components of the air conditioning system, the decrease in pressure caused by the cabin filter – even by a clogged one – must not exceed a vehicle-specific limit. Otherwise, overburdened fan motors could cause the failure of the whole air conditioning system.

Why is it, quality and quantity of the activated carbon used for the filter are so important?
High-quality activated carbon stands out for its large inner surface created at a sophisticated process in absence of air and at high temperatures. The sponge-like structure neutralizes harmful and foul-smelling gases. To collect as many gases as possible over the complete filter service life, both quality and quantity of activated carbon – that is, enough of it – matter.

What is the difference between woven and non-woven fleece?
Usually, the filter medium consists of a filter-specific combination of different layers. Often, both types of fleece – woven and non-woven ones – are combined: Non-woven layers are particularly suitable for efficient separation of rather big particles. They are used for prefilters, for example. Woven fleece, on the contrary, is particularly suitable for efficient separation of smaller particles.

Activated carbon observed under the microscope

Did you know?

One gram of activated carbon has an internal surface of approx.

1 000 m²

A teaspoon of activated carbon thus has the same surface as a whole soccer pitch.

Truck filters: product range

Successful with Bosch filters
Four-time European Truck Racing Champion Jochen Hahn relies on Bosch filters.

The right filter for each vehicle – especially with commercial vehicles there is no room for compromises. Bosch thus provides the complete range from a single source and for all common types of commercial vehicles and engines.

- Filter system competence:
  Inventor and global leader concerning diesel injection systems, developer of the Denoxtronic system
- Safety thanks to first-class product quality:
  Use of high-quality materials, meticulous processing and tough product tests –
  for more than 85 years
- Complete range from a single source:
  Low stock-keeping and ordering efforts thanks to a comprehensive product range which is constantly updated and thus always up to date
- High product availability:
  Bosch ensures quick availability of its parts by means of an international sales and logistics network
- Strategic partner for the future:
  Suitable diagnostic solutions and trainings for wholesalers and workshops

Diesel filters	Oil filters	Air filters	Cabin filters	Denoxtronic filters	Special filters
Bosch diesel filters protect the injection system. They reliably separate particles and water from fuel and contribute to optimum engine performance.	Bosch oil filters protect the engine. They reliably remove soot and metal particles from engine oil.	Bosch air filters protect the engine. They reliably remove particles from the intake air thus contributing to optimum engine performance.	Bosch cabin filters protect the vehicle occupants against pollen, fine dusts as well as harmful and foul-smelling gases.	Bosch Denoxtronic filters protect the Denoxtronic injection system. They reliably remove particles from AdBlue® thus contributing to optimum dosing.	Special filters for special tasks – from air-drier cartridges, coolant and hydraulic-fluid filters through to oil separators.

No compromises with commercial vehicles:
Bosch quality filters

Expensive downtimes
Commercial vehicles make money every day. But out-of-action vehicles cost their operator some 2 000 to 3 000 euros a day. Even worse: sudden engine damage with failure of the cooling system can result in the need to compensate for spoiled goods. That is why engines and injection systems need reliable protection – with Bosch quality filters.

Diesel filters with water separators
Due to the high flow rate, commercial vehicles are often equipped with water separators prefiltering water and coarse particles. Fine filtering of fuel, however, is the actual diesel filter's task.

Change diesel filters regularly
as specified by the vehicle manufacturer!

Air filters
A separation degree of 99.9 % is demanded for air filters in commercial vehicles, whereas 99.8 % is enough for cars. In commercial vehicles, the flow of dust must thus be cut by half. This is achieved by even finer pores of the filter medium. Construction-site vehicles are usually equipped with additional air filters, for example secondary filter inserts and cyclone separators.

Change air filters regularly
as specified by the vehicle manufacturer!

Oil filters
In addition to the main flow filter filtering the whole amount of oil with each cycle, commercial vehicles are usually also equipped with a bypass filter. It supports the effect of the main flow filter separating extremely fine particles.

Why use bypass filtration of the oil?
Over time, very fine particles – mainly soot particles – build up in oil and cannot be separated by the main flow filter alone.

The consequences:

- The oil does not lubricate as well
- It becomes more viscous and no longer reaches all the areas needing lubrication
- Increased engine wear

Change oil filters regularly
as specified by the vehicle manufacturer!

