INTERNATIONAL STANDARD

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Aerospace — Lightweight polytetrafluoroethylene (PTFE) hose assemblies, classification 400 °F/3 000 psi (204 °C/20 684 kPa) and 204 °C/21 000 kPa (400 °F/3 046 psi) — Procurement specification

Aéronautique et espace — Tuyauteries flexibles en polytétrafluoroéthylène (PTFE), série légère, classification 400 °F/3 000 psi (204 °C/20 684 kPa) et 204 °C/21 000 kPa (400 °F/3 046 psi) — Spécification d'approvisionnement

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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 8913 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

This third edition cancels and replaces the second edition (ISO 8913:1994). Criteria for imperial dimension (inch-based) hose assemblies as used for commercial aviation are being introduced.

Introduction

This International Standard establishes the basic performance and quality requirements for lightweight polytetrafluoroethylene (PTFE) hose assemblies for use in aerospace fluid systems.

The procurement requirements are intended to ensure that hose assemblies which are procured in accordance with this specification are of the same quality as the hose assemblies used during the original qualification testing. Compliance with these test and procurement requirements is necessary for hose assemblies that are used in fluid systems where a malfunction would affect the safety of flight.

Aerospace — Lightweight polytetrafluoroethylene (PTFE) hose assemblies, classification 400 °F/3 000 psi (204 °C/20 684 kPa) and 204 °C/21 000 kPa (400 °F/3 046 psi) — Procurement specification

1 Scope

This International Standard specifies requirements for lightweight polytetrafluoroethylene (PTFE) hose assemblies for use in aircraft hydraulic systems at temperatures between − 55 °C and 204 °C (− 65 °F and 400 °F), and at a nominal pressure up to 3 000 psi (20 684 kPa) or 21 000 kPa (3 046 psi). The hose assemblies are also suitable for use within the same temperature and pressure limitations in aircraft pneumatic systems where some gaseous diffusion through the wall on the PTFE liner may be tolerated.

The use of these hose assemblies in high-pressure pneumatic storage systems is not recommended. In addition, installations in which the limits specified in this International Standard are exceeded, or in which the application is not covered specifically by this International Standard, for example for oxygen, are subject to the approval of the purchaser.

Annex A is a listing of hose assembly procurement standards conforming to this International Standard.

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 2685:1998, *Aircraft — Environmental test procedure for airborne equipment — Resistance to fire in designated fire zones*

ISO 2859-1:1999, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3161:1999, *Aerospace — UNJ threads — General requirements and limit dimensions*

ISO 5855-3:1999, *Aerospace — MJ threads — Part 3: Limit dimensions for fittings for fluid systems*

ISO 6772:1988, *Aerospace — Fluid systems — Impulse testing of hydraulic hose, tubing and fitting assemblies*

ISO 7258:1984, *Polytetrafluoroethylene (PTFE) tubing for aerospace applications — Methods for the determination of the density and relative density*

ISO 8829:1990, *Aerospace — Polytetrafluoroethylene (PTFE) hose assemblies — Test methods*

ISO 8829-2, *Aerospace — Test methods for polytetrafluoroethylene (PTFE) inner-tube hose assemblies — Part 2: Non-metallic braid*

EN 9100, *Aerospace series — Quality management systems — Requirements (based on ISO 9001:2000) and Quality systems — Model for quality assurance in design, development, production, installation and servicing (based on ISO 9001:1994)*

EN 9133, *Aerospace series — Quality management systems — Qualification procedure for aerospace standard parts*

SAE AS150, *Hose assembly, type classifications of, basic performance and fire resistance*

SAE AS1055, *Fire testing of flexible hose, tube assemblies, coils, fittings and similar system components*

SAE AS7003, *Nadcap program requirements*

SAE AS7112, *National aerospace and defense contractors accreditation program (Nadcap) requirements for fluid system components*

ASTM A262, *Standard practices for detecting susceptibility to intergranular attack in austenitic stainless steels*

PRI PD2101, *Aerospace quality assurance, product standards, qualification procedure, fluid systems*

3 Classification

Hose assemblies furnished under this International Standard shall be classified as follows:

— Type A — 3 000 psi (20 684 kPa) pressure system,

— Type B — 21 000 kPa (3 046 psi) pressure system.

When no classification is specified by reference to this International Standard, type B shall apply.

4 Requirements

4.1 Qualification

4.1.1 General

Hose assemblies supplied in accordance with this International Standard shall be representative of products which have been subjected to and which have successfully passed the requirements and tests specified in this International Standard.

4.1.2 Manufacturer qualification

Manufacturer approval shall be granted by outside agency procedure as specified in Table B.1, procedure no. 1).

4.1.3 Product qualification

Product approval shall be granted by outside agency procedure as specified in Table B.1, procedure no. 2.

4.2 Materials

4.2.1 General

The hose assembly materials shall be as described in this International Standard (see, in particular, Table C.1). All materials not specifically described in this International Standard shall be of the highest quality and suitable for the purpose intended.

