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Road vehicles — Dimethyl Ether (DME) refuelling connector with pressure equalizing port

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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.

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

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Introduction

This document was developed for the examination, testing and certification of newly produced dimethyl-ether vehicle fuelling nozzles with a pressure-equalizing port and receptacles with a pressure-equalizing port for pressure-equalization filling systems only. It applies to nozzles with a pressure equalizing port and receptacles with a pressure-equalizing port used in the dimethyl-ether pressure-equalization filling system and not to the fuel system of the vehicle.

A nozzle with a pressure-equalizing port conforming to this document will be functionally compatible from a safety and performance perspective with all listed receptacles with pressure-equalizing ports of compatible profile and system pressure. Similarly, a receptacle conforming to this document will be functionally compatible from a safety and performance perspective with all listed nozzles with pressure-equalizing ports of compatible profile and system pressure.

As there may eventually be many different kinds of nozzles with pressure-equalizing ports and receptacles with pressure-equalizing ports available from a variety of manufacturers which, for safety reasons, should all be compatible with each other, this document specifies one standardized profile of receptacle. This standard profile incorporates the design specifications (mating materials, geometry and tolerances) which may be considered in the certification of a submitted nozzle or receptacle.

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Road vehicles — Dimethyl Ether (DME) refuelling connector with pressure equalizing port

1 Scope

This document applies only to dimethyl-ether refuelling connectors with a pressure-equalizing port, hereinafter referred to as devices, constructed entirely of new, unused parts and materials. Dimethyl-ether refuelling connectors with a pressure-equalizing port consist of the following components, as applicable:

- a) nozzle with a pressure-equalizing port,

The refuelling nozzle and pressure-equalizing port are integrated so that the connecting of the refuelling path and pressure-equalizing path is performed with a single action (mounted on the dispenser side) (see [Clause 5](#)).

- b) receptacle with a pressure-equalizing port (mounted on vehicle) (see [Clause 7](#)).

This document applies to devices which use dimethyl ether as fuel, hereinafter referred to in this document as M15 [see [9.2 c](#)]:

This document applies to devices with standardised mating components.

This document applies to connectors which prevent dimethyl-ether vehicles from being fuelled by fuel-station dispensers for other gaseous fuels.

This document is applicable to dimethyl ether in accordance with ISO 16861.

All references to pressures (kPa) throughout this document are considered gauge pressures unless otherwise specified.

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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 16861, *Petroleum products — Fuels (class F) — Specifications of dimethyl ether (DME)*

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/obp>

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

**3.1
dry air**

air with moisture content such that the dew point of the air at the required test pressure is at least 11 °C below the ambient test temperature

**3.2
working pressure**

maximum pressure that a *connector* (3.7) with a pressure-equalizing port can be expected to withstand in actual service

**3.3
dimethyl ether**

DME

methoxymethane

organic compound with the formula CH_3OCH_3 , simplified to $\text{C}_2\text{H}_6\text{O}$

Note 1 to entry: Dimethyl ether is liquid below -25 °C.

**3.4
pressure-equalization filling system**

filling system in which liquefied fuel gas in a storage tank is poured into a vehicle fuel container after pressure is equalized between the vehicle fuel container and the storage tank of the filling station

Note 1 to entry: Pressure is equalized by connecting pressure-equalizing piping between the gas phase parts of the container and the storage tank.

**3.5
nozzle**

dimethyl-ether refuelling nozzle with pressure equalizing port
device which permits quick connection and disconnection of the fuel supply hose and the pressure equalizing hose to the *dimethyl-ether receptacle with pressure equalizing port* (3.6) simultaneously in a safe manner

**3.6
receptacle**

dimethyl-ether refuelling receptacle with pressure equalizing port
device connected to a vehicle or storage system which receives the *dimethyl-ether refuelling nozzle with pressure equalizing port* (3.5) and permits safe transfer of fuel and DME vapor for pressure equalizing