Cabin filters
Trucks are work areas. The main focus should thus be on protecting the drivers' health. Activated-carbon cabin filters guarantee fresh air – even in tunnels or traffic jams:

- Filtration of foul-smelling and harmful gases
- Improved concentration
- Improved view due to less deposits on the windows

Bosch recommends changing the cabin filter every 200 000 to 300 000 km.

High market potential

Every year, some

13.4 million

commercial vehicles exceeding 6 tons of GVW cover an overall distance of 145 000 km in long-haul traffic on European roads.

Did you know?

The technical requirements placed on commercial-vehicle filters are

2–3 times

higher than in case of car filters – e.g. concerning vibration resistance, dust retention capacity and replacement intervals.

Bosch Denoxtronic filters:
clean AdBlue® for accurate dosing

Purpose of Denoxtronic filters

- The Denoxtronic AdBlue® dosing system and SCR catalytic converters reduce emissions of nitrogen oxide
- Denoxtronic filters are integrated into the supply module. They protect the injector, thus supporting correct AdBlue® dosing

Recommended replacement interval:
Depending on the circumstances of their application, Denoxtronic filters should be replaced every 120 000 to 320 000 km.
Please check the vehicle manufacturer specifications!

What is AdBlue®?

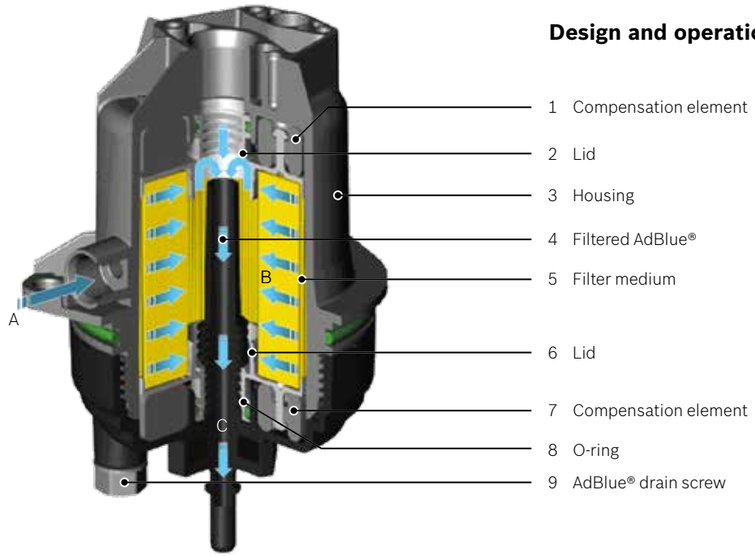
AdBlue® is a watery urea solution composed of up to 32.5 % urea and up to 67.5 % demineralized water. This liquid is injected into the exhaust stream causing a so-called selective catalytic reduction (SCR). It turns nitrogen oxide and ammonia into water and nitrogen.

Due to its high water content, AdBlue® freezes and expands at just -11.5 °C. In this case, compressible compensation elements prevent damage to both the filter and the supply module.

Sales arguments at a glance

Customer benefits	Product features
High particle separation rate	Microporous filter medium with special impregnation
High dust retention capacity	Large filter surface
Chemical resistance to aggressive AdBlue®	Use of high-quality materials
Frost resistance	Compressible compensation elements

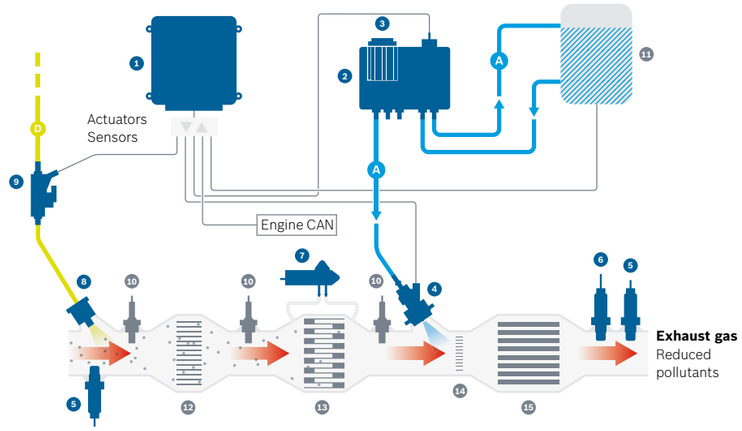
Design and operation of the Denoxtronic filters



