Fuel handling and treatment on board

Introduction
Fuel-related engine breakdowns are not a new problem. Between storage and combustion, the fuel must be transferred, heated, filtered and purified in order to meet the engine manufacturer's specifications. Depending on the quality of the fuel delivered on board, this can be a complex process and Gard regularly sees engine breakdowns and operational problems caused by poor fuel quality or poor fuel treatment on board. The bulk of such engine breakdowns arises from the use of heavy fuel oil (HFO) and the number of cases where engine damage is caused by catalytic fines seems to be in the majority. Gard has also seen engine problems caused by mixing of incompatible fuels and filters clogged by sludge.

The purpose of this circular is to remind ship owners and operators of important issues regarding fuel handling and treatment on board and to highlight the importance of structured training of crew members to prevent operational problems and engine damage.

Changes in rules and regulations
The drive towards the use of low sulphur fuel oils (LSFO)¹ is causing fuel refining processes to change, sometimes resulting in lower quality HFO being delivered to ships. More blending of different oil components to optimise sulphur content may create side effects such as instability, incompatibility, ignition and combustion difficulties and an increase in the levels of catalytic fines. The need for frequent changeovers between different types of fuels clearly increases the opportunity for errors. Therefore, it is very important that the crew be familiar with the properties of the fuel supplied and the limitations of the particular ship’s fuel treatment plant.

Gard has issued a series of recommendations previously but, because of changes in rules and regulations influencing both the quality of available fuel and the operating procedures on board, it is important to reiterate some of this guidance. Below is a summary of Gard's advice on fuel handling and treatment on board. It is considered especially important to emphasise this advice to new crew members and junior engineers. For further information and additional details on practical cases and important learning points, please see the Loss Prevention Compilation: “Bunkers and bunkering”.

Fuel oil storage and tanks
Even if fuel is within specification, problems can arise at the very first stage of storage. Build-up of sediment inside the tanks can cause contamination of new fuel and mixing of different batches of fuel can lead to unstable fuel. Important precautions are:

- Regularly clean storage and settling/service tanks. Large particles will settle in the tanks and these particles can be whirled up during rough weather and supplied to the separators, sometimes in concentrations above the limits set out in ISO 8217.² Cleaning of fuel oil tanks is often only performed during scheduled yard stay and the implementation of routines for more frequent cleaning should be considered.
- Regularly drain settling/service tanks to remove water and sludge, preferably on a daily basis.
- Place new bunkers into empty tanks whenever possible. Be aware that mixing of two stable fuels does not guarantee a compatible mixture and the sediment potential can increase drastically after mixing.

¹ Permissible levels of sulphur oxide (SOx) emissions are regulated via IMO’s MARPOL Annex VI and various domestic regulations. The sulphur content limit for LSFO allowed therefore depends on the location of the ship and the regulations in force at the time. At the time of writing, the maximum sulphur limit of fuel oils used outside emission control areas (ECAs) and other designated areas is 3.5%, while inside ECAs the limit is 1.0% (ref. IMO MARPOL Annex VI). Identified designated areas other than the MARPOL ECAs are: EU Community ports (0.1%), Turkish ports (0.1%) and California coastal areas (1.0% for marine gas oil (MGO) and 0.5% for marine diesel oil (MDO)).
² ISO 8217 specifies the requirements for petroleum fuels for use in marine engines and boilers prior to appropriate treatment before use.
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- If mixing cannot be avoided, carry out tests to ensure that the two types of fuel are compatible. Use a fast, reliable and recognised testing service to analyse fuel samples and avoid using the new fuel until the analysis results have been reviewed. Carefully adhere to the recommendations provided with the results from the test laboratory.

- Where time is a critical factor but there are doubts about the compatibility and sediment potential of a mixed fuel, carry out the simple on-board test (test kits for this purpose should be available on board) as a minimum, and avoid using the mixed fuel during critical operations or when navigating in restricted areas.

- Consider if bunkering upon entering a port is an option (draft, cargo, timing, etc., permitting) instead of when leaving a port. This will allow analysis of the new fuel to be available prior to leaving port, which of course is the ideal situation.

Fuel oil separation
Even if the HFO received complies with the requirements of ISO 8217, operational problems can arise if the treatment plant and in particular the HFO separators are not properly operated and maintained. In order to efficiently reduce the level of catalytic fines and other impurities present in the fuel, such as rust, sand, dust and water, separator manufacturer's recommendations should be followed. Important precautions are:

- Keep the HFO inlet temperature at 98°C. The efficiency of the separators is dependent on the inlet temperature of the fuel and even a small reduction in temperature will reduce the quality of the separation. Some commonly observed causes of failures are leaking heating coils, wrong set points for temperature sensors and defective monitoring systems.

- Use the correct flow ratio and gravity disc. The longer the fuel is in the separator, the better the cleaning of the fuel oil will be. For separators without gravity discs, it is recommended to always use all available HFO separators and to run them in parallel, with a corresponding feed rate. If the separators are of the manual type with gravity discs, they must be operated in series with a purifier followed by a clarifier, but with the lowest possible flow. On this type of separators, the use of correct gravity discs is crucial and the discs have to be changed depending on the density of the fuel used.

- Maintain the separators according to manufacturer's instructions and, as far as practically possible, use manufacturer's approved parts only. In addition, the separators should be checked by the manufacturer's service engineers at regular intervals. One commonly observed causal factor for failure is incorrect assembly of the separators after cleaning.

- Verify the efficiency of the separators and the cleanliness of the service tank by sampling the fuel in the system before and after the separators and as close to the engines as possible. Send the samples in for analysis by a recognised laboratory. Verification of separators should be carried out at least once per year.

Fuel changeover
Ships that trade between areas with different sulphur limitations should have detailed changeover procedures. Insufficient knowledge of the actions required in a given situation may result in engine failure, so changeover procedures should be practised before entering restricted waters, especially in ships that do not perform fuel changeovers on a regular basis. The risk of incompatibility when mixing HFO and low sulphur distillates, or even marine gas oil (MGO), can be high and requires increased awareness.

Conclusion
For the safety of the crew, ship and cargo, and to minimise costs and periods off-hire caused by engine breakdowns, it is important that ship owners and operators focus on the quality of fuel handling and treatment on board. All engine crew must receive proper and regular training and it is particularly important to ensure that junior engineers become familiar with the ship’s fuel treatment equipment and how to perform regular maintenance.

Changes in rules and regulations may lead to changes in procedures so training and facilitation of experience exchange are essential for the crew to be able to detect the cause of a fuel-related problem when it occurs, and adjust the fuel handling and treatment procedures to minimise potential losses.

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