INTERNATIONAL STANDARD

ISO 1825

Second edition
1996-12-15

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

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

Reference number
ISO 1825:1996(E)

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.

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.

International Standard ISO 1825 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 1825:1975), which has been technically revised.

Annexes A to K form an integral part of this International Standard. Annexes L and M are for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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

1 Scope

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

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 37:1994, *Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties.*

ISO 188:—[1], *Rubber, vulcanized - Accelerated ageing and heat-resistance tests.*

ISO 1382:1996, *Rubber - Vocabulary.*

ISO 1402:1994, *Rubber and plastics hoses and hose assemblies - Hydrostatic testing.*

ISO 1817:1985, *Rubber, vulcanized - Determination of the effect of liquids.*

ISO 2230:1973, *Vulcanized rubber - Guide to storage.*

ISO 4649:1985, *Rubber - Determination of abrasion resistance using a rotating cylindrical drum device.*

ISO 4671:1984, *Rubber and plastics hose and hose assemblies - Methods of measurement of dimensions.*

ISO 4672:—[2], *Rubber and plastics hoses - Subambient-temperature flexibility tests.*

1) To be published. (Revision of ISO 188:1982)

2) To be published. (Revision of ISO 4672:1988)

ISO 6246:1995, *Petroleum products - Gum content of light and middle distillate fuels - Jet evaporation method.*

ISO 7326:1991, *Rubber and plastics hoses - Assessment of ozone resistance under static conditions.*

ISO 7989:1988, *Zinc coatings for steel wire.*

ISO 8031:1993, *Rubber and plastics hoses and hose assemblies - Determination of electrical resistance.*

ISO 8033:1991, *Rubber and plastics hose - Determination of adhesion between components.*

3 Definitions

For the purposes of this International Standard the definitions given in ISO 1382 apply, together with the following.

3.1 hose assembly: A hose with either permanent or reusable end fittings attached.

4 Types

4.1 Hoses shall be of one of the following six types:

a) type A, non-electrically bonded;

b) type B, electrically bonded;

c) type C, non-electrically bonded but incorporating an antistatic cover compound;

d) type D, non-electrically bonded but incorporating an antistatic cover compound and a low fuel contaminating inner lining;

e) type E, with enhanced defuelling capability (electrically conducting and incorporating a wire helix reinforcement);

f) type F, with enhanced defuelling capability (non-electrically conducting and incorporating a non-metallic helix reinforcement and an antistatic cover).

4.2 All six types of hose shall be designed for:

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

b) operation within the temperature range - 25 °C to + 55 °C and to be undamaged by climatic conditions of - 40 °C to + 70 °C;

c) operating at the pressures given in table 4.

NOTE 1 Hoses of types A, B, C and D are primarily intended for use as fuel delivery hose to aircraft and also for the bottom loading and off-loading of fuellers and tank trucks used in aviation product service where low hydrant pressures are encountered. They remain substantially circular in cross section when reeled on drums (see table 1), and should not be confused with hoses of the collapsible type, which are intended to be reeled flat.

NOTE 2 Hoses of types E and F contain an embedded helix reinforcement and are intended for normal fuelling duties but have an enhanced defuelling capability enabling high speed defuelling operations to be performed.

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

Table 1 - Service reeling diameters

Nominal internal diameter of hose	Minimum external diameter of reeling drum used in service
mm	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

5 Construction

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 contain a lining of rubber resistant to petroleum fuel of minimum thickness 1,6 mm at any point.

The hose shall contain a reinforcement of woven, braided or spirally wound textile material. The reinforcement layers shall be treated with a compound resistant to petroleum fuel.

The hose shall contain an outer cover with a minimum thickness at any point of 1,6 mm for hoses with internal diameters between 19 mm and 31,5 mm, and 2,0 mm for hoses with internal diameters of 38,0 mm and larger. This rubber cover shall be 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 to ISO 7989.

NOTE 3 The cover may have a shallow cloth marked finish.

NOTE 4 For type F hoses a non-metallic helix reinforcement of nylon 6 or nylon 6.6 monofilament has been found to be suitable.

6 Physical properties

The physical properties of the compounds used for the lining and cover shall be as given in table 2 when tested by the methods given therein.

The physical properties of the finished hose shall be as given in table 3 when tested by the methods given therein.

No test shall be carried out within 24 h of manufacture of the hose. Test pieces shall be conditioned at a temperature of 23 °C +- 5 °C, for at least 3 h before testing; this may be part of the 24 h after manufacture.

Table 2 - Requirements for rubber compounds

Property	Requirement		Method of test
	Lining	Cover	
Minimum tensile strength (in MPa)	7,0	7,0	ISO 37 (dumb-bell test pieces)
Minimum percentage elongation at break	250	300	ISO 37 (dumb-bell test pieces)
Maximum percentage swelling in fuel	50	75	ISO 1817 (48 h at 40 °C in liquid B)
Maximum percentage fuel-soluble matter	3,0	Not applicable	Annex A
Cold embrittlement	No cracking	No cracking	Annex B
*Abrasion resistance	Not applicable	140 mm^3	Method A of ISO 4649
Resistance to ageing	Change in tensile strength and elongation at break of lining and cover shall be not greater than +- 30 % of the original value		ISO 188 (7 days at 70 °C)

* Tests shall be carried out either on test pieces taken from the hose or from separately vulcanized sheets of rubber taken from production batches.

The recommended minimum frequency of testing is given in annex M.

