INTERNATIONAL STANDARD

**ISO 16861**

First edition
2015-05-15

# Petroleum products — Fuels (class F) — Specifications of dimethyl ether (DME)

*Produits pétroliers — Combustibles (classe F) — Spécifications du diméthyléther (DME)*



Reference number
ISO 16861:2015(E)



ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

 

# Contents

Page

# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information



The committee responsible for this document is ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 4, *Classifications and specifications*.



 

# Introduction

According to its physical properties, dimethyl ether (DME) can be used as fuel. It is comparable to liquefied petroleum gas (LPG) so it can be used as heating fuel, either mixed with LPG or in its pure form. DME also has very good auto-ignition qualities which makes it a replacement fuel for diesel.

The energy efficiency chain is a key issue for choosing DME, which has a better life cycle $CO_2$ balance than most of the other alternative fuels. DME is a commodity which can be made from various raw materials, including natural gas, coal, black liquor, biomass, and wastes.

As some national standards have been already issued, it seems important to create an international DME specification standard in order to unify the requirements at an international commercial level and to ease the international development of DME as fuels.

This International Standard focuses on DME as heating fuel for industrial boilers and for households for cooking and heating, and as alternative to diesel for vehicles.

# Petroleum products — Fuels (class F) — Specifications of dimethyl ether (DME)

**WARNING — The handling and use of products as specified in this International Standard can be hazardous if suitable precautions are not observed. This International Standard does not purport to address all of the safety and health considerations that can be associated with its use. It is the responsibility of the users of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.**

## 1 Scope

This International Standard specifies the characteristics of DME used as fuel of which the main component is the dimethyl ether synthesized from any organic raw materials.

This International Standard is applicable for DME used as heating fuel, industrial fuel, and to replace diesel fuel or gas oil. It does not deal with the possible additives necessary for specific end-use applications, for example, odorant typically added to heating fuel and lubricity improvers for DME used as replacement of diesel. Such additives are typically specified for the different end-use applications, at an appropriate level — national, regional, or international.



## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.



ISO 17196:2014, *Dimethyl ether (DME) for fuels — Determination of impurities — Gas chromatographic method*

ISO 17197:2014, *Dimethyl ether (DME) for fuels — Determination of water content — Karl Fischer titration method*

ISO 17198:2014, *Dimethyl ether (DME) for fuels — Determination of total sulfur, ultraviolet fluorescence method*

ISO 17786:2015, *Dimethyl ether (DME) for fuels — Determination of high temperature (105°C) evaporation residues — Mass analysis method*

ISO 29945, *Refrigerated non-petroleum-based liquefied gaseous fuels — Dimethylether (DME) — Method of manual sampling onshore terminals*

## 3 Components and test methods

The DME for fuel specified shall conform to the detailed requirements shown in Table 1.

NOTE A more specific overview of the general physical properties of DME is given in Annex A. These properties might be of importance to the end-user, but do not form part of the trade specification as in this International Standard.

**Table 1 — DME specifications (before addition of additives)**

| Property | Units | Limit | Test methods |
|---|---|---|---|
| DME purity | mass % | 98,5 min | 5.1 |
| Methanol | mass % | 0,050 max | 5.2 |
| Water | mass % | 0,030 max | 5.3 |
| Hydrocarbons (up to $C_4$) | mass % | 1,00 max | 5.4 |
| Carbon dioxide ($CO_2$) | mass % | 0,10 max | 5.5 |
| Carbon monoxide (CO) | mass % | 0,010 max | 5.6 |
| Methyl formate | mass % | 0,050 max | 5.7 |
| Ethyl methyl ether | mass % | 0,20 max | 5.8 |
| Evaporation residues | mass % | 0,007 0 max | 5.9 |
| Total sulphur | mg/kg | 3,0 max | 5.10 |

## 4 Sampling method

A representative sample subject to the analyses shall be obtained in accordance with the procedure instructed in ISO 29945.



## 5 Test methods

### 5.1 DME purity



The purity of DME should be calculated using Formula (1).

$$P = 100 - \left( X_{\mathrm{MeOH}} + X_{\mathrm{H_2O}} + X_{\mathrm{HC}} + X_{\mathrm{CO_2}} + X_{\mathrm{CO}} + X_{\mathrm{MF}} + X_{\mathrm{EME}} + X_{\mathrm{ER}} + X_{\mathrm{S}} \times 10^{-4} \right) \quad (1)$$

where

$P$ is the DME purity (mass %);

$X_{\mathrm{MeOH}}$ is the methanol concentration measured by 5.2 (mass %);

$X_{\mathrm{H_2O}}$ is the water concentration measured by 5.3 (mass %);

$X_{\mathrm{HC}}$ is the hydrocarbons (up to $C_4$) concentration measured by 5.4 (mass %);

$X_{\mathrm{CO_2}}$ is the $CO_2$ concentration measured by 5.5 (mass %);

$X_{\mathrm{CO}}$ is the CO concentration measured by 5.6 (mass %);

$X_{\mathrm{MF}}$ is the methyl formate concentration measured by 5.7 (mass %);

$X_{\mathrm{EME}}$ is the ethyl methyl ether concentration measured by 5.8 (mass %);

$X_{\mathrm{ER}}$ is the evaporation residues concentration measured by 5.9 (mass %);

$X_{\mathrm{S}}$ is the total sulfur concentration measured by 5.10 (mg/kg).

### 5.2 Methanol

The methanol shall be tested in accordance with ISO 17196:2014.

### 5.3 Water

The water shall be tested by ISO 17197:2014.

### 5.4 Hydrocarbons (up to C4)

The hydrocarbons (up to $C_4$) shall be tested in accordance with ISO 17196:2014.

### 5.5 Carbon dioxide

The carbon dioxide shall be tested in accordance with ISO 17196:2014.

### 5.6 Carbon monoxide

The carbon monoxide shall be tested in accordance with ISO 17196:2014.

### 5.7 Methyl formate

The methyl formate shall be tested in accordance with ISO 17196:2014.



### 5.8 Ethyl methyl ether

The ethyl methyl ether shall be tested in accordance with ISO 17196:2014.



### 5.9 Evaporation residues

The evaporation residues shall be tested in accordance with ISO 17786:2015.

### 5.10 Total sulfur

The total sulfur shall be tested in accordance with ISO 17198:2014.