KOLBENSCHMIDT

DAMAGE**DIAGNOSIS**

OIL CONSUMPTION AND OIL LOSS

OUR **HEART** BEATS FOR YOUR ENGINE.

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1. INTRODUCTION

1.1 GENERAL INFORMATION ON OIL CONSUMPTION

For a long and fault-free service life, an engine needs engine oil. Most car drivers give little thought to the importance of doing a regular check of the oil level. It is not until the oil level check light or warning light comes on and the dipstick shows the oil is low that the question of why the engine is losing oil comes to be asked.

If an engine is low on oil, the term „oil consumption" tends to be used very generally. It is important in the repair shop to make a clear distinction between oil loss and actual oil consumption.

- **Experts refer to oil consumption as the quantity of engine oil that enters and is burned up in the combustion chamber.**
- **Oil loss occurs when engine oil escapes from the engine through a leak.**

1.2 DEFINING OIL CONSUMPTION (COMPARISON AMOUNTS)

There are various ways of expressing levels of oil consumption. On an engine test rig, oil consumption is expressed as „grammes per kilowatt-hour". A good sealing system will achieve values of 0.5 to 1 g / kWh. This method is not suitable for use in practice as oil consumption cannot be precisely defined in grammes, nor can performance be measured with the vehicle in operation. For this reason, oil consumption is often measured in „litres per 1,000 km" or as a „percentage of fuel consumption". The latter is most commonly used to express measurements as it is more precise than „litres per 1,000 km". The reason for this is that engines are also used when the vehicle is stationary, and will sometimes experience lengthy idling times (congestion, waiting at traffic lights, charging, running the air conditioning). Moreover, in some instances the engine may need to be used to operate auxiliary units, such as loading cranes or in pump operation, without the vehicle driving a single kilometre.

1.3 WHEN IS AN ENGINE CONSUMING TOO MUCH OIL?

In practice, opinions about the point at which oil consumption is excessive differ widely in different countries.

Due to the running clearances required as part of the design, the moving parts in an engine, particularly the pistons and valves, are not 100% gas-tight and oil-tight. This means that oil is consumed at a low but steady rate. In the combustion chamber, the oil film on the cylinder surface is also widely subject to high-temperature combustion. This causes the engine oil to vaporise, burn and be released into the environment with the exhaust gas.

Workshop manuals and operating instructions often provide information on the maximum permitted oil consumption for the engine.

If the manufacturer‘s specification is not available, max. 0.25 to 0.3% for utility vehicles and up to 0.5% oil consumption for buses can be assumed.

Oil consumption in modern passenger car engines is usually less than 0.05%; the maximum permissible oil consumption stands at 0.5% (all percentage values relate to actual fuel consumption).

Normal oil consumption may be higher for older engine types, stationary engines and under special operating conditions.

A decision with regard to the need for any remedial measures can be made by comparing the actual oil consumption with the maximum permissible oil consumption.

Diesel engines consume more engine oil than petrol engines. Engines with a turbocharger also need more engine oil than engines without a turbocharger due to lubrication of the turbocharger.

For technical reasons, oil consumption is at its lowest after the engine‘s running-in phase and increases over the life of the engine due to wear. Wear within the engine will affect all components equally. For this reason, carrying out partial repairs, such as replacing only pistons or piston rings, often results in minimal improvement for oil consumption levels.

EXAMPLE CALCULATION FOR UTILITY VEHICLES

A utility vehicle consumes roughly 40 litres of fuel for 100 km travelled. This can be extrapolated to 400 litres of fuel for 1,000 km.

- 0.25% of 400 litres of fuel equals 1 litre of oil consumption / 1,000 km
- 0.5% of 400 litres of fuel equals 2 litres of oil consumption / 1,000 km

EXAMPLE CALCULATION FOR PASSENGER CARS

A passenger car consumes roughly 8 litres of fuel for 100 km travelled. This can be extrapolated to 80 litres of fuel for 1,000 km.

- 0.05% of 80 litres of fuel equals 0.04 litre of oil consumption / 1,000 km
- 0.5% of 80 litres of fuel equals 0.4 litre of oil consumption / 1,000 km

1.4 HOW TO CHECK OIL LEVEL AND OIL CONSUMPTION CORRECTLY

Checking the oil level

Mistakes are often made when reading the oil level, with the result that actual oil consumption is wrongly interpreted.

- To read the oil level correctly, the vehicle must be on a level surface.
- Wait five minutes after switching off a warm engine to give the engine oil time to drain back into the oil pan.
- After withdrawing the dipstick, hold it vertical with the end pointing downwards so that the engine oil does not track back up the dipstick resulting in an incorrect reading.

If the engine oil level is low, it should be topped up slowly 0.1 litre at a time. This will prevent too much engine oil being added too quickly so that the oil level ends up being too high (see section 2.6 „Oil level being too high").

After an oil change, do not immediately top up to the specified oil level. Instead just fill to the minimum mark. Then run the engine until the oil pressure has built up. After switching off the engine, wait a couple of minutes for the engine oil to flow back into the oil pan. Having done this, check the oil level again and top up the difference to the maximum mark.

Measuring vehicle oil consumption:

- Check the oil level using the proper method and top up to the maximum mark.
- Drive the vehicle for 1,000 km keeping a record of the fuel consumption.
- Check the oil level again after 1,000 km and top up to the maximum mark. The quantity added will be the oil consumption at 1,000 km.
- More precise method: Divide the quantity added by the recorded fuel consumption and compare it to the values stated above.

Top up amounts

When the oil is changed a certain amount of engine oil is left in the engine (adhering to pipes, channels, oil coolers, oil pumps, units and surfaces).
The oil quantities stated in the repair shop manual or in operating instructions often fail to make a distinction between initial filling quantity (for a dry, oil-free engine) and the quantity for an oil change (with/without filter replacement).
If the oil quantity for initial filling is added when changing the oil, the oil level will be too high.
The reverse is also possible. If the quantity of oil specified for an oil change is too low and the engine is started, it will not have enough engine oil.
If the oil level is not checked and topped up, the low level will often be mistakenly attributed to oil consumption.

