# Guidelines for the Use of Low Sulphur Fuel Oils
## (IMO 2020 compliance)

**May 2019**

**Guidance Note**
**NI 559 DT R00 E**

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# BUREAU VERITAS MARINE & OFFSHORE

## GENERAL CONDITIONS

### 1. INDEPENDENCE OF THE SOCIETY AND APPLICABLE TERMS

**1.1** The Society shall remain at all times an independent contractor and neither the Society nor any of its officers, employees, servants, agents or subcontractors shall be or act as an employee, servant or agent of any other party hereto in the performance of the Services.

**1.2** The operations of the Society in providing its Services are exclusively conducted by way of random inspections and do not, in any circumstances, involve monitoring or exhaustive verification.

**1.3** The Society acts as a services provider. This cannot be construed as an obligation bearing on the Society to obtain a result or as a warranty. The Society is not and may not be considered as an underwriter, broker in Unit's sale or chartering, expert in Unit's valuation, consulting engineer, controller, naval architect, designer, manufacturer, shipbuilder, repair or conversion yard, charterer or shipowner; none of them above listed being relieved of any of their expressed or implied obligations as a result of the interventions of the Society.

**1.4** The Society only is qualified to apply and interpret its Rules.

**1.5** The Client acknowledges the latest versions of the Conditions and of the applicable Rules applying to the Services' performance.

**1.6** Unless an express written agreement is made between the Parties on the applicable Rules, the applicable Rules shall be the Rules applicable at the time of entering into the relevant contract for the performance of the Services.

**1.7** The Services' performance is solely based on the Conditions. No other terms shall apply whether express or implied.

### 2. DEFINITIONS

**2.1** **"Certificate(s)"** means classification or statutory certificates, attestations and reports following the Society's intervention.

**2.2** **"Certification"** means the activity of certification in application of national and international regulations or standards, in particular by delegation from different governments that can result in the issuance of a Certificate.

**2.3** **"Classification"** means the classification of a Unit that can result or not in the issuance of a classification Certificate with reference to the Rules. Classification is an appraisement given by the Society to the Client, at a certain date, following surveys by its surveyors on the level of compliance of the Unit to the Society's Rules or to the documents of reference for the Services provided. They cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.

**2.4** **"Client"** means the Party and/or its representative requesting the Services.

**2.5** **"Conditions"** means the terms and conditions set out in the present document.

**2.6** **"Industry Practice"** means international maritime and/or offshore industry practices.

**2.7** **"Intellectual Property"** means all patents, rights to inventions, utility models, copyright and related rights, trade marks, logos, service marks, trade dress, business and domain names, rights in trade dress or get-up, rights in goodwill or to sue for passing off, unfair competition rights, rights in designs, rights in computer software, database rights, topography rights, moral rights, rights in confidential information (including know-how and trade secrets), methods and protocols for Services, and any other intellectual property rights, in each case whether capable of registration, registered or unregistered and including all applications for and renewals, reversions or extensions of such rights, and all similar or equivalent rights or forms of protection in any part of the world.

**2.8** **"Parties"** means the Society and Client together.

**2.9** **"Party"** means the Society or the Client.

**2.10** **"Register"** means the public electronic register of ships updated regularly by the Society.

**2.11** **"Rules"** means the Society's classification rules and other documents. The Society's Rules take into account at the date of their preparation the state of currently available and proven technical minimum requirements but are not a standard or a code of construction neither a guide for maintenance, a safety handbook or a guide of professional practices, all of which are assumed to be known in detail and carefully followed at all times by the Client.

**2.12** **"Services"** means the services set out in clauses 2.2 and 2.3 but also other services related to Classification and Certification such as, but not limited to: ship and company safety management certification, ship and port security certification, maritime labour certification, training activities, all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board. The Services are carried out by the Society according to the applicable referential and to the Bureau Veritas' Code of Ethics. The Society shall perform the Services according to the applicable national and international standards and Industry Practice and always on the assumption that the Client is aware of such standards and Industry Practice.

**2.13** **"Society"** means the classification society **'Bureau Veritas Marine & Offshore SAS'**, a company organized and existing under the laws of France, registered in Nanterre under number 821 131 844, or any other legal entity of Bureau Veritas Group as may be specified in the relevant contract, and whose main activities are Classification and Certification of ships or offshore units.

