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# Aerospace — Test methods for polytetrafluoroethylene (PTFE) inner-tube hose assemblies —

## Part 2: Non-metallic braid

*Aéronautique et espace — Méthodes d'essai des tuyauteries flexibles à tube intérieur en polytétrafluoroéthylène (PTFE) —*

*Partie 2: Tuyauteries à gaine non métallique*



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# Contents

Page

# 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 8829-2 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.



ISO 8829-2 cancels and replaces ISO 8829:1990, which has been technically revised.



ISO 8829 consists of the following parts, under the general title *Aerospace — Test methods for polytetrafluoroethylene (PTFE) inner-tube hose assemblies*:



— *Part 1: Metallic (stainless steel) braid*

— *Part 2: Non-metallic braid*

## Introduction

This part of ISO 8829 is intended to standardize the test methods for qualification of polytetrafluoroethylene (PTFE) hose and hose assemblies used in aircraft fluid systems. The tests are intended to simulate the most strenuous demands encountered in aircraft. Compliance with these test methods is necessary for hose and hose assemblies which are used in systems where a malfunction could affect the safety of flight.



 

# Aerospace — Test methods for polytetrafluoroethylene (PTFE) inner-tube hose assemblies —

## Part 2: Non-metallic braid

## 1 Scope

This part of ISO 8829 specifies test methods for flexible polytetrafluoroethylene (PTFE) inner tubes with non-metallic braided hose and hose assemblies used in aircraft fluid systems, in the pressure and temperature ranges covered by pressure classes and temperature types, as specified in ISO 6771.

This part of ISO 8829 applies to the hose and the hose coupling. The tests and assembly requirements for the connecting end fittings are covered in the procurement specification.

This part of ISO 8829 is applicable when reference is made to it in a procurement specification or other definition document.



NOTE Fluids used for the tests are listed in Annex A.



## 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 6771[1)], *Aerospace — Fluid systems and components — Pressure and temperature classifications*

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

ISO 6773:1994, *Aerospace — Fluid systems — Thermal shock testing of piping and fittings*

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

1) To be published. (Revision of ISO 6771:1987)

 

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1**
**fire sleeve**
flame- and heat-retardant element, normally tubular, slipped over the hose assembly and fastened to the hose fitting

**3.2**
**fire-cover**
flame- and fire-retardant element, normally (silicone) rubber, moulded over the hose and hose fittings

## 4 Test temperature

Unless otherwise specified, tests shall be conducted between 15 °C and 32 °C (59 °F and 90 °F).

## 5 Tests on PTFE inner tubes

### 5.1 Density and relative density

#### 5.1.1 Principle



The test is intended to control the crystallinity of PTFE inner tubes.

#### 5.1.2 Test methods



The relative density of the PTFE tubing shall be measured in accordance with ISO 7258:1984, method A or method B. The density of the PTFE tubing shall be measured in accordance with ISO 7258:1984, method C.

### 5.2 Tensile tests

#### 5.2.1 Principle

This test is intended to determine the mechanical properties of the PTFE tubing.

#### 5.2.2 Test conditions

Test specimens shall be conditioned for at least 2 h at room temperature prior to testing.

#### 5.2.3 Apparatus

##### 5.2.3.1 Testing machine

The test shall be carried out using a power-driven machine which is capable of maintaining a uniform rate of jaw separation at 50 mm/min (2 in/min) and which has a suitable dynamometer and a device for measuring the force applied within ± 2 %. If the capacity range cannot be changed during a test, as in the case of pendulum dynamometers, the force applied at breaking point shall be measured within ± 2 %, and the smallest tensile force measured shall be accurate to within ± 10 %. If the dynamometer is of the compensating type for measuring tensile stress directly, means shall be provided to make adjustments for the cross-sectional area of the test specimen. The response of the recorder shall be sufficiently rapid for the force applied to be measured accurately during the elongation of the test specimen to breaking point. If the test machine is not equipped with a recorder, a device shall be provided that indicates, after fracture, the maximum force applied during elongation. Testing machines shall be capable of measuring elongation in increments of 10 %.

 

#### 5.2.3.2 Micrometer

The micrometer used for measuring flat test specimen thickness shall be capable of exerting a pressure of 25 kPa ± 5 kPa (3,63 psi ± 0,7 psi) on the test specimens, and of measuring the thickness to within ± 0,025 mm (0,001 in).

