INTERNATIONAL STANDARD

ISO 1825

Third edition
2010-03-15

Rubber hoses and hose assemblies for aircraft ground fuelling and defuelling — Specification

Tuyaux et flexibles en caoutchouc pour le ravitaillement carburant et la vidange des avions au sol — Spécifications

Reference number
ISO 1825:2010(E)

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Published in Switzerland

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Foreword

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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 1825 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

This third edition cancels and replaces the second edition (ISO 1825:1996), which has been technically revised (for details, see the Introduction).

Introduction

This specification has been updated to bring it into line with the two most common specifications used for this product in the field, EN 1361:2004 and API 1529, 6th edition. As the 1996 edition of ISO 1825 was closer to EN 1361, EN 1361 was used as the basis for redrafting. Where possible, an attempt has been made to align all three specifications. As a result of this, the following changes have been made to the specification:

a) type A (hoses without any special electrical properties) has been eliminated;

b) type D (hoses with a conductive cover but without a low-extraction tube compound) has been eliminated;

c) there are now four hose types (all with a low-extraction tube);

d) a hose flammability test has been introduced;

e) a cyclic kinking test has been introduced;

f) a flex test at –30 °C has been introduced;

g) the flexibility at room temperature test is carried out at 20 °C as opposed to 23 °C originally.

Rubber hoses and hose assemblies for aircraft ground fuelling and defuelling — Specification

1 Scope

This International Standard specifies the dimensions and construction of, and requirements for, four types of hose and hose assembly for use in all operations associated with the ground fuelling and defuelling of aircraft.

All four types are designed for

a) use with petroleum fuels having an aromatic-hydrocarbon content not exceeding 30 % by volume;

b) operation within the temperature range of −30 °C to +65 °C and such that they will be undamaged by climatic conditions of −40 °C to +70 °C when stored in static conditions;

c) operation at up to 2,0 MPa (20 bar) maximum working pressure, including surges of pressure which the hose can be subjected to in service.

NOTE 1 Type C hoses are intended for general pressure applications on all vehicles used for plane fuelling. They can also be used for vehicle/rail car loading and discharge where excessive vacuum does not occur.

NOTE 2 Type F hoses can be used for plane delivery applications on vehicles that are also used for defuelling at high flow rates where type C hoses are not suitable.

NOTE 3 Type E and F hoses can also be used for vehicle/rail car loading and discharge, for trailer to fueller transfer and for elevation platform supply (riser) to provide greater kink resistance.

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

ISO 1382, *Rubber — Vocabulary*

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

ISO 1817:2005, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 2230, *Rubber products — Guidelines for storage*

ISO 4649:2002, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

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 6246, *Petroleum products — Gum content of light and middle distillate fuels — Jet evaporation method*

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

ISO 7989-1, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 1: General principles*

ISO 7989-2, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 2: Zinc or zinc-alloy coating*

ISO 8031, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1382 and ISO 8330 and the following apply.

3.1
hose assembly
hose with either permanent or reusable end fittings attached

3.2
electrically bonded hose/hose assembly
hose/hose assembly that uses a metallic wire connection to conduct static electricity

3.3
electrically conductive hose/hose assembly
hose/hose assembly that is capable of conducting static electrical charges, using a conductive rubber layer, without the use of a metallic wire

1) Under revision as ISO 10619-2.

4 Classification

Hoses for this application are classified into four types and two grades according to their construction and electrical properties.

Type	Grade	Construction
B	M	Electrically bonded, incorporating at least two low-resistance electrically conductive wires and a conductive cover compound.
C	Ω	Electrically conductive, incorporating a conductive cover compound.
E	M	Electrically bonded, incorporating at least one metallic wire helix, at least two low-resistance electrically conductive wires and a conductive cover compound. Has an enhanced defuelling capability.
F	Ω	Electrically conductive, incorporating at least one non-electrically conductive non-metallic helix and a conductive cover compound.

5 Service reeling diameter

Hoses shall be designed for operation on equipment fitted with hose reels of the diameters given in Table 1.

NOTE These hoses remain substantially circular in cross-section when reeled on drums and should not be confused with hoses of the collapsible type that are intended to be reeled flat.

Table 1 — Service reeling diameters

Nominal internal diameter of hose	Minimum external diameter of reeling drum used in service
	mm
19,0	225
25,0	300
31,5	375
38,0	450
50,0	550
63,0	600
76,0	600
100,0	900
101,5	900

6 Materials and construction

6.1 Hoses

If the hose is mandrel-built and vulcanized on a mandrel, particulate-type release agents shall not be used. The hose shall be uniform in quality and be free from porosity, air holes, foreign inclusions and other defects when inspected visually.

The hose shall comprise the following components:

— a lining of synthetic rubber resistant to petroleum fuel;

— a reinforcement consisting of layers of woven, braided or spirally wound textile material;

— an outer cover made of synthetic rubber which shall be conductive and resistant to abrasion, outdoor exposure and petroleum fuel.

