MOTORSERVICE

Practical skills

Our knowledge for your work

SERVICE
TIPS & INFOS

POSTER
INSIDE

KOLBENSCHMIDT

Piston damage – recognising and rectifying!

It is not at all a rare occurrence for repairs to be carried out and then for the same damage to occur again and the same components to fail again because, although the damaged parts were replaced, nothing was done to eliminate the cause of the problem. For this reason a certain amount of “detective work” is always needed to track down the fault.

In many cases the engineer is presented with just a faulty component, with no information about how long the component was in service before it failed, or what the extent of the damage is. Naturally this makes it difficult to retrace how the fault happened, and the resulting diagnosis invariably offers a general, non damage-specific conclusion.

3.4 Damage due to abnormal combustion

Ring land fractures

Description of the damage
- Ring land fracture on one side of the piston between the first and second compression ring (Fig. 1).
- Fracture, starting at the groove base at the top and running at a diagonal angle into the piston material, emerging at the groove base underneath (Fig. 2).
- Fracture is extended downwards.
- No piston seizure marks or signs of overheating.

Fig. 1

Fig. 2 Cross section of fracture

Damage assessment
Land fractures are not caused by material faults, but by material overload. A distinction can be made between 3 different causes:

1. Knocking combustion:
The octane rating of the fuel was not capable of covering the engine's needs under all operating and load conditions (refer to the chapter entitled "General information about piston damage due to abnormal combustion in petrol engines").

Ring land fractures caused by knocking combustion usually occur on the pressure side. On a diesel engine, knocking combustion is caused by an ignition delay.

36 | Piston damage – recognising and rectifying

MOTORSERVICE Damage due

2. Hydraulic locks:
Liquid (water, coolant, oil or fuel) accidentally enters the combustion chamber when the engine is stopped or running. As the liquid is incompressible, the piston and crankshaft drive are subjected to enormous stresses during the compression cycle. This results in ring land fractures, boss fractures or connecting rod/crankshaft damage.

Fig. 3 shows the course of
occurs with knocking comb
hydraulic locks: the force
fracture and acting from
land causes the fracture
extend downwards.

3. Installation faults:
If the piston rings are incorrectly compressed, more force is required when installing the piston. Forcibly pressing in or knocking in the piston causes pre-damage to the ring lands in the form of fine hairline cracks.

The ring lands fracture
direction as the pressu
below in this case (Fig.

Possible causes for the damage
Knocking combustion on petrol engines:
- Fuel without suitable anti-knock properties. The fuel quality must correspond to the compression ratio of the engine, i.e. the octane rating of the fuel must cover the octane requirements of the engine under all operating conditions.
- Petrol contaminated by diesel, which lowers the octane rating of the fuel.
- Excessively high compression ratio caused by excessive machining of the engine block surface and cylinder head mating surface, e.g. for engine reconditioning or tuning purposes.
- Ignition timing too advanced.
- Mixture too lean, resulting in higher combustion temperatures.
- Intake air temperatures too high, caused for example by inadequate ventilation of the engine compartment or incorrect switching of the intake air flap to summer operation (particularly on older carburettor engines).

Knocking combustio
- Injection nozzles
or leaks.
- Injection pressure
too low.
- Compression pre
correct cylinder
piston protrusio
or damaged/wo
- Defective cylind
- Damage to the
- Improper or ex
(e.g. starting s
- Defective turbo

KOLBENSCHMIDT

Extract from the brochure

The aim of this brochure is to provide the interested reader with an overview of the different types of damage that can be encountered in the innermost part of an internal combustion engine, as well as to provide a useful tool for specialists which will help to diagnose faults and determine their causes. The process of assessing engine damage is similar to a medical assessment in that it requires an all-encompassing approach to identify the cause(s) of a problem, which may not always be clear and obvious.

Details on this subject can be found in our brochure "Piston damage – Recognising and Rectifying". Order-No.: 50 003 973-02 (English) or via www.ms-motorservice.com

MOTORSERVICE

Motorservice Group.
Quality and service from a single source.
The Motorservice Group is the sales organisation for the global aftermarket activities of KSPG (Kolbenschmidt Pierburg). It is one of the leading suppliers of engine components for the independent aftermarket, including the premium brands KOLBENSCHMIDT, PIERBURG and TRW Engine Components, as well as the BF brand. Our comprehensive product range allows our customers to obtain engine components from a single source. As a problem solver for dealers and garages, Motorservice offers extensive service and the technical expertise that you would expect from the subsidiary of one of the largest automotive suppliers.