Dial micrometers exerting either a force of 0,8 ± 0,15 N (0,18 lbf ± 0,034 lbf) on a circular foot 6,35 mm (0,25 in) in diameter or a force of 0,2 ± 0,04 N (0,045 lbf ± 0,009 lbf) on a circular foot 3,2 mm (0,125 in) in diameter conform to the pressure requirement specified above. A micrometer should not be used to measure the thickness of test specimens narrower in width than the diameter of the foot, unless the contact pressure is properly adjusted.

### 5.2.4 Calibration of testing machine

The testing machine shall be calibrated.

If the dynamometer is of the strain-gauge type, the test machine shall be calibrated at one or more forces at regular intervals.

### 5.2.5 Test specimens

The specimens shall be in accordance with Figure 1.

NOTE Careful maintenance of the cutting edges of the die is extremely important and can be achieved by light daily honing and touching up of the cutting edges with jeweler's hard honing stones. The condition of the die may be assessed by determining the breaking point on any series of broken test specimens. When broken test specimens are removed from the jaws of the test machine, it is advantageous to pile these test specimens and note if there is any tendency to break at or near the same portion of each test specimen. Breaking points consistently occurring at the same place may be an indication that the die is dull, nicked or bent at that particular position.



Dimensions in millimetres

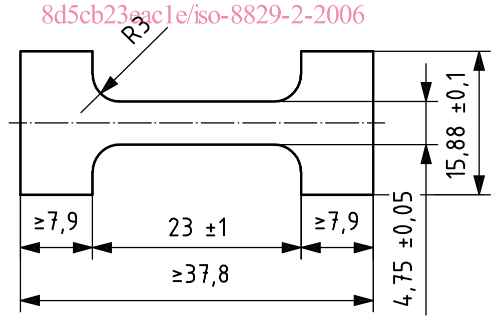


**Figure 1 — Test specimen for tensile test**

### 5.2.6 Determination of tensile strength and elongation

#### 5.2.6.1 Procedure

Place the test specimens (see 5.2.5) in the jaws of the testing machine (5.2.3.1), taking care to adjust the specimen symmetrically so that the tension will be distributed uniformly over the cross-section. Start the machine and note continuously the distance between the jaws, taking care to avoid parallax. At fracture, measure and record the elongation to the nearest 10 % on the scale.

#### 5.2.6.2 Expression of results

Calculate the tensile strength, $R_m$, in newtons per square millimetre[2)], using the following equation:

$$R_m = \frac{F}{S}$$

where

$F$ is the measured force, in newtons, required to fracture the test specimens;

$S$ is the cross-sectional area, in square millimetres, of the test specimen before application of force.

Calculate the percentage total elongation at fracture, $A_t$, using the following equation:

$$A_t = \left( \frac{L_u - L_o}{L_o} \right) \times 100$$

where

$L_u$ is the length measured between the jaws at fracture of the test specimen;

$L_o$ is the original length measured between the jaws before application of force.

## 5.3 Rolling and proof-pressure tests



### 5.3.1 Principle

This test is intended to check that there are no flaws in the sintered tube.



### 5.3.2 Rolling test — Procedure

Pass each tube, in a single pass, through six sets of metal rollers so that it is subjected to the sequence of diametral flexings specified in Table 1; rollers shall be arranged to prevent inadvertent rotation in the tube. It is assumed that the tube is in a horizontal position and that pressure of the first set of rollers is exerted vertically; angles given for the final three sets of rollers may be taken as either clockwise or counterclockwise from the vertical diameter of the tube. Roller angles shall be as specified in Table 1. A tolerance of ± 2° is allowed on each roller angle. The roller gap dimensions shall not be larger than those specified in Table 2 for each size.

**Table 1 — Roller functions and angles**

| Set of metal rollers | Type of action | Roller angle |
|---|---|---|
| 1 | Flattening | 0° |
| 2 | Flattening | 90° |
| 3 | Rounding | 0° |
| 4 | Flattening | 45° |
| 5 | Flattening | 135° |
| 6 | Rounding | 45° |

2) 1 N/mm$^2$ = 1 MPa

 

