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The Crankcase – bone of contention or Achilles heel?

Inserve Ltd provides risk management services to marine insurers and their clients. Simon Groves talks here about the vagaries of the crankcase and the need to improve bearing reliability.

In the field of marine loss prevention we need only consider fires and crankshaft bearing failures and we will have addressed the largest and the most frequent categories of hull and machinery losses respectively.

The majority of fires are those caused by flammable liquids reaching hot surfaces and are easily preventable – just eliminate the ignition point. SOLAS has gone some way to addressing this but it is poorly interpreted and applied. A simple requirement to have all marine engines fitted with water jacketed exhaust systems would be the most effective solution.

Crankshaft bearing failures are harder to prevent and there remain a lot of misconceptions about what goes on inside the crankcase. Statistics show that around 60% of medium speed and 80% of high speed diesel engine insured losses involve crankshaft bearings.

There is a misunderstanding that oil mist detectors alert an operator to an overheating bearing and thereby prevent damage. In reality this is not the case. Oil mist detectors are intended to prevent crankcase explosions. By the time an oil mist has formed and the alarm sounded something within the crankcase has severely overheated and in the case of a bearing, the degree of overheating will have already caused physical damage.

Bearing temperature monitoring is the only way of sensing the onset of a bearing failure such that the engine can be slowed or stopped before damage occurs. Such equipment is most commonly fitted to main bearings where all that is required is a static probe. However, it is the connecting rod bottom end bearing or crankpin bearing which is most at risk. For the rotating connecting rod bearing it is necessary to fit either a temperature transmitter/receiver or to catch the oil as it sprays out of the connecting rod bearing (splash oil monitoring).

These and other types of temperature monitoring have been available for many years but a lot of engine manufacturers remain reluctant to install them. The reasons seem to be twofold, firstly they do not want it to appear that there is a possible weakness in their engines and secondly, and more cynically, such equipment would be harmful to the sales of spare parts, particularly crankshafts and bearing shells.

This situation cannot continue. Combustion pressures are increasing along with engine performance and correspondingly the bearing loads have increased. Bearing materials have been developed to withstand the additional loads but can be less tolerant of the typical problems encountered in the crankcase. There has never been a better time to focus our attention on enhancing the reliability of crankshaft bearings.

Ovality is still a major cause of crankpin bearing failures, and is that which is most often overlooked during maintenance. Generally an engine will need to have reached over 50,000 running hours before ovality appears but with higher firing loads and uprated engines, it is being after as little as 15,000 hours in some cases. Ovality affects the connecting rod bottom end bearing housing and the crankpin, both of which should be measured whenever the bottom end bearing is opened up e.g. for piston removal.

The connecting rod mating surfaces should be closely inspected for fretting and cracking and similar to ovality, if any is found then it should be remedied by machining.

It is often overlooked that connecting rod bolts on four stroke engines have a finite life. They subject to cyclic stresses because of the stress reversal on the induction stroke and are therefore susceptible to fatigue. Renewal criteria vary from engine to engine, they may be according to running hours or elongation.

On four stroke engines particularly, the cleanliness of the lubricating oil has a large impact on bearing life. Regular sampling and analysis is now accepted practice particularly when the analysis is provided by the oil supplier. However, too much reliance is placed on comments received from the laboratory. It should be remembered that each engine type has its own criteria for oil purity and the laboratory only reports results according to industry norms. There is still a need for the operator to scrutinise the results and make his own judgements about the source of any contamination and what remedial action is required.

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