KSPG (Kolbenschmidt Pierburg).
Renowned supplier to the international automotive industry.
As long-standing partners to the automotive industry, the companies in the KSPG Group develop innovative components and system solutions with acknowledged competence for air supply and emission control, for oil, water and vacuum pumps, for pistons, engine blocks and engine bearings. The products comply with the high demands and quality standards of the automotive industry. Low emissions, reduced fuel consumption, reliability, quality and safety – these are the forces that drive innovation at KSPG.

Motorservice Partner:

Headquarters:
MS Motorservice International GmbH
Wilhelm-Maybach-Straße 14–18
74196 Neuenstadt, Germany
www.ms-motorservice.com

4 028977 611797
50 003 801-02 – 11/14 EN

KSPG Automotive

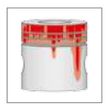
MOTORSERVICE

Piston Damage and causes

Piston Crown Damage

Seizure due to overheating (mainly piston crown)

- Overheating due to abnormal combustion
- Bent/blocked oil splash jet
- Installation of incorrect pistons
- Faults in the engine cooling system
- Restriction of clearances in the upper running surface



Impact marks

- Excessive piston protrusion
- Excessive reworking of the cylinder head mating face
- Incorrect valve recess
- Incorrect cylinder head gasket
- Oil carbon deposits on the piston crown
- Insufficient valve clearance

Fused / melted off material

- Faulty injectors
- Incorrect quantity of injected fuel
- Incorrect injection timing
- Insufficient compression
- Ignition delay
- Oscillations in the fuel-injection lines

Cracks in the piston crown and combustion bowl

- Faulty or incorrect injector
- Incorrect injection timing
- Incorrect quantity of injected fuel
- Insufficient compression
- Deficient piston cooling
- Installation of pistons with incorrectly shaped piston recess
- Performance enhancement (e.g. chip tuning)

Piston Ring Damage

Material washout in the ring zone

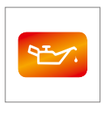
- Incorrectly installed piston rings
- Fuel flooding
- Severe axial wear of piston ring grooves and piston rings
- Piston ring flutter

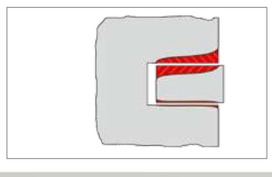
Radial wear due to fuel flooding

- Faults during the mixing stage
- Abnormal combustion
- Insufficient compression pressure
- Incorrect piston protrusion

Axial wear due to ingress of dirt

- Abrasive dirt particles due to inadequate filtration
- Particles of dirt which are not completely removed during an engine overhaul (swarf, blasting material)
- Abraded particles caused when the engine is being run in

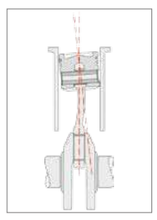




Damage to the Piston Skirt

Asymmetric wear pattern of the piston

- Twisted/bent connecting rod
- Connecting rod small end bored at an oblique angle
- Cylinder bores not straight
- Individual cylinders not installed straight
- Excessive connecting rod bearing clearance



45° seizure

- Excessively narrow fit of the piston pin
- Seizure in the connecting rod small end (insufficient lubrication when the engine was first taken into operation)
- Incorrectly installed shrink-fit-connecting rod
- Excessive load on the engine before it reaches operating temperature

Dry-running damage

- Over-rich operation
- Abnormal combustion (misfiring) insufficient compression
- Defective cold-starting device
- Oil dilution with fuel

Damage to the Cylinder Liners

Cavitation

- Poor or inaccurate seating of the liner
- Use of incorrect O-rings
- Use of unsuitable coolants
- Insufficient pre-pressure in the cooling system
- Operating temperature too low/too high
- Restricted coolant flow

Shiny marks in the upper part of the cylinder

Oil carbon deposits on the piston top land due to:

- Excessive ingress of engine oil into the combustion chamber due to defective parts
- Increased emissions of blow-by gases with oil entering the intake tract
- Insufficient separation of oil mist from the blow-by gases
- Frequent idle or short journey operation

Details on this subject can be found in our brochure “Piston damage – Recognising and Rectifying”.

Further information can be obtained directly from your local Motorservice partner or at www.ms-motorservice.com

The Motorservice Group is the sales organisation for the global aftermarket activities of KSPG (Kolbenschmidt Pierburg). It is one of the leading suppliers of engine components for the independent aftermarket, including the premium brands KOLBENSCHMIDT, PIERBURG and TRW Engine Components, as well as the BF brand. Our comprehensive product range allows our customers to obtain engine components from a single source.

KOLBENSCHMIDT

KSPG Automotive
www.ms-motorservice.com

4 028977 520242