**2.14** **"Unit"** means any ship or vessel or offshore unit or structure of any type or part of it or system whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

### 3. SCOPE AND PERFORMANCE

**3.1** Subject to the Services requested and always by reference to the Rules, the Society shall:

- review the construction arrangements of the Unit as shown on the documents provided by the Client;
- conduct the Unit surveys at the place of the Unit construction;
- class the Unit and enter the Unit's class in the Society's Register;
- survey the Unit periodically in service to note whether the requirements for the maintenance of class are met.

The Client shall inform the Society without delay of any circumstances which may cause any changes on the conducted surveys or Services.

**3.2** The Society will not:

- declare the acceptance or commissioning of a Unit, nor its construction in conformity with its design, such activities remaining under the exclusive responsibility of the Unit's owner or builder;
- engage in any work relating to the design, construction, production or repair checks, neither in the operation of the Unit or the Unit's trade, neither in any advisory services, and cannot be held liable on those accounts.

### 4. RESERVATION CLAUSE

**4.1** The Client shall always: (i) maintain the Unit in good condition after surveys; (ii) present the Unit for surveys; and (iii) inform the Society in due time of any circumstances that may affect the given appraisement of the Unit or cause to modify the scope of the Services.

**4.2** Certificates are only valid if issued by the Society.

**4.3** The Society has entire control over the Certificates issued and may at any time withdraw a Certificate at its entire discretion including, but not limited to, in the following situations: where the Client fails to comply in due time with instructions of the Society or where the Client fails to pay in accordance with clause 6.2 hereunder.

**4.4** The Society may at times and at its sole discretion give an opinion on a design or any technical element that would 'in principle' be acceptable to the Society. This opinion shall not presume on the final issuance of any Certificate or on its content in the event of the actual issuance of a Certificate. This opinion shall only be an appraisal made by the Society which shall not be held liable for it.

### 5. ACCESS AND SAFETY

**5.1** The Client shall give to the Society all access and information necessary for the efficient performance of the requested Services. The Client shall be the sole responsible for the conditions of presentation of the Unit for tests, trials and surveys and the conditions under which tests and trials are carried out. Any information, drawing, etc. required for the performance of the Services must be made available in due time.

**5.2** The Client shall notify the Society of any relevant safety issue and shall take all necessary safety-related measures to ensure a safe work environment for the Society or any of its officers, employees, servants, agents or subcontractors and shall comply with all applicable safety regulations.

### 6. PAYMENT OF INVOICES

**6.1** The provision of the Services by the Society, whether complete or not, involve, for the part carried out, the payment of fees thirty (30) days upon issuance of the invoice.

**6.2** Without prejudice to any other rights hereunder, in case of Client's payment default, the Society shall be entitled to charge, in addition to the amount not properly paid, interests equal to twelve (12) months LIBOR plus two (2) per cent as of due date calculated on the number of days such payment is delinquent. The Society shall also have the right to withhold Certificates and other documents and/or to suspend or revoke the validity of Certificates.

**6.3** In case of dispute on the invoice amount, the undisputed portion of the invoice shall be paid and an explanation on the dispute shall accompany payment so that action can be taken to solve the dispute.

### 7. LIABILITY

**7.1** The Society bears no liability for consequential loss. For the purpose of this clause consequential loss shall include, without limitation:

- Indirect or consequential loss;
- Any loss and/or deferral of production, loss of product, loss of use, loss of bargain, loss of revenue, loss of profit or anticipated profit, loss of business and business interruption, in each case whether direct or indirect.

The Client shall defend, release, save, indemnify, defend and hold harmless the Society from the Client's own consequential loss regardless of cause.

**7.2** Except in case of wilful misconduct of the Society, death or bodily injury caused by the Society's negligence and any other liability that could not be, by law, limited, the Society's maximum liability towards the Client is limited to one hundred and fifty per-cents (150%) of the price paid by the Client to the Society for the Services having caused the damage. This limit applies to any liability of whatsoever nature and howsoever arising, including fault by the Society, breach of contract, breach of warranty, tort, strict liability, breach of statute.