2. OIL CONSUMPTION CAUSED BY

2.1 LEAKING INTAKE SYSTEMS AND DEFECTIVE AIR FILTERING

En route to the combustion chamber, the intake air passes a number of places where components are joined together (Fig. 1). If there is a leak at these joints, the engine will draw in unfiltered, contaminated air. The same effect will be seen if intake air is insufficiently filtered.

Reasons for this include:

- Neglecting air filter maintenance (exceeding change intervals)
- Not maintaining sufficient levels of cleanliness when changing the air filter (dirt gets into the clean side)
- Filter elements are faulty, deformed or degraded, or have become dislodged
- Unsuitable or incorrect filter elements
- Filter elements damaged by compressed air
- Missing filter elements

Dirt that enters the combustion chamber with the intake air rapidly produces abrasive wear on the cylinder sliding surfaces, pistons and piston rings.

Dirt also accumulates in the piston ring grooves and combines with the engine oil to form an abrasive paste (Fig. 2). Constant rotation of the piston rings means that they get worn away at the top and bottom and the piston ring grooves become enlarged (Fig. 3).

Wear caused by dirt on the piston rings mainly occurs in the axial direction and at the top of the ring sides. In the radial direction (on the sliding surface), the piston rings also get worn by mixed friction. However, here the wear has less of an effect than on the sides of the ring. Wear at the top and bottom of the piston rings causes loss of tension and axial guidance of the piston rings. This causes problems with the seal between the pistons and cylinder bores.

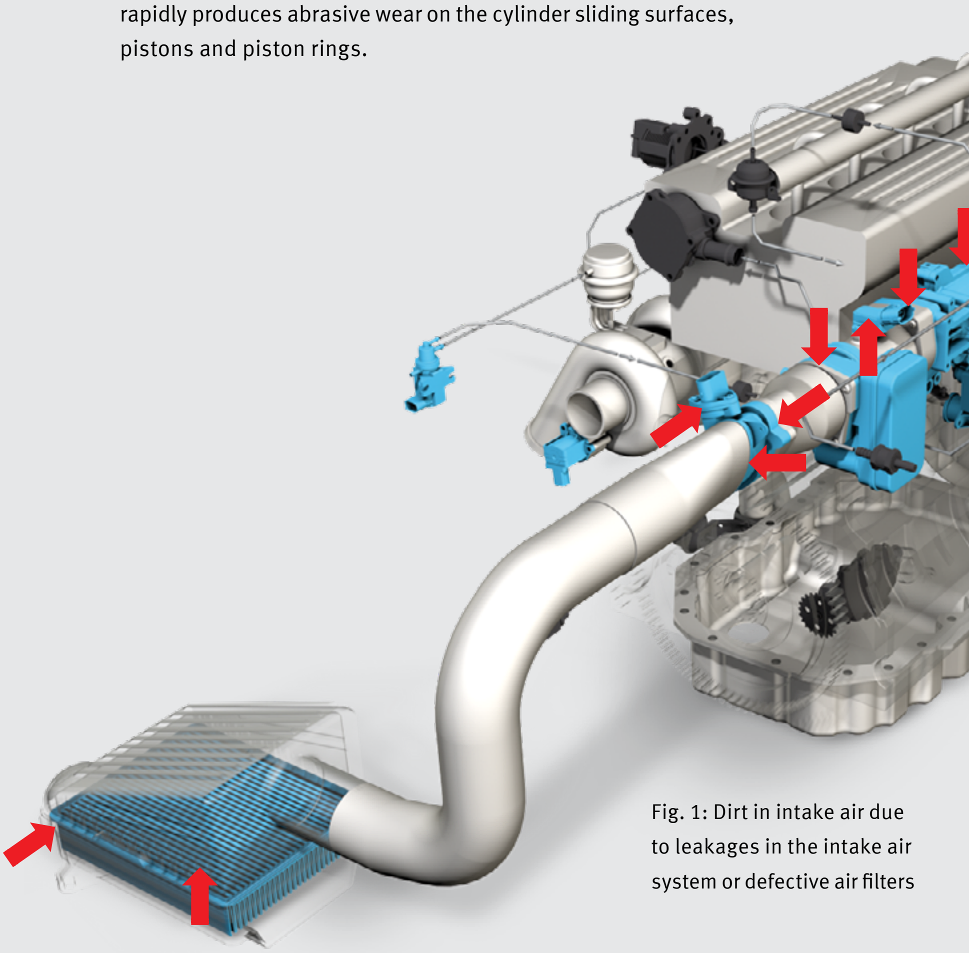


Fig. 1: Dirt in intake air due to leakages in the intake air system or defective air filters

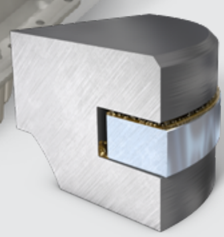


Fig. 2: Dirt particles in the piston ring grooves

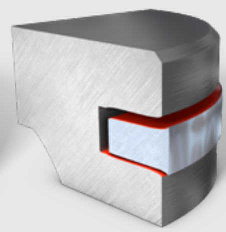


Fig. 3: Worn piston ring groove with worn piston ring

2.2 WORN VALVE STEM SEALS AND VALVE GUIDES

The valve stem seals seal the valve stem against the valve guide. If the play between the valve and the valve guide becomes too great due to wear or because the valve stem seal is worn or has become damaged during installation, engine oil will get into the intake air or exhaust tract. The engine oil will then burn up or escape into the environment with the exhaust gases.

