

New sulphur limits in marine fuel – guidance for maintaining engine and boiler safety and availability

Vessels owners and operators should use the following for guidance purposes to maintain engine and boiler safety and availability when using Low Sulphur Distillate Oils (LSDO)

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1. Sulphur control for international shipping

1.1 Revised IMO MARPOL Annex VI – 2008

SO_x, PM, Fuel - Regulations

Regulation 14

Sulphur Oxides (SO_x) and Particulate Matter (PM)

The sulphur content of any fuel oil used globally shall not exceed:

4.50% m/m S prior to 1 January 2012

3.50% m/m S on and after 1 January 2012

0.50% m/m S on and after 1 January 2020

The sulphur content of any fuel oil used in designated Emission Control Areas (ECA) shall not exceed:

1.50% m/m S prior to 1 July 2010

1.00% m/m S on and after 1 July 2010

0.10% m/m S on and after 1 January 2015

1.2 California Air Resources Board (CARB):

17 CCR, Section 93118.2, Title 17

Airborne Toxic Control Measure for Fuel Sulphur and other operational Requirements

for Ocean-going Vessels within Californian Waters and 24 Nautical Miles of the Californian Baseline

Table 1: Fuel Requirements for Ocean-Going Vessel Main (Propulsion) Diesel Engines, Auxiliary Diesel Engines (Including Diesel-Electric), and Auxiliary Boilers

Fuel Requirement	Effective Date	Fuel
Phase I	July 1, 2009*	Marine gas oil (DMA) at or below 1.5% sulfur; or Marine diesel oil (DMB) at or below 0.5% sulfur
Phase II	January 1, 2012	Marine gas oil (DMA) or marine diesel oil (DMB) at or below 0.1% sulfur

1.3 European Union

Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels and amending Directive 93/12/EEC, amended by Directive 2005/33/EC.

As from 1st January 2010, ships at berth for longer than 2 hours within ports in the European Union are required to switch to 0.1 % sulphur content marine fuel oil under Article 4b of Directive 2005/33/EC.

2. Operational conditions/requirements approaching Ports in Europe related to Fuel Change Over

Destination: Port inside an ECA

- Global cap 4.5 (3.5) % S, Heavy Fuel Oil, heated
- ECA 1.5 (1.0) % S, Heavy Fuel or Distillate Oil, heated or unheated
- At Berth 0.1 % S, Low Sulphur Distillate Oil, unheated or cooled

Destination: Port without ECA

- Global cap 4.5 (3.5) % S, Heavy Fuel Oil, heated
- At Berth 0.1 % S, Low Sulphur Distillate Oil, unheated or cooled

3. Consideration on Low Sulphur Distillate Oil

In general the following items should be observed with respect to fuel properties of a low sulphur distillate oil intended to be used to meet the above mentioned sulphur requirements:

- Lubricity: important especially for fuel injection and gear type pumps,
- Viscosity: fuel oil cooler might be necessary in the supply system
- Compatibility: solubility of asphaltenes has to be considered (change over process)
- Addition of bio fuels (FAME) could create additional problems (compatibility, stability, fouling, hygroscopic)
- Different flashpoint for marine fuel oil and for fuel used land-based for trucks and for inland water vessels (60/55 °C)
SOLAS II-2 , Reg. 4, 2.1.1 : min. flashpoint 60 °C (43 °C outside machinery space cat. A, e.g. emergency engines)
- According to the current revision of ISO 8217 the min. viscosity @ 40 °C for DMA and DMB is 2.0 mm²/s(cSt), only for DMX the minimum is 1.4 mm²/s

4. Shipboard Installations and Equipment affected

- Fuel tank capacity and arrangement for the different grades of fuel
- Fuel oil supply system: e.g. pipes, pumps, cooler/heater, fuel oil booster systems
- Main propulsion and auxiliary engines, at berth normally auxiliary engines only
- Main and auxiliary oilfired boilers, including dual fuel boilers on LNG carriers

4.1 Fuel Tank Capacity and Arrangement

Depending on whether the approach to the port is via an ECA or not, 2 or even 3 different fuel oil grades might be in use.

For an existing vessel the following options exist:

- Sufficient fuel tank capacity and arrangements for the different grades
- Subdivision of existing service tanks
- Dumping and refilling of FO service tanks

4.2 Service Tank Arrangements

- SOLAS Reg. II-1/26.11
IACS Unified Interpretation SC 123: Machinery installation – Service Tank Arrangements
- ECA
IACS Recommendation: Machinery installations of ships intended to navigate in SOx Emission Control Areas – Service Tank Arrangements

Please consider:

- Structural modifications or subdivision of fuel oil tanks are subject to Class approval
- As a consequence, SOLAS and Class requirements for valves, fittings, filling, venting and overflow but also level and temperature alarms must be verified
- LSDO tanks should not be located directly adjacent to hot HFO tank walls
- Free standing tank solutions and temporary fuel oil systems, e.g. by hoses, are not acceptable