4.2.2 Metals

Metals used in the hose and fittings shall be corrosion-resistant steel, nickel alloy or titanium, and shall conform to the applicable specifications given in Table 1 (or equivalent specifications; see Annex C).

4.3 Construction

4.3.1 General

The hose assembly shall consist of:

— a seamless PTFE inner tube (see 4.3.2),

— corrosion-resistant steel wire reinforcement (see 4.3.3), and

— corrosion-resistant steel, nickel alloy and/or titanium end fittings (see 4.3.4),

as required to meet the construction and performance requirements laid down in this International Standard and as required for its intended use.

4.3.2 Inner tube

The inner tube shall be of a seamless construction of PTFE resin of uniform gauge; it shall have a smooth bore and shall be free from pitting and projections on the inner surface. Additives may be included in the compound from which the tube is extruded with no more than 2 % of such additives being retained in the mixture.

4.3.3 Reinforcement

The reinforcement shall consist of corrosion-resistant steel wire conforming to the applicable specifications given in 4.2.2. The wires shall be arranged over the inner tube so as to provide sufficient strength to ensure compliance with the requirements laid down in this International Standard.

Broken or missing reinforcing wires shall be cause for rejection; crossed-over reinforcing wires shall not be cause for rejection of the flexible hose assembly.

4.3.4 Fittings

4.3.4.1 General

It shall be proven that all fittings comply with the requirements laid down in this International Standard.

4.3.4.2 Insert fittings

Insert fittings shall be manufactured in one piece wherever possible; those made of other than one-piece construction shall be butt-welded, fabricated unless otherwise agreed by the purchaser, from corrosion-resistant steel or nickel alloy tubing, or titanium. Welded and redrawn tubing (materials 8 and 9; see Annex C) may be used.

Table 1 — Metals to be used in hose assemblies

Form	Metal	Material no. (see Annex C)
Bars and forgings	Austenitic, annealed or as-rolled, corrosion-resistant steel	1
	Austenitic, annealed or as-rolled, stabilized, corrosion-resistant steel	2 to 4
	Precipitation-hardening, corrosion-resistant steel	5 to 8
	Titanium 6Al-4V	9
	Nickel alloy type 625	10
Tubing	Austenitic, seamless or welded, annealed, corrosion-resistant steel	11
	Austenitic, seamless or welded, stabilized, corrosion-resistant steel	12 and 13
	Austenitic, welded and drawn, high-pressure, corrosion-resistant steel	14
	Cold-worked, stress-relieved, titanium alloy	15
	Nickel alloy, type 625, seamless or welded, annealed	16
Wire	Austenitic, cold-drawn, corrosion-resistant steel	17 to 20

4.3.4.3 End fitting collars (sockets)

All end fitting collars (sockets), crimped or swaged, fabricated from type 304 stainless steel, shall be capable of passing an embrittlement test as specified in ASTM A262, practice E, prior to assembly to the fitting and subsequent crimp or swaging operation. Collars (sockets) fabricated from stabilized austenitic steel (Type 304L, 321 or 347) are acceptable without being subjected to the embrittlement test.

4.4 Inner tube

4.4.1 Density and relative density

The density of the hose inner tube shall not exceed 2,155 g/cm^3 when tested in accordance with ISO 7258:1984, either method A or method B. The relative density shall not exceed 2,204 g/cm^3 when tested in accordance with ISO 7258:1984, method C.

4.4.2 Tensile strength

When tested in accordance with ISO 8829:1990, 4.2, the longitudinal tensile strength for all tube sizes shall be at least 15,1 MPa (2 200 psi).

When tested in accordance with ISO 8829:1990, 4.2, the transverse tensile strength for sizes DN16 (−10) and larger shall be at least 12,4 MPa (1 800 psi); for sizes under DN16 (−10), the transverse strength need not be tested.

4.4.3 Elongation

When tested in accordance with ISO 8829:1990, 4.2, the elongation shall be at least 200 %.

4.4.4 Tube roll

The tube shall not leak, split, burst or show any signs of malfunction, when tested through the sequence as specified in ISO 8829:1990, 4.3.2.

4.4.5 Tube proof pressure

After being subjected to the tube roll test sequence (see 4.4.4), the tube, without reinforcing wires, shall not leak, burst or show any signs of malfunction, when tested as specified in ISO 8829:1990, 4.3.3.

4.4.6 Electrical conductivity

When tested in accordance with ISO 8829:1990, 4.4, the electrical current shall be equal to or greater than