NOTE

It is advisable to replace the valve stem seals whenever the engine is reconditioned as they become worn over a long service life and the material hardens with age. The delicate sealing lips on the valve stem seals can easily get damaged on the sharp grooves for the valve cotter halves; to prevent this protective bushings should be used when mounting (Fig. 2).

Fig. 1: Valve stem seals

Fig. 2: Fitting a valve stem seal

2.3 WORN IN-LINE INJECTION PUMPS

The moving parts of an in-line injection pump are usually lubricated by the engine oil circuit. If pump elements are worn, engine oil can flow between the pump cylinder and the pump piston during the downstrokes and enter the pump element working spaces. Here the engine oil will mix with the diesel fuel and be injected into the combustion chamber during the injection process and burn off.

This mainly affects engines manufactured up to the mid-90s. Stricter emissions legislation means that in-line injection pumps have gradually been replaced by serial pump-nozzle injectors or common rail systems that have a different design and do not experience problems with oil consumption.

2.4 UNFAVOURABLE OPERATING CONDITIONS FOR TURBOCHARGER

In contrast to other parts of the engine, turbochargers do not have radial oil seals made of elastomer material. This is because of the high temperatures and high engine speeds (up to 330,000 rpm) they are subject to.

A labyrinth seal is located behind the turbine and compressor impeller which not only inhibits escape of engine oil, but also the entry of compressed air and hot exhaust gases into the bearing housing. The gas pressures at the turbine impeller and compressor impeller end prevent engine oil from escaping. The washers on the turbocharger shaft have the effect of forcing engine oil escaping from the bearing positions out from the shaft by centrifugal force.

Engine oil escaping from the radial bearings as well as intake air and exhaust gases that find their way into the inside of the turbocharger are taken back to the oil pan via the return line.

If the turbocharger is losing engine oil via the intake or exhaust gas port, this usually means the pressure equilibrium is impaired due to problems with the oil/gas return line.

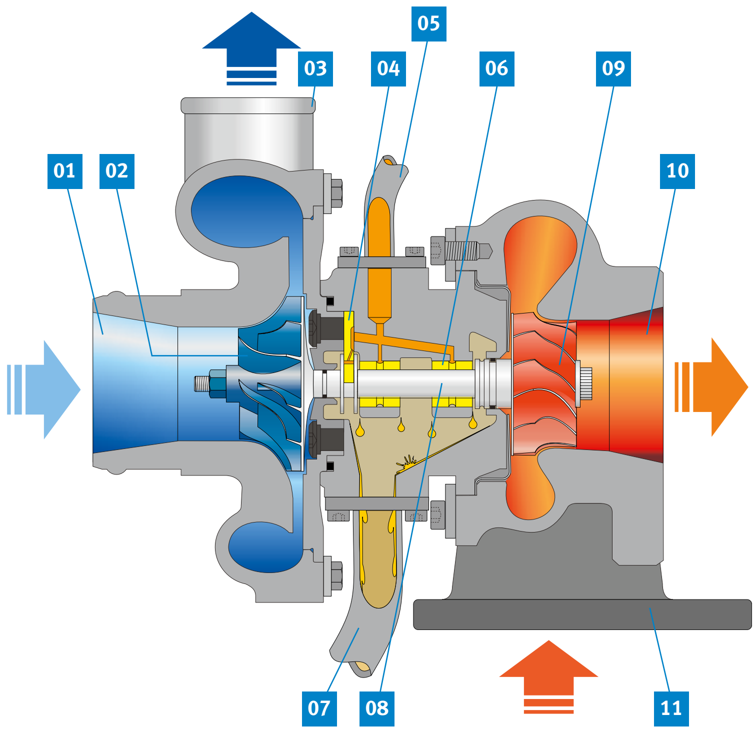
Reasons for oil leakage:

- Blocked, kinked, constricted or carbonised return line
- Oil level too high
- Internal pressure in crankcase too high due to excessive wear on pistons, piston rings and cylinder bores (excessive blow-by gases)
- Internal pressure in crankcase too high due to crankcase ventilation failure

NOTE

Due to the much more widespread use of turbocharged engines, oil consumption caused by unfavourable turbocharger operating conditions occurs much more commonly than in the past.

01 Fresh air inlet
02 Compressor impeller
03 Fresh air outlet (compressed)
04 Axial shaft bearing (thrust washer)
05 Oil supply connection
06 Radial shaft bearing
07 Return side
08 Turbocharger shaft
09 Turbine impeller
10 Exhaust gas outlet
11 Exhaust gas inlet



2.5 EXCESS PRESSURE IN CRANKCASE

Blow-by gases are pressurised combustion gases that enter the crankcase by way of the pistons and piston rings. Wear on pistons, piston rings or cylinder bores causes blow-by gas levels to increase. As a result, there will be greater strain on the crankcase ventilation and/or the crankcase bleed valve. Increased gas pressure will build up inside the crankcase and gas will leak from the engine together with the engine oil via the radial oil seals. On engines that are in good order increased pressure in the crankcase resulting from blow-by gases could also be caused by the crankcase bleed valve being faulty, dirty or frozen up. Greater pressure in the crankcase also causes increased strain on the valve stem seals. Engine oil is forced into the exhaust tract or the intake air system where it burns up and escapes into the environment together with the exhaust gases.

2.6 OIL LEVEL BEING TOO HIGH

If the oil level is too high, the crankshaft will be immersed in the crankcase sump and additional oil mist will form. If the engine oil is unsuitable, dirty or old, oil foam may develop. This will swamp the oil separator system for the crankcase ventilation and render it ineffective. Engine oil together with the blow-by gases will enter the intake air system in foam or droplet form via the crankcase bleed valve. These are then drawn in and burned off by the engine.

