INTERNATIONAL STANDARD

ISO 8789

Second edition
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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

Reference number
ISO 8789:2009(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 8789 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

This second edition cancels and replaces the first edition (ISO 8789:1994), which has been technically revised. The main changes are as follows:

a) The requirement for permeability to propane gas has been modified.

b) Some of the requirements of E/ECE/TRANS/505, Addendum 66: Regulation No. 67, Revision 1 (04.08.2000), *Approval of specific equipment of motor vehicles using liquefied petroleum gases in their propulsion system*, Annex 8, have been included. The impulse test has not been included since motor vehicle systems are static pressure systems and the impulse test is designed for dynamic pressure systems.

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

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard 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.

NOTE Those contracting parties that have agreed to the United Nations Regulation No. 67, Revision 1, requirements are advised to follow that document to become a qualified supplier of LPG motor vehicle hose.

2 Normative references

The following referenced documents are indispensable for the application 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, *General purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 188:2007, *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 — 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 4672:1997, *Rubber and plastics hoses — Sub-ambient temperature flexibility tests*[1)]

ISO 7326:2006, *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*

1) Under revision as ISO 10619-2.

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.

4 Materials and construction

The hose shall consist of

a) a smooth-bore lining 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).

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 National regulations may define the type of reinforcement to be used.

5 Dimensions

5.1 Internal diameter

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

Table 1 — Minimum and maximum internal diameters

Hose size	Minimum internal diameter mm	Maximum internal diameter mm
6,3	6,2	7,0
10	9,3	10,1
12,5	12,3	13,5
16	15,5	16,7
19	18,6	19,8

5.2 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.

5.3 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 Performance requirements

6.1 General

The requirements for type and routine testing are specified in Annex A and recommendations for production acceptance testing are given in Annex B. Unless otherwise specified, condition test pieces in accordance with ISO 23529 before testing.

6.2 Visual examination

All bulk hose and hose assemblies shall be inspected to verify that the hose identification has been properly applied.

6.3 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

Property	Requirements		Test method
	Lining	Cover	
Minimum tensile strength	10,0 MPa	10,0 MPa	ISO 37 (dumb-bell test piece)
Minimum elongation at break	250 %	250 %	ISO 37 (dumb-bell test piece)
Resistance to ageing [3 days at (100 ± 1) °C, using the air-oven method in ISO 188:2007]			
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 37 (dumb-bell test piece)

6.4 Finished hose

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.

In addition, hoses shall be examined for visible defects in the outer cover and to verify that the hose identification is correct and has been properly marked.

Table 3 — Physical properties of finished hose

Property	Requirement	Test method
Proof pressure	7,5 MPa (75 bar)	ISO 1402, hold for 10 min
Minimum burst pressure	15,0 MPa (150 bar)	ISO 1402
Adhesion between lining and reinforcement and between reinforcement and cover (min.)	2,0 kN/m	ISO 8033
Ozone resistance	No cracking observed under ×2 magnification	ISO 7326:2006, method 2 Ozone concentration (100 ± 5) parts per hundred million, temperature (40 ± 1) °C and (50 ± 5) % relative humidity for 72 h at 20 % elongation
Low-temperature flexibility	No cracks and shall subsequently pass the proof pressure test specified above	ISO 4672:1997, method B At (–40 ± 2) °C
Permeability to propane gas (max.)	0,007 $cm^3/(m^2 \cdot s)$ or 36,0 cm^3 per metre of hose in 24 h	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

7 Requirements for fittings

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

7.2 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 The material specifications and the type of fitting which can be used may be affected by national regulations.

8 Requirements for hose assemblies

8.1 Gas leakage

When a test assembly prepared from a hose (400 ± 10) mm long and filled with a suitable 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.

8.2 Minimum burst pressure

Hose assemblies shall meet the requirement specified in Table 3.

8.3 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.

9 Marking

9.1 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. MAN;

b) the number of this International Standard, i.e. ISO 8789:2009;

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. 4Q09 (other date-coding methods are allowed as long as they are clear to the user).

EXAMPLE MAN/ISO 8789:2009/10/LPG/3,0 MPa (30 bar)/4Q09

9.2 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

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 warehousing or sale
Visual examination	X	X
Dimensions		
Measurement of internal diameter	X	X
Measurement of concentricity	X	N/A
Hose tests		
Proof test	X	X
Burst test	X	N/A
Leakage test (hose assemblies) (see 8.1)	X	N/A
Ozone resistance	X	N/A
Cold 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	N/A
Minimum elongation at break	X	N/A
Tensile strength after ageing	X	N/A
Elongation at break after ageing	X	N/A
Resistance to *n*-pentane, tensile test	X	N/A
Resistance to *n*-pentane, elongation at break test	X	N/A
Volume change in *n*-pentane	X	N/A
Permeability to propane gas	X	N/A
X = Test shall be carried out. N/A = Test not applicable.		

Annex B
(informative)

Periodic testing of production hoses

Property	Production tests	
	Frequency: one sample every 3 000 m of each size produced	Frequency: three samples every 12 months of each size produced
Visual examination	X	X
Dimensions		
Measurement of internal diameter	X	X
Measurement of concentricity	X	X
Hose tests		
Proof test	X	X
Burst test	X	X
Leakage test (hose assemblies) (see 8.1)	X	X
Ozone resistance	N/A	X
Cold flexibility test	N/A	X
Adhesion (between reinforcement and cover)	N/A	X
Adhesion (between lining and reinforcement)	N/A	X
Minimum tensile strength	N/A	X
Minimum elongation at break	N/A	X
Tensile strength after ageing	N/A	X
Elongation at break after ageing	N/A	X
Resistance to *n*-pentane, tensile test	N/A	X
Resistance to *n*-pentane, elongation at break test	N/A	X
Volume change in *n*-pentane	N/A	X
Permeability to propane gas	N/A	X
X = Test shall be carried out. N/A = Test not applicable.		

Annex C
(informative)

Recommendations for lengths of supplied hoses and tolerances on lengths of hose assemblies

C.1 Hoses

The lengths of hoses in the manufacturer's standard pack, with the lengths marked, should preferably be within ± 2 % of the lengths indicated.

When no specific hose lengths have been ordered, the percentages of different lengths in any given delivery or pack of at least 500 m should preferably be as indicated in Table C.1.

Table C.1 — Hose lengths in delivery when no lengths specified

Length of hose	Percentage of total length
Greater than or equal to 1 m but less than or equal to 10 m	5 % max.
Greater than 10 m but less than or equal to 15 m	25 % max.
Greater than 15 m	75 % min.

C.2 Hose assemblies

The tolerances on the lengths of hose assemblies should preferably conform to the values given in Table C.2.

Table C.2 — Tolerances on lengths of hose assemblies

Length of hose assembly mm	Tolerances (up to and including nominal size 19)
Up to and including 630	$^{+7}_{-3}$ mm
Over 630 and up to and including 1 250	$^{+12}_{-4}$ mm
Over 1 250 and up to and including 2 500	$^{+20}_{-6}$ mm
Over 2 500 and up to and including 8 000	$^{+1,5}_{-0,5}$ %
Over 8 000	$^{+3}_{-1}$ %

ICS 43.060.40; 83.140.40

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