1 Compensation element
2 Lid
3 Housing
4 Filtered AdBlue®
5 Filter medium
6 Lid
7 Compensation element
8 O-ring
9 AdBlue® drain screw

A Inflow of contaminated AdBlue®
B Filtration of AdBlue®
C Clean AdBlue® is conducted to the dosing module

Denoxtronic exhaust-gas treatment and sensors (e.g. for DNOX 2.2)



Bosch components
Denoxtronic:
1 Dosing control unit / Electronic engine control unit
2 Supply module
3 Denoxtronic filter
4 Dosing module
5 NO_x sensor
6 Particulate matter sensor
7 Differential pressure sensor
8 Diesel injection unit
9 Diesel metering unit with shut-off valve

Other components
10 Exhaust-gas temperature sensor
11 AdBlue® tank
12 Oxidation catalyst
13 Coated diesel particulate filter
14 Mixer
15 SCR catalytic converter with ammonia slip catalyst

A AdBlue®
D Diesel
— Electrical connection
Hot

Main advantages of Bosch Denoxtronic filters

- Protection of the Denoxtronic injection system
- Supports optimum AdBlue®dosing
- Filter protection, even at low temperatures

Bosch Denoxtronic filters:
filter replacement made easy

Replacement of Denoxtronic 2.1 filters
The filter is screwed onto the housing cover of the Denoxtronic supply module and is extracted from the housing along with the cover. In case the filter detaches from the cover or gets stuck at the housing, it can be extracted using the extraction tool.

Replacement of Denoxtronic 2.2 filters
Using the extraction tool, the filter is extracted from the Denoxtronic supply module. The matching extraction tool is included within the service kit.

Denoxtronic filter extraction tool for DNOX 2.1
The extraction tool is used only if the filter detached from the cover or got stuck at the housing (part number: 0 986 613 295).

Spare-part sets for repairs and servicing

Type/KIT									
DNOX 1 Service	1 457 436 042	●	●	●	●	●			DAF, MAN, IVECO, Scania, Volvo
DNOX 1 Repair	F 00B H40 025			●	●		●		DAF, MAN, IVECO, Scania, Volvo
DNOX 2.1 Service	1 457 436 006	●		●	●				Case, IVECO, KHD, Renault, Volvo
DNOX 2.1 Repair	1 457 030 020						●		Case, IVECO, KHD, Renault, Volvo
DNOX 2.2 Service	1 457 436 033	●	●					●	Cummins, Mack, Nissan, Renault, Volvo
DNOX 6.5 Service	1 457 436 039	●	●					●	Perkins, IVECO, CNH, JCB, Daimler India, CAMC (China)

Explanation of filter short codes

Diesel filters

Part numbers	to
F 026 402 **000**	F 026 402 **999**
1 457 431 **686**	1 457 434 **519**
0 986 450 **508**	0 986 450 **963**
0 450 126 **002**	0 450 907 **031**

N xxxx = **N 2999** = Example of a short code

Gasoline filters

Part numbers	to
F 026 403 **000**	F 026 403 **999**
0 450 902 **151**	0 450 915 **003**
0 986 450 **009**	0 986 450 **963**

F xxxx = **F 3999** = Example of a short code

Oil filters

Part numbers	to
F 026 407 **000**	F 026 408 **999**
0 451 102 **056**	0 451 403 **210**
1 457 429 **102**	1 457 429 **820**

P xxxx = **P 8999** = Example of a short code

Air filters

Part numbers	to
F 026 400 **000**	F 026 401 **899**
1 987 429 **029**	1 987 429 **606**
1 457 433 **002**	1 457 433 **972**

S xxxx = **S 1899** = Example of a short code

Denoxtronic filters

Part numbers	to
1 457 030 **020**	1 457 436 **042**

D xxxx = **D 6042** = Example of a short code

Standard cabin filters

Part numbers	to
1 987 431 **000**	1 987 431 **299**
1 987 432 **000**	1 987 432 **299**
1 987 435 **000**	1 987 435 **499**

M xxxx = **M 1299** = Example of a short code

Activated-carbon cabin filters

Part numbers	to
1 987 431 **300**	1 987 431 **599**
1 987 432 **300**	1 987 432 **599**
1 987 435 **500**	1 987 435 **999**

