



## Diesel Piston Crown Erosion

A diesel injection system must deliver (meter) the right amount of fuel in the right form (atomised) in the right place (spray pattern) at the right time (system timing). With everything correct, combustion takes place without liquid fuel being deposited on the combustion chamber surfaces. This maintains a thin boundary layer of gas between the surfaces and the burning mixture. In turn, this provides thermal protection of the combustion chamber by limiting the heat transfer to the components. The boundary layer is very thin (measured in microns) but the insulation it provides is of the utmost importance (Fig. 1).

A malfunction or the incorrect adjustment of the fuel injection system will often cause fuel to wet the combustion chamber surfaces. (Figs. 2 to 4)

When this happens, the fuel burns in direct contact with the surfaces without the protective boundary layer being present. The rate of heat transfer from the combustion gases increases dramatically and temperatures rapidly exceed the melting point of piston alloys. Piston crown erosion inevitably follows.

The first illustration shows a typical example of crown erosion. The periphery has been severely melted and burnt away and heavy carbon deposits are evident. Notice that a piece of steel is embedded in the exact centre of the crown. It is in fact the tip of the injector, which clearly under such conditions, has simply been squirting unatomised fuel onto the piston. Rare proof indeed of cause and effect.

The second illustration similarly shows crown erosion due to a deformed spray pattern. Notice how the fuel, having burnt and eroded the crown area, has attached the ring lands and initiated a full skirt seizure.

When crown erosion is discovered in a diesel engine, make an immediate and thorough check of the whole fuel injection system. A piston alloy has not yet been invented that will resist fuel burning on its surface, and to blame the component's metallurgy, will simply delay identification of the true cause - a fuel injection system malfunction.

