INTERNATIONAL STANDARD

ISO 8913

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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

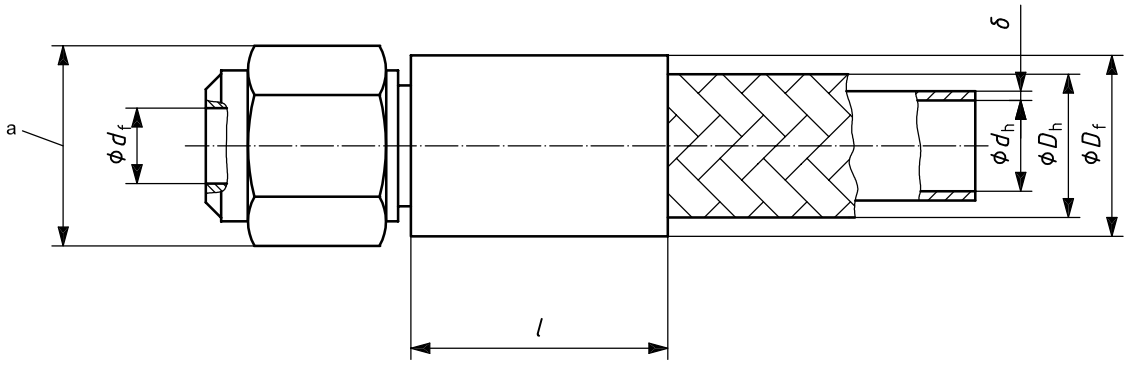
a) 6 µA for sizes DN06 to DN12 (inclusive) (−04 to −08);

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.

4.5.4 Assembly length

Tolerances on hose assembly lengths shall be as specified in 4.5.4.1 and 4.5.4.2, unless otherwise specified.

4.5.4.1 Imperial (inch) units (Type A)

a) ± 0,125 in for lengths under 18 in.

b) ± 0,250 in for lengths from 18 in to 36 in exclusive.

c) ± 0,500 in for lengths from 36 in to 50 in exclusive.

d) ± 1 % for lengths of 50 in and over.

4.5.4.2 SI (metric) units (Type B)

a) ± 5 mm for lengths under 500 mm.

b) ± 10 mm for lengths from 500 mm to 1 000 mm exclusive.

c) ± 15 mm for lengths from 1 000 mm to 1 500 mm exclusive.

d) ± 1 % for lengths of 1 500 mm and over.

4.6 Screw threads

Unless otherwise specified (see 4.3.4), fitting threads shall be in accordance with ISO 3161 for imperial (inch) fittings and ISO 5855-3 for SI (metric) fittings. A 10 % increase in the tolerance of the fitting thread of the nut during assembly and 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 manufacturer's or standard's 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.

4.8.2 Fittings

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

4.8.3 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 (1 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 hose assembly manufacturer's name or trademark (optional);

b) ISO 8913 type A or type B, as applicable;

c) the hose assembly manufacturer's CAGE/NATO code;

d) the complete hose assembly part number;

e) the nominal pressure "21 000 kPa" or "3 000 psi", as applicable;

f) the operating temperature "204 °C" or "400 °F", as applicable;

g) the pressure test symbol "PT";

h) the date of hose assembly manufacture, expressed in terms of month and year or batch number;

i) fire resistance type according to ISO 2685, SAE AS1055 or SAE AS150, when applicable.

4.9 Workmanship

4.9.1 General

Workmanship shall be of such quality as to ensure that hose assemblies furnished under this specification are free of defects that compromise, limit or reduce performance or intended use.

Hose assemblies shall be free of burrs, scratches, sharp edges, loose components, chips or foreign materials.

4.9.2 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.

4.9.3 Cleaning

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

4.10 Hose assembly — Test and performance requirements

4.10.1 Proof pressure

When tested in accordance with ISO 8829:1990, 5.8, each hose assembly shall withstand the proof pressure specified in Table 4a or 4b, as applicable, without malfunction or leakage.

4.10.2 Elongation and contraction

When test specimens of the sample hose assemblies are tested in accordance with ISO 8829:1990, 5.5, there shall be no more than a ± 2 % change in length in a 250 mm (10 in) gauge length.

Table 4a — Pressure requirements for Type A hose assemblies — Imperial units

Hose size (nom.)	Operating pressure psi (kPa)	Proof pressure psi (kPa)	Burst pressure	
			Room temperature min. psi (kPa)	High temperature min. psi (kPa)
04	3 000 (20 685)	6 000 (41 368)	16 000 (110 320)	12 000 (82 740)
06			14 000 (96 530)	10 500 (72 400)
08				
10			12 000 (82 740)	9 000 (62 055)
12				
16				

Table 4b — Pressure requirements for Type B hose assemblies — SI units

Hose size (nom.)	Operating pressure kPa (psi)	Proof pressure kPa (psi)	Burst pressure	
			Room temperature min. kPa (psi)	High temperature min. kPa (psi)
DN06	21 000 (3 046)	42 000 (6 091)	84 000 (12 183)	63 000 (9 137)
DN10				
DN12				
DN16				
DN20				
DN25				

4.10.3 Volumetric expansion

When test specimens of the sample hose assemblies are tested in accordance with ISO 8829:1990, 5.6, the volumetric expansion shall not exceed the limits specified in Table 3, as applicable.

4.10.4 Leakage

When test specimens of the sample hose assemblies are tested in accordance with ISO 8829:1990, 5.7, there shall be no leakage.