R xxxx = **R 1599** = Example of a short code

FILTER+ cabin filters

Part numbers	to
0 986 628 **500**	0 986 628 **599**

A xxxx = **A 8599** = Example of a short code

Special filters

Part numbers	to
0 986 628 **250**	0 986 628 **259**
F 026 404 **008**	F 026 404 **021**
F 026 404 **011**	F 026 404 **011**

Z xxxx = **Z 8259** = Example of a short code
K xxxx = **K 4021** = Example of a short code

Bosch coolant filters:
perfect protection of the cooling system

Purpose of coolant

- Dissipation of heat created during engine operation

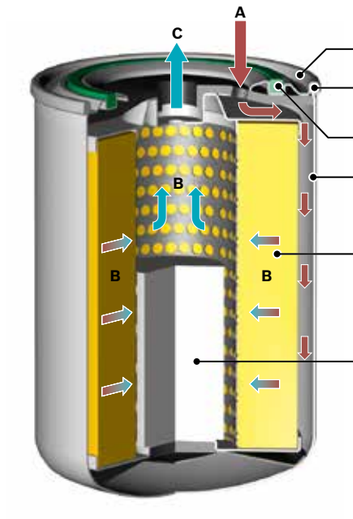
Purpose of coolant filters
Bosch coolant filters protect the fine channels of the cooling system against deposits reliably removing particles and other residues.

Consequences of insufficient coolant filtration

- Pitting (corrosion within the cooling system)
- Premature wear of the coolant pump
- Deposits of calcium and magnesium
- Acidification and bacterial growth
- Particle residues within the cooling system

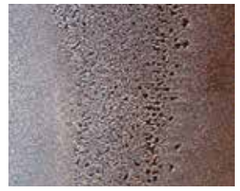
Recommended replacement interval
Coolant filters should regularly be changed together with the oil filter.

Design and operation of coolant filters



1 Filter cover
2 Double beading
3 Seal ring
4 Housing
5 Filter medium
6 Inhibitor tablet*

A Inflow of contaminated coolant
B Coolant is filtered and chemical additives are added
C Cleaned coolant is conducted to radiator



Insufficient coolant filtration can result in pitting. The result: damage to the cylinder due to corrosion.

Sales arguments at a glance

Customer benefits	Product features
High dust retention capacity	Filter medium with special impregnation
Long service life	Corrosion-resistant housing, coolant-resistant seals
Prevents bacterial growth and acidification*	Easily soluble chemical additives

* in cases with inhibitor tablet

The advantages of Bosch coolant filters

- Protection of the cooling system
- Long filter service life, long replacement intervals
- Easily soluble chemical additives*

*not standard

Bosch air-drier cartridges: dry and clean – compressed air in commercial vehicles

Purpose of air-drier cartridges

- Bosch air-drier cartridges protect the pneumatic system of commercial vehicles. They dehumidify compressed air and reliably remove particles and droplets of oil

Use of compressed air in commercial vehicles

In commercial vehicles, compressed air is used for several functions:

- Service brake and parking brake systems
- Trailer brake system
- Air suspension
- Door operation, e.g. on buses
- Traction control

Recommended replacement interval:

Air-drier cartridges should be changed once a year!

Consequences of poor dehumidification of compressed air

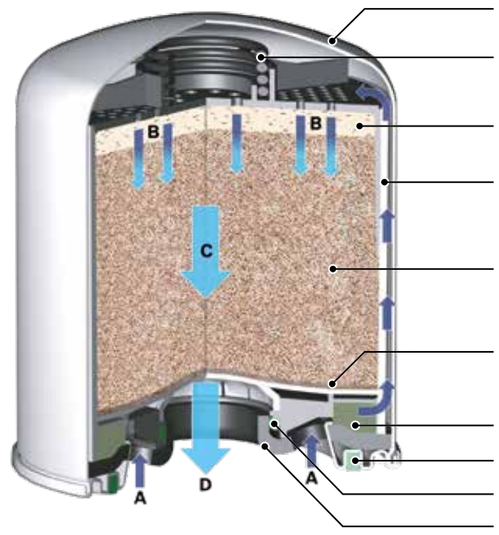
If compressed, air heats up and absorbs water vapor which condenses as it cools down to ambient temperature:

- Risk of malfunctioning valves due to frozen water – in case of cold weather
- Corrosion in air reservoirs as well as on valves and cylinders
- Erosion of oil lubricant film in brake-system components

