OPERATIONAL GUIDELINES FOR THE USE OF SHELL VLSFO\(^1\) AND BIO-VLSFO\(^2\)

THE GUIDELINES BELOW ARE NOT EXHAUSTIVE AND ARE INTENDED ONLY TO ASSIST IN THE RISK ASSESSMENT PROCESS AND IN HANDLING SHELL VLSFO ON BOARD SHIP. THE RECEIVING VESSEL SHALL BE SOLELY RESPONSIBLE FOR SATISFYING ITSELF AS TO THE SUFFICIENCY OF INSTRUCTIONS PROVIDED HEREIN AND SHALL EXERCISE DUE DILIGENCE TO IDENTIFY ANY INSUFFICIENCY, ERRORS OR INCONSISTENCIES IN THESE GUIDELINES. NOTHING HEREIN SHALL AFFECT THE RESPONSIBILITIES AND OBLIGATIONS OF SHELL SHOULD ANY CONTAMINATION OR DAMAGE SUBSEQUENTLY BE FOUND, TO CONTEND THAT THE SAME WAS CAUSED BY INADEQUATE STORAGE OR HANDLING AND/OR SOME OTHER BREACH OF DUTY. THE GUIDELINES ARE USED AT THE USER’S SOLE RISK AND RESPONSIBILITY AND SHELL DOES NOT ACCEPT ANY LIABILITY ARISING OUT OF OR IN CONNECTION WITH THE USAGE AND/OR THE IMPLEMENTATION OF THESE GUIDELINES

THESE OPERATIONAL GUIDELINES ARE INTENDED FOR SHELL FUEL ONLY

It is the responsibility of the vessel to safely manage the changeover of fuels in order to meet the legislative sulphur limits required. In line with good practice, a risk assessment should be carried out by the operator and crew. The guidelines below are to assist in the Risk Assessment process.

This risk assessment should include: Procedures to segregate different types of fuels from different sources; Procedures for compatibility testing and segregating fuels until compatibility can be confirmed; Plans to address constraints when handling specific fuels; and Procedures to verify machinery performance.

Consideration should be given to segregation of storage tanks as well as the fuel transfer, processing and delivery systems. The fuel oil return system should be confirmed as being arranged to ensure minimal cross contamination.

For detailed information on equipment, users are encouraged to refer to:
- CIMAC Recommendation 25: Recommendations Concerning the Design of Heavy Fuel Treatment plants for Diesel Engine;
- International Chamber of Shipping: Provisional Guidance to Shipping Companies and Crews on Preparing for Compliance with the 2020 ‘Global Sulphur Cap’ for Ships’ Fuel Oil in Accordance with MARPOL Annex VI, and
- International Association of Classification Societies No 151: Recommendation for petroleum fuel treatment systems for marine diesel engines

COMPATIBILITY

- Segregation between all fuels is highly recommended, as compatibility between Shell VLSFOs is not guaranteed.
- Compatibility between Shell’s VLSFO and 3rd party fuels is not guaranteed.
- It is advisable to test all fuels onboard for compatibility by the ASTM D4740 spot test method. A rating of above 2 indicates incompatibility.

STORAGE

- Storage tanks should be arranged to avoid the mixing of newly bunkered fuel with existing fuel on board and should be empty and free of sludge and water prior to receiving fuel. This will avoid significant compatibility issues, reduce possible layering of fuel and reduce bunker sounding calculation errors.
- When loading into a storage tank previous fuels should not be mixed in proportions above 5%.
- SHELL’S VLSFO grades may require heating during storage, especially when stored for extended periods or in cold climates.
- Storage tanks must be fitted with heating coils sufficient to maintain the fuel at a temperature 15°C above the pour point of the fuel. Fuel temperatures should be raised to at least 45°C a day or so before use.