Table 3 - Requirements for the finished hose

Property	Requirement	Method of test
Adhesion between components		Annex C
dry	2,0 N/mm width (min)	
after contact with fuel	1,5 N/mm width (min)	
Resistance to fuel contamination		Annex D
(types A, B, C, E and F)	10 mg (max)	
(type D)	2 mg (max)	
Ozone resistance at 40 °C +- 2 °C	No cracking observed under x 2 magnification	ISO 7326
Flexibility at 23 °C +- 5 °C	No permanent deformation or visible structural damage, no increase in electrical resistance and shall comply with the proof pressure requirements given in table 4 when measured at 23 °C +- 5 °C	Annex E
Flexibility at - 25 °C +- 3 °C	As for flexibility at 23 °C +- 5 °C	ISO 4672 Method B
Crush recovery (type F only)		Annex F
after 1 min	Regain 90 % of original diameter	
after 10 min	Regain 95 % of original diameter	
Kink resistance	A kinked hose is unacceptable	Annex G

7 Pressure requirements

When tested in accordance with annex H the maximum working pressure, proof pressure and minimum bursting pressure of the hoses shall be as given in table 4.

Table 4 - Pressure rating

Maximum working pressure*	Proof pressure	Minimum bursting pressure
MPa	MPa	MPa
2,0	4,0	8,0

* It is essential that the maximum pressure, including surge pressure to which the hose is subjected in service does not exceed the permissible maximum working pressure specified.

8 Dimensions and tolerances

8.1 Internal diameters and tolerances

When measured in accordance with ISO 4671 the internal diameters and tolerances shall be as given in table 5.

Table 5 - Diameters and tolerances

Internal diameter	Tolerance
mm	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

* This size has been included to cover metric mandrel sizes fully.

8.2 Thickness

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

8.3 Concentricity

The concentricity, based on a total indicator reading between the bore and the outside surface of the cover, determined in accordance with ISO 4671, shall be not more than 1,0 mm.

8.4 Tolerance on length

The tolerance on the measured length shall be +- 1 % of the specified length.

8.5 Mass per unit length of hose

The maximum mass per unit length shall be as given in table 6.

Table 6 - Mass per unit length of hose

Nominal internal diameter	Maximum mass per unit length of hose	
	A, B, C and D	E and F
mm	kg/m	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	-
101,5	6,5	-

9 Resistance to vacuum

9.1 The hose length, as supplied, shall be tested at 23 °C +- 5 °C no earlier than 24 h after manufacture.

9.2 All sizes of hose types A, B, C and D shall be capable of withstanding a vacuum of 0,015 MPa absolute for 10 min without suffering visible structural damage.

Hoses of sizes 19 mm to 63 mm inclusive shall also withstand a vacuum of 0,085 MPa absolute without loss of circularity exceeding 20 % of the internal diameter.

9.3 Hoses of type E shall withstand a vacuum of 0,015 MPa absolute for 10 min and hoses of type F a vacuum of 0,035 MPa absolute for 10 min. When tested in accordance with annex J both types of hose shall show no visible signs of structural damage.

10 Hose assemblies

10.1 Couplings

The dimensions of the couplings shall be compatible with the dimensions of the hose. The method of attachment of the couplings shall be such that the hose assembly complies with 10.2.

10.2 Test for security of coupling attachment

Hose assemblies shall withstand, without leakage or movement of the coupling out of the hose, the test described in annex K. There shall be no visible cuts or other damage to the hose lining.

11 Electrical bonding

11.1 General

During and after subjection to the hydrostatic pressure tests described in annex H, electrical continuity of each hose shall be maintained from end to end and electrical continuity of each hose assembly shall be maintained from one coupling to the other. In addition, the hose shall show no signs of leakage or other damage, including breakdown in electrical continuity of types B and E (see 11.2) or increase in electrical resistance above the specified limits of types C, D and F (see 11.3).

11.2 Types B and E (electrically bonded)

No fewer than two low resistance electrical bonding wires shall be provided between, or incorporated in, the reinforcement plies and arranged in such a manner that electrical continuity is maintained along the length of the hose in service. Each bonding wire shall have not less than nine strands. The metal used shall have high resistance to fatigue. When attaching couplings to types B and E hoses, the protruding length of bonding wire shall be folded into the hose bore, positioned between lining and fitting tail and extend along approximately half the length of the fitting

tail. If the hose is supplied without couplings, bonding wires shall protrude approximately 150 mm at each end of the hose.

NOTE 5 A suitable method of confirming electrical continuity is by use of a 4,5 V battery and a 3,5 V, 0,3 A test bulb. A dimly lighted bulb is sufficient to indicate satisfactory continuity.

11.3 Types C, D and F (non-electrically bonded incorporating an antistatic cover compound)

When tested in accordance with ISO 8031, the electrical resistance shall be between the following limits:

$1 \times 10^3\ \Omega/m$ to $1 \times 10^6\ \Omega/m$.

NOTE 6 For these hoses it is necessary to create a bond between the cover and the coupling.

NOTE 7 The conditioning parameters should be agreed between the manufacturer and the purchaser.

12 Cleanliness

The hose bore shall be thoroughly cleansed, flushed and dried before despatch.

13 Protection for despatch

To protect the couplings and to prevent damage to the lining, corrosion-resistant protective end caps shall be fitted to all hoses and hose assemblies at the manufacturer's works after testing is completed.

Recommendations for storage are given in annex L.