Sales arguments at a glance

Customer benefits	Product features
Large reserves for water absorption	Use of high-quality air-drier granulate
High resistance to pulsation and burst pressure	Robust high-quality processing
Even longer service life of air-drier granulate	Integrated oil separator

Design and operation of air-drier cartridges

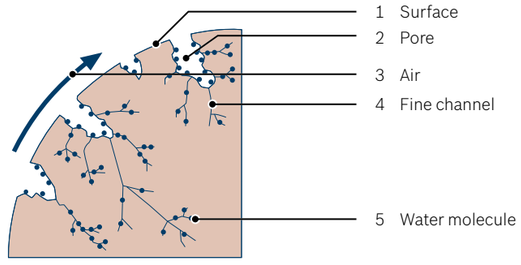


1 Housing
2 Compression spring
3 Oil separator
4 Air-drier container
5 Air-drier granulate
6 Fleece
7 Prefilter
8 Seal ring
9 O-ring
10 Thread plate

A Contaminated, humid air passes the prefilter – separation of coarse particles
B Separation of oil mist
C Drying of compressed air within the air-drier container
D Dry, clean compressed air is returned to the pneumatic system

Microstructure of air-drier granulate

This desiccant is made of a granulate with a grain size of 1–3 mm. Pores and tiny channels within the granulate create a large internal surface for the collection of water molecules.
The amount of granulate inside each air-drier cartridge – about 1 kg – has an internal surface of 1 million m², which is equivalent to approx. 20 soccer pitches.

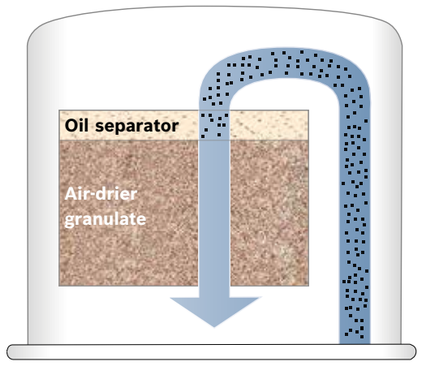


1 Surface
2 Pore
3 Air
4 Fine channel
5 Water molecule

The advantages of air-drier cartridges

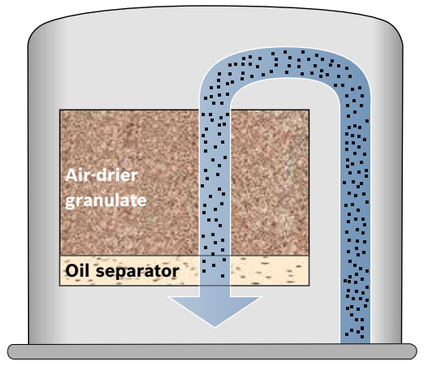
- Protection of the pneumatic system
- Excellent performance even under difficult conditions
- Service life extended even further thanks to the integrated oil separator

Bosch air-drier cartridges: smart design for an extended service life



Bosch air-drier cartridge

Oil mist is separated
before reaching the air-drier granulate
→ water-absorption capability remains fully intact, extended service life



Other air-drier cartridges

Oil mist is separated
after reaching the air-drier granulate
→ deteriorated water-absorption capability, reduced service life

Regeneration of air-drier cartridges
Water droplets in compressed air are stored by the fine pores of the granulate.
During the so-called regeneration cycle a vent valve opens. The pressure inside the air-drier container drops, dry air from the regeneration-air tank flows through the granulate in opposite direction, absorbs moisture and leads it out. The regeneration cycle takes place once the pneumatic system stored enough compressed air within its reservoirs – irrespective of the degree of moisture of the granulate.

Bosch oil separators: essential for the engine, good for the environment

Purpose of crankcase oil separators

- Bosch oil separators protect the engine intake duct. They reliably clean returned blow-by gases separating oil mist and particles.

How are blow-by gases formed?
During engine operation, gases flow out of the combustion chamber, through the construction-borne gaps between piston and cylinder wall and into the crankcase. Even with optimum sealing, these blow-by gases make up approximately 0.5 % to 2 % of the entire gas volume inside the cylinders. Blow-by gases contain fuel residues, soot particles and oil mist.

