

Cylinder Liner Cavitation Erosion

The cavitation erosion (see picture 1) that is found in diesel engines on the exterior side of the cylinder (wet) liners, has been a theme of investigation by engine and corresponding component manufacturers, even though no definite manner of eliminating the problem has been found.

Picture 1

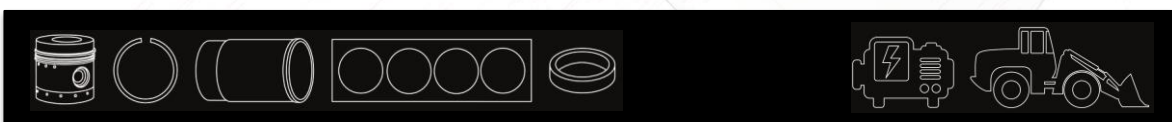
The degree and size of erosion or decay as well as its form and distribution on the affected zones can vary from engine to engine and inclusively from cylinder to cylinder within the same engine.

The affected areas form vertical strips or patches sometimes in alignment with the thrust face of the piston within the cylinder, or also formed immediately over the top sealing ring of the liner. The erosion can penetrate the wall of the cylinder and permit the flow of antifreeze/coolant to the oil or vice versa.

Cause:

- Excess in harmonic vibrations of the engine.
- Loose fitting liners

These result in a fast formation and implosion of small vapor bubbles within the coolant which attack the cylinders' liner wall.



The vibration in combination with collapsing bubbles produces an erosive effect over the surface of the liner's exterior face. This occurs as the piston moves up and down within the cylinder causing vibration especially over the area of thrust in the cylinder liner. We can say that the wall of the sleeve, which comes in contact with the coolant, quickly moves inwards and outwards striking these vapor formations. During this process, tiny bubbles are formed that implode or collapse violently producing shock waves against the liner's wall. The results of these implosions at the impact area of the liner's wall have been calculated to reach over 10,000° F with pressures of over 10,000 psi. Furthermore, if the coolant contains enough free oxygen (for oxide formation), the effect of the cavitation is amplified by corrosion.

A specific material, which would prevent cavitation erosion within reasonable cost, has not yet been found. Nevertheless, some coatings can be applied to delay cavitation erosion until it is time for major engine repairs.

The FP Diesel liners meet or exceed the original equipment specifications, which are also subjected to the same cavitation damage. In order to reduce or prevent cavitation, manufacturer recommendations should be followed.

In many cases, cavitation can be avoided by reducing harmonic vibrations. For example, by making sure the injection complies with the manufacturer's specifications, the engine's speed is governed according to the manufacturer's data and that the control functions. Also, do not underestimate the importance of correct clearances between liner and cylinder blocks; incorrect liner fit is a serious contributor to liner vibration resulting in cavitation erosion.



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Engine manufacturers have specific additives for the coolant called SCA (supplementary cooling additive). These additives will form a protective coating over the cylinder liner, which is exposed to the coolant, therefore reducing cavitation damage. With time, additive concentration reduces in the system, consequently making it necessary to follow system maintenance recommendations in order to keep the adequate levels. The following points will be supplied:

- pH control to avoid corrosion
- Water hardness control to avoid mineral deposit formation
- Cavitation protection

In all cases, it is required that all manufacturer's recommendations regarding coolants, base additives, additives, coolant filters as well as maintenance schedules should be strictly adhered to or followed at all times.

The FP Diesel cylinder liners are manufactured under strict quality control standards.



For step by step instructions on how to best leverage
the new FP Diesel security enhancements, visit
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