4.10.5 Thermal shock and burst at high temperature

4.10.5.1 Preconditioning

Two test specimens of the sample hose assemblies shall be tested: one test specimen shall be air-aged (see 5.5.6.2) and the other shall be unaged (see 5.5.6.3).

4.10.5.2 Requirement

When tested in accordance with ISO 8829:1990, 5.17, the test specimens shall neither leak nor show any signs of malfunction during the proof pressure phase of the test. During the burst pressure phase of the test, if leakage or signs of malfunction occur below the minimum burst pressure at the high temperature specified in Table 4a or 4b, as applicable, the samples shall be deemed to have failed.

4.10.6 Impulse

4.10.6.1 Preconditioning

Six sample hose assemblies having a 90° elbow fitting on one end of the hose and a straight fitting on the other end of the hose shall be tested.

Two test specimens shall be oil-aged, two air-aged and two unaged (see 5.5.6).

After this initial preconditioning, subject the test specimens at room temperature to the proof pressure specified in Table 4a or 4b, as applicable, for at least 5 min. Then pressurize the test specimens to 21 000 kPa or 3 000 psi, as applicable. While maintaining this pressure at room temperature, immerse the test specimens in a 35 g/l ± 1 g/l sodium chloride solution — the sodium chloride solution shall contain a dry basis containing mass fractions of not more than 0,1 % sodium iodide and 0,5 % total impurities — for 8 min to 10 min. Allow to dry in air for the remainder of 1 h. Repeat this subsequent immersion and air-drying process no fewer than 50 times.

4.10.6.2 Requirement

When tested in accordance with ISO 8829:1990, 5.10 (i.e. in accordance with ISO 6772), the sample hose assemblies shall comply with the test requirements without any signs of leakage [see also 7 h)].

Size DN20 (12) and larger may be bent in a 90° configuration, in lieu of 180° as defined in ISO 8829:1990, 5.10, at a reduced length as noted in Table 5a or 5b, as applicable, to reduce fluid volume.

Table 5a — Length of test specimens — Imperial units

Dimensions in inches

Hose size	Length of test specimens				
	for impulse tests (4.10.6) (six specimens, nos. 7 to 12)	for flexure tests (4.10.7) (two specimens, nos. 1 and 2)	for electrical conductivity test (4.10.13) (one specimen, no. 15)	for fire resistance (4.10.14) (three specimens, nos. 16 to 18)	for other tests (six specimens, nos. 3 to 6 and nos. 13 and 14)
04	12	16	One sample for each size with a specimen length as specified in ISO 8829-2	27	18
06	15	19			
08	18	21			
10	21	23			
12	25 (18)[a]	27			
16	31 (23)[a]	32			

[a] Value in parentheses is the reduced assembly length if testing is performed at 90° bend in lieu of 180°.

Table 5b — Length of test specimens — SI units

Dimensions in millimetres

Hose size	Length of test specimens				
	for impulse tests (4.10.6) (six specimens, nos. 7 to 12)	for flexure tests (4.10.7) (two specimens, nos. 1 and 2)	for electrical conductivity test (4.10.13) (one specimen, no. 15)	for fire resistance (4.10.14) (three specimens, nos. 16 to 18)	for other tests (six specimens, nos. 3 to 6 and nos. 13 and 14)
DN06	300	400	One sample for each size with a specimen length as specified in ISO 8829-2	600	500
DN10	400	500			
DN12	500				
DN16		600			
DN20	600 (450)[a]	700			
DN25	800 (600)[a]	800			

[a] Value in parentheses is the reduced assembly length if testing is performed at 90° bend in lieu of 180°.

4.10.7 Flexure

When test specimens of the sample hose assemblies are flexure tested in accordance with ISO 8829:1990, 5.11, they shall not leak or show any other sign of malfunction. The test specimens shall be mounted in the test setup as shown in ISO 8829:1990, 5.11, Figure 6, having the dimensions specified in Table 6, as applicable.

Table 6 — Flexure test dimensions

SI units (dimensions in millimetres)			Imperial units (dimensions in inches)		
Hose size (nom.)	**Inside bend radius** r ± 10 %	**Length** l (approx.)	**Hose size** (nom.)	**Inside bend radius** r ± 10 %	**Length** l (approx.)
DN06	38	82	**04**	1,50	3,50
DN10	63	136	**06**	2.50	5,62
DN12	73	158	**08**	2,88	6,50
DN16	82	180	**10**	3,25	7,25
DN20	101	222	**12**	4,00	9,00
DN25	127	280	**16**	5,00	11,12

4.10.8 Stress degradation

When test specimens of the sample hose assemblies are tested in accordance with ISO 8829:1990, 5.1, they shall not exceed an average rate of effusion of 80 ml/min per metre of hose length or 2,0 cm^3/min per inch of hose length, as applicable, for any size.

4.10.9 Pneumatic surge

When test specimens of the sample hose assemblies are tested in accordance with ISO 8829:1990, 5.16, the inner tube of the test specimens shall not collapse or show signs of degradation.

4.10.10 Pneumatic effusion

When test specimens of the sample hose assemblies are tested in accordance with ISO 8829:1990, 5.2, they shall not exceed a total rate of effusion of 26 ml/m of hose length or 8 cm^3 per foot of hose length, as applicable, for any size.

