Exhaust turbocharger

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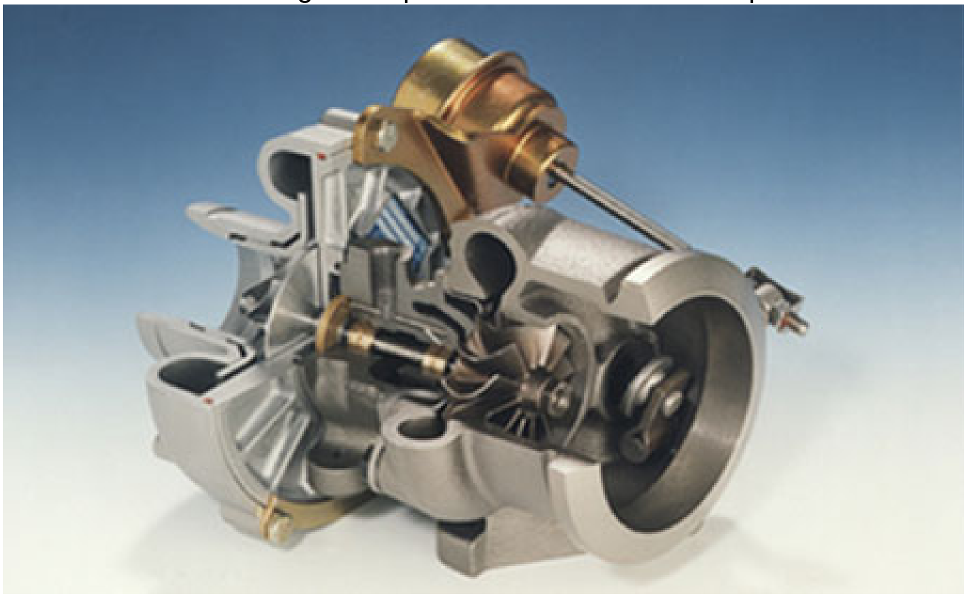
Function

The exhaust turbocharger compresses the air supplied to the engine. Compared with naturally aspirated engines, cylinder filling is much better. Engine performance is increased whilst at the same time consumption is reduced and emission values are improved.

During exhaust gas turbocharging, exhaust gas energy which would otherwise escape into the environment unused is used to drive a turbine. A compressor is mounted on the shaft of the turbocharger opposite the turbine. The compressor draws in the combustion air, directing it to the engine in compressed form. There is no mechanical connection to the engine.

Exhaust turbocharger components

The exhaust turbocharger comprises a turbine and a compressor between which there is



a fixed mechanical connection established via a common shaft. The turbine is driven by the exhaust gases from the engine and supplies the drive energy for the compressor. In most cases, centripetal turbines and centrifugal compressors are used for turbochargers.

Centrifugal compressor

A centrifugal compressor essentially comprises:

- Compressor wheel
- Diffuser
- Spiral housing

When the compressor wheel turns, it draws in air axially (in the direction of the longitudinal axis) and accelerates the air to a high velocity. The air exits the compressor wheel in the radial direction. In the diffuser, the velocity of the air is reduced, mostly without losses. As a consequence, both pressure and temperature rise. The diffuser is formed from the rear wall of the compressor and a part of the spiral housing. The air is collected inside the spiral housing and the velocity continues to be reduced until the air exits the compressor.

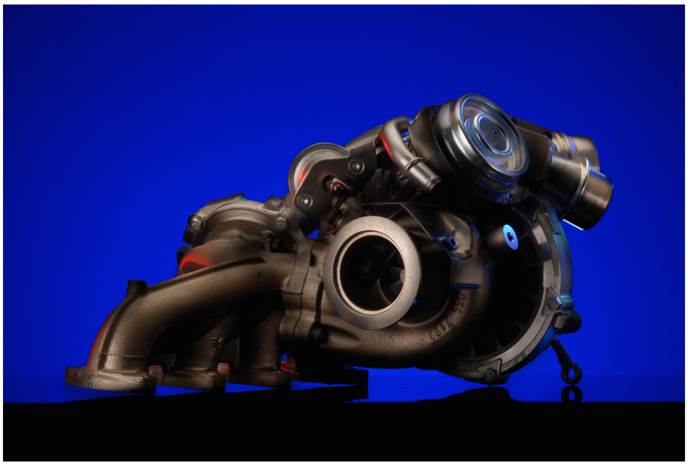
Centrifugal turbines

On the drive side, only centrifugal turbines (also known as centripetal turbines) are used in exhaust turobochargers for passenger cars, commercial vehicles and industrial engines. They convert the pressure of the exhaust gas into kinetic energy inside the spiral housing and feed the gas to the turbine wheel at constant velocity. In the turbine wheel, the kinetic energy of the exhaust gas is converted into rotation energy of the shaft. The turbine wheel is designed so that virtually all of the kinetic energy is converted on exiting the wheel.