Oil separation: Protection of both engine and environment
Before emission standards were first introduced, blow-by gases were simply released into the environment to prevent a dangerous increase of pressure inside the crankcase. Nowadays, they must be returned to the engine intake duct. The problem with this: Oil and other particles these gases contain must be separated first. Otherwise they would contaminate and damage turbochargers, air-mass meters, intercoolers, valves, and catalytic converters. Oil separators reliably perform this task.

Recommended replacement interval
In short-distance and distribution traffic, crankcase oil separators should be changed every 40 000 km; in long-distance traffic, they should be replaced every 80 000 km.

The advantages of Bosch oil separators

- Efficient separation of oil mist from blow-by gases
- Effective filtration and collection of aerosols
- Contribute to compliance with emission standards

Bosch hydraulic-fluid filters: filters that can take the pressure

Purpose of hydraulic fluids

- Transmission of very high pressures within hydraulic systems – for instance, to lift the dump body

Purpose of hydraulic-fluid filters

- Protection of the hydraulic system against contaminants such as dust, metal particles and water

Recommended replacement interval:
Hydraulic-fluid filters should be replaced every 500 to 1 000 hours of operation and/or at latest once a year.

Properties of hydraulic fluids
Hydraulic fluid is used to transmit pressures in hydraulic systems. These pressures can be up to 400 bar, thus demanding hydraulic fluids to meet tough requirements:

- Low temperature sensitivity for viscosity (fluidity)
- Low compressibility
- Low tendency to form foams
- High shear stability, i.e. no rupture of the lubricant film – even if subject to high mechanical strains

The advantages of Bosch hydraulic-fluid filters

- Protection of the hydraulic system
- High dust retention capacity
- Long replacement intervals

Well-conceived packaging: information, product finder, and instructions – all in one

Saving both time and money: practical packaging

- Elaborate design: perfectly suitable for workshops and end consumer; short code visible on three sides
- International: filter types in several languages
- Sturdy design: easy to handle and to store, resistant to transport damage

Any relevant information at a glance

* depends on minimum packaging size

Professional merchandising:
advise, inform, impress

Being well informed means increasing sales. Customers are keen on any information concerning their vehicle. The more workshops and automotive retailers know about workshop products, the easier they can forward this information to their customers – in a target-oriented manner.

Brochures

Workshop posters

Catalogs

Know-how for professionals:
ESI[tronic] software and test equipment

Everything about engine management from a single source
Complex and connected vehicle systems demand increasingly well qualified diagnoses and comprehensive repair know-how from today's workshops – for engine management, mechanical and electronic components have converged in recent years. Bosch therefore offers workshops extensive system expertise and a complete range of test equipment from a single source. Modern, high-performance diagnostic equipment, technical trainings, and a hotline support workshops in all repairs on electronic systems.

ESI[tronic] software for diagnoses and servicing
ESI stands for "Electronic Service Information" and is the name of the software for servicing tasks. This includes:

- Professional ECU diagnosis
- Guided troubleshooting right on the system
- Experience-based repair – known faults. Find the matching solution for your problem within seconds.
- OEM-quality maintenance schedules and plans
- Interactive circuit diagrams

Tailor-made for workshops
ESI[tronic] software is completely geared to the needs of workshops. Easy operation, quick access, and a standardized system across all brands make ESI[tronic] software a user-friendly information tool. Comprehensive market coverage and constant updates are provided as a matter of course.
The software packages have a modular structure – that is, a diagnostic specialist can subscribe to the specific "information types" of relevance for him.

http://www.bosch-workshop-world.com

Air-conditioner service with the new ACS 752

Driven by efficiency

Bosch technologies are used worldwide in almost all vehicles. People, and assuring their mobility, is what we are focused on.

Therefore, we have dedicated the last 125 years of pioneering spirit and expertise in research and manufacturing to achieving this.

We continue to work on our unique combination of solutions for spare parts, diagnostic devices, workshop equipment and services:

- Solutions for efficient vehicle repairs
- Innovative workshop equipment and software
- The world's most comprehensive range of new and replacement parts
- Large network of wholesale customers, for quick and reliable parts supply
- Competent hotline support
- Comprehensive educational and training offers
- Targeted sales and marketing support

Find out more at:
bosch-automotive-aftermarket.com

What drives you drives us.

AA-TR/PAF1 F 026 P02 866 2017/03 Subject to technical and program changes.

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