



### 3 Piston crown

#### 3.8 Cracks in piston crown

**Symptoms** The pistons in Figures 1 and 2 exhibit erosion-type surface damage in the area of the top land. In Figure 3, this effect can be seen only on the rim of the combustion cavity, while in Figure 4 it can be seen, additionally, also on the crown.

**Cause and Effect** Figure 1 shows a crack in a sports-engine piston, with the breakage running in the direction of the gudgeon pin. In Figures 2 and 3, the crack runs in the direction of thrust, i. e. at right angles to the axis of the gudgeon pin. In Figure 4, the piston crown has a network of cracks.

Otto engine (Figure 1)

Very high mechanical loads on engines used for sports and racing purposes, combined with heavy heating of the crown, lead to breakage with burnt holes. The breakage line runs in the direction of the gudgeon pin.

Diesel engine

The swirl-chamber engine piston shown in Figures 2 and 3 has been subjected to particularly high thermal load in the crown area in the vicinity of the injection channel. Impeded thermal expansion due to the temperature differences in the crown causes plastic deformations in the surface area which can lead to cracks during cooling-down phases.

The load by the gas pressure produces deformations of the crown particularly at right angles to the direction of the gudgeon pin, and encourages the crack to progress from the outside of the crown. This can cause the entire cross-section of the crown to crack through. In the case of the prechamber engine piston shown in Figure 4, the flame jet hits the centre of the shallow combustion cavity. Excessive thermal stresses then lead to the cracks in the crown.

For crown cracks caused by foreign particles or impacts against the cylinder head, see 3.3.1.

**Remedy** Otto engine

For sports use, employ suitable pistons, e. g. made of forged blanks with high strength.

Diesel engine

If engine power is raised by increasing the injection quantity or excessive setting of the injection pump control, this leads to increased thermal load on the piston. For this reason, always carry out adjustments in accordance with the engine manufacturer's instructions.