Reasons for oil level being too high:

- Fuel getting into the engine oil due to poor mixture formation, incomplete combustion or frequent short-distance drives
- Wrong amount used when changing oil (too much engine oil added)
- Engine oil topped up unnecessarily (vehicles without dipstick)
- Mistakes when reading the oil level (vehicle on a slope, dipstick not inserted correctly or read incorrectly)
- Wrong dipstick
- Automatic top-up systems faulty

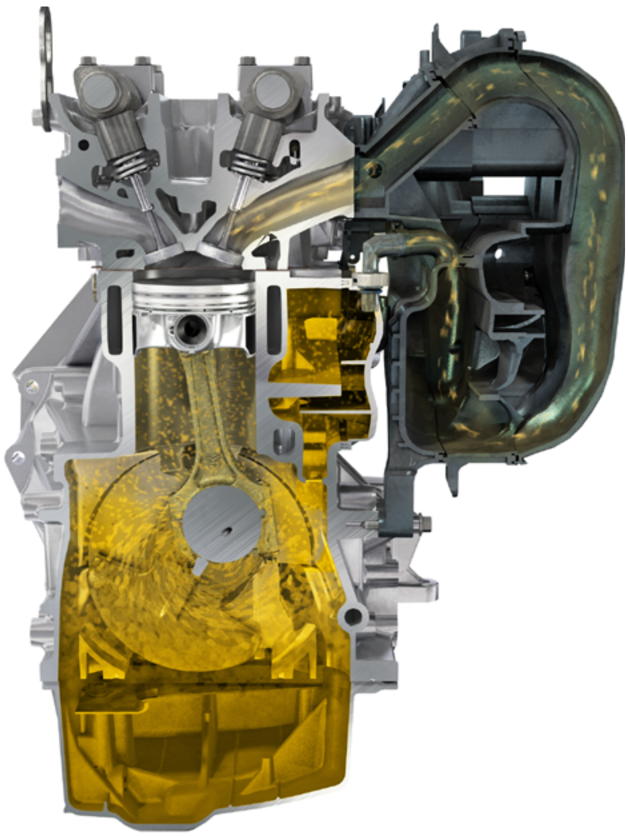


Fig. 1: Oil level too high

2.7 FUEL FLOODING AND MIXED FRICTION WEAR

Combustion defaults and unburned fuel often result in fuel flooding when the engine is in operation.

The unburned fuel in the combustion chamber causes the oil film on the cylinder surface to weaken as the oil film (shown in yellow in Fig. 2 and 3) is diluted or washed off. The surfaces of the piston and cylinder bore are no longer metallically separated from one another due to the missing oil film, resulting in mixed friction wear (Fig. 3). Engine performance drops and oil consumption rises.

Reasons for fuel flooding in petrol engines:

- Frequent short-distance journeys with the engine not at operating temperature (oil dilution and loss of engine oil viscosity)
- Defects in the mixture formation (mixture too rich)
- Faults in the ignition system (misfiring due to defective ignition coils, spark plugs, ignition cables, etc.)
- Mechanical engine problems (wear, valve timing errors)
- Poor-quality fuel
- A combination of the problems stated above

In diesel engines the injected fuel ignites when exposed to highly compressed air in the combustion chamber. Lack of compression (poor filling) or poor fuel quality result in ignition delays, incomplete combustion and liquid fuel collecting in the combustion chamber.

Reasons for fuel flooding in diesel engines:

- Faulty and leaking injection nozzles
- Fault in the fuel injection pump or settings incorrect
- Incorrectly routed and poorly secured injection lines (vibrations)
- Mechanical faults (piston striking against the cylinder head due to excessive piston protrusion, see section 2.8 „Excessive piston protrusion“)
- Poor filling of the combustion chamber with fresh air due to:
  - Blocked air filter
  - Defective or worn turbocharger
  - Intake system leaking (turbocharged engines)
  - Worn or fractured piston rings
- Poor fuel quality (poor selfignition and incomplete combustion)
- A combination of the problems stated above

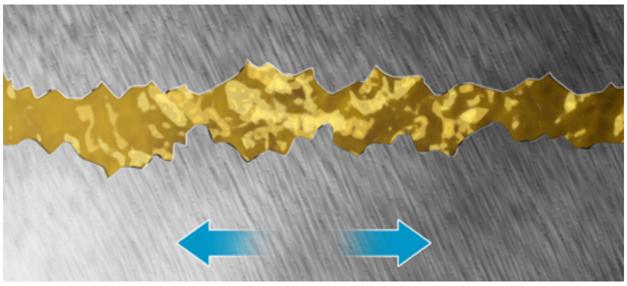


Fig. 2: Liquid friction

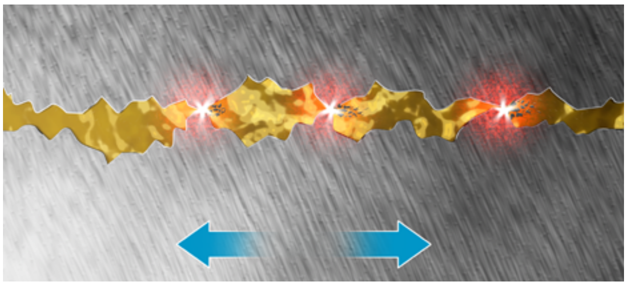


Fig. 3: Mixed friction

2.8 EXCESSIVE PISTON PROTRUSION

If the piston protrusion is too great on a diesel engine (Fig. 1), the pistons will strike against the cylinder head and jolt the injection nozzles. The resultant vibrations cause pressure fluctuations and the injection nozzles to open unpredictably. Additionally, fuel will be injected into the combustion chambers in an uncontrolled way causing combustion defaults.
Unburned fuel will also be deposited on the cylinder sliding surfaces causing the lubricating film to degrade. This results in a high degree of mixed friction on the pistons, piston rings and the cylinder sliding surfaces (see section 2.7 „Fuel flooding and mixed friction wear“).

