

# DRAFT INTERNATIONAL STANDARD

## ISO/DIS 9938

ISO/TC 20/SC 10

Secretariat: DIN

Voting begins on:  
2020-09-16

Voting terminates on:  
2020-12-09

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### Aerospace — Polytetrafluoroethylene (PTFE) hose assemblies, classification 204 °C/28 000 kPa — Procurement specification

*Aéronautique et espace — Tuyauteries flexibles en polytétrafluoroéthylène (PTFE), classification 204 °C/28 000 kPa — Spécification d'approvisionnement*

ICS: 49.080; 83.140.40

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Reference number  
ISO/DIS 9938:2020(E)

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Published in Switzerland

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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.

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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document 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 9938:1994), which has been technically revised.

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

- clause 2, Normative references, was updated;
- references in the whole document were updated;
- column "Material No." was added to Table 1;
- note in 4.3.4.1 General (Fittings) was deleted;
- Annex A now only contains the equivalent components.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

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# Aerospace — Polytetrafluoroethylene (PTFE) hose assemblies, classification 204 °C/28 000 kPa — Procurement specification

## 1 Scope

This International Standard specifies requirements for polytetrafluoroethylene (PTFE) hose assemblies for use in aircraft hydraulic systems at temperatures between -55 °C and +204 °C and at a nominal pressure up to 28 000 kPa (280 bar). 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 of 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, shall be subject to the approval of the purchaser.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 2685:2022  
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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*

## 3 Terms and definitions

No terms and definitions are listed in this document.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

## 4 Requirements

### 4.1 Qualification

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.

### 4.2 Materials

#### 4.2.1 General

The hose assembly materials shall be as described in this International Standard. 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 or titanium and shall conform to the applicable specifications described in Table 1.

**Table 1 — Metals to be used in hose assemblies**

Form	Metal	Material No.
Bars and forgings	Austenitic, annealed or as-rolled, corrosion-resistant steel	AMS 5639 (304)
	Austenitic, annealed or as-rolled, stabilized, corrosion-resistant steel	AMS 5645 (321), AMS 5646 (347)
	Precipitation-hardening, corrosion-resistant steel	AMS 5643 (17-4), AMS 5644, AMS 5743
	Titanium 6Al-4V	AMS 4928 (6-4)
Tubing	Austenitic, seamless or welded, annealed, corrosion-resistant steel	MIL-T-8504 (304)
	Austenitic, seamless or welded, stabilized, corrosion-resistant steel	MIL-T-8808 (321), MIL-T-8808 (321)
	Cold-worked, stress-relieved titanium alloy	AMS 4945
Wire	Austenitic, cold-drawn, corrosion-resistant steel	AMS 5689, AMS 5690, AMS 5697

### 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 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 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 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 on the outside surface of 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 or buckled wires more than 1,5 mm above the outside diameter surface shall be cause for rejection. Overlapping or 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. Unless otherwise specified by the purchaser, the hose assemblies shall have flareless fittings (24° cone coupling).

##### 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, unless otherwise agreed by the purchaser, fabricated from corrosion-resistant steel tubing or titanium. Welded and redrawn tubing (materials No. 8 and No. 9) may be used for corrosion-resistant steel.

#### 4.4 Inner tube requirements

##### 4.4.1 Density and relative density

The relative density of the hose inner tube shall not exceed 2,155, when tested in accordance with ISO 7258, either method A or method B (as specified in ISO 8829-1). The density shall not exceed 2,204 g/cm<sup>3</sup>, when tested in accordance with ISO 7258, method C (as specified in ISO 8829-1).

##### 4.4.2 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> 1).

When tested in accordance with ISO 8829-1:2009, 4.2, the transverse tensile strength for sizes DN16 and larger shall be at least 12,4 N/mm<sup>2</sup>; for sizes under DN16, the transverse strength need not be tested.

##### 4.4.3 Elongation

When tested in accordance with ISO 8829-1:2009, 4.2, the elongation shall be at least 200 %.

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

#### 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 8829-1:2009, 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 8829-1:2009, 4.3.3.

#### 4.4.6 Electrical conductivity

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

- a) 10  $\mu$ A for sizes DN06 to DN12 (inclusive);
- b) 20  $\mu$ A for sizes DN16 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 2.

#### 4.5.2 Physical requirements

Hose assemblies shall comply with the physical and linear density (weight) requirements specified in Table 3.

#### 4.5.3 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) in Table 2.

### 4.6 Screw threads

Unless otherwise specified (see 4.3.4), 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 shall not be cause for rejection of the hose assembly.

### 4.7 Part numbering of interchangeable parts

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

### 4.8 Identification of products

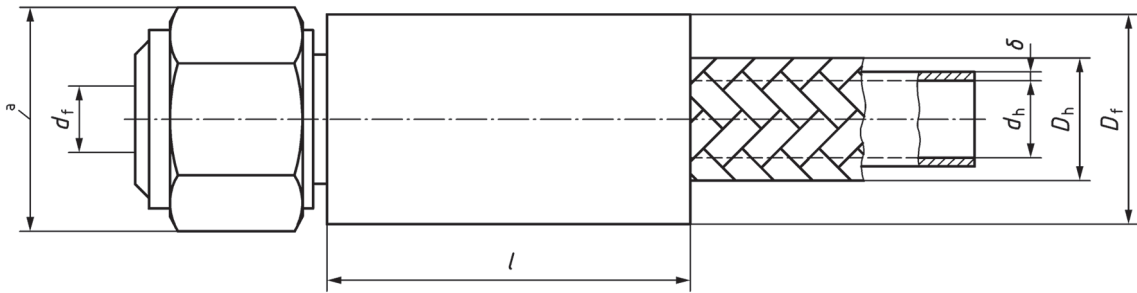
#### 4.8.1 General

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

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**Key**

a See footnote b) to Table 2

**Figure 1 — Hose and fitting dimensions**

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

Dimensions in millimetres

Hose size (nom.)	Hose (braided)		Fitting		Attachment length $l$ max.	Wall thick-ness of inner tube $\delta$ min.
	Inside diam-eter $d_h$ min.	Outside diameter $D_h$ min. max.	Inside diam-eter <sup>a</sup> $d_f$ min.	Outside diameter <sup>b</sup> $D_f$ max.		
DN06	5,4	10,1 12,6	3,4	23	58	0,9
DN10	7,6	14,0 15,8	6,1	26	64	
DN12	9,9	17,0 20,9	8,6	31	70	1
DN16	12,3	21,6 24,6	10,4	36	76	1,1
DN20	15,3	25,1 30,5	12,9	43	83	
DN25	21,6	30,7 38,1	19,3	51	96	

<sup>a</sup> Minimum inside diameter through the elbow area may be 85 % of the values given for  $d_f$ .

<sup>b</sup> Width across corners of nut and socket hexagon may exceed the values given for  $D_f$ .

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

Hose size	Hose weight <sup>a</sup> max. kg/m	Operating pressure kPa	Proof pressure kPa	Burst pressure		Bend radius at inside of bend min. mm	Volumetric expansion max. ml/m
				Room temperature min. kPa	High temper-ature min. kPa		
DN06	0,4	28 000	56 000	112 000	84 000	76	3,2
DN10	0,66					127	4,7
DN12	0,81					146	6,7
DN16	1,25					165	10,8
DN20	1,7					197	14,8
DN25	2,86					245	37

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