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Petroleum products — Fuels (class F) — Considerations for fuel suppliers and users regarding marine fuel quality in view of the implementation of maximum 0,50 % sulfur in 2020

Produits pétroliers — Combustibles (classe F) — Considérations à l'usage des fournisseurs de combustibles et des utilisateurs pour la qualité des combustibles pour la marine en vue de la mise en application de la teneur maximale en soufre de 0,50 % en 2020

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 General considerations for 0,50 mass % S marine fuels **3**
4.1 Overview 3
4.2 Sulfur content 3
4.3 Flash point 3
4.4 Application of ISO 8217:2017 to 0,50 mass % S fuels 3
5 Specific considerations for 0,50 mass % S marine fuels **3**
5.1 Overview 3
5.2 Kinematic viscosity 3
5.3 Cold flow properties/Wax formation 4
5.4 Stability 4
5.5 Ignition characteristics 4
5.6 Catalyst fines 4
6 Compatibility **5**
Annex A (informative) **Fuel classification** **6**
Annex B (informative) **Composition of marine fuels — ISO 8217:2017, Clause 5 and Annex B** **7**
Annex C (informative) **Stability** **9**
Annex D (informative) **Commingling of fuels** **10**
Bibliography **12**

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Foreword

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This document was prepared by Technical Committee ISO/TC 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*, Subcommittee SC 4, *Classifications and specifications*.

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Introduction

This document was developed in cooperation with ship owners, ship operators, classification societies, fuel testing services, engine designers, marine fuel suppliers, traders, fuel additive suppliers and the petroleum industry, in view of the implementation of maximum 0,50 mass % S in marine fuels in 2020 for operation outside Emission Control Areas (ECAs).

The increasing demands of environmental legislation are leading to a transition in the nature of marine fuels. This document takes into consideration the anticipated diverse range of characteristics of these marine fuels.

In view of the implementation date, it was considered that a revision of ISO 8217:2017 was not possible in the given timeframe. As such, the best option for the industry was the development of this document.

MARPOL Annex VI[1] aims among other things to reduce SO_x emissions from fuel oil combustion on board ships engines. This can be achieved by using fuels with a lower sulfur content or by operating an approved equivalent alternative mean (e.g. exhaust gas scrubber). It is the fuel purchaser's and the user's responsibility to establish applicable requirements and to specify on that basis the corresponding maximum fuel sulfur content required to the supplier.

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Petroleum products — Fuels (class F) — Considerations for fuel suppliers and users regarding marine fuel quality in view of the implementation of maximum 0,50 % sulfur in 2020

1 Scope

This document addresses quality considerations that apply to marine fuels in view of the implementation of maximum 0,50 mass % S in 2020 and the range of marine fuels that will be placed on the market in response to the international statutory requirements to reduce exhaust gas emissions. It defines general requirements that apply to all 0,50 mass % sulfur (S) fuels and confirms the applicability of ISO 8217 for those fuels.

It gives technical considerations which might apply to particular fuels for the following characteristics:

— kinematic viscosity;

— cold flow properties;

— stability;

— ignition characteristics;

— catalyst fines.

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Additionally, it provides considerations on the compatibility between fuels and additional information on ISO 8217:2017, Annex B (see Annexes B and D).

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NOTE 1 For the purposes of this document, 0,50 mass % S fuels refers to distillate and residual fuels with a sulfur content up to 0,50 mass %.

NOTE 2 For the purposes of this document, “mass %” and “volume %” are used to represent the mass and volume fractions respectively.

NOTE 3 This document can also be used in conjunction with earlier editions of ISO 8217 in the event an earlier edition is referenced in the commercial agreement between parties.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8217:2017, *Petroleum products — Fuels (class F) — Specifications of marine fuels*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

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3.1
stability
stability of a residual fuel
resistance to the breakdown and precipitation of asphaltenic sludge despite being subjected to forces, such as thermal and ageing stresses, while handled and stored under normal operating conditions

3.2
compatibility
ability of two or more fuels to be commingled at a defined ratio without evidence of material separation, which could result in the formation of multiple phases, such as flocculation, where dispersed particles of asphaltenes form bigger clusters which might lead to sludge formation

3.3
stability reserve
ability of an oil to maintain asphaltenes in a peptized (colloidally dispersed) state and prevent flocculation of the asphaltenes

3.4
cloud point
CP
temperature at which a cloud of wax crystals first appears in a transparent liquid when it is cooled under specified conditions

[SOURCE: ISO 3015:2019, 3.1[2], modified — In the definition, liquid has been specified to be "transparent".]

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3.5
cold filter plugging point
CFPP
highest temperature at which a given volume of distillate fuel fails to pass through a standardized filtration device in a specified time when cooled under standardized conditions

[SOURCE: IP 309[3]]

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3.6
pour point
PP
lowest temperature at which a fuel will continue to flow when it is cooled under specified standard conditions

[SOURCE: ISO 3016:2019, 3.1[4], modified — In the definition, "sample of a petroleum product" has been replaced by "fuel".]

3.7 Total sediment-aged

3.7.1
potential total sediment
TSP
total sediment, determined by ISO 10307-1[15], after ageing a sample of residual fuel for 24 h at 100 °C under prescribed conditions

[SOURCE: ISO 10307-2:2009, 3.1[16]]

3.7.2
accelerated total sediment
TSA
total sediment, determined by ISO 10307-1, after dilution of a sample of residual fuel with hexadecane in the ratio of 1 ml per 10 g of sample under carefully controlled conditions, followed by storage for 1h at 100 °C

[SOURCE: ISO 10307-2:2009, 3.2]

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4 General considerations for 0,50 mass % S marine fuels

4.1 Overview

This clause addresses aspects which apply to all fuels produced to meet a 0,50 mass % S limit.

