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Rubber hoses and hose assemblies for liquefied petroleum gas in motor vehicles — Specification

Tuyaux et flexibles en caoutchouc pour circulation de gaz de pétrole liquéfié dans les véhicules à moteur — Spécifications

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Foreword

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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 ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*.

This fourth edition cancels and replaces the third edition (ISO 8789:2018), which has been technically revised. The main changes compared to the previous edition are as follows:

— in Table 2, "70 ± 1" for both lining and cover has been changed to "80 ± 1";

— in 8.2, “45° cone” has been changed to “45° flare";

— Clause 10 has been upgraded to the latest agreed upon verbiage;

— 11.1 and 11.2 have been upgraded to the latest agreed upon verbiage;

— Annexes A and B have been upgraded to the latest agreed upon verbiage.

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

This document has been developed to harmonize international requirements for LPG hoses and hose assemblies used in motor vehicles, for instance United Nations Regulation No. 67.

Rubber hoses and hose assemblies for liquefied petroleum gas in motor vehicles — Specification

1 Scope

This document specifies the requirements for rubber hoses and hose assemblies, up to a maximum hose size of 19, for use in motor vehicles with liquefied petroleum gas (LPG) installations. The hoses are designed for use up to a maximum working pressure of 3,0 MPa (30 bar) and at working temperatures from −40 °C up to and including +80 °C.

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 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 188:2011, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

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

ISO 4080:2009, *Rubber and plastics hoses and hose assemblies — Determination of permeability to gas*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 7326:2016, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8033, *Rubber and plastics hoses — Determination of adhesion between components*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

ISO 10619-2, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

ASME B1.1, *Unified Inch Screw Threads (UN and UNR Thread Form)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 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 https://www.electropedia.org/

4 Materials and construction

4.1 Materials

The hose shall consist of:

a) a smooth-bore rubber lining-resistant rubber suitable for liquefied petroleum gas;

b) a reinforcement of natural textile, synthetic textile or corrosion-resistant metal wire (stainless steel) applied by any suitable technique;

c) a cover of oil- and weather-resistant rubber (if, however, the hose is reinforced with corrosion-resistant wire, no cover is required).

4.2 Construction

The lining and cover shall be of uniform thickness, concentric and free from holes, porosity and other defects. The cover finish may be smooth or fabric-marked. To avoid the formation of bubbles due to gas permeation, the cover shall be pin-pricked.

NOTE There is a possibility that national regulations define the type of reinforcement to be used.

5 Dimensions and tolerance

5.1 Inside diameter

When measured in accordance with ISO 4671, the inside diameter shall be between the minimum and maximum values specified in Table 1.

Table 1 — Minimum inside diameter, maximum inside diameter and minimum bending radii

Hose size	Minimum inside diameter mm	Maximum inside diameter mm	Minimum bend radius mm
5,0	4,6	5,4	90
6,3	6,2	7,0	120
10	9,3	10,1	150
12,5	12,3	13,5	180
16	15,5	16,7	190
19	18,6	19,8	200

5.2 Minimum bending radii

The hoses shall not be used at bend radii, measured at the inside of the bend, smaller than the minimum bend radii specified in Table 1.

5.3 Concentricity

When determined in accordance with ISO 4671, the concentricity, based on a total indicator reading between the bore and the outside surface of the cover, shall be no greater than 1,0 mm.

5.4 Length

The length of supplied hoses and hose assemblies shall be the subject of agreement between the manufacturer and the purchaser.

NOTE Recommendations for lengths of supplied hoses and tolerances on lengths of hose assemblies are given in Table C.2.

6 Physical properties of rubber compounds

When determined by the methods listed in Table 2, the physical properties of the compounds used for the lining and cover shall conform to the values specified in Table 2.

Tests shall be carried out on test pieces taken from the hose. No tests shall be carried out within 24 h after manufacture of the hose.

Table 2 — Physical properties of rubber compounds used for cover and lining in finished hose

Property	Requirements		Test method
	Lining	Cover	
Minimum tensile strength, MPa	10,0	10,0	ISO 37 (dumb-bell test piece)
Minimum elongation at break, %	250	250	ISO 37 (dumb-bell test piece)
Resistance to ageing of lining [(168 ± 2) h at (80 ± 1) °C, using the air-oven method in ISO 188:2011]			
Resistance to ageing of cover [(336 ± 2) h at (80 ± 1) °C, using the air-oven method in ISO 188:2011]			
Change in tensile strength from original value (max.), %	±25	±25	ISO 37 (dumb-bell test piece)
Change in elongation at break from original value (max.), %	−30 to +10	−30 to +10	ISO 37 (dumb-bell test piece)
Resistance to *n*-pentane [immersion for 72 h at (23 ± 2) °C in accordance with ISO 1817]			
Change in tensile strength from original value (max.), %	±25	±35	ISO 37 (dumb-bell test piece)
Change in elongation at break from original value (max.), %	±30	±35	ISO 37 (dumb-bell test piece)
Change in volume (max.), %	±20	±30	ISO 1817 (rectangular cut piece)
NOTE In cases where it is difficult to remove suitable samples of the liner or the cover for testing, it is permissible to use vulcanised plates of either the cover or liner taken from the production batch or batches of compound used to produce the hose. It should be noted on any test report whether the test samples were taken from the hose or from vulcanised plates.			

