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**Aerospace — Hose assemblies in  
polytetrafluoroethylene (PTFE) for use  
up to 232 °C and 10 500 kPa — Technical  
specifications and requirements**

*Aéronautique et espace — Tuyauteries flexibles en  
polytétrafluoroéthylène (PTFE), pour utilisation jusqu'à 232 °C et  
10 500 kPa — Spécifications techniques et exigences*

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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 10502 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

This second edition cancels and replaces the first edition (ISO 10502:1992), which has been technically revised as follows:

- a) requirements have been aligned to ISO 8829-1;
- b) units in inches have been added;
- c) in 3.4.1, the requirement relating to relative density has been updated;
- d) in 3.7, length tolerances have been added; [ISO 10502:2012](https://standards.iteh.ai/catalog/standards/sist/94a37d6d-2691-446a-9369-014574679cc0/iso-10502-2012)
- e) in 3.9.3, a requirement has been added to include as a permanent marking on the hose assembly the fire resistance type according to ISO 2685; <https://standards.iteh.ai/catalog/standards/sist/94a37d6d-2691-446a-9369-014574679cc0/iso-10502-2012>
- f) Annex A, dealing with equivalent materials and components, has been updated.

# Aerospace — Hose assemblies in polytetrafluoroethylene (PTFE) for use up to 232 °C and 10 500 kPa — Technical specifications and requirements

## 1 Scope

This International Standard specifies requirements for polytetrafluoroethylene (PTFE) hose assemblies for use in aircraft hydraulic, fuel and lubricating oil systems at temperatures between –55 °C (–67 °F) and 232 °C (450 °F) for Class I assemblies and between –55 °C (–67 °F) and 135 °C (275 °F) for Class II assemblies, and at nominal pressures up to 10 500 kPa (1 523 psi) (105 bar<sup>1)</sup>). The hose assemblies are also suitable for use within the same temperature and pressure limitations in aerospace pneumatic systems where some gaseous diffusion through the wall of the PTFE liner is tolerated.

This International Standard covers hose assemblies of the following classes:

- class I: hose assemblies with fitting of corrosion-resistant steel or titanium parts [232 °C (450 °F)];
- class II: hose assemblies with fitting of corrosion-resistant steel and aluminium parts [135 °C (275 °F)], DN12 and larger.

The hose assemblies specified in this International Standard are not intended for use in pneumatic storage systems. In addition, it is intended that 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, be subject to the approval of the purchaser.

## 2 Normative references

ISO 10502:2012  
<https://standards.iteh.ai/catalog/standards/sist/94a37d6d-2691-446a-9369-014544699ce0/iso-10502-2012>

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

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

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

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

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

ISO 8829-1:2009, *Aerospace — Test methods for polytetrafluoroethylene (PTFE) inner-tube hose assemblies — Part 1: Metallic (stainless steel) braid*

1) 1 bar = 100 kPa.

### 3 Requirements

#### 3.1 Qualification

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

#### 3.2 Materials

##### 3.2.1 General

The hose assemblies shall be uniform in quality and free from defects in material as is consistent with good manufacturing practice. They shall conform to the applicable specifications and requirements of this International Standard.

##### 3.2.2 Metals

Corrosion-resistant steel shall be used for the hose; fittings shall be of corrosion-resistant steel, titanium, or aluminium alloy suitably treated to resist corrosion when in storage or during normal service use. Metals shall conform to the applicable specifications given in Table 1 (or equivalent specifications; see Annex A).

**Table 1 — Metals for use in hose assemblies**

Form	Metal	Material No. (see Annex A)
Bars and forgings	Austenitic, annealed or as-rolled, corrosion-resistant steel	1
	Austenitic, annealed or as-rolled, heat-stabilized, corrosion-resistant steel	2 and 3
	Precipitation-hardening, corrosion-resistant steel, solution heat treated and in artificially aged condition	4, 5 and 6
	Titanium 6Al-4V	7 and 23
	Aluminium alloy 2014	17
	Aluminium alloy 2024	18
	Aluminium alloy 6061	19 and 20
Tubing	Austenitic, seamless or welded, annealed, corrosion-resistant steel	8
	Austenitic, seamless or welded, stabilized, corrosion-resistant steel	9 and 10
	Titanium 3Al-2,5V	11
	Titanium T40	24
	Aluminium alloy 5052	21
	Aluminium alloy 6061	22
Wire	Austenitic, cold-drawn, corrosion-resistant steel	12, 13 and 14

#### 3.3 Construction

##### 3.3.1 General

The hose assembly shall consist of

- a seamless PTFE inner tube (see 3.3.2),
- corrosion-resistant steel-wire reinforcement (see 3.3.3), and
- aluminium, corrosion-resistant steel or titanium end-fittings (see 3.3.4),

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

### 3.3.2 Inner tube

The inner tube shall be of a seamless construction of virgin PTFE resin of uniform gauge; it shall have a smooth bore and shall be free from pitting or projections on the inner surface. Additives may be included in the compound from which the tube is extruded.

