
**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

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 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 the following URL: 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 third edition cancels and replaces the second edition (ISO 8789:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

- normative references have been updated;
- requirement on physical properties of finished products has been added;
- minimum bend radii has been introduced;
- new clauses on frequency of testing and type tests have been added.

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.

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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 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 lie 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 [Annex C](#).

6 Physical properties

6.1 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 (70 ± 1) °C, using the air-oven method in ISO 188:2011]			
Resistance to ageing of cover [(336 ± 2) h at (70 ± 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 <i>n</i> -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 ·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 The fittings shall be made of stainless steel, brass or plated ferrous material to prevent corrosion.

8.2 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 ISO 68-1 for metric threads), and sealing is preferably by means of a 45° cone. 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 been 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, routine testing and the minimum frequency of such tests shall be as specified in Table A.1.

Type tests are those tests carried out in order to obtain product approval.

Routine tests are those carried out on each length of hose or hose assembly.

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

11 Type tests

Type testing is carried out in order to confirm that all the materials, construction and test requirements of this document have been met by the method of manufacture and hose design.

Type testing shall be repeated at a minimum of every five years or whenever there is a change in the method of manufacture of materials.

12 Marking

12.1 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) the number of this document, i.e. ISO 8789:2018;
- 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. 2Q18 (other date-coding methods are allowed as long as they are clear to the user).

EXAMPLE XXX/ISO 8789:2018/10/LPG/3,0 MPa (30 bar)/2Q18.

12.2 Hose assemblies shall bear the name or trademark of the assembling manufacturer and the thread size.

Annex A (normative)

Type and routine testing of production hoses and hose assemblies

Table A.1 — Type and routine testing of production hoses and hose assemblies

Property	Type tests Frequency (for each hose size): at initial product qualification, in the event of product changes after initial qualification and after 5 years	Routine tests Performed on each length of finished hose prior to ware- housing or sale
Dimensions		
Measurement of inside diameter	X	X
Measurement of concentricity	X	X
Hose tests		
Visual examination	X	X
Proof pressure test	X	N/A
Burst pressure test	X	N/A
Ozone resistance test	X	N/A
Low temperature flexibility test	X	N/A
Adhesion (between reinforcement and cover)	X	N/A
Adhesion (between lining and reinforcement)	X	N/A
Minimum tensile strength	X	X
Minimum elongation at break	X	X
Tensile strength after ageing	X	N/A
Elongation at break after ageing	X	N/A
Resistance to <i>n</i> -pentane, tensile test	X	N/A
Resistance to <i>n</i> -pentane, elongation at break test	X	N/A
Volume change in <i>n</i> -pentane test	X	N/A
Permeability to propane gas	X	N/A
Hose assembly tests		
Visual examination	X	X
Proof pressure test	X	X
Burst pressure test	X	N/A
Leakage test (see 9.1)	X	N/A
Permeability to propane gas	X	N/A
X = Test required.		
N/A = Test not applicable.		