7 Performance requirements

7.1 General

Unless otherwise specified, condition test pieces in accordance with ISO 23529 before testing.

7.2 Visual examination

All hoses and hose assemblies shall be examined for visible defects in the cover and inspected to verify that the hose identification is correct and has been properly applied and marked.

7.3 Finished hose and hose assemblies

When determined by the methods listed in Table 3, the physical properties of the finished hose shall conform to the values specified in Table 3.

Table 3 — Physical properties of finished hose and hose assemblies

Property	Requirement	Test method
Proof pressure, MPa (bar)	7,5 (75)	ISO 1402, hold for 10 min
Minimum burst pressure, MPa (bar)	15,0 (150)	ISO 1402
Adhesion between lining and reinforcement and between reinforcement and cover (min.), kN/m	2,0	ISO 8033
Ozone resistance (100 mPa ± 5 mPa) × 40 ± 1 °C × 50 ± 5 % RH × 72 h × 20 %)	No cracking observed under × 2 magnification	ISO 7326:2016, method 2
Low-temperature flexibility, −40 ± 2 °C	No cracks and shall subsequently pass the proof pressure test specified above	ISO 10619-2, minimum bend radius according to Table 1
Permeability to propane gas (max.), $cm^3/(m^2 \cdot s)$ or cm^3 per metre of hose in 24 h	0,007 or 36,0	ISO 4080:2009, method 3 Use hose size 19 for test Adjust water bath temperature to maintain a hose pressure of (1 ± 0,02) MPa

8 Requirements for fittings

8.1 Fitting material

The fittings shall be made of stainless steel, brass or plated ferrous material to prevent corrosion.

8.2 Fitting description

Fittings of the crimp-on type or of the reusable screw-together type shall be used. The swivel nut shall be provided with a UNF thread (in accordance with ASME B1.1 for inch threads) or in accordance with ISO 68-1 for metric threads, and sealing is preferably by means of a 45° flare. Other types of sealing surface are acceptable provided the hose assembly meets the test requirements. The fitting design shall be such that the fittings can be applied without removal of any cover material.

NOTE There is a possibility that the material specifications and the type of fitting used are affected by national regulations.

9 Requirements for hose assemblies

9.1 Leakage test

When the hose assembly which has be prepared from a hose (400 ± 10) mm long and filled with a propane gas at a pressure of 3,0 MPa (30 bar) is immersed in water for a period of 5 min, the assembly shall not show any sign of leakage while underwater.

9.2 Minimum burst pressure, proof pressure and permeability to propane

Hose assemblies shall meet the requirement as specified in Table 3.

9.3 Visual examination

Hose assemblies shall be inspected to verify that the correct fittings are fitted and that the hose assembly identification has been properly applied.

10 Frequency of testing

Type testing and routine testing shall be as specified in Table A.1.

Type tests are those tests required to confirm that a particular hose or hose assembly design, manufactured by a particular method from particular materials, meets all the requirements of this document. The tests shall be repeated at a maximum of five-year intervals, or whenever a change in the method of manufacture or materials used occurs. They shall be performed as specified in the product standard except those of the same size and construction.

Routine tests are those tests required to be carried out on each length of finished hose or hose assembly prior to dispatch.

Production acceptance tests are those tests, specified in Table B.1, which should preferably be carried out to control the quality of manufacture. The frequencies specified in Annex B are given as a guide only.

11 Marking

11.1 Hose marking

Hoses shall be legibly and durably marked every 750 mm with at least the following information:

a) the manufacturer's name or identification, e.g. XXX;

b) a reference to this document, i.e. ISO 8789;

c) the nominal size of the hose, e.g. 10;

d) the identification “LPG”;

e) the maximum working pressure, in megapascals and in bars, or in either, with the units indicated, e.g. 3,0 MPa (30 bar);

f) the quarter and the last two digits of the year of manufacture, e.g. 3Q19 (other date-coding methods are allowed as long as they are clear to the user).

EXAMPLE XXX/ISO 8789/10/LPG/3,0 MPa (30 bar)/3Q19.

For item b), the hose manufacturer shall use the latest publication of this document; otherwise, the year of publication shall be included in the marking.

11.2 Hose assembly marking

Hose assemblies meeting the requirements of this document shall be permanently marked with at least the following information:

a) the manufacturer's name or identification, e.g. XXX;

b) the maximum working pressure of the assembly, in megapascals and in bars, or in either, with the units indicated, e.g. 3 MPa (30 bar);

NOTE 1 The maximum working pressure of a hose assembly is equal to the maximum working pressure of the component having the lowest maximum working pressure.

c) two digits indicating the last two digits of the year of assembly followed by a slash and the two digits indicating the month of assembly, e.g. 19/08 (monthly, daily and other date-coding methods are allowed as long as they are clear to the user).

EXAMPLE XXX/3 MPa (30 bar)/19/08.

NOTE 2 Typical markings include but are not limited to stamping the fitting socket and embossing on a metal or plastic ring.