**7.3** All claims shall be presented to the Society in writing within three (3) months of the completion of Services' performance or (if later) the date when the events which are relied on were first discovered by the Client. Any claim not so presented as defined above shall be deemed waived and absolutely time barred.

### 8. INDEMNITY CLAUSE

**8.1** The Client shall defend, release, save, indemnify and hold harmless the Society from and against any and all claims, demands, lawsuits or actions for damages, including legal fees, for harm or loss to persons and/or property tangible, intangible or otherwise which may be brought against the Society, incidental to, arising out of or in connection with the performance of the Services (including for damages arising out of or in connection with opinions delivered according to clause 4.4 above) except for those claims caused solely and completely by the gross negligence of the Society, its officers, employees, servants, agents or subcontractors.

### 9. TERMINATION

**9.1** The Parties shall have the right to terminate the Services (and the relevant contract) for convenience after giving the other Party thirty (30) days' written notice, and without prejudice to clause 6 above.

**9.2** In such a case, the Classification granted to the concerned Unit and the previously issued Certificates shall remain valid until the date of effect of the termination notice issued, subject to compliance with clause 4.1 and 6 above.

**9.3** In the event where, in the reasonable opinion of the Society, the Client is in breach, or is suspected to be in breach of clause 16 of the Conditions, the Society shall have the right to terminate the Services (and the relevant contracts associated) with immediate effect.

### 10. FORCE MAJEURE

**10.1** Neither Party shall be responsible or liable for any failure to fulfil any term or provision of the Conditions if and to the extent that fulfilment has been delayed or temporarily prevented by a force majeure occurrence without the fault or negligence of the Party affected and which, by the exercise of reasonable diligence, the said Party is unable to provide against.

**10.2** For the purpose of this clause, force majeure shall mean any circumstance not being within a Party's reasonable control including, but not limited to: acts of God, natural disasters, epidemics or pandemics, wars, terrorist attacks, riots, sabotages, impositions of sanctions, embargoes, nuclear, chemical or biological contaminations, laws or action taken by a government or public authority, quotas or prohibition, expropriations, destructions of the worksite, explosions, fires, accidents, any labour or trade disputes, strikes or lockouts.

### 11. CONFIDENTIALITY

**11.1** The documents and data provided to or prepared by the Society in performing the Services, and the information made available to the Society, are treated as confidential except where the information:

- is properly and lawfully in the possession of the Society;
- is already in possession of the public or has entered the public domain, otherwise than through a breach of this obligation;
- is acquired or received independently from a third party that has the right to disseminate such information;
- is required to be disclosed under applicable law or by a governmental order, decree, regulation or rule or by a stock exchange authority (provided that the receiving Party shall make all reasonable efforts to give prompt written notice to the disclosing Party prior to such disclosure.

**11.2** The Parties shall use the confidential information exclusively within the framework of their activity underlying these Conditions.

**11.3** Confidential information shall only be provided to third parties with the prior written consent of the other Party. However, such prior consent shall not be required when the Society provides the confidential information to a subsidiary.

**11.4** Without prejudice to sub-clause 11.1, the Society shall have the right to disclose the confidential information if required to do so under regulations of the International Association of Classifications Societies (IACS) or any statutory obligations.

### 12. INTELLECTUAL PROPERTY

**12.1** Each Party exclusively owns all rights to its Intellectual Property created before or after the commencement date of the Conditions and whether or not associated with any contract between the Parties.

**12.2** The Intellectual Property developed by the Society for the performance of the Services including, but not limited to drawings, calculations, and reports shall remain the exclusive property of the Society.

### 13. ASSIGNMENT

**13.1** The contract resulting from to these Conditions cannot be assigned or transferred by any means by a Party to any third party without the prior written consent of the other Party.

**13.2** The Society shall however have the right to assign or transfer by any means the said contract to a subsidiary of the Bureau Veritas Group.

### 14. SEVERABILITY

**14.1** Invalidity of one or more provisions does not affect the remaining provisions.

**14.2** Definitions herein take precedence over other definitions which may appear in other documents issued by the Society.