For type E and F hoses only, an embedded helix reinforcement shall be included in the construction. For type E hoses, the wire reinforcement used shall be a hard steel and shall have a galvanized finish in accordance with ISO 7989-1 and ISO 7989-2.

Types B and E shall also incorporate low-resistance electrically conductive wires to ensure that the hoses are electrically conductive.

The cover may have a shallow cloth-marked finish.

6.2 Hose assemblies

In order to produce the required electrical properties, the method of attachment of the couplings shall be in accordance with Clause 9.

7 Dimensions and tolerances

7.1 Internal diameter

When measured in accordance with the most appropriate method in ISO 4671, the internal diameter shall lie within the tolerance limits specified in Table 2.

Table 2 — Internal diameters and tolerances

Internal diameter mm	Tolerance limits mm
19,0	± 0,8
25,0	± 0,8
31,5	± 0,8
38,0	± 0,8
50,0	± 1,2
63,0	± 1,2
76,0	± 1,2
100,0	± 1,6
101,5	± 1,6

7.2 Thickness

When measured in accordance with the most appropriate method in ISO 4671, the thickness of the lining shall be not less than 1,6 mm.

When measured in accordance with the most appropriate method in ISO 4671, the thickness of the cover shall be not less than 1,6 mm for hoses of nominal bore less than 50 and not less than 2,0 mm for hoses of nominal bore 50 and greater.

7.3 Concentricity

When determined in accordance with the most appropriate method in 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.

7.4 Tolerances on length

The tolerances on the measured length shall be ± 1 % of the specified length.

7.5 Mass per unit length of hose

The maximum mass per unit length shall be as given in Table 3.

Table 3 — Mass per unit length of hose

Nominal internal diameter	Maximum mass per unit length of hose	
	Types B and C kg/m	Types E and F kg/m
19,0	0,9	1,1
25,0	1,1	1,5
31,5	1,4	1,9
38,0	1,7	2,2
50,0	2,7	3,0
63,0	3,5	4,0
76,0	4,0	4,7
100,0	6,5	7,5
101,5	6,5	7,5

8 Physical properties

8.1 Rubber compounds

The physical properties of the rubber compounds used for the lining and cover shall comply with the values given in Table 4, when tested by the methods listed in Table 4. Tests shall be carried out on test pieces or test samples taken either from the hose or from separately vulcanized sheets, except for the cold embrittlement and abrasion resistance tests which shall be carried out on moulded test pieces vulcanized to the same state as the hose. The tests which shall be carried out for type testing and routine testing are given in Annex M. The tests recommended for production acceptance testing are given in Annex N.

Table 4 — Requirements for rubber compounds

Property	Unit	Requirement		Method of test
		Lining	Cover	
Tensile strength, min.	MPa	7,0	7,0	ISO 37 (dumb-bell test pieces)
Elongation at break, min.	%	250	300	ISO 37 (dumb-bell test pieces)
Change in volume (swelling) in fuel, max.	%	50	75	7.3 of ISO 1817:2005 (48 h at 40 °C in liquid B)
Fuel-soluble matter, max.	%	4,0	Not applicable	Annex A
Cold embrittlement		No cracking	No cracking	Annex B
Abrasion resistance, max.	mm^3	Not applicable	140	Method A of ISO 4649:2002
Ageing				ISO 188 (7 days at 70 °C) (air-oven method)
Tensile strength change, max.	%	± 30	± 30	ISO 37 (see above)
Elongation at break change, max.	%	± 30	± 30	ISO 37 (see above)

8.2 Finished hoses and hose assemblies

Finished hoses and hose assemblies shall meet the requirements specified in Table 5.

Table 5 — Requirements for finished hoses and hose assemblies

Property	Requirement	Method of test
Hose dimensions		
Internal diameter	See Table 2	ISO 4671
Lining thickness, min.	1,6 mm	ISO 4671
Cover thickness, min.	1,6 mm (nominal bore < 50) 2,0 mm (nominal bore 50 and greater)	ISO 4671
Concentricity, max.	1,0 mm	ISO 4671
Length tolerances	± 1 %	ISO 4671
Mass per unit length, max.	See Table 3	
Hose tests		
Adhesion between components (dry), min. After contact with fuel, min.	3,0 N/mm 2,0 N/mm	Annex C
Fuel contamination, R_e, max.	10 mg/100 ml	Annex D
Ozone resistance	No cracking observed under ×2 magnification	ISO 7326 (40 °C)
Flexibility at ambient and low temperature	No permanent deformation or visible structural damage, no increase in electrical resistance outside the specified limits, no impairment of electrical continuity and shall comply with the proof-pressure requirements in Annex J at (20 ± 5) °C.	Annex E (20 °C) Annex F (30 °C)
Crush recovery (type F only) After 1 min After 10 min	 Regains 90 % of original diameter Regains 95 % of original diameter Shall comply with the proof-pressure requirement in Annex J at (20 ± 5) °C	Annex G