

INTERTANKO

Int. Association of Independent Tanker Owners

OCIMF

Oil Companies International Marine Forum

GUIDANCE FOR HAZARD IDENTIFICATION

FOR USE OF AND SWITCHING TO LOW SULPHUR MARINE GAS OIL IN AUXILIARY BOILERS AND ASSOCIATED EQUIPMENT ONBOARD TANKERS

TO MEET REQUIREMENTS OF THE EU SULPHUR DIRECTIVE 2005/33/EC

December 2009

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EXECUTIVE SUMMARY

This paper provides guidelines to oil tanker operators and other interested parties on the potential consequences of enforcement of the EU Directive 2005/33/EC (for text see Appendix 1) provision mandating use of marine fuels with maximum 0.1% sulphur content when ships are at berth in EU ports from 1 January 2010, (the "Provision").

Compliance with the Provision necessitates assessments on safety and operational impacts for using low sulphur fuel oils on ships. Ships' installations have generally been designed and manufactured to be used with residual fuels (HFO). Currently ships can only comply with these rules by using Marine Gas Oil (MGO) defined as DMA grade in Table 1 of ISO 8217:2005 (standard for marine fuels), which has a low (0.1%) sulphur content ("LSMGO").

The differences between the composition and physical criteria of LSMGO and HFO make significant differences with regard to the safe operation and specific operational instructions for the ship's crew. Therefore, operators will need to undertake a risk assessment process and, based on the result, consider the need for modification to equipment as well as updating instructions and training for the crew.

INTERTANKO has produced this Guide, supported by OCIMF to provide a simple check list of items which should be part of a Risk Assessment and a Hazard Identification (HAZID) assessment, for boiler systems in oil tankers covering the switching to and long term operations on LSMGO. It is also recommended that this assessment is conducted in cooperation with the equipment/installations manufacturers or experienced entity and the classification society of each system type.

Classification societies should be consulted to determine what survey and approval are required for modifications. This may include requirements for documentation to be submitted for approval, certification of components and materials, survey and testing onboard.

Ship owners should document that they have initiated the upgrading process, that necessary modifications have been planned for and are in progress and that its completion is foreseeable and dependent on supply of solutions, parts and class approvals, as appropriate.

BACKGROUND FOR ASSESSMENTS – USE OF DIFFERENT FUEL TYPES

The Provision will limit the traditional use of HFO under all operating conditions during stay in the EU ports. It will be necessary to switch to lighter fuel oil types such as Marine Gas Oil (MGO), which have different chemical properties, including reduced sulphur and should be handled in different ways. The main differences are:

- Heat value - The heat characteristic of the fuels has an effect on combustion in the boiler and its capacity and it should be considered. This can impact heat transfer and circulation, uptake temperature, quality of the inert gas, emissions, etc.. (SAFETY AND ENVIRONMENTAL CONCERN)
- Viscosity – LSMGO has a much lower viscosity range than HFO which may have an impact on fuel pumps designed to operate with HFO. (OPERATIONAL AND SAFETY CONCERNS)

- Density – LSMGO has lower density than HFO. This may require that the amount of fuel to the burner will differ from the original pre-set amount. Most marine installations have the oil amount pre-adjusted based on a calculation of the main fuel (i.e. HFO) which takes its density into account. Failure to re-adjust the oil quantity to the burner for the LSMGO may lead to loss of power, ignition problems and/or increase of smoke emissions. (SAFETY, OPERATIONAL AND ENVIRONMENTAL CONCERNS).
- Flash point – Although not under direct control of ship owners, it is to be noted that the flash point temperature for some of the LSMGO may be below the SOLAS requirement in which case it should be rejected. Particular concern is due to the lack of proper control on fuels before delivery to ships. (SAFETY CONCERN).
- Lubricating properties – Generally LSMGO also has lower lubricating properties which when coupled with reduced viscosity can lead to reduced performance and abnormal wear conditions. This is an important aspect to consider with relation to fuel system spare parts requirements and maintenance schedules (OPERATIONAL CONCERN).

ITEMS TO BE ASSESSED

Based on the differences between the types and characteristics of the fuels ships are required to use, tanker owners should consider the following items as part of their assessment with regard to change-over and to long term use of LSMGO:

- Fuel Storage Capacity and Segregation
- Fuel Pumps
- Piping System
- Flame detection devices
- Burners
- Boiler including combustion control

Fuel Storage Capacity and Segregation

Fuel storage capacity should be reviewed to ensure suitable quantity onboard to complete entire cargo discharge operation, taking into consideration port delay and generators consumption. Although for some types of ship, e.g. parcel tankers, with extended port operations, it may not always be practicable to dedicate enough storage space for the whole stay, and in such cases the timely supply of bunkers is a factor to consider.