**14.3** In case of doubt as to the interpretation of the Conditions, the English text shall prevail.

### 15. GOVERNING LAW AND DISPUTE RESOLUTION

**15.1** These Conditions shall be construed and governed by the laws of England and Wales.

**15.2** The Parties shall make every effort to settle any dispute amicably and in good faith by way of negotiation within thirty (30) days from the date of receipt by either one of the Parties of a written notice of such a dispute.

**15.3** Failing that, the dispute shall finally be settled under the Rules of Arbitration of the Maritime Arbitration Chamber of Paris ("CAMP"), which rules are deemed to be incorporated by reference into this clause. The number of arbitrators shall be three (3). The place of arbitration shall be Paris (France). The Parties agree to keep the arbitration proceedings confidential.

### 16. PROFESSIONAL ETHICS

**16.1** Each Party shall conduct all activities in compliance with all laws, statutes, rules, economic and trade sanctions (including but not limited to US sanctions and EU sanctions) and regulations applicable to such Party including but not limited to: child labour, forced labour, collective bargaining, discrimination, abuse, working hours and minimum wages, anti-bribery, anti-corruption, copyright and trademark protection, personal data protection (https://personaldataprotection.bureauveritas.com/privacypolicy).

Each of the Parties warrants that neither it, nor its affiliates, has made or will make, with respect to the matters provided for hereunder, any offer, payment, gift or authorization of the payment of any money directly or indirectly, to or for the use or benefit of any official or employee of the government, political party, official, or candidate.

**16.2** In addition, the Client shall act consistently with the Bureau Veritas' Code of Ethics. https://group.bureauveritas.com/group/corporate-social-responsibility

GUIDANCE NOTE NI 559

# Guidelines for the Use of Low Sulphur Fuel Oils (IMO 2020 compliance)



May 2019

## Section 1 General



## Section 2 Challenges associated to the Use of Low Sulphur Fuel Oil



## Section 3 Mitigation Measures

## Section 4 Tests and Procedures

# SECTION 1 GENERAL

## 1 Introduction

### 1.1 Global and local sulphur cap

**1.1.1** IMO MARPOL Annex VI limits the sulphur content of the fuels used onboard ships with a view to cutting the emission of SOx (sulphur oxides) into the atmosphere. The sulphur content of fuel oils used onboard ships (except if equipped by sulphur emission abatement technologies) is not to exceed:

- 3,50% until 31/12/2019, worldwide
- 0,50% on and after 01/01/2020, worldwide
- 0,10% within Emission Control Areas (ECAs).

In addition, local regulations impose restrictions on fuel oil sulphur content in specific areas or e.g. when the ship is at berth.

**1.1.2** Unless they are fitted with an approved exhaust gas cleaning system (scrubber), ships have to bunker fuels complying with the above limitations, which means that:

- ships have to bunker fuels with max 0,50% sulphur
- depending on their operational profile (in and out of ECAs), ships may have to bunker and use fuels with different sulphur contents.

### 1.2 Very low sulphur fuel oils (VLSFO)

**1.2.1** Very low sulphur fuel oils are currently available. Composition variability is expected requiring special focus during onboard handling.

In addition, the following situations may lead to mixing fuels of different origins, with possible consequences on the power and propulsion system of the ship:

- change-over between very low sulphur fuel oil and ultra low sulphur fuel oil in case of operation alternately in and out of ECAs
- switch-over between fuels after re-bunkering.

### 1.3 Purpose

**1.3.1** This document describes possible challenges related to marine fuels and provides recommendations in order to avoid issues when using low sulphur fuel oil.

## 2 Application

### 2.1 Scope

**2.1.1** The provisions of this Guidance Note apply to existing and new ships which intend to use VLSFO in order to comply with regulation 14.1.3 of IMO MARPOL Annex VI to be entering in force on 1st January 2020.

**2.1.2** The provisions of this Guidance Note address the design, construction and operation of marine engines and boilers and of their fuel oil storage and supply systems.

**2.1.3** For multi-engine plants (power generation plant or propulsion plant), the Society may consider the capability of a certain number of engines to operate with VLSFO, with the rest of engines running on HFO (with sulphur emission abatement technologies such as scrubber) or alternative fuel such as LNG, on a case by case basis.

