Loss Prevention Circular No. 08-07

Warning - Fuel oil quality might be at stake

Fuel oil quality is directly related to the safe operation of ships and it is important for any ship operator to focus on preserving fuel oil quality.

Bearing in mind that the European Union Directive 2005/33/EC which deals with sulphur content comes into force on 11 August 2007 and the North Sea Sox Emission Control Area (SECA) will be fully implemented on 22 November 2007, the refinery industry may explore more advanced production/blending processes to satisfy the global demand for low sulphur fuel. The traditional method of assessing fuel oil quality and suitability may be unreliable in certain circumstances. In relation to the delivery of low sulphur fuel, a growing number of deliveries with excessive Aluminum and Silicon content, problems with fuel stability and ignition quality have been reported.

Fuel oil ignition and combustion quality is not yet part of the ISO 8217 fuel oil specification and the Calculated Carbon Aromatic Index (CCAI) has historically been the default method of estimating heavy fuel oil ignition quality. The fuel oil density and viscosity are the key parameters needed for calculating the CCAI, and the number 860 has for years been considered the limit for an acceptable ignition quality for a trunk piston engine. With refineries increasingly using Heavy Cycle oil (HC) in the blending process to achieve low sulphur values, the CCAI and the Calculated Ignition Index (CII) have often been found to be too inaccurate and inadequate to detect fuel with poor ignition properties. The most widely used equipment for fuel ignition tests has been the FIA-100 FCA, which is already available from some test laboratories and comes with an Institute of Petroleum approved test method, IP 541/06.
Typical engine problems experienced when using a fuel oil with poor ignition properties are:

- Difficulties or complete failure in starting the engine
- Undesirable peak pressures which can lead to blow by and collapse of piston rings
- Unstable operation and loss of power
- Varying revolutions, which are highly undesirable for the operation of auxiliary engines
- Increased deposits in the combustion area and in the exhaust gas system, including turbo charger and boiler
- Increased emissions of NOx

In a worst case scenario poor fuel oil ignition and combustion properties can render the engine inoperative and compromise the safe operation of the ship.

To illustrate the consequences of poor ignition and combustion properties, a vessel recently reported a knocking sound to the main engine as well as numerous piston seizures. Temporary repairs were executed, but the vessel's C/E did not realise that the problems experienced might have something to do with the fuel oil properties, and opted to continue running the engine at reduced RPM with the same fuel oil until the vessel reached a port of refuge. When the engine was opened up severe damages were discovered to all cylinder units. Main bearings had to be renewed and the crankshaft's main bearing journals had to be polished in addition to numerous of different parts inspected/overhauled. The damage repairs amounted to USD 1.2 million, and involved 40 days off-hire.

During repairs it was felt that the damage seen had similarities to that which could have been caused by fuel oil with poor ignition and combustion properties, and a decision was made to perform an ignition quality test.

For more information regarding the Gard loss prevention products, please contact:
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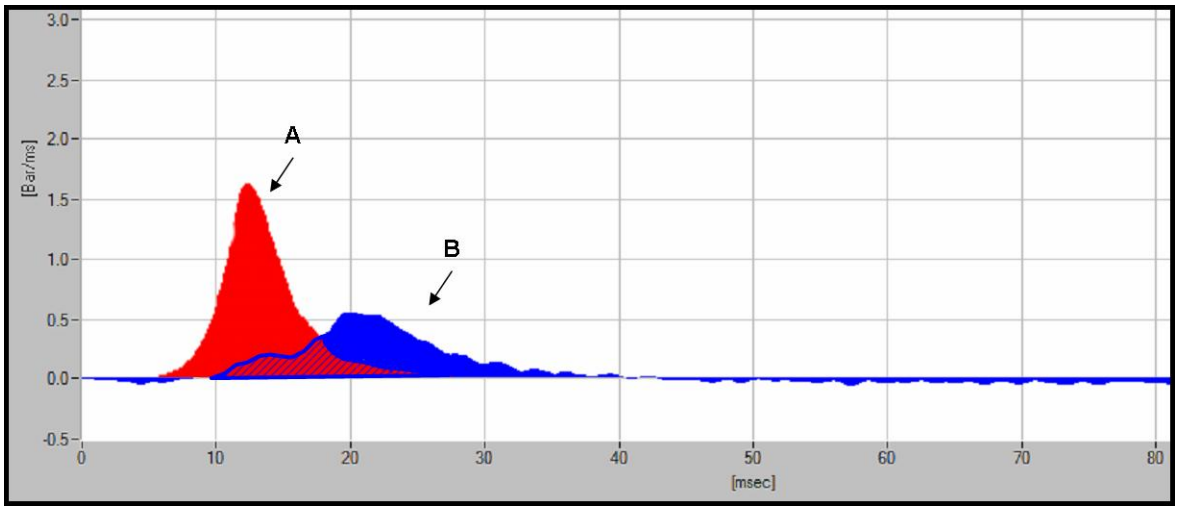
The diagram below illustrates the results from the fuel oil ignition tests performed with the FIA 100/3 (A), compared with a reference curve illustrating test results for 'normal' fuel oil.



A: Reference curve. Normal peak pressure and an ignition delay of 5.9 ms (millisecond). Start of main combustion, 7.85 ms.
B: Our vessel. Low peak pressure with "after burning" effects. Ignition delay 13.8 ms, start of main combustion, 21.6 ms.

Among the comments made by the laboratory were;

The combustion properties are bad … Fuel oils with poor ignition and combustion properties may contribute to high pressure peaks and thermal overload in the combustion chamber. This causes what is known as hard, knocking or noisy engine running, especially at low load operation, and which is highly undesirable over extended periods of time. Among the possible effects is poor fuel economy, loss of power, build up of carbonaceous deposits, damaged piston rings, burned down piston crowns and ruined cylinder lubrication.
The severity of these impacts is influenced to a great extent by engine type, model and age, load profile and operational condition. In general engines of older design are more prone to operational problems caused by poor ignition and combustion properties than engines of more recent design, while slow speed engines seem to be less prone to operational problems than medium and high speed engines. (It should be noted that this fuel was bunkered outside the SECA area)

Lessons learned:

- It is important to secure adequate quality control of your fuel oil purchase contacts/providers.
- The ship's crew should be better trained to detect these types of problems when they occur in order to minimise costs, vessel's off-hire periods and not least the safety of crew and ship/cargo.
- Fuel oil tests do not always adequately describe the fuel oil's properties, in particular with respect to ignition and combustion quality
- The increased demand for low sulphur fuel will require better understanding of fuel parameters which are not described in the ISO standard.

Please also contact your engine manufacturer and your fuel oil test laboratory service provider to obtain further information on the above.

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