NOTE

If repairs are made to the crank mechanism, the piston protrusion must always be checked and set as per the manufacturer‘s specifications or the specifications in our „Pistons and Components“ catalogue (Fig. 2).
Pistons expand both across the diameter and heightwise until the operating temperature is reached. Checking the pistons for freedom of movement when assembling the engine (by turning the engine‘s crankshaft by hand) does not provide any assurance that the pistons will not strike the cylinder head when the operating temperature is reached.

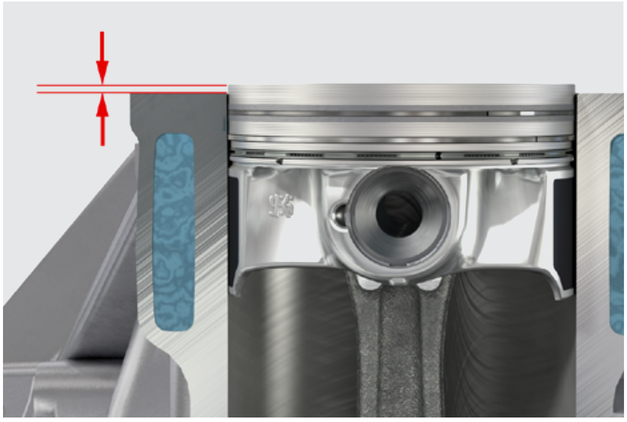


Fig. 1: Piston protrusion

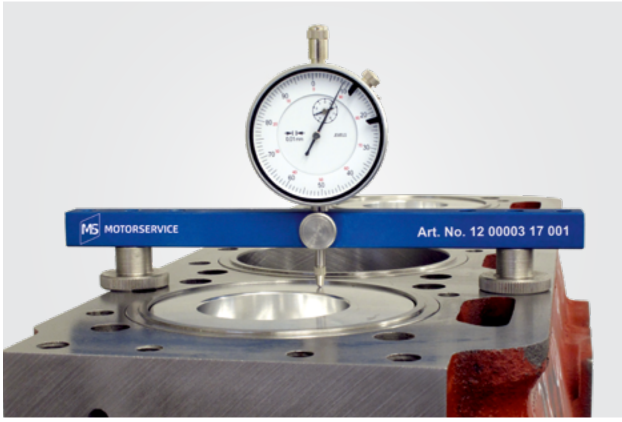


Fig. 2: Measurement of piston protrusion

2.9 IRREGULAR OR MISSED OIL CHANGE INTERVALS

If the service intervals specified by the engine manufacturer are not complied with, old and contaminated engine oil will enter the engine. Since the required oil characteristics will no longer be present, there will be a greater risk of wear or damage. In addition to complying with the oil change intervals, it is absolutely essential to check and correct the key engine adjustment and test values as part of the service. This will help to extend the service life and is a prerequisite for optimum operating conditions.

NOTE
Sometimes more frequent oil changes are required for engines that can run on gas (LPG, CNG) as well as normal fuel.
The same applies to biofuels (e.g. RME).

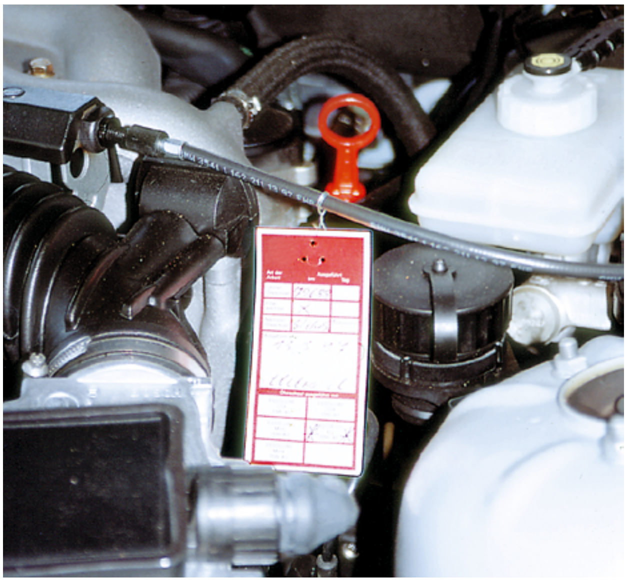


Fig. 3: Oil change tag

2.10 USING LOW-GRADE ENGINE OILS

If unsuitable or low-grade engine oils are used, optimum engine operation cannot be guaranteed in all operating states. Using inferior grade oil will significantly increase component wear – primarily in extreme situations such as cold starts and full-load operation.
Engine oil must comply with the vehicle manufacturer's specifications and/or be approved by the manufacturer.
If the engine oil does not have key characteristics, e.g. due to the wrong or insufficient additivation, wear and therefore oil consumption will increase. Poorer viscosity and a higher ratio of volatile constituents mean low-grade engine oils will vaporise more quickly on the hot cylinder sliding surfaces, directly increasing oil consumption.

Fig. 4: Oil change

2.11 DISTORTION OF CYLINDER BORES

Distortion of cylinder bores is easy to identify from individual, bright areas on the cylinder sliding surface (Fig. 1). Distortion causes elevations in the cylinder sliding surface on which the honed surface becomes worn down. The piston rings are not able to reliably seal distorted or deformed cylinder bores to prevent the ingress of engine oil or combustion gases.
The engine oil will not be wiped off by the piston rings in places where the distortion occurs and will find its way into the combustion chamber and be burned off. The combustion gases streaming past the piston rings increase pressure in the crankcase and may result in yet more oil consumption (see section 2.5 „Excess pressure in crankcase“).