## 3 References

### 3.1 Industry standards

**3.1.1**

- ISO 8217 is the most commonly used specification for marine fuel oils
- The international council on combustion engines (CIMAC) has issued several technical guidelines related to marine engines and installations, covering various aspects such as fuels and lubes.

Note 1: These guidelines can be found in the CIMAC website (www.cimac.com).

## 4 Definitions

### 4.1 Fuels

#### 4.1.1 Terminology

For the purpose of this Guidance Note, the following terminology will be used:

- very low sulphur fuel oil (VLSFO), when the maximum sulphur content is between 0,10% m/m and 0,50% m/m
- ultra low sulphur fuel oil (ULSFO), when the maximum sulphur content is less than 0,10% m/m
- or marine gas oil (MGO) with a maximum content of 0,50% m/m or 0,10% m/m.

#### 4.1.2 Distillate marine fuels

According to ISO 8217: 2017, Table 1, Distillates Marine Fuels include the following grades:

- DMX
- DMA
- DMZ
- DMB
- DFA
- DFZ
- DFB.

Note 1: DMX, having a flashpoint of 43°C, may only be used where permitted by SOLAS II-2/4.2.1.2 and 3.

#### 4.1.3 Residual Marine Fuel oils

According to ISO 8217:2017, Table 2, Residual Marine Fuels include the following grades:

- RMA
- RMB
- RMD
- RME
- RMG
- RMK.

## 4.2 Fuel properties

#### 4.2.1 Parameters related to cold flow properties

a) The Cloud Point (CP) is the temperature at which wax crystals first appear in a transparent liquid when it is cooled under specified conditions (as per ISO 3015). It applies only for clear and bright Distillate Marine fuels.

b) The Cold Filter Plugging Point (CFPP) is the highest temperature at which a given volume of fuel fails to pass through a standardized filtration device in a specified time when cooled under standardized conditions (as per ASTM D6371). It applies only for Distillate Marine fuels.

c) The Pour Point (PP) is the lowest temperature at which a fuel continues to flow when it is cooled under specified standard conditions (as per ISO 3016).

#### 4.2.2 Stability

A fuel is considered as stable when it tends to keep its properties during storage and operation. Unstable fuels change condition when certain circumstances (e.g. thermal and ageing) affect their resistance to breakdown resulting in asphaltenic sludge.

#### 4.2.3 Compatibility

Compatibility of two different fuels is an indication of their ability to be mixed together, the resulting blend being stable.

The term compatibility is often confused with stability. It should be noted that whereas the operational impact is similar, compatibility is a handling issue, applicable to the mixing of two or more different fuels whereas stability applies to a single fuel.

#### 4.2.4 Catalytic fines (Cat fines)

Cat fines are aluminum and silicon oxides present in fuels containing blend components originating from the fluidised catalyst cracking (FCC) unit of the refinery.

Cat fines are abrasive if allowed to enter the engine and must be removed in the onboard treatment processes, of which the separators are the most important part.

#### 4.2.5 Acid number

Acid number is a measure of the acidity level in the fuel.

## 4.3 Fuel operations

#### 4.3.1 Change-over

Change-over refers to the procedure carried out by a ship which changes the fuel in use to a fuel with different sulphur content when entering or leaving a sulphur emission control area (ECA).

#### 4.3.2 Transition

Transition refers to the process of replacing any fuel on board with sulphur content > 0,50% by a fuel with sulphur content ≤ 0,50% or vice-versa.

#### 4.3.3 Switch-over

Switch-over refers to the process of replacing any fuel on board by another fuel having a similar sulphur content.

# SECTION 2 CHALLENGES ASSOCIATED TO THE USE OF LOW SULPHUR FUEL OIL

## 1 Low viscosity

### 1.1 Use of fuels with low viscosity

**1.1.1** The use of fuels with viscosities below 2 cSt may result in internal leakages in fuel pumps.

**1.1.2** Due to low viscosity, fuel pumps (in particular worn pumps) may not deliver the fuel at the required pressure, which would prevent the fuel consumers from developing their rated power. A too low viscosity at the engine inlet can cause internal leakages in the fuel injection system, which may have consequences on the engine performance at low load (difficulties in starting or maneuvering).