4.10.11 Repeated installation

4.10.11.1 Procedure

Test specimens of the sample hose assemblies shall be tested as follows. Screw end fittings of the hose assemblies to appropriate union adapters eight times using system fluid or an equivalent lubricant. Each of the eight cycles shall include the complete removal of the hose fitting from the union adapter. Tighten fitting nuts to the torque values specified in Table 7; test one half of the samples to the minimum tightening torque and test the other half to the maximum tightening torque. Following the first, fourth, and eight installations, carry out a proof pressure test in accordance with 4.10.1. Following the eighth installation, pressure test the hose fittings with air or nitrogen gas for 5 min at the nominal system pressure.

4.10.11.2 Requirement

The hose assembly end fittings shall show no signs of leakage, galling or other malfunction.

Table 7 — Repetitive installation torque values

Hose fitting size		Torque values							
		24° cone fitting				8°30′ dynamic beam fitting			
		Nm		(lb·in)		Nm		(lb·in)	
SI	Imperial	min.	max.	min.	max.	min.	max.	min.	max.
DN06	**04**	15	22	(135)	(190)	17	19	(151)	(168)
DN10	**06**	24	32	(215)	(280)	31	34	(270)	(300)
DN12	**08**	53	62	(470)	(550)	49	54	(432)	(480)
DN16	**10**	70	84	(620)	(745)	67	75	(594)	(660)
DN20	**12**	97	119	(855)	(1 055)	85	95	(756)	(840)
DN24	**16**	129	155	(1 140)	(1 370)	104	115	(918)	(1 020)

4.10.12 Burst pressure at room temperature

When test specimens of the sample hose assemblies are tested in accordance with ISO 8829:1990, 5.9.3, they shall not leak or burst at any pressure below the burst pressure at room temperature specified in Table 4a or 4b, as applicable.

4.10.13 Electrical conductivity

When tested in accordance with ISO 8829:1990, 5.3, hose assemblies shall be capable of conducting a direct current equal to or greater than

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

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

4.10.14 Fire resistance

4.10.14.1 Procedure

If the hose assemblies are required to withstand a specified resistance to fire, three test specimens of the sample hose assemblies may be fitted with appropriate fire sleeves. Table B.2 gives the appropriate fire resistance test specification.

NOTE On occasions, a test may not be valid because of failure to hold the flame temperature at the specified value; for this reason, it is advisable to prepare additional hose assemblies for this test.

4.10.14.2 Requirement

The test specimens shall withstand the effects of the flame without leakage for the following periods as appropriate:

— fire-resistant assemblies, 5 min;

— fire-proof assemblies, 15 min.

5 Quality assurance

5.1 Responsibility for inspection

Unless otherwise specified in the contract or purchase order, the supplier is responsible for carrying out all inspections and tests in accordance with the requirements specified in this International Standard.

Unless otherwise specified, the supplier may use his own facilities or any commercial laboratory acceptable to the procuring activity. The purchaser reserves the right to perform any of the inspections set out in this International Standard where such inspections are deemed necessary to ensure that supplies and services conform to specified requirements.

5.2 Classification of inspections

The examining and testing of hose assemblies shall be classified as

— qualification inspections (see 5.3);

— quality conformance inspections (see 5.4).

5.3 Qualification inspections

5.3.1 Qualification test samples

Test samples shall consist of the number of test specimens specified in Table 8, and the number and lengths of test specimens specified in Table 5a or 5b, as applicable.

Table 8 — Qualification test sequence and number of test specimens in sample

Relevant inspection/test		Inner tube only	Sample hose assemblies																	
			Test specimen no.																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4.3	Construction (General examination)[a]	XX																		
4.4.1	Density and relative density[a]	XX																		
4.4.2	Tensile strength[a]	XX																		
4.4.3	Elongation[a]	XX																		
4.4.4	Tube roll[a]	XX																		
4.4.5	Tube proof pressure[a]	XX																		
4.4.6	Electrical conductivity[a]	XX																		
4.5 to 4.9	(General examination)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.10.1	Proof pressure		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.10.2	Elongation and contraction		X	X																
4.10.3	Volumetric expansion				X	X														
4.10.4	Leakage						X	X												
4.10.5	Thermal shock and burst at high temperature						X	X												
4.10.6	Impulse[b] unaged								X	X										
	air-aged										X	X								
	oil-aged												X	X						
4.10.7	Flexure		X	X																
4.10.8	Stress degradation														X	X				
4.10.9	Pneumatic surge														X	X				
4.10.10	Pneumatic effusion				X	X														
4.10.11	Repeated installation		X	X																
4.10.12	Burst pressure at room temperature				X	X														
4.10.13	Electrical conductivity																X			
4.10.14	Fire resistance (if required)																	X	X	X

NOTE X means one inspection/test; grey-shaded areas mean not applicable.

[a] Production lot records may be used to verify conformance to these tests if the PTFE tube of the hose assembly being used is an established production item.

[b] These test specimens shall have a 90° elbow fitting on one end of the hose and a straight-type fitting on the other end of the hose. If approval is being sought for both the bent-tube and the forged-elbow configurations, the one-half of the sample (i.e. three test specimens) shall use the bent elbows, while the other half of the sample shall have the forged elbows.

5.3.2 Test report, test samples and data for the purchaser

If the tests are carried out at a location other than the laboratory of the purchaser, the following information shall be made available to the purchaser on request.

a) Test report — three copies of a test report which shall include a report of all tests and outline description of the tests and conditions.

b) Test sample — the sample which was tested, when requested by the purchaser. Samples subjected to qualification tests shall not be shipped as part of a contract or purchase order.

c) Drawings — three sets of assembly and subassembly drawings. The assembly drawings shall have a cut-away section showing all detail components in their normal assembly position and shall define all details and subassemblies.

d) List of sources of hose or hose components, including name of source and product identification for inner tube, hose and assembly.

