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Road vehicles — Dimethyl Ether (DME) fuel system components —

Part 2: Performance and general test methods

Véhicules routiers — Composants des systèmes de combustible Diméthyle Ether (DME) —
Partie 2: Performances et méthodes d'essai générales

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

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 41, *Specific aspects for gaseous fuels*.

A list of all parts in the ISO 20766 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

For the purposes of this document, all fuel system components in contact with Dimethyl Ether have been considered suitable for Dimethyl Ether as defined in ISO 16861. However, it is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this document and can be tested in accordance with the appropriate functional tests.

All references to pressure in this document are considered to be gauge pressures unless otherwise specified.

This document is based on a service pressure for Dimethyl Ether used as fuel of 1 500 kPa (15 bar) settled at 20 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio).

Road vehicles — Dimethyl Ether (DME) fuel system components —

Part 2: Performance and general test methods

1 Scope

This document specifies performance and general test methods for Dimethyl Ether (DME) fuel system components intended for use on the types of motor vehicles defined in ISO 3833.

This document is applicable to vehicles (mono-fuel, bi-fuel or dual-fuel applications) using Dimethyl Ether in accordance with ISO 16861 and ASTM D7901. It is not applicable to the following:

a) fuel containers;

b) stationary gas engines;

c) container-mounting hardware;

d) electronic fuel management;

e) refuelling receptacles.

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 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 22760-1:2019, *Road vehicles — Dimethyl Ether (DME) fuel system components — Part 1: General requirements and definitions*

ASTM D4814, *Standard Specification for Automotive Spark-Ignition Engine Fuel*

IEC 68-2-52, *Kb: Salt Spray Fog Test*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22760-1 and the following 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/

3.1
fill cycle
sequence of events performed on a filling system that has a defined beginning and ending

3.2
duty cycle
sequence of events performed on a component that has a defined beginning and ending

3.3
service pressure
settled pressure of the fluid at 20 °C

4 General

4.1 Unless otherwise stated, the tests shall be conducted at a room temperature of 20 °C ± 5 °C.

4.2 Components shall comply with the tests specified in this document as well as the relevant parts of ISO 22760, as applicable for each component.

NOTE Because of the peculiarities of some components, the list of tests given in this document (Clauses 5 to 15) is not exhaustive. Where additional tests are required, their provisions are given in other parts of ISO 20766.

4.3 Unless otherwise specified, all tests shall be conducted using dry air or nitrogen. Tests may also be conducted with Dimethyl Ether, provided appropriate safety measures are taken.

4.4 Unless otherwise specified, all pressures shall have a maximum tolerance of ±5 %. Unless otherwise specified, all temperatures shall have a maximum tolerance of ±5 %. Unless otherwise specified, all dimensions shall have a maximum tolerance of ±5 %.

5 Hydrostatic strength

5.1 General

A component shall not show any visible evidence of rupture when subjected to the following test procedure.

a) Plug the outlet opening of the component and have the valve seats or internal blocks assume the open position.

b) Apply, with a test fluid, the hydrostatic pressure specified in the applicable part of ISO 20766 to the inlet of the component for a period of at least 3 min.

c) The hydrostatic pressure shall then be increased at a rate of less than or equal to 1,4 MPa/s until component failure. The hydrostatic pressure at failure shall be recorded. The benchmark value for a specific component shall be determined by testing a component that has not undergone previous testing.

Previously untested sample shall withstand at least 2,25 times working pressure. Hydrostatic testing of components that have been subjected to previous testing shall result in an acceptable failure pressure that is at least 80 % of the benchmark value or at least 2,25 times the working pressure of the component.

The samples used in this test shall not be used for any other testing.

6 Leakage

6.1 General

6.1.1 Prior to conditioning, purge the component, then seal it at 30 % of the working pressure using nitrogen or dry air.

6.1.2 Conduct all tests while the device is continuously exposed to the specified test temperatures. The device shall either be bubble free or display a leakage rate of less than 15 cm^3 (normal)/h when subjected to the following test method.

If components are subjected to more than one working pressure, the test may be conducted in subsequent steps.

6.2 External leakage

6.2.1 Plug each device outlet into the appropriate mating connection.

6.2.2 Apply pressurized dry air or nitrogen to the inlet of the test device.

6.2.3 At all test temperatures, immerse the components in a suitable test medium for $2\,\text{min}\left(^{+30}_{0}\right)\text{s}$ or use a helium vacuum test (global accumulation method) or other equivalent method.

6.2.4 If there are no bubbles for the specified time period, the sample passes the test. If bubbles are detected, measure the leakage rate using an appropriate method; the leakage rate should not be more than that specified in 6.1.2.

6.3 Internal leakage

6.3.1 The internal leakage test is applicable only to devices that are intended to be leak-tight in closed position. The aim of this test is to check the pressure tightness of the closed system.

6.3.2 Connect the inlet or outlet (as applicable) of the device to the appropriate mating connection, leaving the opposite connection(s) open.

6.3.3 Apply the test pressure to the inlet or outlet (as applicable) of the device using dry air or nitrogen as the test fluid.

6.3.4 At all applicable test temperatures mentioned in 6.4, immerse the component in a suitable test medium for $2\,\text{min}\left(^{+30}_{0}\right)\text{s}$ or use any other equivalent method.