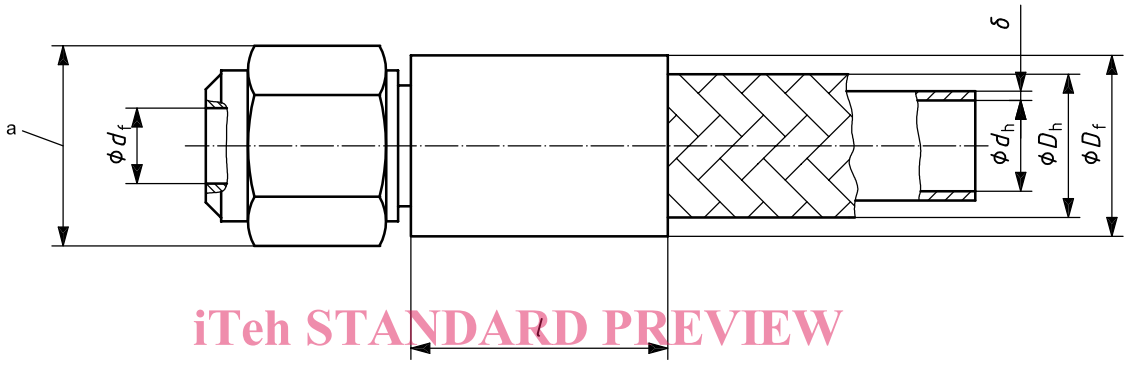
a) 6 µA for sizes DN06 to DN12 (inclusive) (–04 to –08);

b) 12 µA for sizes DN16 (–10) and over.

4.5 Hose

4.5.1 Dimensional requirements

The hose assembly dimensions, except for length, shall be as specified in Figure 1 and Table 2A or 2B.



a See footnote b to Table 2a or 2b.

Figure 1 — Hose and fitting dimensions

Table 2a — Hose and fitting dimensions as shown in Figure 1 — Imperial units

Dimensions in inches

Hose size	Hose (braided)			Fitting		Attachment length	Wall thickness of inner tube		Spherical ball size for hose assembly inside diameter [a]	
	Inside diameter	Outside diameter		Inside diameter	Outside diameter [b]					
	d_h	D_h		d_f	D_f	l	δ			
(nom.)	min.	min.	max.	min.	max.	max.	min.	max.	Straight fittings	Elbow fittings
04	0,212	0,360	0,390	0,135	0,690	0,98	0,035	0,046	0,122	0,115
06	0,298	0,455	0,490	0,240	0,800	1,09	0,035	0,046	0,216	0,204
08	0,391	0,585	0,615	0,340	0,970	1,33	0,040	0,051	0,306	0,289
10	0,485	0,690	0,730	0,410	1,100	1,36	0,045	0,056	0,369	0,349
12	0,602	0,950	0,990	0,508	1,380	1,40	0,045	0,056	0,459	0,434
16	0,852	1,230	1,270	0,760	1,660	1,60	0,045	0,056	0,684	0,646

[a] Minimum specified inside diameter shall be verified by passing a spherical ball through the hose assembly (see 4.5.3)

[b] Width across corners of nut and socket hexagon may exceed the values given for D_f.

Table 2b — Hose and fitting dimensions as shown in Figure 1 — SI units

Dimensions in millimetres

Hose size	Hose (braided)			Fitting		Attachment length	Wall thickness of inner tube		Spherical ball size for hose assembly inside diameter [a]	
	Inside diameter	Outside diameter		Inside diameter	Outside diameter [b]					
	d_h	D_h		d_f	D_f	l	δ			
(nom.)	min.	min.	max.	min.	max.	max.	min.	max.	Straight fittings	Elbow fittings
DN06	5,4	9,1	9,9	3,4	17,5	24,9	0,9	1,2	3,1	2,9
DN10	7,6	11,6	12,4	6,1	20,3	27,7	0,9	1,2	5,5	5,2
DN12	9,9	14,9	15,6	8,6	24,6	33,8	1	1,3	7,7	7,3
DN16	12,3	17,5	18,5	10,4	28	34,5	1,1	1,4	9,4	8,8
DN20	15,3	24,1	25,1	12,9	35	35,6	1,1	1,4	11,7	11
DN25	21,6	31,2	32,3	19,3	42,2	40,6	1,1	1,4	17,4	16,4

[a] Minimum specified inside diameter shall be verified by passing a spherical ball through the hose assembly (see 4.5.3)

[b] Width across corners of nut and socket hexagon may exceed the values given for D_f.

4.5.2 Physical requirements

The hose assemblies shall comply with the physical and weight/linear density requirements specified in Table 3.

Table 3 — Physical requirements of hose assemblies and linear density (weight) of hose

Hose size (nom.)		Linear density (weight) of hose [a] max.		Bend radius at inside of bend min.		Volumetric expansion max.	
SI	Imperial	kg/mm	(lb/in)	mm	(in)	ml/m	(cm^3/in)
DN06	**04**	0,17	(0,009)	38	(1,50)	2,6	(0,065)
DN10	**06**	0,27	(0,015)	63	(2,50)	3,4	(0,085)
DN12	**08**	0,36	(0,020)	73	(2,88)	5,3	(0,135)
DN16	**10**	0,48	(0,027)	82	(3,25)	8,7	(0,220)
DN20	**12**	0,98	(0,058)	101	(4,00)	11,8	(0,300)
DN25	**16**	1,52	(0,085)	127	(5,00)	29,5	(0,750)

[a] The linear density (weight) of the hose shall be determined on a minimum length of 300 mm (12 in), as applicable.

4.5.3 Bore check

The hose assembly shall permit the free passage of a solid rigid sphere throughout its length. See Table 2a or 2b as applicable.