Log sheets, containing required test data, shall remain on file at the source test facility and shall not be sent to the qualifying activity unless specifically requested.

5.3.3 Qualification testing

Qualification testing shall consist of all the examinations and tests specified in 4.4 and 4.10; the test sequence shall be as shown in Table 8.

5.3.4 Criteria for requalification

The following are the criteria for requalification.

a) Any change in a previously qualified hose-to-fitting joint and/or hose construction relative to design, material, or method of attachment would require a full requalification.

b) Qualification approval of other types of end fitting connection designs, using a previously qualified hose-to-fitting joint design, requires the following additional testing to be performed:

   — proof pressure test (see 4.10.1);

   — leakage test (see 4.10.4);

   — repeated installation (see 4.10.11);

   — room-temperature burst (see 4.10.12).

c) If hose previously qualified is procured from a new manufacturing source, then complete requalification testing is required.

5.4 Quality conformance inspections

5.4.1 General

Quality conformance inspections shall be sampled in accordance with the procedure laid down in ISO 2859-1 and shall consist of the following tests:

a) individual tests — 100 % inspection (see 5.4.2);

b) sampling tests (see 5.4.3);

c) periodic control tests (see 5.4.4).

5.4.2 Individual tests

Each hose assembly shall be subjected to the following tests:

a) general examination of product (see 4.5 to 4.9);

b) proof pressure tests (see 4.10.1).

Production samples that are proof pressure tested with water shall be air-dried prior to capping (see cleaning requirements in 4.9.3).

5.4.3 Sampling tests

The following inspections or tests shall be carried out in the order indicated:

a) leakage tests (see 4.10.4);

b) burst pressure at room temperature (see 4.10.12).

The inspections or tests shall be carried out on eight hose assemblies, selected at random from each inspection lot. The inspection lot shall consist of not more than 3 000 hose assemblies, all of one size, manufactured under essentially the same conditions. One hose assembly tested from each lot of 375 hose assemblies is also permitted.

5.4.4 Periodic control tests

5.4.4.1 General

The inspections and tests specified in 5.4.2 and 5.4.3 shall be carried out as indicated on eight hose assemblies manufactured from bulk hose length selected at random from each inspection lot. The inspection lot shall consist of not more than 6 000 m (20 000 ft) of hose, all of one size, manufactured under essentially the same conditions. The use of two hose assemblies manufactured and tested from each lot of 1 500 m (5 000 ft) is also permitted.

5.4.4.2 Assembly and braid

Four hose assemblies from a lot of 6 000 m (20 000 ft) [or one hose assembly from a lot of 1 500 m (5 000 ft)] shall be subjected to the following tests in the order indicated:

a) elongation and contraction (see 4.10.2);

b) impulse (see 4.10.6) (unaged samples only, which may have straight fittings on both ends).

5.4.4.3 Hose inner liner

Four hose assemblies from a lot of 6 000 m (20 000 ft) [or one hose assembly from a lot of 1 500 m (5 000 ft)] shall be subjected to the following tests in the order indicated:

a) stress degradation (see 4.10.8);

b) electrical conductivity (see 4.10.13).

5.4.5 Rejection and re-test

5.4.5.1 Rejection

If one or more items selected from a lot fails to meet the requirements of this International Standard, the lot shall be rejected.

5.4.5.2 Resubmitted lots

Once a lot (or part of a lot) has been rejected by the purchaser, it may be resubmitted for tests after the manufacturer has supplied, in writing, full particulars concerning the cause of previous rejection and the action taken to correct the defects in the lot.

5.4.6 Changes in inspection procedures

Changes in inspection severity levels (for example from normal to tightened inspection) shall be in accordance with ISO 2859-1. All inspection plans shall be single sampling plans with an acceptable quality level (AQL) of 0 %.

5.4.7 Destructive test sample

Prior to testing, a letter “D” shall be permanently marked on each end fitting of those hose assemblies used for destructive tests (see 5.3.3, 5.4.3 and 5.4.4).

5.5 Test conditions

5.5.1 Assembly, ends and hose

5.5.1.1 Assembly, ends

Qualification tests shall be carried out on assemblies using straight-type swivel ends with dimensions as shown in Figure 1 and Table 2a or 2b, as applicable, except for the test specimens requiring 90° elbow fitting on one end. Satisfactory qualification tests on these hose assemblies shall constitute qualification approval on hose assemblies using other fitting configurations that have an identical hose attachment method and end fitting connection design.

5.5.1.2 Assembly, hose

Qualification shall be carried out on assemblies using one hose construction and one hose manufacturer. Separate qualification tests shall be carried out for each manufacturer of hose and each different construction.

5.5.2 End connections

Each hose end shall be connected to a steel fitting, using a lubricant, and torque-tightened.

5.5.3 Test fluids

Test fluids shall be as specified in ISO 8829.

5.5.4 Temperature measurements

Unless otherwise specified, temperature measurements shall be taken within 150 mm (6 in) of the hose assemblies under test. Unless otherwise specified, all temperatures shall have a tolerance of $^{+8}_{-3}$ °C $\left(^{+15}_{-5}\ °F\right)$.