4.3 Fuel Oil Supply System: e.g. Pipes, Pumps, Cooler/Heater, Fuel Oil Booster Systems

- The fuel oil supply system must to be in compliance with fuel change over procedure as specified by the engine and boiler/burner manufacturer for the relevant fuel grades
- For LSDO a fuel oil cooler is recommended
- For existing pumps loss of delivery pressure at low viscosities is to be expected
- Additionally installed fuel oil supply systems have to comply with the Class requirements for unattended machinery spaces in terms of alarms, redundancy and stand-by pumps
- Fuel return lines have to be considered to avoid possible contamination of low sulphur fuel by other fuels

4.4 Main Propulsion and Auxiliary Engines, at Berth normally Auxiliary Engines only

- Lubricity: important especially for fuel injection and gear type pumps, the experience of marine diesel engines on LSDO with less equal 0.1 % S is limited
- Viscosity: fuel oil cooler might be necessary in the supply system to achieve the required viscosity for injection
- The fuel change over procedure may vary from engine type to engine type
- Operation of the engine and the choice of lubricants has to be in compliance with the engine manufacturer's specification

4.5 Main and Auxiliary Boilers, especially Burners and Burner Control System

The manufacturer of the boiler, burner or the burner control system has to assure that the system is suitable for the burner operation with the different fuel grades.

In particular:

- The flame monitoring sensors must be suitable for the different spectral emission ranges
- The pre-purging process has to take LSDO operation into account
- The fuel oil/ air ratio might have to be corrected
- The nozzles of steam, air or pressure atomizing burners have to be selected in accordance with the specification of the manufacturer for the different fuel grades
- The heat flux in the different boiler areas has to be considered by the manufacturer for the fuel grades to be used

- Fuel oil shut off valves /quick closing valves have to be checked for leakages and proper and safe operation on LSDO
- Any fuel change-over has to be carried out in accordance with the specification of the boiler/burner manufacturer
- For air atomizing burners for LSDO sufficient compressed air has to be available

5. Potential need for Inspection/Approval/Certification before using Low Sulphur Distillate Oils

5.1 Prerequisite for Class

- All machinery shall be operated in accordance with design limitations, including also fuel specifications
- It will be the sole responsibility of the operator to ensure that his vessel is suited for operation on the fuels required by e.g. the EU Directive 2005/33/EC
- Prior to the operation of any equipment on such fuel oil, the suitability of the equipment e.g. pumps, engines, boilers and burners for such operation outside the normal range of marine fuels has to be clarified with the equipment manufacturer or in consultation with the associated system provider.

It is recommendable to carry out a HAZOP (HAZard and OPerability) study or similar to identify need for modifications with associated approval and survey by Class.

As a minimum the following items should be considered:

- Service tank operation
- LSDO supply system including pump capacity, stand-by functions, by-passing of heaters and optional cooling
- Operational modes for all equipment concerned,
- Load limitation on LSDO operation, including min. and max. load
- Fuel change over procedures for the different types of equipment
- Boiler/ burner control and safety equipment including flame monitoring sensor
- Software modifications for burner and boiler control due to the different fuel properties, e.g. pre- and post purging sequences and fuel/air ratio, but also for diesel engines and automated fuel change over, if applicable

Resultant modifications are to be reviewed, approved and surveyed by the Classification Society.

5.2 Approval before using Low Sulphur Distillate Oils

Any structural modification on a fuel tank, as well as modifications of the fuel oil system, is subject to Class approval, material- and component certification and survey including e.g. pressure test after modification.

- In general all modifications of safety systems, hardware or software, are subject to Class approval and survey, in this case especially the boiler and burner control and safety system is concerned
- Components and systems are to be arranged with redundancy as per Class requirements.
- Any additional requirement for unattended machinery spaces (e.g. control & automation, redundancy etc.) apply as applicable.

5.3 Surveys required

A Survey shall include:

- A demonstration of the operation of boiler /burner on LSDO, the following tests shall be carried out during this demonstration:
 - Testing of alarm and monitoring
 - Testing of the safety system / flame detector / shut-off
 - Testing of the boiler control system
 - Testing of pre-purging and ignition
 - Demonstration of the boiler operation at various loads on LSDO including low load with stable flame
 - Demonstration of max. load on LSDO as specified by the boiler/burner manufacturer
- A verification that fuel change over procedures for all equipment concerned are documented and available onboard
- A test to demonstrate the capability to change over from HFO to LSDO as per the onboard fuel change over procedure.

5.4 Manuals and Training of Crew/Operators

- All relevant operation and service manuals have to be updated for LSDO operation, covering as applicable revised specification of fuel qualities (e.g. minimum viscosity and low sulphur content) and maximum permissible wear (e.g. of fuel pumps).
- Detailed fuel change over procedures and manuals have to be developed in consultation with the equipment manufacturers and the crew/operators have to be trained accordingly.

Please contact us for further inquiries. We are ready to assist

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