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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

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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).

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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 Technical Committee 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 1825:2010), which has been technically revised.

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

— the normative references have been updated;

— fuel discoloration test has been added to bring the document in line with EI 1529.

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

1 Scope

This document 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 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 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 1817:2015, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 4649:2010, *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 6246, *Petroleum products — Gum content of 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*

ISO 10619-2:2011, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

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

3.2
electrically bonded hose/hose assembly
hose/*hose assembly* (3.1) that uses a metallic wire connection to conduct static electricity

3.3
electrically conductive hose/hose assembly
hose/*hose assembly* (3.1) that is capable of conducting static electrical charges, using a conductive rubber layer, without the use of a metallic wire

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.

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 Material 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 types 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 diameters

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	ISO 1817:2015, 8.3 (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	ISO 4649:2010, Method A
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)	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