Causes:

- Incorrect tightening torque and angle of rotation used when tightening cylinder head bolts
- Uneven cylinder block and cylinder head faces
- Dirty or distorted threads on the cylinder head bolts
- Use of incorrect or unsuitable cylinder head gaskets
- Faulty, worn or soiled bolt head contact surfaces on wet and dry cylinder liners
- Contact corrosion on dry cylinder liners
- Out-of-true or distorted bores on dry cylinder liners
- Incorrectly mounted or twisted O-rings on wet cylinder liners

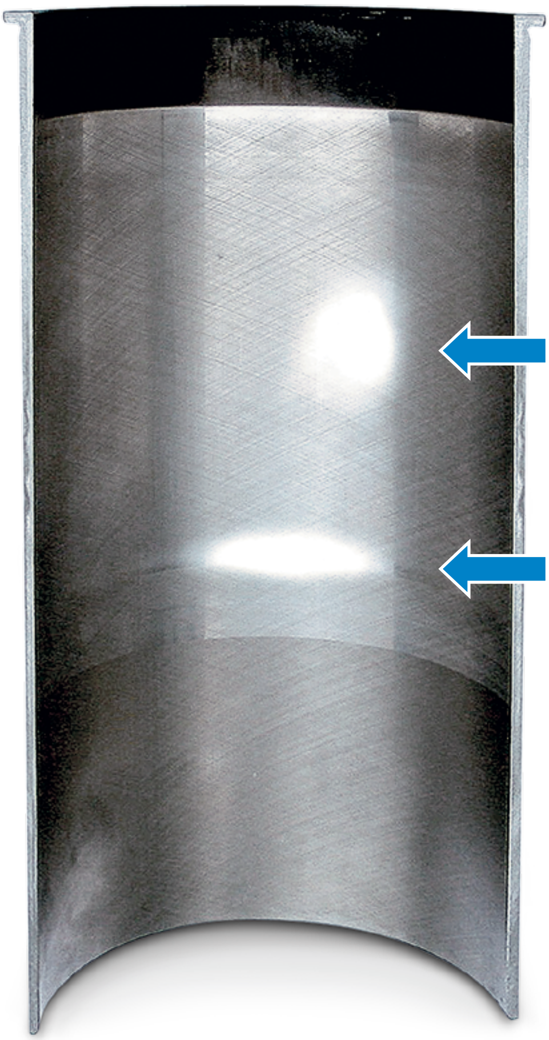


Fig. 1: Wear on the sliding surface due to distortion

2.12 FAULTS IN CYLINDER MACHINING

Faulty machining of cylinder bores or errors in geometry not rectified by boring and honing result in problems with the „cylinder bore-piston-piston rings“ sealing system.

Faults made or not rectified during machining:

- Out-of-true cylinder bore (2nd, 3rd and 4th out-of-roundness, see Fig. 2)
- Funnel, barrel/conical shaped and rippled cylinder bores
- Honing with blunt and/or the wrong tools
- Honing with incorrect or old cooling lubricant (honing oil)
- Honing with the wrong machining parameters (incorrect honing angle, specified roughness value not adhered to)

In addition to the problems already referred to with the seal between the piston and cylinder bore if the topography of the cylinder surface is incorrect, mixed friction and therefore significantly increased wear may occur on the pistons, piston rings and cylinder bores.

Direct problems with the sealing function will not only contribute to increased oil consumption, but also rapidly advancing wear will significantly weaken the sealing system.