6.3.5 If there are no bubbles for the specified time period, the sample passes the test. If bubbles are detected, measure the leakage rate using an appropriate method; the leakage rate should not be more than that specified in 6.1.2.

6.4 Test conditions

6.4.1 The device shall be pressurized at 150 % of the working pressure and then conditioned until temperature equilibrium is achieved at room temperature, as applicable, and maintained at that temperature for at least 30 min.

6.4.2 The device shall be pressurized at 150 % of the working pressure and then conditioned until temperature equilibrium is achieved at a low temperature of −40 °C or −20 °C, as applicable, and maintained at that temperature for at least 30 min.

6.4.3 The device shall be pressurized at 150 % of the working pressure and then conditioned until temperature equilibrium is achieved at high temperature of 65 °C, 85 °C or 120 °C, as applicable, and maintained at that temperature for at least 30 min.

7 Excess torque resistance

A component designed to be connected directly to threaded fittings shall be capable of withstanding, without deformation, breakage or leakage, a torque effort equal to or greater than 150 % of the rated installation value, when tested in accordance with the following test procedure.

a) Test an unused component, applying the torque adjacent to the fitting.

b) For a component having a threaded connection or threaded connections, apply the turning effort for 15 min, release it, then remove the component and examine it for deformation and breakage.

c) Subject the component to the leakage test specified in Clause 6.

d) Subject the component to the hydrostatic strength test specified in Clause 5.

8 Bending moment

A component shall be able to operate without cracking, breaking or leaking when tested in accordance with the following procedure.

a) Assemble the connections of the component, ensuring that they are leak-tight, to one or several appropriate mating connection(s) representative of the design. After assembly, the length of the inlet tubing shall be greater than 300 mm (see Figure 1).

b) The outlet connection shall be rigidly supported at a distance of 25 mm from the component outlet, except in the following cases:

— if the component has an integral mounting means that is independent of the inlet and outlet connections, the component shall be mounted using the integral mounting means specified by the manufacturer;

— if the component is intended to be mounted using either the integral mounting means or the component outlet, the mounting means that produces the most severe test condition shall be used.

c) Check this assembly for leaks according to 6.4.1 before subjecting it to step d).

d) With the component in the closed position, pressurize the system to 5 kPa and apply a force in accordance with Table 1, at 300 mm from the inlet, maintaining it for 15 min. Without removing the force, check the component for leakage in accordance with the test method given in Clause 6, at room temperature.

NOTE Depending on how this test is performed, it can be necessary to raise the load to compensate for buoyancy.

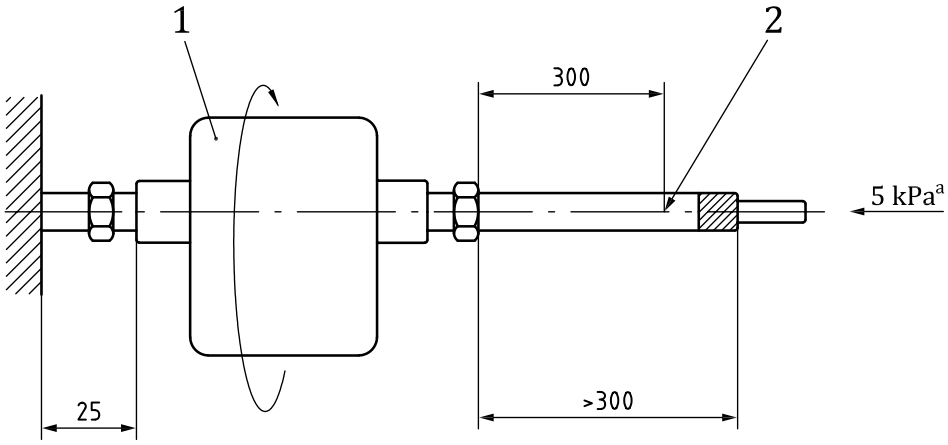
e) Perform step d) of the procedure four times, rotating the component by 90° around the horizontal axis between each test. Between tests, open and close (if applicable) the component three times with the bending moment removed.

f) At completion of the above tests, remove the component and examine it for deformation; then subject it to the leakage test specified in Clause 6 and the hydrostatic strength test specified in Clause 5.

Table 1 — Bending moment test force

Outside diameter of tubing mm	Force (minimum) N
6	3,4
8	9,0
≥12	17,0

Dimensions in millimetres



Key

1 component
2 force point
[a] 4 × 90° rotation.

Figure 1 — Bending moment

9 Continued operation

9.1 General

For details on test methods pertaining to particular components, see the respective parts of ISO 22760.

The method specified in this clause is general in nature and also applies to miscellaneous components.

Other components (those for which specific requirements are not specified) shall be subjected to the following continuous operation test for a total number of cycles to be determined by the testing agency. The determination of the total number of cycles shall be based on 15 000 fill cycles and/or 50 000 duty cycles.

9.2 Test methods

9.2.1 Test procedure

The component shall be installed as indicated and cycled using dry air, nitrogen or Dimethyl Ether, under all the appropriate loads.

Connect the component securely, using a suitable fitting, to a pressurized source of dry air, nitrogen or Dimethyl Ether, and subject it to the number of cycles specified in the ISO 22760 part corresponding to the specific component, as applicable. A cycle shall consist of one full operation and reset within an appropriate period as determined by the testing agency.