**Table 2 — Roller gap dimensions[3)]**

| Hose size | | | | Flattening gap max. | | | | Rounding gap max. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Metric part | Inch part | Equivalent outside diameter of tube | | Class B 10 500 kPa (1 523 psi) and lower nominal pressure | | Class D 21 000 kPa (3 046 psi) and higher nominal pressure | | Class B 10 500 kPa (1 523 psi) and lower nominal pressure | | Class D 21 000 kPa (3 046 psi) and higher nominal pressure | |
| Size | Size | mm | (in) | mm | (in) | mm | (in) | mm | (in) | mm | (in) |
| DN05 | – 03 | 4,762 | (0,187) | 5,2 | (0,203) | 5,2 | (0,203) | 5,5 | (0,218) | 6,4 | (0,250) |
| DN06 | – 04 | 6,350 | (0,250) | 5,5 | (0,218) | 7,1 | (0,281) | 5,5 | (0,218) | 6,4 | (0,250) |
| DN08 | – 05 | 7,937 | (0,312) | 5,5 | (0,218) | — | — | 6,4 | (0,250) | — | — |
| DN10 | – 06 | 9,525 | (0,375) | 5,5 | (0,218) | 7,1 | (0,281) | 7,9 | (0,312) | 8,3 | (0,328) |
| DN12 | – 08 | 12,700 | (0,500) | 5,9 | (0,234) | 8,3 | (0,328) | 9,5 | (0,375) | 11,9 | (0,469) |
| DN16 | – 10 | 15,875 | (0,625) | 6,4 | (0,250) | 8,3 | (0,328) | 12,7 | (0,500) | 14,7 | (0,578) |
| DN20 | – 12 | 19,050 | (0,750) | 6,4 | (0,250) | 8,3 | (0,328) | 12,7 | (0,500) | 17,5 | (0,688) |
| DN25 | – 16 | 25,400 | (1,000) | 6,4 | (0,250) | 8,3 | (0,328) | 19,1 | (0,750) | 21,0 | (0,828) |
| DN32 | – 20 | 31,750 | (1,250) | 7,9 | (0,312) | 11,1 | (0,438) | 22,2 | (0,875) | 25,4 | (1,000) |
| DN40 | – 24 | 38,100 | (1,500) | 9,5 | (0,375) | — | — | 31,8 | (1,250) | — | — |



### 5.3.3 Proof-pressure test — Procedure

After the roll test, hold the tube for not less than 2 min. at proof pressures as shown in Table 3, using water or air as the test medium.



**Table 3 — Proof pressure[3)]**

| Hose size | | | | Proof pressure | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Metric part | Inch part | Equivalent outside diameter of tube | | Class B 10 500 kPa (1 523 psi) and lower nominal pressure | | Class D 21 000 kPa (3 046 psi) and higher nominal pressure | | Nominal pressure 10 342 kPa (1 500 psi) and lower nominal pressure | | Nominal pressure 20 684 kPa (3 000 psi) and higher nominal pressure | |
| Size | Size | mm | (in) | kPa | (psi) | kPa | (psi) | kPa | (psi) | kPa | (psi) |
| DN05 | – 03 | 4,762 | (0,187) | 2 690 | (390) | 3 310 | (480) | 2 690 | (390) | 3 310 | (480) |
| DN06 | – 04 | 6,350 | (0,250) | 2 480 | (360) | 2 620 | (380) | 2 480 | (360) | 2 620 | (380) |
| DN08 | – 05 | 7,937 | (0,312) | 2 000 | (290) | — | — | 2 000 | (290) | — | — |
| DN10 | – 06 | 9,525 | (0,375) | 1 590 | (230) | 1 930 | (280) | 1 590 | (230) | 1 930 | (280) |
| DN12 | – 08 | 12,700 | (0,500) | 1 240 | (180) | 1 520 | (220) | 1 240 | (180) | 1 520 | (220) |
| DN16 | – 10 | 15,875 | (0,625) | 1 170 | (170) | 1 170 | (170) | 1 170 | (170) | 1 170 | (170) |
| DN20 | – 12 | 19,050 | (0,750) | 965 | (140) | 890 | (130) | 965 | (140) | 890 | (130) |
| DN25 | – 16 | 25,400 | (1,000) | 621 | (90) | 660 | (95) | 621 | (90) | 660 | (95) |
| DN32 | – 20 | 31,750 | (1,250) | 448 | 65) | 660 | (95) | 448 | (65) | 660 | (95) |
| DN40 | – 24 | 38,100 | (1,500) | 310 | (45) | — | — | 310 | (45) | — | — |

3) Special size high pressure hose assembly callout shall utilize lower hose size value noted.

 