## 2 Cold flow properties

### 2.1 General

**2.1.1** Cold flow properties of fuel oils are closely linked to their paraffin content.

**2.1.2** Exposing a fuel to temperatures below the cold flow properties of that specific fuel, may lead to formation of wax deposits in the storage tanks, in the separators and to the clogging of the fuel filters.

It is therefore of utmost importance for the purchaser to ensure that the cold flow characteristics are suitable, taking into account:

- the design of the ship's fuel systems
- the operating area of the ship; and
- the heating capabilities of tanks and filters.

**2.1.3** The cold flow properties are measured as Pour Point (PP), Cloud Point (CP) and Cold Filter Plugging Point (CFPP). Refer to the definitions in Sec 1, [4.2.1].

### 2.2 Pour point (PP)

**2.2.1** Pour point is an essential characteristic of the fuel as it determines the temperature below which the fuel becomes unpumpable.

### 2.3 Cold filter plugging point (CFPP) - Cloud point (CP)

**2.3.1** The temperature difference between PP and CFPP can be small or large as PP can be modified by use of cold flow improving additives.

ISO 8217: 2017 specifies that CFPP and PP be reported for distillates. It should be noted that fuels meeting the PP limits may still result in operational difficulties as filter clogging can occur in the temperature range between CP and PP. As such, it is recommended to prepare filters for heat tracing and know the CFPP prior to consumption. This will facilitate proper temperature management in order to avoid filter blocking and fuel starvation.

## 3 Stability

### 3.1 Consequences of fuel instability

**3.1.1** Possible consequences include:

- excessive asphaltenic sediments in tanks which cannot be pumped out
- separator sludging
- blocking of filters and pipes.

The formation of asphaltenic sludge is not reversible as precipitated asphaltenes cannot be returned to their dissolved state.

## 4 Incompatibility

### 4.1 Description

**4.1.1** Two fully stable fuels can result in an incompatible mix when mixed together resulting in asphaltenic sludge precipitation.

However, mixing two fuels neither of which contains asphaltenes can never result in asphaltenic sludge.

### 4.2 Consequences of fuel incompatibility

**4.2.1** The worst case consequence of incompatibility between two fuels is fuel starvation leading to loss of propulsion or power generation. In addition, incompatibility issues may require difficult and costly cleaning of the concerned equipment.

# 5 Cat fines

## 5.1 Fuel cat fines content

**5.1.1** ISO 8217:2017 allows max 60 ppm Al+Si in fuel as bunkered. It is vital that fuels are treated onboard in order to meet the max Al + Si limit specified by engine manufacturers (typically 10 to 15 ppm).

## 5.2 Impact of the cat fines

**5.2.1** Engines components such as liners, piston rings, fuel pumps, and injection valves may be affected by the abrasive effect of the cat fines, leading in some cases to heavy damages.

# SECTION 3 MITIGATION MEASURES

## 1 General

### 1.1 Operational

**1.1.1** As a general rule, in order to prevent compatibility issues, mixing of fuels should be avoided until the compatibility between two fuels is known, e.g. through lab testing. It is recognized that there will also be mixing in the fuel system when changing from one fuel to the other. During this period, compatibility issues may be encountered. This will pass once the change-over, switch-over or transition have been completed.

When mixing in a storage tank cannot be avoided, the following actions are to be performed:

- check the compatibility of the fuels in advance by laboratory testing and decide, on the basis of the test results, whether mixing is acceptable or not
- if the compatibility cannot be checked due to unavailability of one fuel, the amount of the first fuel is to be reduced to a safe minimum before the second one is added.

It should be noted that simple tests are available for onboard testing but in-depth laboratory testing, when time permits, is recommended as it provides higher reliability levels.

**1.1.2** It is recommended to perform tank bottom draining where practicable and tank cleaning on a regular basis.

**1.1.3** During the fuel transition, switch-over and change-over procedures, the proper condition of filters and operation of the separators are to be carefully monitored to detect any fuel compatibility problems as quickly as possible.

## 2 Configuration of the fuel tanks to reduce compatibility issues

### 2.1 Segregation of tanks

**2.1.1** To reduce the incompatibility risk, the storage tanks, settling tanks and service tanks should be separate (one storage tank, settling tank and service tank for each type of fuel).