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1 Shell’s VLSFO meets ISO 8217; complies with the minimum flash point specification required by SOLAS; and contains a maximum of 0.50% sulphur (by ISO 8754). Operational guidelines are also available for UISFO (0.1% sulphur max.)
2 These operational guidelines are applicable to VLSFO containing biocomponents. Shell’s Bio-VLSFO does meet all the specifications of ISO 8217 except for the FAME content.
FUEL HANDLING
- Steam tracing for all pipelines should be monitored during use to prevent overheating. Steam tracing can be turned off when using fuels with low viscosity (below 10 cSt), providing the fuel is maintained 15°C above its pour point, to prevent overheating and the risk of “gassing up”.
- Preheating of fuel oil before and during purification requires careful attention to avoid operational problems.
- The fuel in the settling tank should be kept ~ 65 °C. The service tank temperature, and the temperature in the fuel service system should be monitored to prevent the fuel falling below 75 °C.
- The purifier should be set to a temperature of 95 °C to 98 °C to ensure efficiency, although this temperature can be reduced when using low pour point fuels providing purifier efficiency is known to be effective.
- When employing the use of a gravity disc in a purifier, this should be consistent with the specific gravity of the VLSFO fuel being handled.
- Sludge and drain pipes should be designed to prevent blockages, and may require heating.
- For those vessels with a single settling/service tank arrangement, the settling tank fuel level should be reduced as far as is possible without risking the purifier supply pump losing suction. Purifier suction should then be transferred to the service tank. Any remaining oil in the settling tank can be drained to the overflow tank through the drain cock. The settling tank can then be filled with VLSFO and heated to ~ 65 °C. While the settling tank is heating, the service tank level can be run down to safe levels. Purifier suction can then be transferred back to the settling tank.
- For vessels with two service tanks, their arrangement can be used to keep Shell’s VLSFO segregated from other fuel. If the vessel has two settling tanks one can be emptied and cleaned ready for the new fuel.
- Some SHELL VLSFO can have a significant lower viscosity than many high sulfur fuel oils. This may cause a line cleaning effect, leading to additional contamination being carried around the fuel system. Sludge cycle can be set to a lower value than normal, e.g. 60 mins and reset as previously after 24 hours if there are no operational problems. Careful monitoring of the filters is also advised. Additional backflushing of the fuel autofilter can be expected.
- Plans should be developed to prevent cross contamination when emptying Overflow and Drain tanks.
- It is recommended that samples of the fuel are taken form the handling system at regular intervals to verify that the settling and purification systems are working efficiently.
- Settling tanks and service tanks should be emptied, cleaned regularly and designed to permit easy removal of accumulated water and sludge.

FUEL CHANGEOVER
- Engine manuals should be consulted for advice on any restrictions on the engine load at the time of a changeover.
- Before changeover and whenever possible, remove accumulated materials from the purifier and run a compatibility test.
- A reduction in cylinder oil feed rate or use of oil with a lower base oil number should be considered when switching from high sulfur fuel oil to SHELL’s VLSFOs. Prolonged use with mismatched cylinder oil should be avoided. Refer to engine manufacturers recommendations.

ENGINE CONSIDERATIONS
- The fuel temperature at the main engine and auxiliary engines can be lower than at the purifiers. However, the minimum temperature in the system should be 70 °C. The fuel should not be heated such that its viscosity drops below 2 cSt as lubricity will decrease.

<table>
<thead>
<tr>
<th>Fuel viscosity at 50°C, cSt</th>
<th>Approximate temperature above which the fuels viscosity falls below 2 cSt</th>
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<tbody>
<tr>
<td>380</td>
<td>Greater than 160 °C</td>
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<tr>
<td>180</td>
<td>Greater than 160 °C</td>
</tr>
<tr>
<td>50</td>
<td>Greater than 160 °C</td>
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<tr>
<td>10</td>
<td>135 °C</td>
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<tr>
<td>5</td>
<td>100 °C</td>
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</tbody>
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- Before switching to lower viscosity fuels, equipment, in particular gaskets, pump glands and seals should be checked, adjusted or replaced to prevent leaks.

LUBRICANT CONSIDERATIONS
- VLSFO may require a different lubricant compared to other grades and the engine manufacturer’s service letters should be consulted.
- It is highly recommended that the condition of the engine/cylinders are monitored throughout a changeover and on an ongoing basis to ensure maximum protection of the engine (in line with the manufacturer’s recommendations).

USE IN BOILERS
- When the fuels is to be used in an auxiliary boiler burner, the low fuel temperature trip may need to be adjusted to suit the lower temperature requirement of Shell’s VLSFO. The temperature setting for the fuel heater should be reduced to around 75°C.
The boiler manufacturer should be consulted to determine if there is a requirement to modify the burner arrangement (including method of atomization and flame detector sensitivity).

**USING VLSFO CONTAINING BIO-COMPONENTS**

- SHELL BIOVLSFO has been trialled in numerous vessels and consumed as the regular fuel with no additional workload for the crew, however, the vessel should be aware of the following:
  - Fuels containing biocomponents may have an impact on material compatibility such as seals, hoses etc. Contact your engine manufacturers for more information. Monitoring throughout fuel use is recommended.
  - Fuels containing biocomponents may have a better solvency power leading to mobilization of dirt in the fuel system. Mobilization of dirt might lead to a (temporarily) higher load of the purifier.
  - The calculation for specific energy according to ISO 8217:2017 Annex H does not provide an accurate indication for fuels containing biocomponents. A test method such as ASTM D240 can be carried out to provide a reliable result.
  - Fuels containing biocomponents may impact NOx emissions for your engine. Contact your engine manufacturer for more information.