**3.7
connector**

dimethyl-ether refuelling connector with pressure equalizing port
joined assembly of *dimethyl-ether refuelling nozzle with pressure equalizing port* (3.5) and receptacle with pressure equalizing port

**3.8
non-sparking material**

material that does not contain, by mass, more than 7,5 % in total of magnesium, titanium and zirconium

[SOURCE: IEC 60079-0:2018, 8.3]

**3.9
service gasket**

replaceable gasket ensuring tightness of the connections between ports of the nozzle and receptacle

**3.10
cycle life**

number of connections and disconnections between the *nozzle* (3.5) and the *receptacle* (3.6) required for testing purposes

3.11

service life

number of operations of the check valve in the receptacle for testing purposes

4 General construction requirements

4.1 Nozzles and receptacles shall be designed with the following safety, durability and maintainability requirements:

- 1) Working pressure: all nozzles and receptacles are designed to have a working pressure defined by the manufacturer and clearly marked on the device (see [9.2 d](#)).
- 2) Design life: all nozzles shall be tested at 100 000 connect/disconnect cycles and all receptacles at 20 000 connect/disconnect cycles for conformity with this document. The service gasket may be changed after a minimum of 20 000 cycles.

4.2 Nozzles and receptacles shall be:

- designed to be secure against displacement, distortion, warping or other damage under normal conditions of handling and use;
- designed to release less than 1 cm³ from liquid connection and 1 cm³ from vapour connection during disconnection;
- constructed to maintain operational integrity under normal and reasonable conditions of handling and usage;
- manufactured and produced according to the test plan in [Annex B](#).

4.3 Nozzles and receptacles shall be manufactured with materials suitable and compatible for use with dimethyl ether, in accordance with ISO 16861, at the pressure and the temperature ranges to which they will be subjected.

4.3.1 The temperature range shall be:

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for the receptacle:

- moderate operating conditions: -20 °C to +85 °C;
- cold operating conditions: -40 °C to +85 °C;

for the nozzle:

- moderate operating conditions: -20 °C to +65 °C;
- cold operating conditions: -40 °C to +65 °C.

In some regions, it is possible that the temperature range specified is not sufficient. In such cases, a wider temperature range, representative of that specific region, shall be considered.

4.4 Nozzles and receptacles shall be operated either to connect or disconnect without the use of tools.

4.5 Jointing components shall provide gas tight sealing performance.

5 Nozzles

The design of the nozzle shall ensure that:

- a) it is compatible with the receptacle as specified in [Clause 6](#);

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- b) entrapment of fingers and/or cold burns are not possible;
- c) the maximum push-on force during connection is 100 N at any pressure up to 1 500 kPa in the nozzle;
- d) the maximum pull-off force during disconnection is 50 N at 1 500 kPa;
- e) the force to operate the lever, if any, applied at the centre of the grip area of the lever, is 150 N maximum at any pressure up to 1 500 kPa in the nozzle;
- f) if a latch is provided and in use, it shall be capable of being normally disarmed by the user;
- g) it is not possible to open the liquid and vapour flow paths valves in the nozzle if the nozzle is not properly locked and sealed on the receptacle;
- h) a locking mechanism is incorporated that locks in the connected position;
- i) it is not possible to unlock the nozzle from the receptacle unless the liquid and vapour flow paths valves in the nozzle are closed;
- j) internal blocking due to freezing does not occur under intended operating conditions;
- k) it will withstand a torque of 150 % of the mounting torque specified by the manufacturer without damage;
- l) the external surfaces of the nozzle are corrosion resistant or protected against corrosion and are made of materials (non-sparking materials) that do not cause sparks when dropped on a surface;
- m) changing the service gasket shall not result in any dimethyl ether release;
- n) the minimum cycle life of the service gasket is 20 000 cycles;
- o) the nozzle is provided with a means to securely attach it to the delivery hose and the pressure equalizing hose;
- p) the nozzle shall conform to the performance requirements of [Clause 10](#) to ensure interchangeability.

6 Standard receptacle dimensions

A receptacle shall conform to the design specifications detailed in [Figure 1](#).