भारतीय मानक
Indian Standard

IS 16704 : 2018
ISO 16861 : 2015

पेट्रोलियम उत्पाद — ईंधन (क्लास एफ) — डाइमिथाइल ईथर की विशिष्टि (डीएमई)

Petroleum Products — Fuels (Class F) — Specifications of Dimethyl Ether (DME)

ICS 75.160.20; 71.080.60

भारतीय मानक ब्यूरो
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May 2018 **Price Group 3**

Petroleum and Related Products of Their Synthesis or Biological Origin Sectional Committee, PCD 03

NATIONAL FOREWORD

The Indian Standard which is identical with ISO 16861 : 2015 'Petroleum products — Fuels (class F) — Specifications of dimethyl ether (DME)' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Petroleum and Related Products of Their Synthesis or Biological Origin Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

The technical committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
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

For tropical countries like India, the standard temperature and the relative humidity shall be taken as (27 ± 2)°C and (65 ± 5) percent, respectively.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

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_{MeOH} is the methanol concentration measured by 5.2 (mass %);

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

X_{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_{CO} is the CO concentration measured by 5.6 (mass %);

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

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

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

X_{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.

Annex A
(informative)

Physical properties of DME

A.1 General

Table A.1

Property	Methane	Propane	DME	Butane	Methanol	Diesel oil
Chemical formula	CH_4	C_3H_8	CH_3OCH_3	C_4H_{10}	CH_3OH	—
Boiling point (°C)	−161,5	−42,0	−24,8	−0,5	64,7	180 to 360
Liquid density (kg/m^3)	415 (−164 °C)	582 (−42 °C)	670 (20 °C)	600 (−0,75 °C)	786,6 (25 °C)	800 to 840
Gas specific gravity (via air)	0,554	1,523	1,588	2,007	1,106	—
Saturated vapour pressure (MPa, 20 °C)	0,0053 (−86,3 °C)	0,912	0,53	0,210	0,013	—
Ignition point (°C)	540	450	350	405	385	250
Explosion limit (vol. %)	5 to 15	2,1 to 9,5	3,4 to 27	1,8 to 8,4	6,7 to 36	0,6 to 7,5
Cetane number	—	5	>55	10	3	40 to 55
Net calorific value – liquid (MJ/kg)	50,2	46,5	28,9	48	20,1	43,1
Net calorific value – gas (MJ/Nm^3)	35,9	91	59,3	118	—	—
NOTE Liquid density is not a parameter from which purity of DME is confirmed. However, measurement practice of density at loading and discharging ports are intended to be uniformed to avoid quantitative difference between two ports to be caused by different measurement practices.						

The density of DME at a given temperature can be estimated using Formula (A.1) [3].

$$\rho = A/\{B^{[1+(1 - T/C)^D]}\} \quad \text{(A.1)}$$

where

ρ is the density (kg/m^3);

A is 55,6001;

B is 0,236704;

C is 401,406;

D is 0,243367;

T is the temperature (K).

Bibliography

[1] Handbook DME, & Japan DME Forum, pp.34-35, p.196, (2006)

[2] Data Book DME *The High Pressure Gas Safety Institute of Japan (KHK)*, p.11

[3] Spencer C.F., & Danner R.P. J. Chem. Eng. Data. 1972, p. 17

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

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Amendments Issued Since Publication

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