5.5.5 Pressure measurements

Unless otherwise specified, all pressures shall have a tolerance of ± 500 kPa (± 100 psi).

5.5.6 Preparation of test specimens

5.5.6.1 Oil aging

In all tests using oil-aged test specimens, the hose assemblies shall be filled with a high-temperature test fluid and soaked in an air oven at a temperature of 204 °C (400 °F) for 7 d. All air shall be excluded from the bore of the assembly during the test. No pressure shall be applied to the assembly during the aging period.

5.5.6.2 Air aging

Air-aged test specimens shall be kept in air at a temperature of 204 °C (400 °F) for 7 d.

5.5.6.3 Unaged test specimens

Unaged assemblies shall be as manufactured.

5.6 Inspection methods

5.6.1 Examination of product

5.6.1.1 Inner tube

Each length of tubing shall be examined to determine conformance to the requirements laid down in 4.3.2 with respect to material, size, workmanship and dimensions.

5.6.1.2 Hose assembly

Each hose assembly shall be visually inspected to determine conformance to this International Standard, and inspected for compliance with construction and reinforcement requirements (see 4.3). In addition, each hose assembly shall be checked to determine conformance with respect to dimensions and linear density (see 4.5).

6 Preparation for delivery

6.1 Storage and packaging

All openings shall be sealed with appropriate caps and plugs. Storage and packaging shall be to the customer's requirements.

6.2 Marking

Interior and exterior containers shall be marked according to the customer's requirements.

7 Ordering data

The following information shall be included in the purchase order:

a) reference to this International Standard (i.e. title, number and date of edition);

b) details of parts required (part number, size, length, sleeving);

c) type, size, or special features of end fittings desired (see 4.3.4);

d) data requirements (see 5.3.2);

e) applicable levels of preservation, packaging and marking (see 6.1 and 6.2);

f) a statement in the event of a special request that test specimens subject to destructive testing are to be considered or shipped as part of the contract or order;

g) whether fire resistance or fireproofing is required;

h) any deviations from the parameters for impulse testing specified in ISO 6772 and ISO 8829 (see 4.10.6).

Annex A
(informative)

Equivalent hose assembly product standards governed by ISO 8913

ISO product standards governed by ISO 8913 are currently not available. Regional and national standards governed by this International Standard are listed in Table A.1.

Table A.1 — Hose assembly product standards

ISO Part no.	SAE Part no. imperial	AECMA Part no. metric	Description
	AS115	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flareless, Straight to Straight, Lightweight
	AS116	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flareless, Straight to 45°, Lightweight
	AS117	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flareless, Straight to 90°, Lightweight
	AS118	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flareless, 45° to 45°, Lightweight
	AS119	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flareless, 45° to 90°, Lightweight
	AS120	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flareless, 90° to 90°, Lightweight
	AS153	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flared, Straight to Straight, Lightweight
	AS154	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flared, Straight to 45°, Lightweight
	AS155	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flared, Straight to 90°, Lightweight
	AS156	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flared, 45° to 45°, Lightweight
	AS157	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flared, 45° to 90°, Lightweight
	AS158	prEN 3585 prEN 3586 prEN 4565	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Flared, 90° to 90°, Lightweight
	AS1909	prEN 3583 prEN 3584	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Dynamic Beam, Straight to Straight, Lightweight
	AS1910	prEN 3583 prEN 3584	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Dynamic Beam, Straight to 45°, Lightweight
	AS1911	prEN 3583 prEN 3584	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Dynamic Beam, Straight to 90°, Lightweight
	AS1912	prEN 3583 prEN 3584	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Dynamic Beam, 45° to 45°, Lightweight
	AS1913	prEN 3583 prEN 3584	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Dynamic Beam, 45° to 90°, Lightweight
	AS1914	prEN 3583 prEN 3584	Hose assembly, Nonmetallic — 3 000 psi/21 000 kPa, PTFE, Dynamic Beam, 90° to 90°, Lightweight

Annex B
(normative)

Equivalent national qualification procedure and fire resistance specification

As yet, International Standards for the qualification of hose assembly manufacturer's and a qualified product listing applicable to this International Standard are not available. For the time being, national procedures are listed in Table B.1.

Table B.1 — Manufacturer — Product qualification procedure

Procedure no.	AECMA regional procedure	USA aerospace procedure
1 (Manufacturer)	EN 9100	SAE AS7003/AS7112
2 (Product)	EN 9133	PRI PD2101

As yet, adoption of an International Standard for the fire resistance testing of hose assemblies has not been agreed upon. For the time being, equivalent standards are listed in Table B.2.

Table B.2 — Equivalent fire resistance test specification

ISO specification	USA/SAE specification
ISO 2685:1998, Annex E, *Test conditions for fluid system components*	AS1055, *Fire testing of flexible hose, tube assemblies, coils, fittings and similar system components*

Annex C
(informative)

Equivalent materials

As yet, International Standards giving specifications for appropriate materials to be used in hose assemblies in aircraft fluid systems are not available. For the time being, materials and components specified in national standards are given in Table C.1. Materials of equivalent properties and characteristics as specified in other national standards may be used; however, it should be borne in mind, when selecting materials, that non-equivalent materials may cause differences in test results and, more importantly, in the performance of hose assemblies. References to national standards will be deleted and replaced by references to International Standards when they become available — some specifications for materials and forms have reached the stage of draft proposal and reference is made to these for information purposes in the far-right column of Table C.1.