Charging pressure regulation

If the turbo engine is to reach optimum performance levels, the charging pressure of the exhaust turbocharger must be matched to the engine load and the engine speed. Bypass on the turbine side (bypass channel) is the simplest form of charging pressure regulation. The turbine is small enough to meet the requirements for torque response at low speeds and ensure that the engine drives well. In such a design, shortly before the maximum torque is reached, more exhaust gas is supplied to the turbine than is necessary to generate the charging pressure.

Therefore, once the required charging pressure has been reached, some of the exhaust gas is diverted around the turbine through a bypass. The charging pressure control valve, which opens and closes the



on the basis of the charging pressure. In modern passenger car diesel engines, variable turbine geometry (VTG) with rotating guide vanes has established itself as the state of the art. With VTG, the flow cross-section of the turbine can be adjusted based on the engine operating point. All of the exhaust gas energy is used and the setting of the flow cross-section of the turbine can be optimised for any operating point, thereby improving the efficiency of the turbocharger and as a result that of the engine compared with bypass control. Constantly adapting the turbine cross-section to the prevailing driving conditions of the engine also reduces fuel consumption and emissions. The engine torque, which is already high even at low speeds, along with a carefully adapted control strategy, enable a perceptible improvement in driving dynamics to be achieved.

Environmental protection

The use of turbocharging has resulted in the diesel engine conquering the passenger car market. The benefits of the turbocharged diesel engine (cost-effectiveness and high torque, for example), which had been appreciated for many years by drivers of commercial vehicles, have been winning over more and more passenger car purchasers. Today, modern diesel engines offer low consumption and emissions combined with high performance and driving pleasure.

The advantages of the turbocharger

Compared with an equivalent power naturally aspirated engine, the turbo engine consumes less fuel, because exhaust gas energy which would otherwise not be used helps to increase the power of the engine. Therefore, at the same power rating, a turbo engine can be designed more compactly than a naturally aspirated engine. The reduced friction and thermal losses of the smaller displacement turbo engine bring with them other advantages.

With a view to further reductions in CO2 emissions for all drive concepts, turbocharging is also taking on increasing significance where petrol engines are concerned. For petrol engines, the turbocharger is a key technology for what is referred to as downsizing (reducing displacement and the number of cylinders), as it provides a means of significantly reducing consumption without impairing performance and comfort.

Vorteile des Turboladers

Der Turbomotor hat im Vergleich zu einem gleich starken Saugmotor einen geringeren Verbrauch. Der

Grund: Ein Teil der Abgasenergie, die sonst nicht genutzt würde, trägt zur Leistungssteigerung des Motors bei. Bei gleicher Leistung kann ein Turbolader daher kleiner ausgelegt werden als ein Saugmotor. Die geringeren Reibungs- und Wärmeverluste des hubraumkleineren Turbomotors bringen weitere Vorteile.

Angesichts einer weiteren Reduzierung der CO2-Ausstöße bei allen Antriebskonzepten gewinnt die Turboaufladung auch beim Otto-Motor an Bedeutung. Hier ist der Turbolader eine Schlüsseltechnologie für das sogenannte „Downsizing“ als Mittel zur deutlichen Verbrauchsreduzierung ohne Leistungs- und Komforteinbußen. Downsizing umschreibt das Verkleinern des Hubraums und der Zylinderzahl.

Depreciation

What is good for the exhaust turbocharger?

The turbocharger is designed and built so that in most cases is will last the lifetime of the engine. It does not require any particular care and maintenance. Inspections are limited to a few periodic checks as part of regular service and maintenance. For the turbocharger to last as long as the engine, the following service requirements set out by the vehicle or engine manufacturer must be met in full:

- Oil change intervals
- Maintenance of the oil filter system
- Checking the oil pressure
- Cleaning the air filter system

What can damage the exhaust turbocharger?

90% of all damage to turbochargers is caused by:

- Ingress of foreign bodies into the turbine or the compressor
- Dirt in oil – Insufficient oil supply (oil pressure/filter system)
- Excess exhaust gas temperatures (faults affecting ignition or injection equipment)

Such damage can be avoided by regular maintenance. During maintenance work, e.g. on the air filter system, it is important to check for foreign bodies in the turbocharger.

Ursache für Schäden am Turbolader

90 Prozent aller Schäden am Turbolader entstehen durch folgende Ursachen, die durch regelmäßige Wartung vermeidbar sind:

- Eindringen von Fremdkörpern in die Turbine oder den Verdichter
- Schmutz im <link http: www.mein-autolexikon.de schmierung motoroel.html external-link-new-window external link in new>Öl
- Mangelnde Ölversorgung (Öldruck/Filteranlage)
- Überhöhte Abgastemperaturen (Fehler an Zünd- oder Einspritzanlagen)

Bilder

Hersteller

MAHLE

Febi_EN

HELLA

BorgWarner

Quelle:
http://www.my-cardictionary.comhttps://www.my-cardictionary.com/cardictionary/products/exhaust-turbocharger.html