**2.1.2** Whatever the tank configuration, mixing in the fuel system is unavoidable during the change-over, switch-over or transition from one fuel to another. In order to limit the risks associated with fuel incompatibility, it is recommended to carry out fuel change-over or switch-over as per [2.2].

### 2.2 Tank arrangements

#### 2.2.1 Tank arrangement with two settling tanks and one service tank

Where the ship is equipped with two settling tanks and one service tank, the following procedure should be followed before starting the fuel change-over, switch-over or transition procedure:

a) minimize the service tank content as far as safely practicable

b) refill the service tank with the new fuel.

#### 2.2.2 Tank arrangement with one settling tank and one service tank

Where the ship is equipped with one settling tank and one service tank, the following procedure should be followed before starting the fuel change-over, switch-over or transition procedure:

a) minimize the settling tank content as far as safely practicable

b) refill the settling tank with the new fuel

c) minimize the service tank content as far as safely practicable

d) refill the service tank from the settling tank.

Note 1: Such arrangement may happen on ships that need not comply with SOLAS II-1/26.11. See also IACS UI SC123 for alternative arrangement and emergency changeover procedure.

## 3 Measures to reduce viscosity issues

### 3.1 General

**3.1.1** The technical capability of the ship's fuel heating systems to handle different types of fuels is to be evaluated prior to the use of high viscosity fuels. Where necessary, restrictions on fuel suitability for use onboard the ship are to be established and observed.

### 3.2 Arrangements to ensure suitable fuel viscosity for the engine/boiler

**3.2.1** Attention is drawn on the need for cooling certain low viscosity fuels in order to maintain their viscosity in the permitted range.

### 3.3 Fuel change-over, switch-over or transition

**3.3.1** During the change-over, switch-over or transition procedure from a fuel with high viscosity to a fuel with low viscosity (or vice versa), the temperature gradient is not to exceed that recommended by the engine manufacturer.

# 4 Arrangement of the fuel tanks

## 4.1 Tank design

**4.1.1** Cat fines and impurities issues can be addressed by facilitating the settling of fuels and avoiding scattering of settled particles during operation, using fuel oil settling and service tanks with a sloping bottom and return pipe led to the tank bottom rather than to the tank top. The tanks are to be fitted with draining arrangements permitting the removal of impurities likely to accumulate in the lower part of such tanks.

# 5 Onboard fuel treatment

## 5.1 Separator

**5.1.1** Onboard separation can effectively reduce the water, sediment and cat fines contained in the fuel.

**5.1.2** Regarding the efficiency of the separator to remove cat fines, high removal capacity may require oversizing of the separator.

**5.1.3** Recommendations from the separator manufacturer are to be followed in particular as regards:

- the setting of the fuel temperature at the separator inlet
- the use of the correct feed flow rate, in consideration of the actual fuel consumption of the engines and of the actual cat fine concentration in the bunkered fuel oil
- the operating mode of the separators (in parallel or in series)
- the use of the correct gravity discs (where applicable)
- the maintenance of the separators.

# 6 Measures to avoid wax deposits

## 6.1 Fuel heating system

### 6.1.1 General

A fuel heating system should be installed, capable of providing sufficient heating to maintain the fuel at sufficient temperature in the storage tanks (as a minimum 10°C above the pour point).

The operating temperatures anticipated at sea should also be considered.

### 6.1.2 Heat tracing of filters

In order to reduce the risk of plugging and ensure a good circulation, fuel filters should be provided with a heat tracing system having a sufficient capacity to maintain the temperature inside the filter higher than the CFPP of the fuels intended to be used.

# SECTION 4 TESTS AND PROCEDURES

## 1 On-board tests

### 1.1 Verification of the fuel change-over

**1.1.1** The change-over capability of the fuel oil supply system, boiler and engines is to be checked during the sea trials.

Note 1: The lubricating oil change-over, where required for engines, is also to be checked.

**1.1.2** It is recommended to have onboard change-over procedures in place to assist the crew on when to change over to ULSFO in order to be compliant before entering ECAs.