Additional storage capacity for LSMGO should be carefully planned. Using one of the current HFO settling tanks may not be an option if it is adjacent to a heated HFO service or settling tank to ensure that LSMGO is not preheated in an unintended way.

It is advisable to segregate storage of HFO and LSMGO, as the latter has scouring properties which would dislodge the sludge and wax and cause filters to clog or block controls and pressure gauge lines.

When changing over/switching between fuels, it should be ensured that fuel in the return/recirculation pipes is returned to the correct fuel tank. Particular care should be taken to avoid contamination of LSMGO by fuels with a higher sulphur level.

Fuel Pumps

LSMGO is a DMA grade under ISO8217 which has a viscosity between 1.5 to 6 cSt. @40 degrees Centigrade

According to manufacturers, most pumps currently in use are designed to operate with a minimum fluid viscosity of 4 cSt. Some of the current pumps may cope with lower viscosities such as 3.0 cSt or slightly lower value. For pumps operating well within their design rating, manufacturers may advise that they are suitable for use with lower viscosities. An assessment must be made for all fuel pumps onboard (most fuel pumps are either screw pumps or gear pumps) whether they are able to operate with the lower viscosity associated with the LSMGO and eventually consider modifications or replacement.

The actual operating temperature of the LSMGO should be considered as the viscosity mentioned in the LSMGO specification is indicated with a reference temperature and that the actual operation temperature might be higher resulting in the actual viscosity to be further reduced. Fuel pumps running continuously during periods when the boiler/burner is in standby position may heat up, causing the temperature of the fuel to increase and thereby the viscosity to decrease which may result in gasification of the fuel. In this case, the control of the pumps should be considered as well. In case the pump control system is not preset in advance, it may be preferable to adjust the control system in such a way that the pumps are always shut off when not in operation.

Consideration should be given to cooling the LSMGO to control the viscosity, but possible failure of the cooling system must be considered as part of the hazard assessment.

Finally, advice and solutions should be sought from the manufacturers with regard to the LSMGO low lubricity as there is a risk of increased wear as well as breakdown, if the pump is not suited for the lower lubricity.

Piping System

It preferable not to use the same fuel lines for HFO and LSMGO, as the latter has scouring properties which would dislodge the sludge and wax causing filters to clog or blockage of control and pressure gauge lines. Where lines have to be used for both fuel types, care should be taken to ensure that changeover procedures consider isolation of trace heating systems when operating on LSMGO.

To avoid contamination of the LSMGO particular attention must be paid to the Fuel recirculation lines from the boiler which may need to be redirected and changeover procedures developed.

Due to their searching nature, the use of LSMGO in systems which have generally previously operated with HFO can result in leakage of fuel from pipe flanges, equipment seams and other fittings.

Flame Detection Devices

It is recommended that flame detection should be matched to the fuel used since HFO and LSMGO have differences in the frequency of the flame flicker in the furnace noting that any change will need to be Class approved.

Burners

Burners, in general, and tips, in particular, must be appropriate for each type of fuel to be used. There are three basic types of burner operation.

Pressure jet burner - Typically used on smaller boiler types and run on MDO and HFO. It should be observed, however, that generally the lowest viscosity that the fuel pumps can accommodate is normally 4.5 cSt. Use of LSMGO which typically has a lower viscosity may require modifications to the pumps. A lower viscosity may also cause an increase in the fuel throughput with the risk of increased smoke emissions.

Rotary cup burner - Rotary cup burners are used on many boiler types and run on MDO and HFO. However, when using LSMGO which has a typical lower viscosity of 4.5 cSt, the fuel pumps may need to be re-adjusted/modified. For smaller burners, the fuel amount (pressure) should be checked/adjusted in order to obtain smoke free combustion. For larger burners, there is a risk of coke deposit build up at the burner cup if the installation is not fitted with a suitable heat shield. This caused by radiated heat into the rotary cup generating very high temperature in the rotary cup resulting in the fuel carbonising. Therefore the rotary cup installation may need to be checked and modified as necessary. The control system of the main burner should also be checked/adjusted so that the LSMGO does not auto-ignite.