### 3.3.3 Reinforcement

The reinforcement shall consist of corrosion-resistant steel wires conforming to the applicable specifications given in 3.2.2. The wires shall be arranged on the outside surface of the inner tube so as to provide sufficient strength to ensure compliance with the requirements of this International Standard.

Broken or missing reinforcing wires or buckled wires more than 1,5 mm (0.06 in) above the outside diameter surface shall be cause for rejection. Crossed-over reinforcing wires need not be cause for rejection of the hose assembly.

### 3.3.4 Fittings

#### 3.3.4.1 General

It shall be proven that all fittings comply with the requirements of this International Standard. The hose attachment fitting may be of a permanent or of a reusable design.

Unless otherwise specified by the purchaser, the hose assembly end fittings shall have 24° cone fittings.

#### 3.3.4.2 Insert fittings

Insert fittings shall be manufactured in one piece wherever possible. Those constructed of more than one piece shall have either welded joints using butt-weld or lap-weld design, or braze joints using lap-braze design, fabricated from annealed corrosion-resistant steel, titanium or aluminium alloy tubing. Welded and redrawn tubing (materials No. 8 and No. 9; see Annex A) may be used for corrosion-resistant steel.

## 3.4 Inner tube requirements

### 3.4.1 Density and relative density

The relative density of the hose inner tube shall not exceed 2,210 g/cm<sup>3</sup> (0.079 8 lb/in<sup>3</sup>) when tested in accordance with ISO 7258, either method A or method B (as specified in ISO 8829-1). The density shall not exceed 2,155 g/cm<sup>3</sup> (0.077 9 lb/in<sup>3</sup>) when tested in accordance with ISO 7258, method C (as specified in ISO 8829-1).

### 3.4.2 Tensile strength

When tested in accordance with ISO 8829-1:2009, 4.2, the longitudinal tensile strength for all sizes of tubes shall be at least 15,1 N/mm<sup>2</sup> (2 190 psi)<sup>2)</sup>.

When tested in accordance with ISO 8829-1, the transverse tensile strength for sizes DN16 and larger shall be at least 12,4 N/mm<sup>2</sup> (1 798 psi); for sizes under DN16, the transverse strength need not be tested.

### 3.4.3 Elongation

When tested in accordance with ISO 8829-1, the elongation shall be at least 200 %.

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2) 1 N/mm<sup>2</sup> = 1 MPa.

### 3.4.4 Tube roll

The tube shall not leak, split, burst or show any signs of malfunction, when tested through the sequence specified in ISO 8829-1.

### 3.4.5 Tube proof pressure

After being subjected to the tube roll test sequence (see 3.4.4), the tube, without reinforcing wires, shall not leak, burst or show any signs of malfunction, when tested as specified in ISO 8829-1.

### 3.4.6 Electrical conductivity

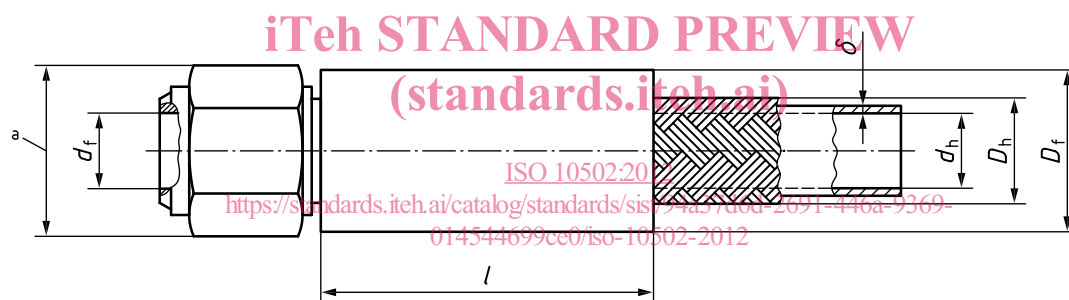
When tested in accordance with ISO 8829-1:2009, 4.4, the electrical current shall be greater than or equal to

- a) 10  $\mu$ A for sizes DN05 to DN12 (incl.), or
- b) 20  $\mu$ A for sizes DN16 and over.

## 3.5 Hose

### 3.5.1 Dimensional requirements

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



- <sup>a</sup> Width across corners of nut and socket hexagon may exceed the values given for  $D_t$  (see footnote b of Table 2).