## 2 Documents and procedures

### 2.1 Ship implementation plan (SIP)

#### 2.1.1 General

It is recommended to develop a ship implementation plan (SIP), outlining how the ship may prepare in order to comply with the required sulphur content limit of 0.50% by 1 January 2020, in line with MEPC.1/Circ.878.

The aim of the SIP is to identify and bring solutions to the following main concerns:

- compatibility
- cold flow properties.

As per MEPC.1/Circ.878, it may include:

- risk assessment and mitigation plan (impact of new fuels)
- fuel oil system modifications and tank cleaning (if needed)
- fuel oil capacity and segregation capability
- procurement of compliant fuel
- fuel oil transition plan.

#### 2.1.2 Tank cleaning

It is recommended to apply the Guidance for tank cleaning given in IMO Circular MEPC.1/Circ.878, Appendix 3.

### 2.2 Fuel sampling procedure

**2.2.1** Sampling location and sample handling are to comply with the relevant provisions of IMO Circular MEPC.1/Circ.864.

The fuel verification procedure is to be submitted for information in accordance with Appendix VI to MARPOL Annex VI.

Fuel parameters to be measured are listed in Article [3].

### 2.3 Fuel change-over, switch-over and transition procedures

**2.3.1** Fuel change-over, switch-over and transition procedures are to be prepared covering:

- transition from one fuel to another fuel when re-bunkering
- fuel change-over when entering or leaving ECA
- fuel switch-over following re-bunkering.

## 3 Fuel parameters to be measured and relevant test methods

### 3.1 Test methods available for evaluating fuel quality

**3.1.1** Test methods available for evaluating fuel quality, include tests that can be performed before the delivery of fuels to a ship.

Test methods available include the test methods as listed in Table 1 and Table 2 of ISO 8217.

In addition to the above, test methods to evaluate compatibility between two fuels are also available.

Only a limited number of tests can be done onboard the vessel.

Note 1: In general onboard test kits meet the official test methods (ISO/ASTM/IP) specified in ISO 8217, Table 1 and 2.

Note 2: The test for compatibility assessment according to ASTM D4740 "Cleanliness and Compatibility of Residual Fuels by Spot Test" can be performed in a laboratory or by ship's crew using an on-board test kit.

Tab 1 provides an overview of some available test methods.

**Table 1 : Available test methods.**

| Parameter | Test method |
|---|---|
| Kinematic viscosity at 40°C | ISO 3104, ASTM D445, IP 71/1997 |
| Kinematic viscosity at 50°C | ISO 3104 |
| Density at 15°C | ISO 3675, ISO 12185, ASTM D 4052-6 |
| Cetane index | ISO 4264 |
| Sulfur | ISO 8754, ISO 14596, ASTM D 4294, IP 336 |
| Flash Point (FP) | ISO 2719, ASTM D 93-168 |

| Parameter | Test method |
|---|---|
| Hydrogen Sulphide | IP 570 |
| Acid Number | ASTM D664 |
| Total sediment by hot filtration | ISO 10307-1 |
| Total sediment - aged | ISO 10307-2 |
| Total sediment - potential | ISO 10307-2 |
| Oxidation stability | ISO 12205 |
| Fatty acid methyl ester (FAME) | ASTM D7963, IP 579 |
| Micro carbon residue - micro method on the 10% volume distillation residue (MCR10) | ISO 10370 |
| Micro carbon residue (MCR) | ISO 10370, ASTM D 4530 |
| Cloud point (CP) | ISO 3015 |
| Cold filter plugging point (CFPP) | IP 309, IP 612 |
| Pour point (PP) | ISO 3016 |
| Water (by distillation) | ISO 3733, ASTM D 95-05, IP 74/2000 |
| Water (by titration) | ISO 12937 |
| Ash | ISO 6245, ASTM D 482, IP 4 |
| Lubricity | ISO 12156-1 |
| Vanadium | IP 501, IP 470, ISO 14597 |
| Sodium | IP 501, IP 470 |
| Aluminium and silicon | IP 501, IP 470, ISO 10478, IP 337-95 |
| Calcium, zinc and phosphorus | IP 501, IP 470, IP 500 |
| Cleanliness and compatibility spot test | ASTM D4740-04 |


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