Table C.1 — Equivalent materials

Material no.	France		United Kingdom		USA		ISO future work items
	National standard applicable	Designation	National standard applicable	Description	National standard applicable[a]	Description	
1	AIR9160	Z2 CN 18-10 Z6 CN 18-09	Same as for USA		SAE AMS 5639 **(304)**	Steel bars, forgings, tubing and rings, corrosion-resistant 19Cr-10Ni (SAE 30304), solution heat treated (UNS S30400)	In preparation for bars and forgings
2		Z10 CNT 18-11 Z6 CNT 18-10	BS Aerospace series S 129	18/9 chromium-nickel corrosion-resisting steel (titanium stabilized) billets, bars, forgings and parts	SAE AMS 5645 **(321)**	Steel bars, forgings, tubing and rings, corrosion and heat resistant 18Cr-10Ni-0,4Ti (SAE 30321), solution heat treated (UNS S32100)	In preparation for bars
3		Z10 CNT 18-11 Z6 CNNh 18-10	BS Aerospace series S 130	18/9 chromium-nickel corrosion-resisting steel (niobium stabilized) billets, bars, forgings and parts	SAE AMS 5646 **(347)**	Steel bars, forgings, tubing and rings, corrosion and heat resistant 18Cr-11Ni-0,6(Nb+Ta) (SAE 30347), solution heat treated (UNS S34700)	In preparation for bars
4					SAE AMS 5647 **(304L)**	Steel, corrosion-resistant, bars, wire, forging, tubing and rings, 19Cr-9,5Ni, Solution heat treated (UNS S30403)	—
5	prEN 2539 prEN 3161 prEN 3162	Z6 CNU 17-04	BS Aerospace series S 145	Chromium-nickel-copper-molybdenum corrosion-resisting steel (precipitation hardening) billets, bars, forgings and parts	SAE AMS 5643 **(17-4)**	Steel bars, forging, tubing and rings, corrosion-resistant 16,5Cr-4,0Ni-4,0Cu-0,30(Cb+Ta) solution heat treated (UNS 17400)	In preparation for bars for machining and forging

Table C.1 (*continued*)

Material no.	France		United Kingdom		USA		ISO future work items
	National standard applicable	Designation	National standard applicable	Description	National standard applicable[a]	Description	
6	—	—	Same for USA		SAE AMS 5644 **(17-7)**	Steel bars and forgings, corrosion-resistant 17Cr-7Ni-1Al	—
7	AIR 9160	Z12CND16-04 Z15 CN 16-02			SAE AMS 5743 **(15-5)**	Steel bars and forgings, corrosion and moderately heat-resistant 15,5Cr-4,5Ni-2,9Mo-0,10N (solution heat treated, sub-zero cooled, equalized and oven-tempered) (UNS S35500)	—
8					SAE AMS 5659 **(15-5)**	Steel bars and forgings, corrosion-resistant 15Cr-4,5Ni-0,30Cb-3,5Cu Consumable electrode melted, solution heat treated, precipitation hardened (UNS S15500)	—
9	AIR 9182 prEN 2530 prEN 3311 prEN 3314	T35 T40 T60 TA6V	BS Aerospace series 2TA 11, 2TA 12 and 2TA 13	Bars and section for machining/forging. Stock/forgings and titanium-aluminum-vanadium alloy (tensile strength 900 MPa to 1 160 MPa)	SAE AMS 4928 **(6-4)**	Titanium alloy bars, forgings and rings, 6Al-4V, annealed 120 000 psi (825 MPa) yield strength (UNS R56400)	In preparation for forgings
10					SAE AMS 5666 **(625)**	Nickel alloy, corrosion- and heat-resistant bars and forgings, 62Ni-21,5Cr-9,0Mo-3,65(Cb+Ta) annealed	—
11	AIR 9423	Z2 CN 18-10 Z6 CN 18-09	BS Aerospace series T 72-T 73	18/10 chromium-nickel corrosion-resisting steel tube for hydraulic purposes (niobium/titanium stabilized: 550 MPa)	SAE AMS 5567 **(304)**	Steel, corrosion-resistant (304), aerospace vehicle hydraulic systems, annealed, seamless and welded (UNS S30400)	In preparation for tubes
12		Z6 CNT 18-10			SAE AMS 5557 **(321)**	Tubing, steel, corrosion-resistant (18-8 stabilized), aircraft hydraulic quality (SAE 30321) (UNS S32100)	In preparation for tubes
13	AIR 9160	Z10CNT18-10			SAE AMS 5556 **(347)**	Tubing, steel, corrosion-resistant (18-8 stabilized) aircraft hydraulic quality (SAE 30347) (UNS S34700)	In preparation for tubes

Table C.1 *(continued)*

Material no.	France		United Kingdom		USA		ISO future work items
	National standard applicable	Designation	National standard applicable	Description	National standard applicable[a]	Description	
14					SAE AMS 5561 **(21-6-9)**	Tubing, steel, corrosion-resistant, 9,0Mn-20Cr-6,5Ni-0,28N, aircraft hydraulic quality (UNS S21900)	—
15	prEN 3120	TA3V2.5	—	—	SAE AMS 4945 **(3-2,5)**	Tubing, titanium, 3Al-2,5V, texture controlled	—
16					SAE AMS 5581 **(625)**	Tubing, nickel alloy, 62Ni-21,5Cr-9,0Mo-3,7(Cb+Ta), annealed	—
17		Z10CNT18-10	Same as for USA		SAE AMS 5689 **(321)**	Steel wire, corrosion and heat resistant, 18Cr-9,5Ni-Ti (SAE 30321), solution heat treated (UNS S32100)	—
18		Z6 CND 15-07 Z6 CND 17-11			SAE AMS 5690 **(316)**	Steel wire, corrosion and heat resistant, 17Cr-12Ni-2,5Mo (SAE 30316), solution heat treated (UNS S31600)	—
19		Z2 CN 15-07 DTD 189			SAE AMS 5697 **(304)**	Steel wire, corrosion-resistant, 19Cr-9,5Ni (SAE 30304)	—
20					SAE AMS 5688 **(302)**	Wire, steel, corrosion-resistant, 18Cr-9,0Ni, spring temper (SAE 30302)	—

[a] Material designation is given in bold type in parentheses after the standard number.

