

BLACK SPOTS ON CYLINDER LINERS OF 2-STROKE ENGINES

Occasionally patches of black deposits appear on the cylinder liner wall of 2-stroke engines. The black spots typically appear in the mid-stroke area of the liner, roughly between the oil quills and the scavenge ports.

Analysis shows the deposits mainly consist of Calcium Sulphate, some water is found, and some oxidation products from hydrocarbons. Calcium Sulphate is commonly known as Gypsum.

Calcium Sulphate is formed due to neutralisation of condensed Sulphuric Acid by Calcium Carbonate from the detergent additive of the cylinder oil. Neutralization of condensed Sulphuric Acid is necessary to prevent corrosion. Under normal conditions the Calcium Sulphate is carried away by the continuous refreshment of the oil film on the cylinder liner. If for some reason the refreshment rate of the oil film is reduced in certain areas of the liner surface, Calcium Sulphate is allowed to deposit, resulting in spots. Due to soot and other combustion related products adhering to the surface the spots appear dark or black.

A possible reason for reduced oil refreshment in localised areas is the presence of areas where corrosion has previously taken place. These areas are slightly rougher and slightly recessed compared to the surrounding surface. Such areas are likely to retain the oil film and are slightly less exposed to the scraping effect of the piston rings.

Influencing factors are liner wall temperature, fuel sulphur content, scavenge air humidity, oil feed rate, etc.

Ideally, preventing Sulphuric Acid condensation on the Liner wall by staying above the acid Dew Point would prevent corrosion and the formation of black spots. However, Dew Point temperature is a complicated parameter related to quantity and concentration of the acid produced and the pressure in the cylinder. The recommended cylinder cooling water temperatures should therefore be closely observed.

Water carry-over from the scavenging air cooler into the cylinder must be avoided. Free and unrestricted draining of condensate from the cooler and the water separator must be assured and the scavenging air temperature should be at the recommended level.

The black spots described in this article are a regularly occurring phenomenon. Experience has shown that the black spots appear and disappear during engine operation, depending on different operational parameters. In general the black spots do not have a negative effect on the piston running conditions. Field inspections revealed normal piston ring condition and liner wear rates despite presence of the black spots as described in this article.

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