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Methanol as a fuel for marine applications — General requirements and specifications

Méthanol comme carburant pour les applications marines — Exigences générales et spécifications

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ISO Copyright Officecopyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: + 41 22 749 01 11

Email: copyright@iso.org

E-mail: copyright@iso.org
Website: www.iso.orgwww.iso.org

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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 prepared in cooperation with ship owners, ship operators, national standards bodies, classification societies, fuel testing services, engine and fuel cell designers, marine fuel suppliers, methanol producers, governmental organizations, and other technical organizations to meet the requirements for methanol supplied as marine fuel on a world-wide basis for consumption on board ships.

This document specifies three categories of methanol: marine methanol grade A (MMA), marine methanol grade B (MMB) and marine methanol grade C (MMC).

For the purpose of this document, the term methanol comprises methanol from all forms of production.

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Methanol as a fuel for marine applications — General requirements and specifications

WARNING — The handling and use of products specified in this document can be hazardous if suitable precautions are not observed. This document does not purport to address all of the safety and health considerations as included in the safety data sheet of the product that can be associated with its use. Methanol is a low flash point product (typically 11 °C) and it is the responsibility of the users of this document to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use (see also Reference [1]).

1 Scope

This document defines the general requirements and specifications for methanol from all forms of production at the point of custody transfer, prior to any onboard required treatment, for use as fuel in marine diesel engines, fuel cells and other marine applications. The specifications in this document can also be applied to methanol used as fuel in land-based applications of the same or similar type as those used for marine purposes.

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.

<unknown>IMPCA 001, *Purity and impurities of methanol*</unknown>

<unknown>IMPCA 002, *Chloride as Cl*</unknown>

<unknown>IMPCA 003, *Appearance of methanol*</unknown>

<std>ISO 4259 IMPCA 001, *Purity and impurities of methanol*

IMPCA 002, *Chloride as Cl*

IMPCA 003, *Appearance of methanol*

ISO 4259-2, Petroleum and related products — Precision of measurement methods and results — Part 2: Interpretation and application of precision data in relation to methods of test</std>

<std>ISO 12185, Crude petroleum, petroleum products and related products — Determination of density — Laboratory density meter with an oscillating U-tube sensor</std>

<std>ASTM E1064, *Standard Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration*</std>

<std>ASTM D1078, *Standard Test Method for Distillation Range of Volatile Organic Liquids*</std>

<std>ASTM E1064, *Standard Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration*

ASTM D1078, *Standard Test Method for Distillation Range of Volatile Organic Liquids*</std>

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ASTM D1613, Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products</std>

<std>ASTM D5453, Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence</std>

<unknown>IP PM FK, *Methanol fuel — Assessment of lubricity using the high-frequency reciprocating rig (HFRR)*</unknown>

<unknown>IP PM FK, *Methanol fuel — Assessment of lubricity using the high-frequency reciprocating rig (HFRR)*

IP PM FI, *Determination of the concentration of dispersed particles in marine methanol fuel — Automatic Particle Counter (APC) Light Obscuration Method*</unknown>

3 Terms and definitions

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

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

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

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

3.1
point of custody transfer
point of physical transfer of product that results in change in ownership and/or a change in responsibility

[SOURCE: ISO 20257-2:2021, 3.1.2, modified — "point of" added in the preferred term and in the definition; "hydrocarbon" deleted from the definition.]

3.2
initial boiling point
IBP
temperature indicated by the distillation thermometer at the instant the first drop of condensate leaves the condenser tube

[SOURCE: ASTM D1078-11, 3.1.3, modified — "IBP" added as an admitted term; ", *n*—the" deleted from the definition.]

3.3
dry point
DP
temperature indicated at the instant the last drop of liquid evaporates from the lowest point in the distillation flask, disregarding any liquid on the side of the flask

[SOURCE: ASTM D1078-11, 3.1.2, modified — "DP" added as an admitted term; ", *n*—the" deleted from the definition.]

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4 Application and sampling

This document specifies the properties of methanol at the point of custody transfer ~~(3.1).~~(3.1).

Samples for quality verification may be taken in any location agreed between the parties concerned. Specific sampling requirements which are documented in the referenced test methods shall apply.

Methanol sampling should follow good industry practice of using glass sample bottles, and bottle caps that are UV resistant and have no influence on the quality of methanol (see also Reference ~~[3]).~~[3]). Exposure of methanol to atmospheric moisture should be minimized.