Bibliography

[1] prEN 2530:1994, *Aerospace series — Titanium alloy TI-P63, annealed, 900 MPa $\leqslant R_m \leqslant$ 1 160 MPa — Bars $D_e \leqslant$ 150 mm*

[2] prEN 2539:1999, *Aerospace series — Steel FE-PM3801 (X5CrNiCu17-4) air melted, solution treated and precipitation treated — Bar a or $D \leqslant$ 200 mm, $R_m \geqslant$ 965 MPa*

[3] prEN 3120:1996, *Aerospace series — Titanium alloy TI-P64003, cold worked and stress relieved — Seamless tube for pressure systems, 4 mm $\leqslant D \leqslant$ 51 mm, 690 MPa $\leqslant R_m \leqslant$ 1 030 MPa*

[4] prEN 3161:1999, *Aerospace series — Steel FE-PM3801 (X5CrNiCu17-4) air melted, solution treated and precipitation treated — Bar a or $D \leqslant$ 200 mm, $R_m \geqslant$ 930 MPa*

[5] prEN 3162:1999, *Aerospace series — Steel FE-PM3801 (X5CrNiCu17-4) air melted, solution treated and precipitation treated — Sheet and strip, $a \leqslant$ 6 mm, $R_m \geqslant$ 930 MPa*

[6] prEN 3311:1994, *Aerospace series — Titanium alloy TI-P64001, annealed — Bar for machining $D \leqslant$ 150 mm*

[7] prEN 3314:1994, *Aerospace series — Titanium alloy TI-P64001, solution treated and aged — Bar for machining $D \leqslant$ 75 mm*

[8] prEN 3583, *Aerospace series — Lightweight PTFE flexible hose assembly of a nominal pressure equal to 21 000 kPa and 8° 30' fitting in corrosion resisting steel — Product standard*

[9] prEN 3584:1991, *Aerospace series — Lightweight PTFE flexible hose assembly of a nominal pressure equal to 21 000 kPa and 8° 30' fitting in titanium — Product standard*

[10] prEN 3585, *Aerospace series — Lightweight PTFE flexible hose assembly of a nominal pressure equal to 21 000 kPa with 24° fitting in corrosion resisting steel — Product standard*

[11] prEN 3586, *Aerospace series — Lightweight PTFE flexible hose assembly of a nominal pressure equal to 21 000 kPa with 24° fitting in titanium — Product standard*

[12] prEN 4565, *Aerospace series — Hose assembly, 21 000 kPa, lightweight, polytetrafluoroethylene (PTFE), 204 °C, metallic reinforcement, 37° coupling in CRES — Product standard, inch series*

[13] AIR 9160, *Conditions générales de recette et d'emploi des aciers corroyés utilisés dans les constructions aéronautiques*

[14] AIR 9182, *Condition de réception des tôles de Titane non-allié*

[15] AIR 9423, *Conditions de contrôle des tubes en aciers inoxydables et alliages corroyés résistant à chaud destinés aux circuits de fluides sous pression utilisés dans les constructions aéronautiques*

[16] BS 2S 129:1976, *Specification for 18/9 chromium-nickel corrosion-resisting steel (titanium stabilized) billets, bars, forgings and parts (540 MPa: limiting ruling section 150 mm*)

[17] BS 2S 130:1976, *Specification for 18/9 chromium-nickel corrosion-resisting steel (niobium stabilized) billets, bars, forgings and parts (540 MPa: limiting ruling section 150 mm*)

[18] BS 2S 145:1976, *Specification for chromium-nickel-copper-molybdenum corrosion-resisting steel (precipitation hardening) billets, bars, forgings and parts (1270 MPa to 1470 MPa)*

[19] BS 2TA 11, *Specification for bar and section for machining of titanium-aluminium-vanadium alloys*

[20] BS 2TA 12, *Specification for forging stock of titanium-aluminium-vanadium alloys*

[21] BS 2TA 13, *Specification for forgings of titanium-aluminium-vanadium alloys*

[22] BS T 72-T 73:1977, *Specifications for 18/10 chromium-nickel corrosion-resisting steel tube for hydraulic purposes (niobium/titanium stabilized: 550 MPa)*

[23] SAE AMS4928, *Titanium alloy bars, wire, forgings and rings 6al – 4v annealed*

[24] SAE AMS4945B:2001, *Titanium alloy tubing, seamless, hydraulic 3al – 2,5v, controlled contractile strain ratio cold worked, stress relieved*

[25] SAE AMS5556, *Steel corrosion and heat-resistant, seamless or welded tubing 18cr 11ni 0,70cb (SAE 30347) solution heat treated*