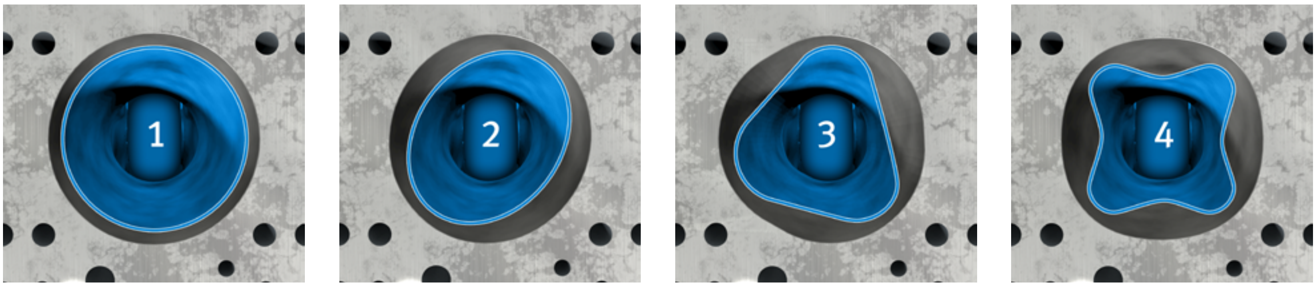


Fig. 2: Out-of-true cylinder bores

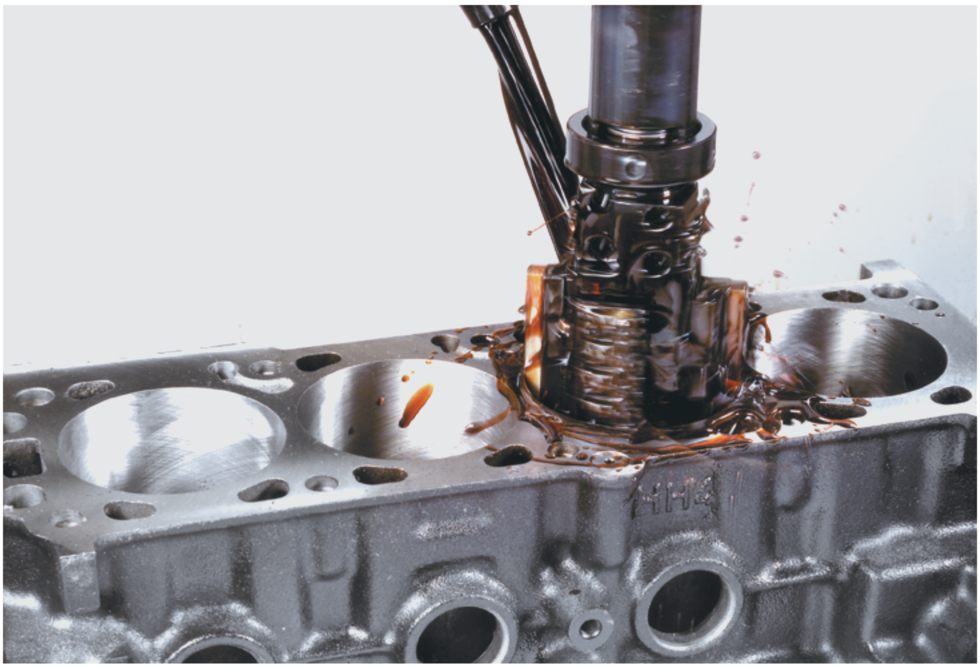


Fig. 3: Cylinder machining

2.13 BENT CONNECTING RODS

If the engine is damaged, the connecting rods often get bent. If the shafts of the big and small connecting rod eyes are not checked for parallelism during engine reconditioning or if a distortion in the connecting rod is not immediately straightened, the piston will run skew in the cylinder bore when the engine is later operated (Fig. 1). The piston rings will then not run in a true circle in the cylinder, but will trace an elliptical pattern, causing severe problems with sealing.
The piston rings will make contact at the bottom on one side and at the top on the other side of the cylinder (Fig. 2). If the piston rings are still able to rotate in the ring groove, the crowning of the piston rings on the sliding surface will increase within a very short period of time. The increased crowning will make the lubricating film left on the cylinder surface significantly thicker and the oil will not be properly wiped off.

As the piston is out-of-plumb, a pumping force will be applied to the piston rings resulting in the increased ingress of oil into the combustion chamber.
Because the piston is skewed, causing it to trace an elliptical pattern, the piston rings will frequently no longer rotate in their ring grooves. This will cause uneven, one-sided radial wear on the piston rings, often resulting in them fracturing.

NOTE
If the pistons or crank mechanism are damaged, the connecting rods must always be checked for dimensional accuracy and misalignment.

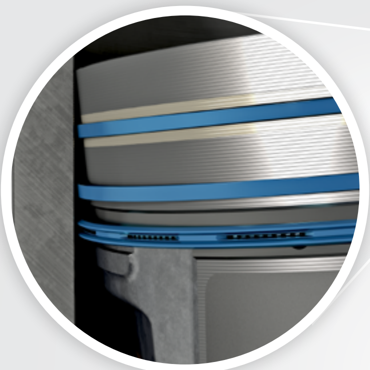


Fig. 2: Piston rings

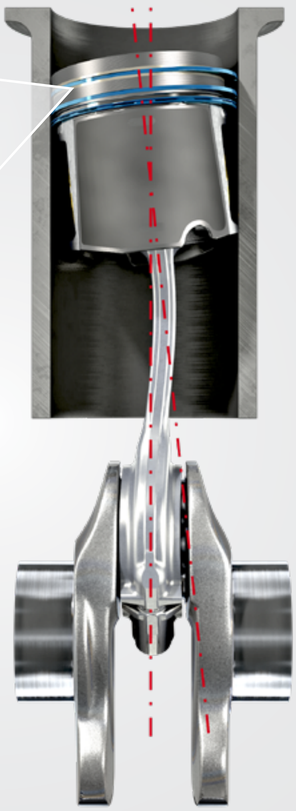


Fig. 1: Out-of-plumb piston

2.14 FRACTURED OR INCORRECTLY MOUNTED PISTON RINGS

Inexpert fitting or using too much force to fit piston rings may cause them to be damaged, bent or to fracture. The engine oil will no longer be properly wiped from the cylinder surface and will enter the combustion chamber where it will burn off.
Hot combustion gases flowing past the piston rings will cause increased piston ring temperatures, weakening of the oil film and loss of power.

Reasons for damage to piston rings:

- Fractured piston rings (when fitting or through weakening due to excessive wear)
- Wrong direction of installation („TOP“ mark must always be facing upwards)
- Use of excessive force when fitting (profile defects and molybdenum coating chipped)
- Damage to piston ring sliding surfaces when fitting (scratches, dints, nicks, incipient cracks)
- Incorrectly mounted oil control rings (wrong orientation of expander springs or incorrect assembly)

ATTENTION

To prevent piston rings being overstrained or bent during installation, circlip pliers must always be used when fitting piston rings. Avoid fitting and taking piston rings off new pistons except where absolutely necessary to help ensure the piston rings retain their shape and tension.

2.15 BLOCKED PISTON RINGS

If the piston rings in a four-stroke engine are not able to move freely in the ring grooves, problems with sealing and increased oil consumption will arise (Fig. 3).

Reasons for blocked piston rings:

- Piston rings do not have the correct dimensions.
- The direction of installation for the piston rings was not observed (e.g. for one-sided keystone rings).
- The piston ring grooves are damaged, dirty or carbonised
- Piston rings have been bent by inexpert handling (into a spiral shape).
- The connecting rods are bent, which results in a skewing of the pistons in the cylinder bores (see section 2.13 „Bent connecting rods“).
- The cylinder bores are out-of-true and distorted (see section 2.11 „Distortion of cylinder bores“).
- Contaminated piston ring grooves (often caused by blasting agent that has not been completely removed after blasting with sand, steel shot or glass beads during reconditioning).