5 General requirements

5.1 ~~5.1~~ The methanol as supplied shall be homogeneous and conform to the characteristics and limits given in ~~Table 1~~Table 1 when tested in accordance with the methods specified in ~~Table 1~~Table 1.

5.2 ~~5.2~~ The methanol shall be free from any materials, including added substances or chemical compounds or both, at a concentration that causes the methanol to be unacceptable for use by way of~~:~~

a) ~~a)~~ jeopardizing the safety of the ship~~;~~

b) ~~b)~~ adversely affecting the performance of the machinery~~;~~ or

c) ~~c)~~ being harmful to personnel.

6 Generally applicable requirements and related test methods

6.1 Methanol grades

~~Table 1~~Table 1 specifies the applicable requirements, limits and test methods for three grades of methanol:

— Marine methanol grade A (MMA): MMA lists the characteristics considered applicable when using methanol as a marine fuel with additional requirements in respect of lubricity and particle count;

— Marine methanol grade B (MMB): MMB lists the characteristics considered applicable when using methanol as a marine fuel;

— Marine methanol grade C (MMC): MMC grade provides for wider tolerances on some of the listed characteristics as compared to MMB.

When tested in accordance with the applicable test methods specified in ~~Table 1~~Table 1, methanol as a fuel for marine applications shall be in accordance with the limits specified in ~~Table 1~~Table 1.

Table 1 — Specifications for methanol as a fuel for marine applications

Characteristics	Units	Limit	MMA	MMB	MMC	Test method(s) a and references
General requirements			~~Clauses 5 to 7~~Clauses 5 to 7			
Appearance			Homogenous, clear and free of suspended matter			IMPCA 003
Density at 15 °C	kg/m³	min.	795,0	795,0	795,0	ISO 12185; see ~~6.2~~6.2
		max.	797,0	797,0	798,0	

Characteristics	Units	Limit	MMA	MMB	MMC	Test method(s) a and references
Methanol mass fraction on dry basis	%	min.	99,85	99,85	99,70	[b]
Impurities mass fraction on dry basis [c]	%	max.	0,15	0,15	0,30	IMPCA 001
Ethanol content on a dry basis	mg/kg	max.	50	50	150	IMPCA 001
Acetone content on a dry basis	mg/kg	max.	30	30	30	IMPCA 001
Total sulfur content	mg/kg	max.	0,5	0,5	10,0	ASTM D5453; see ~~6.3~~6.3
Water content by mass	%	max.	0,100	0,100	0,500	ASTM E1064
Distillation range at 101,3 kPa (760 mm Hg)	°C	max.	1,0	1,0	Report	ASTM D1078 [d]
Chloride content as Cl^- [e]	mg/kg	max.	0,5	0,5	0,5	IMPCA 002
Acidity as acetic acid [e]	mg/kg	max.	30	30	30	ASTM D1613
Lubricity			[f]	–	–	IP PM FK
Particle count			[g]	–	–	IP PM FI

[a] For test methods that do not include precision data for methanol, ISO 4259-2 cannot be applied in case of dispute.

[b] Methanol content by mass on a dry basis equals 100 % minus impurities content by mass on dry basis, according to IMPCA 001.

[c] Impurities content by mass on dry basis shall be calculated as the sum of the individual impurities results obtained from the given test method and reported in per cent by mass instead of mg/kg.

[d] Reported distillation range shall include reporting of the IBP.

~~[e] See Annex E.~~

[e] See Annex E.

[f] Lubricity characteristic shall be agreed between buyer and seller. ~~See Annex C.~~See Annex C.

[g] Particle count shall be agreed between buyer and seller. ~~See Annex D.~~See Annex D.

~~Annex A~~Annex A provides background information on how the methanol grades defined in this document have been established.

6.2 Density

The density at 15 °C of pure methanol is 796,1 kg/m^3. The presence of impurities or water in methanol can affect the density. Density that is outside the permitted range specified in ~~Table 1~~Table 1 can be indicative of contamination.

To convert a density measurement at a different temperature to the corresponding density at 15 °C, see Reference ~~[4].~~[4].

6.3 Total sulfur content

ASTM D5453 covers various fuels containing 1,0 mg/kg to 8 000 mg/kg total sulfur. Following the IMPCA methanol reference specifications[2], [2], the method contained in ASTM D5453 has been found to be suitable for the determination of total sulfur content in methanol, provided that the laboratory performing the analysis has demonstrated that it can achieve a limit of detection < 0,5 mg/kg.