[26] SAE AMS5557, *Steel, corrosion and heat resistant, seamless or welded hydraulic tubing 18,5cr 10,5ni 0,40ti (SAE 30321) solution heat treated*

[27] SAE AMS5561, *Steel, corrosion and heat resistant, welded and drawn or seamless and drawn tubing 9,0mn 20cr 6,5ni 0,28n high-pressure hydraulic*

[28] SAE AMS5567, *Steel, corrosion resistant, seamless or welded tubing 19cr 10ni (SAE 30304) solution heat treated*

[29] SAE AMS5581, *Nickel alloy, corrosion and heat resistant, seamless or welded tubing 62ni 21,5cr 9,0mo 3,7cb annealed*

[30] SAE AMS5643Q:2003, *Steel, corrosion-resistant, bars, wire, forgings, tubing and rings 16cr 4,0ni 0,30cb 4,0cu solution heat treated, precipitation hardenable*

[31] SAE AMS5644D:1964, *Steel bars and forgings, corrosion heat resistant, 17cr 7ni 1al (NON CURRENT)*

[32] SAE-AMS5639H:2002, *Steel, corrosion-resistant, bars, wire, forgings, tubing, and rings 19cr 10ni solution heat treated*

[33] SAE AMS5645P:2001, *Steel, corrosion and heat resistant, bars, wire, forgings, tubing, and rings 18Cr – 10Ni – 0,40Ti (SAE 30321) solution heat treated*

[34] SAE AMS5646M:2002, *Steel, corrosion and heat resistant, bars, wire, forgings, tubing, and rings 18cr 11ni 0,60cb (SAE 30347) solution heat treated*

[35] SAE AMS5647, *Steel, corrosion-resistant, bars, wire, forgings, tubing and rings 19cr 9,5ni solution heat treated*

[36] SAE AMS5659, *Steel, corrosion resistant, bars, wire, forgings, rings, and extrusions 15cr 4,5ni 0,30cb (nb) 3,5cu consumable electrode melted solution heat treated, precipitation hardenable*

[37] SAE AMS5666, *Nickel alloy, corrosion and heat-resistant, bars, forgings, extrusions, and rings 62Ni 21,5Cr 9,0Mo 3,65(Cb [NB] + Ta), annealed*

[38] SAE AMS5667, *Nickel alloy, corrosion and heat-resistant, bars, forgings and rings 72ni 15,5cr 0,95cb 2,5ti 0,70al 7,0fe equalized, precipitation hardenable*

[39] SAE AMS5688, *Steel, corrosion resistant, wire 18cr 9,0ni (SAE 30302) spring temper*

[40] SAE AMS5689, *Steel, corrosion and heat resistant, wire 18cr 10,5ni 0,40ti, solution heat treated*

[41] SAE AMS5690, *Steel, corrosion and heat resistant, wire 17cr – 12ni – 2,5mo (SAE 30316), solution heat treated*

[42] SAE AMS5697, *Steel, corrosion resistant, wire 19cr 9,5ni solution heat treated*

[43] SAE AMS5743, *Steel, corrosion and heat resistant, bars and forgings 15,5cr 4,5ni 2,9mo 0,10n solution heat treated, sub-zero cooled, equalized, and over-tempered*

[44] SAE AS115, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, straight to straight, flareless, lightweight*

[45] SAE AS116, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, straight to 45 deg., flareless, lightweight*

[46] SAE AS117, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, straight to 90 deg., flareless, lightweight*

[47] SAE AS118, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, 45 deg. to 45 deg., flareless, lightweight*

[48] SAE AS119, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, 45 deg. to 90 deg., flareless, lightweight*

[49] SAE AS120, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, 90 deg. to 45 deg., flareless, lightweight*

[50] SAE AS153, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, straight to straight, flared, lightweight*

[51] SAE AS154, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, straight to 45 Md, flared, lightweight*

[52] SAE AS155, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, straight to 90 Md, flared, lightweight*

[53] SAE AS156, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, 45 Md to 45 Md, flared, lightweight*

[54] SAE AS157, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400 Mdf, 45 Md to 90 Md, flared, lightweight*

[55] SAE AS158, *Hose assembly, Ptfe, Cres Reinforced, 3 000 Psig, 400Mdf, 90 Md to 90 Md, flared, lightweight*

[56] SAE AS1909, *Hose assembly, polytetrafluoroethylene, Cres reinforced, 400 deg. F, 3 000 Psi, lightweight, beam seal, straight to straight*

[57] SAE AS1910, *Hose assembly, polytetrafluoroethylene, Cres reinforced, 400 deg. F, 3 000 Psi, lightweight, beam seal, straight to 45 deg.*

[58] SAE AS1911, *Hose assembly, polytetrafluoroethylene, Cres reinforced, 400 deg. F, 3 000 Psi, lightweight, beam seal, straight to 90 deg.*

[59] SAE AS1912, *Hose assembly, polytetrafluoroethylene, Cres reinforced, 400 deg. F, 3 000 Psi, lightweight, beam seal, 45 deg. to 45 deg.*

[60] SAE AS1913, *Hose assembly, polytetrafluoroethylene, Cres reinforced, 400 deg. F, 3 000 Psi, lightweight, beam seal, 45 deg. to 90 deg.*

[61] SAE AS1914, *Hose assembly, polytetrafluoroethylene, Cres reinforced, 400 deg. F, 3 000 Psi, lightweight, beam seal, 90 deg. to 90 deg.*

ICS 49.080; 83.140.40

Price based on 27 pages