Figure 1 — Hose and fitting dimensions



Table 2 — Hose and fitting dimensions (see Figure 1)

Dimensions in millimetres (inches)

Hose dash size	Hose size  (nom.)	Hose (braided)			Fitting		Attach- ment length  <i>l</i>  max.	Wall thickness of inner tube  <i>δ</i>		Number of braids
		Inside diameter  <i>d<sub>h</sub></i>  min.	Outside diameter  <i>D<sub>h</sub></i>  min.    max.		Inside diameter <sup>a</sup>  <i>d<sub>f</sub></i>  min.	Outside diameter <sup>b</sup>  <i>D<sub>f</sub></i>  max.		min.	max.	
-03	DN05	2,3 (0.091)	5,8 (0.228)	6,8 (0.268)	2 (0.079)	12,7 (0.500)	31,8 (1.252)	0,89 (0.035)	1,19 (0.047)	1
-04	DN06	4,4 (0.173)	7,7 (0.303)	9,5 (0.374)	3,4 (0.134)	14,2 (0.559)	31,8 (1.252)			
-05	DN08	5,8 (0.228)	9,3 (0.366)	10,6 (0.417)	4,9 (0.193)	16 (0.630)	34,3 (1.350)			
-06	DN10	7,6 (0.299)	10,9 (0.429)	12,7 (0.500)	6,5 (0.256)	18 (0.709)	37 (1.457)			
-08	DN12	9,9 (0.390)	13,9 (0.547)	15,6 (0.614)	8,5 (0.335)	21,4 (0.843)	44 (1.732)	0,97 (0.038)	1,27 (0.050)	
-10	DN16	12,3 (0.484)	16,3 (0.642)	20,3 (0.799)	11 (0.433)	26 (1.024)	49 (1.930)	1,07 (0.042)	1,37 (0.054)	
-12	DN20	15,6 (0.614)	19,5 (0.768)	23,0 (0.906)	13,8 (0.543)	30 (1.181)	55,1 (2.169)			
-16	DN25	21,6 (0.850)	27,4 (1.079)	29,0 (1.142)	19,7 (0.776)	38,6 (1.520)	65 (2.559)			
-20	DN32	28 (1.102)	33,7 (1.327)	35,3 (1.390)	25,4 (1.000)	50,8 (2.000)	66,1 (2.600)	1,14 (0.045)	1,45 (0.057)	2
-24	DN40	34,1 (1.343)	41,6 (1.638)	43,3 (1.705)	31,7 (1.248)	58 (2.283)	68,1 (2.681)	1,65 (0.065)	1,96 (0.077)	

<sup>a</sup> Minimum inside diameter through the elbow area may be 0,8 mm (0.031 in) less than the values given for *d<sub>f</sub>*.

<sup>b</sup> Width across corners of nut and socket hexagon may exceed the values given for *D<sub>f</sub>*.

### 3.5.2 Physical requirements

Hose assemblies shall comply with the physical and linear density (weight) requirements; refer to the relative dash size as specified in Table 3.

### 3.5.3 Bore check

When bent to the appropriate minimum bend radius as specified in Table 3, the hose assembly shall permit the free passage of a solid rigid sphere throughout its length. The diameter of the sphere shall be 90 % of the appropriate minimum internal diameter of the end fittings as specified in Table 2. For elbow fittings, see footnote a to Table 2.