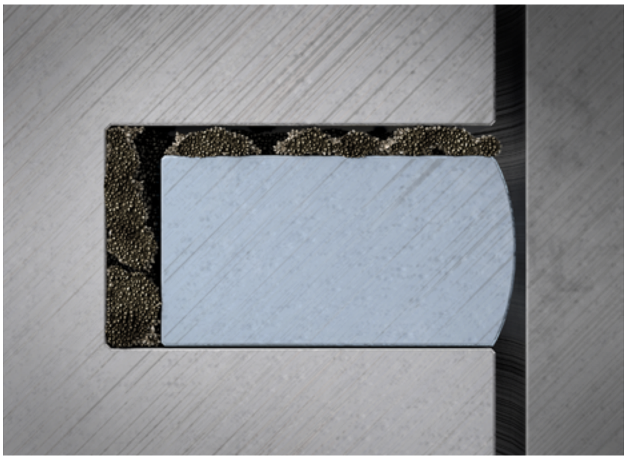


Fig. 3: Blocked piston rings

2.16 UNFAVOURABLE OPERATING CONDITIONS AND USAGE ERRORS

In addition to technical causes that may result in increased oil consumption in the engine and its environment, unfavourable operating conditions for the vehicle may also result in increased oil consumption. All driving conditions that cause an increase in fuel consumption have a negative impact on oil consumption.

The following have a negative impact:

- Frequent journeys with full load
- Frequent stop-start travel (town and city driving with many traffic light stops)
- Frequently driving with a cold engine
- Frequent driving on hills
- Frequent driving on congested roads
- Driving with an overloaded vehicle
- Frequent journeys with a trailer (passenger cars)
- „Thrashing“ the vehicle
- Frequent and sustained idling of the engine (e.g. when loading the vehicle or to operate the heating or air conditioning)
  Explanation: When the vehicle is idling, low combustion pressures result in poor sealing of the piston rings. The engine oil is not properly wiped off and burned.

3. OIL LOSS CAUSED BY

3.1 INCORRECT UTILISATION OF SEALANTS

In modern engines, liquid sealants are used to seal the outside of various systems and to seal systems to one another. However, liquid sealants may only be used for applications for which they are explicitly specified. If other types of seal are used (metal, elastomer, soft material, etc.), liquid sealant should not be applied in addition.

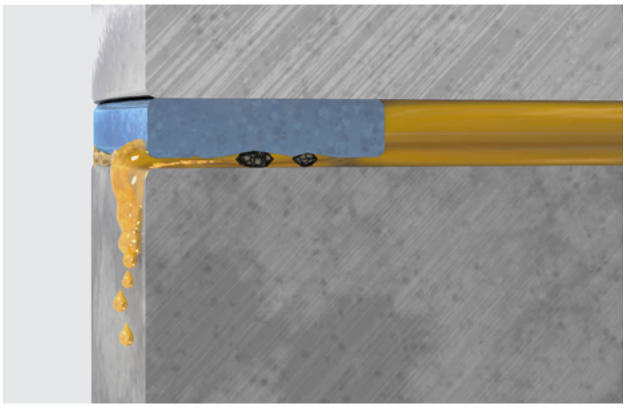
The unnecessary and excessive application of liquid sealant, particularly if solid seals are in use, can cause leaks. In addition, sealant residue that comes away can cause impurities or blockages in the oil or coolant circuit.

ATTENTION
When using sealants, temperature resistance and area of application must be matched to the intended purpose.

NOTE
All sealing areas must be cleaned and de-oiled using a solvent (thinner, brake cleaner, etc.) before installing the seal or applying liquid sealants. If a liquid sealant is applied to contaminated, oil-fouled surfaces, the sealing compound may not adhere to the sealing area. The sealant may be forced out of the sealing gap by the pressure of the liquid and be lost due to the sealing effect. This will result in engine oil or cooling liquid escaping.

3.2 FOREIGN BODIES BETWEEN SEALING AREAS

Foreign bodies between the seal and the component prevent correct sealing and may cause the component to become distorted.
Rust, sealant and paint residue that has not been completely removed may cause similar problems.



NOTE
Foreign bodies that have been overlooked are one of the most easily avoided mistakes. All components should be carefully cleaned before assembling the engine.

3.3 UNSEALED RADIAL OIL SEALS

Radial oil seals consist of a metal insert with an elastomer outer casing that provides the static seal to the housing. Different types of seal are used for the dynamic seal to the shaft:

1. Sealing lips made of PTFE without spring support
2. Elastomer membranes with sealing lips that are additionally supported by corrosion-resistant tension springs made of stainless steel

For the seal to be effective, not only must the radial oil seal be in good condition, so must the shaft surface.

ATTENTION
Radial oil seals made of PTFE are usually installed dry. The waiting period specified by manufacturer before starting the engine after fitting seals must be observed.

3.4 SEALING AREA PROBLEMS

If the surfaces of components are damaged (scratches, corrosion, rust, dented) or are not level, the seal may not fulfil its intended function.
A gap will remain between the seal and the sealing area after joining the components through which engine oil or cooling liquid can escape.

Installation tips:
- All sealing areas must be cleaned and de-oiled using a solvent (thinner, brake cleaner, etc.) before installing the seal or applying liquid sealants.
- The sealing areas using a straightedge and any components that have been remachined must be checked.
- The surface roughness must be checked. For the seal to function correctly, the sealing areas must have the specified roughness.

3.5 FAULTY VACUUM PUMPS

If vacuum pumps are defective, engine oil can enter the vacuum system by this route. This engine oil will not then be available for lubrication of the engine.

Engine oil in the vacuum system will bring about malfunctions and component failure.

3.6 EXCESSIVE OIL PRESSURE

If the oil pressure is too high, housing gaskets, oil filters, oil coolers and pipes may leak or crack.

Reasons for excessive oil pressure:
- Wrong oil pump or pump too big
- Blocked oil filter without overflow valve
- Wrong oil filter
- Paper element in oil filter has disintegrated
- Wrong seals, outlets for engine oil missing or too small
- Plug or cleaning cloth left behind when doing repairs
- Oil feed lines and hoses blocked, kinked or constricted
- Faulty pressure control valves or pressure relief valves
- Malfunctions in the oil circuit due to using the wrong parts, e.g. wrong non-return valves or hoses
- Using engine oil with the wrong viscosity
- Old engine oil that has taken on a jellylike consistency with low ambient temperatures or frost

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