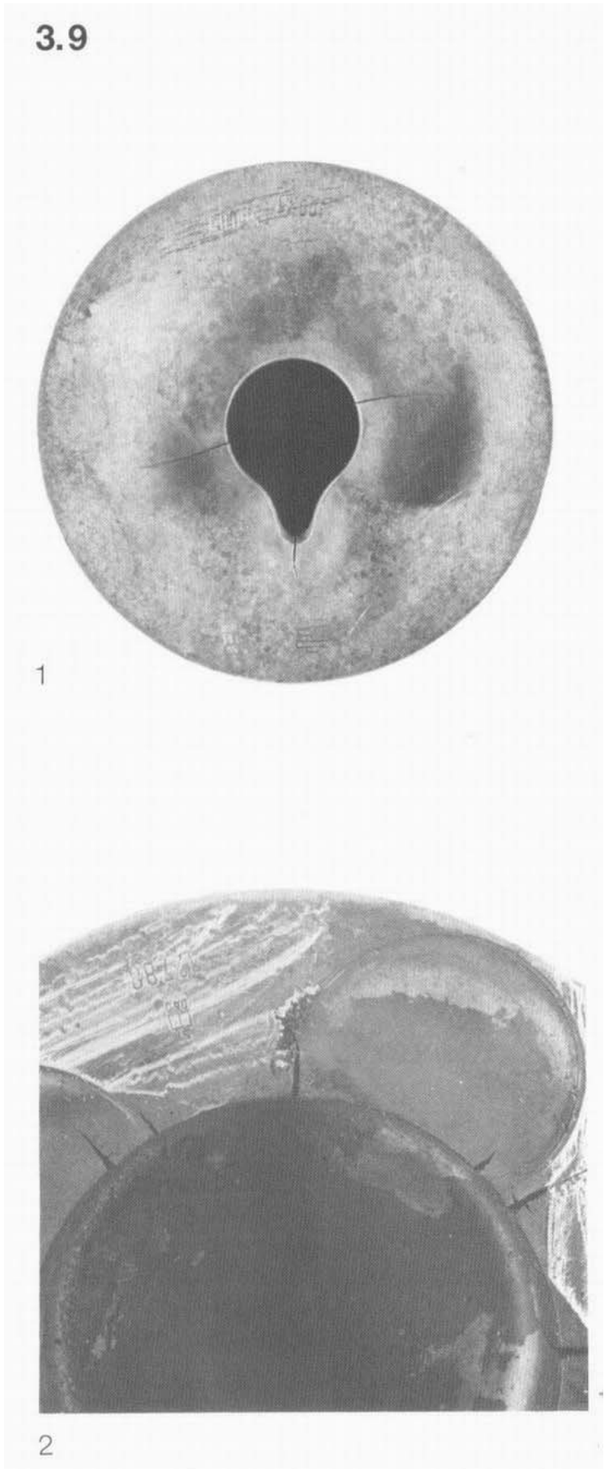

3 Piston crown

3.9 Cracks at rim of combustion cavity

Symptoms

The rim of the combustion cavity of both direct-injection Diesel-engine pistons shown here is cracked. In the case of the piston in Figure 1, the rim, which is undercut because of the spherical shape of the combustion cavity, has deep cracks. The cracks at the cavity edge of the piston in Figure 2 are short but widely gaping.

Cause and Effect

The high thermal Icad on Diesel pistons, with the resultant great temperature difference between the combustion cavity rim and the material behind it, lead to impeded thermal expansion and to compressive stresses at the cavity rim up to and beyond the yield strength, thus causing plastic deformation of the material. During cooling-down, the material displaced by this jolting is "missing" and tensile stresses occur, causing a crack.

Cavity rims which are sharp-edged and undercut, and the intersecting edges of valve recesses at the cavity rim, are particularly at risk.

When evaluating the cracks their location is of major importance. Cracks at the cavity rim in pin direction or at the valve cutouts result in a breaking of the piston to the pin boss within a very short period of time.

Small cracks propagating in major-minor thrust direction function like "reliefs". They can also occur under normal load conditions after very lengthy operation without entailing malfunctions of the piston.

Remedy

Set the injection quantity and injection timing precisely. Excessive power output, brought about for instance by increasing engine speed (excessive setting of the injection pump control) increases thermal load and leads to cracks. Settings should therefore always be carried out in accordance with the engine manufacturer's instructions.