Steam atomising burner - Steam atomising burners are typically used on medium and larger boiler types and run on MDO and HFO. Use of LSMGO with lower viscosity than 4.5 cSt may require adjustments/modifications to the fuel pumps. The viscosity of the fuel traditionally burned in steam atomising burners is commonly in the range 15 – 30 cSt.

Some burner lance designs utilise a concentric steam/fuel line configuration which causes heating of the fuel by the atomizing steam which may lead to vaporisation of LSMGO prior to exit from the pipe. For continuous operation with LSMGO, either, changing the atomizing medium to compressed air, or changing the lance to a parallel steam/fuel line type where heating of the fuel is reduced should be considered. If the compressed air atomizing option is selected, the volume of air required for an entire discharge operation may require installation of additional air compressors.

Boilers including combustion control

The furnace purge process is a critical safety process and must be functioning correctly in line with manufacturers' recommendations for the specific of fuel type in use. It is essential that the entire furnace space is fully purged before introducing a flame. A post-purge of the furnace whenever LSMGO has been used is recommended by all manufacturers and should be considered as part of the procedure.

In the event of a flame failure it could result in a flammable atmosphere being present in the boiler gas spaces. Therefore purge procedures must be developed in conjunction with the manufacturer or experienced entity.

The spark igniters (or equivalent) must be correctly functioning and positioned so as to readily ignite the fuel spray on start up. All boiler flame detection and related safety systems must be operating correctly. In the case of flame detectors, they must be correctly positioned to pick out the particular flame pattern which is encountered with the types of fuel and burner being used.

Automated combustion control system functions should be confirmed to ensure they are operating correctly and reliably. In case of automation failure, careful consideration should be given before engaging manual operation.

To ensure the minimum quantity of carbon deposition material within the combustion and uptake spaces, soot blowers should be operated at the latest possible opportunity before entry into coastal and port waters.

To reiterate: Boiler and fuel system manufacturers should be consulted for fuel switching guidance and to confirm that the boiler, combustion control systems and associated fuel system components, such as pumps, are suitable for the intended types of fuel. Solutions and modifications to the boiler/burner system should be considered carefully and executed by competent and authorised personnel after consultation with manufacturers and classification society.

HAZARD IDENTIFICATION (HAZID) ANALYSIS DOCUMENT:

Safe operation of onboard installations with HFO and LSMGO must be covered with a Hazard Identification (HAZID) assessment document. A HAZID must consider all risks with necessary preventative and mitigation steps identified.

A generic Check List/ the HAZID work sheets is given in Appendix 2 of this document for advice only. Training of ship staff is extremely important. HAZID should include the change over procedure i.e. from HFO to LSMGO and vice versa and automation timings etc., for approval.

Based on the HAZID, necessary measures will be identified for each ship and each installation as appropriate. Such changes, including modifications and training should bring the operations to an acceptable risk level.

Upon completion of modifications, including testing all changes should be recorded in documentation (ashore and onboard) and vessel procedures updated accordingly.

EU Sulphur Directive

The 2005 amendments to the EU Sulphur Directive (2005/33/EC) has a provision requiring ships “at berth” in the EU ports (including “at anchor”) to use a marine fuel with a sulphur content of maximum 0.1% by mass. The application date is 1 January 2010. The relevant articles are copied herewith:

Article 4b

1. With effect from 1 January 2010, member States shall take all necessary measures to ensure that the following vessels do not use marine fuels with a sulphur content exceeding 0.1% by mass:

a) inland waterway vessels; and

b) ships at berth in Community ports, allowing sufficient time for the crew to complete any necessary fuel-changeover operation as soon as possible after arrival at berth and as late as possible before departure.

.....

Article 2 (d) 3.i Ships at berth means ships which are securely moored or anchored in a Community port while they are loading, unloading or hotteling, including the time spent when not engaged in cargo operations

The only exemption is given to ships staying less than 2 hours in port. The entire text of Directive 2005/33/EC can be seen at

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:191:0059:0069:EN:PDF>

HAZARD IDENTIFICATION (HAZID) ANALYSIS DOCUMENT
(Example only)

ITEM/AREA	HAZARD	CAUSE	POTENTIAL EFFECTS	SAFEGUARDS	RECOMMENDATIONS/ACTION
Capacity of tank					
Piping system					
Pumps					
Ignition pumps					
Burner lance					
Atomising					
Boiler and combustion control					
Operational Manual					
.....					