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

Hose dash size	Hose size (nom.)	Maximum hose weight <sup>a</sup>  kg/m (lb/in)	Operating pressure  kPa (psi)	Proof pressure  kPa (psi)	Burst pressure		Bend radius at inside of bend  min.  mm (in)	Volumetric expansion  max.  ml/m (cm <sup>3</sup> /in)	Effusion  (per 1/2 h)  ml/m (cm <sup>3</sup> /ft)	Effusion after stress degradation  (per min)  ml/m (cm <sup>3</sup> /in)	Negative pressure  kPa (inHg)
					min. Room temp. kPa (psi)	High temp. kPa (psi)					
-03	DN05	0,089 (0.005)	10 500 (1 500)	21 000 (3 000)	83 000 (12 000)	48 000 (7 000)	50 (1.97)	1,1 (0.028)	13 (4.0)	394 (10.0)	95 (28)
-04	DN06	0,129 (0.007)	10 500 (1 500)	21 000 (3 000)	83 000 (12 000)	48 000 (7 000)	50 (1.97)	1,1 (0.028)	13 (4.0)	315 (8.0)	95 (28)
-05	DN08	0,147 (0.008)	10 500 (1 500)	21 000 (3 000)	69 000 (10 000)	45 000 (6 500)	50 (1.97)	1,6 (0.041)	16 (4.9)	315 (8.0)	95 (28)
-06	DN10	0,183 (0.010)	10 500 (1 500)	21 000 (3 000)	62 000 (9 000)	45 000 (6 500)	100 (3.94)	—	16 (4.9)	315 (8.0)	95 (28)
-08	DN12	0,235 (0.013)	10 500 (1 500)	21 000 (3 000)	56 000 (8 100)	41 000 (6 000)	120 (4.72)	—	16 (4.9)	158 (4.0)	95 (28)
-10	DN16	0,305 (0.017)	10 500 (1 500)	21 000 (3 000)	48 000 (7 000)	38 000 (5 500)	140 (5.51)	—	16 (4.9)	79 (2.0)	95 (28)
-12	DN20	0,486 (0.027)	7 000 (1 000)	14 000 (2 000)	34 000 (5 000)	24 000 (3 500)	165 (6.50)	—	20 (6.1)	79 (2.0)	70 (21)
-16	DN25	0,863 (0.048)	8 750 (1 250)	17 500 (2 500)	34 000 (5 000)	24 000 (3 500)	190 (7.48)	—	26 (7.9)	79 (2.0)	50 (15)
-20	DN32	1,110 (0.062)	7 000 (1 000)	14 000 (2 000)	27 500 (4 000)	21 000 (3 000)	280 (11.02)	—	26 (7.9)	79 (2.0)	35 (10)
-24	DN40	1,500 (0.084)	7 000 (1 000)	14 000 (2 000)	27 500 (4 000)	21 000 (3 000)	355 (13.98)	—	26 (7.9)	79 (2.0)	30 (9)

<sup>a</sup> Hose weight shall be determined on a minimum length of 300 mm.

### 3.6 Screw threads

Unless otherwise specified (see 3.3.4), fitting threads shall be in accordance with ISO 5855-3. A 10 % increase in the tolerance of the fitting thread of the nut following proof testing need not be cause for rejection of the hose assembly.

### 3.7 Length tolerances

Tolerances on hose assembly lengths shall be as follows:

- $\pm 3,18$  mm (0.125 in) for lengths < 457,2 mm (18 in);
- $\pm 6,35$  mm (0.250 in) for lengths  $\geq 457,2$  mm (18 in) and < 914,4 mm (36 in);
- $\pm 12,7$  mm (0.500 in) for lengths  $\geq 914,4$  (36 in) and < 1 270 mm (50 in);
- $\pm 25,4$  mm (1.0 in) for lengths  $\geq 1 270$  mm (50 in).

### 3.8 Part numbering of interchangeable parts

All parts complying with this International Standard and having the same manufacturer's or standard part number shall be functionally and dimensionally interchangeable.

### 3.9 Identification of products

#### 3.9.1 General

The hose assembly and its component parts shall be permanently marked.

#### 3.9.2 Fittings

The hose manufacturer's name or trade mark shall be permanently marked on one element of all end fittings.

#### 3.9.3 Hose assembly

A permanent marking shall be applied on a fitting or on a permanent band or bands securely attached to the hose. Bands shall be no wider than 25 mm (0.98 in) and shall not impair the flexibility or the performance of the hose. Unless otherwise specified, the marking on the fitting or band shall include the following information:

- a) the assembly manufacturer's name or trade mark, and the number of this International Standard (i.e. ISO 10502);
- b) the complete hose assembly part number;
- c) the nominal pressure, "10 500 kPa (1 523 psi)" or as applicable according to Table 3;
- d) the operating temperature, "232 °C (450 °F)" or "135 °C (275 °F)" (as applicable), if required;
- e) the pressure test symbol, "PT";
- f) the date of manufacture of the hose assembly, expressed in terms of month and year, or the batch number;
- g) fire resistance type according to ISO 2685 (as applicable).

### 3.10 Workmanship

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#### 3.10.1 General

The hose assembly, including all parts, shall be constructed and finished in a thoroughly workmanlike manner. All surfaces shall be free from burrs and sharp edges.

#### 3.10.2 Dimensions and tolerances

All pertinent dimensions and tolerances, where interchangeability, operation or performance of the hose assembly may be affected, shall be specified on all drawings.

#### 3.10.3 Cleaning

All hose assemblies shall be free from oil, grease, dirt, moisture, cleaning solvents and other foreign materials, both internally and externally.

Hose assemblies shall be inspected as follows when properly cleaned.

- a) Visually inspect hose assembly ends for installation of plug or cap at fitting. Both ends should be firmly capped. An uncovered fitting nipple end shall be cause for rejection.
- b) Remove caps or plugs, place a light source at one end of the hose assembly and visually examine the hose assembly, without magnification, from the opposite end. Oil, grease, dirt, moisture or any other foreign materials shall be cause for rejection.