4.2 Sulfur content

ISO 8217:2017, Table 1 and Table 2, do not set sulfur limits other than technical limits for the DM / DF grades in recognition that it is for the purchaser to specify the maximum sulfur content when ordering the fuel based on regulatory requirements applicable to where the fuel will be used. Consequently, sulfur is not a factor in selecting the grade category of an ordered fuel oil.

This means that the purchaser can continue to order the same grade of fuel as before and all corresponding specifications shall be met. In doing so, the required fuel characteristic specific limits for the treatment system and engines, such as CCAI, micro carbon residue, vanadium, aluminium and silicon, are met.

The measurement of the sulfur content shall be according to the test methods specified in ISO 8217.

4.3 Flash point

The flash point for all marine fuels under ISO 8217, except for DMX, is set at 60 °C minimum in accordance with the relevant requirements under the International Convention for Safety of Life at Sea (SOLAS)[5]. These values therefore continue to apply equally to marine fuels produced to meet a 0,50 mass % S limit.

It is therefore the responsibility of fuel suppliers to ensure that each fuel as delivered meets the flash point criterion.

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4.4 Application of ISO 8217:2017 to 0,50 mass % S fuels

The fuels referenced in this document shall meet ISO 8217. All fuels within the scope of ISO 8217 produced to a 0,50 mass % S limit shall fall within either ISO 8217:2017, Table 1 and Table 2.

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NOTE 1 Some fuels on the market meet ISO 8217:2017, Table 2 requirements while consisting of mainly high boiling asphaltenes-free material of petroleum refining. Their characteristics allow them to be considered within the context of ISO 8217:2017, Table 2, (See Annex A).

NOTE 2 It is expected that the kinematic viscosity of 0,50 mass % S fuels might vary widely, even within the same grade (see 5.2) and that 0,50 mass % S fuels can exhibit a directionally waxier nature (see 5.3).

5 Specific considerations for 0,50 mass % S marine fuels

5.1 Overview

This clause addresses aspects which may apply to particular marine fuels produced to meet a 0,50 mass % S limit.

5.2 Kinematic viscosity

Historically, fuels within the same grade were very similar in kinematic viscosity and typically close to the maximum limit of the ordered grade. The kinematic viscosity is expected to vary widely for 0,50 mass % S fuels, even within the same grade and is no longer the controlling characteristic that it once was. For example, some lower viscosity fuels may have other characteristics such as density, carbon residue and catalyst fines typical of higher viscosity grades. Therefore, particular attention should be given to the correct temperature and viscosity settings in the fuel system as different viscosity fuels should be adjusted to the correct temperature to comply with the machinery requirements. The kinematic viscosity of the fuel is therefore best communicated prior to delivery.

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A low kinematic viscosity might have implications on the cold flow properties/wax formation of the fuel, see 5.3.

5.3 Cold flow properties/Wax formation

It is expected that the implementation of the 0,50 mass % S limit will result in a wider range of fuel formulations. There is a common understanding that some 0,50 mass % S fuels can exhibit tendencies towards being of a waxier nature.

Even when stored at a temperature at or above its pour point, the formation of wax crystals is possible in either a distillate or residual fuel, if the storage temperature is below the wax melting temperature. A fuel having a higher wax melting temperature might require heating significantly above its pour point temperature in order to dissolve the wax crystals, preventing them from precipitating in storage tanks and to avoid filter blocking in the fuel management system.

A consequence of this is that a fuel having a relatively low kinematic viscosity might not require much, or even any, heating to achieve the required engine injection viscosity but might nevertheless still require heating to melt the wax crystals present (see Annex A).

For distillate fuels in particular, the fuel purchaser should verify that the cold flow properties (CP, CFPP, PP) of the ordered fuel are suitable for the ship's fuel storage and management system design and the climate conditions expected to be encountered during the intended voyage. ISO 8217 includes the requirement to report CP and CFPP for winter grades of DMA, DMZ, DFA and DFZ.

NOTE More information can be found in the CIMAC guideline for managing cold flow properties of marine fuels[6].

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5.4 Stability

The stability of a residual fuel is essential for the safe handling and use on board ships and for residual fuels the measure of the fuels resistance to precipitate asphaltenes is covered in ISO 8217:2017, Table 2, by total sediment-aged. In view of the diversity of the fuels being brought onto the market[17] to meet the 0,50 mass % S requirement, other test methods that might provide information on the stability and potential instability of fuels have also been evaluated (see Annex C).

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NOTE More information can be found in the CIMAC guideline on General guidance in marine fuel handling in connection to stability and compatibility[7].

5.5 Ignition characteristics

The ignition characteristic of a residual fuel is addressed by the Calculated Carbon Aromaticity Index (CCAI) limits set down in ISO 8217:2017, Table 2 and will be applicable to 0,50 mass % S residual fuels. However, as with the best practices applied today on pre-2020 fuels, attention should be given to each newly sourced fuel put into use, ensuring machinery plant settings are correctly setup and manufacturers operating limits are not exceeded.

NOTE More information can be found in the CIMAC guideline on the Fuel Quality Guide Ignition and Combustion[8].

5.6 Catalyst fines

Catalyst fines (cat fines) might also be found in 0,50 mass % S fuels and the maximum limits on the content of Aluminium plus Silicon in ISO 8217:2017, Table 2, restrict the catalyst fines content in 0,50 mass % S fuels.

Because of the expected wider variation in kinematic viscosity for 0,50 mass % S fuels, even within the same grade, fuels with a lower viscosity might however still have catalyst fines typical of higher viscosity fuels.

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