INTERNATIONAL STANDARD

ISO 7314

Second edition
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Aerospace — Fluid systems — Hose assembly, metal

Aéronautique et espace — Systèmes de fluides — Tuyauteries flexibles métalliques

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Contents

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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.

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.

International Standard ISO 7314 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 7314:1989), of which it constitutes a technical revision.

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Aerospace — Fluid systems — Hose assembly, metal

1 Scope

This International Standard gives specifications for medium pressure, high temperature, flexible metal hose assemblies suitable for continuous operation in liquid and pneumatic systems from − 55 °C to + 400 °C, with short duration excursions up to + 650 °C.

The hose assemblies covered by this International Standard are intended for use in aerospace applications to convey air and gases in pneumatic systems, bleed air systems, heating and ventilating systems, and instrument air systems when used at pressures and temperatures within the limits laid down in tables 1 and 2. This International Standard does not cover flow velocity in such assemblies exceeding 54 m/s; higher velocities require special vibration-dampening devices.

Hose assemblies supplied to the specifications laid down in this International Standard may be of two types:

Type 1: Convoluted inner tube — welded, of moderate mass and moderate flexibility.

Type 2: Convoluted inner tube — seamless or butt-welded and redrawn, of low mass and high flexibility.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8625-1:1993, *Aerospace — Fluid systems — Vocabulary — Part 1: General terms and definitions related to pressure.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 8625-1 apply.

4 Requirements

4.1 Qualification

Any hose assembly supplied to the specifications laid down in this International Standard shall be a product identical in hose construction and end-fitting attachment method to specimens which have been tested and which have passed the qualification tests specified in clause 5.

Qualified hose assemblies of type 2 construction may be automatically substituted for type 1 hoses, but type 1 hoses may not be substituted for type 2 hoses unless customer approval is given.

4.2 Materials

The hose assembly materials shall be uniform in quality, free from defects and suitable for use in continuous ambient and/or fluid temperatures ranging from − 55 °C to + 400 °C with short fluid temperature excursions up to 650 °C. The materials shall be consistent with good manufacturing practices and shall conform with the applicable specifications and the requirements specified in this International Standard.

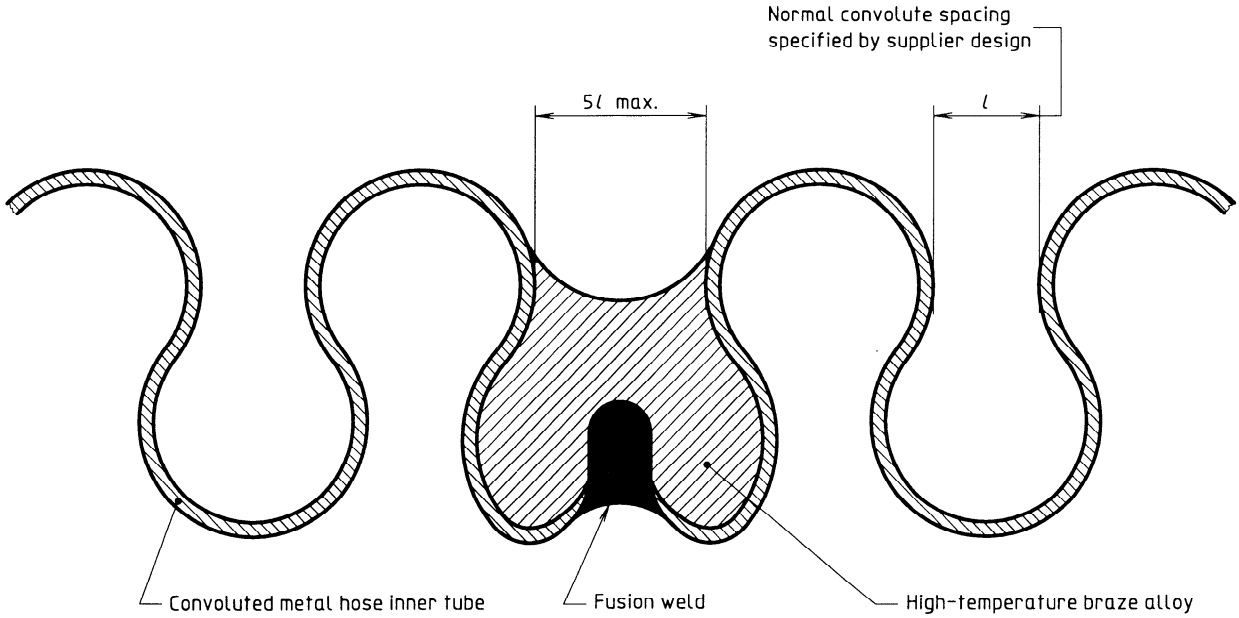

Figure 1 — Inner tube splice configuration

Table 1 — Dimensions and performance requirements for hose assemblies

Hose nominal size DN	Hose		Fitting	Operating pressure at 20 °C[1]		Proof pressure at 20 °C[1]		Burst pressure at 20 °C[1]	
	Inside diameter min.	Outside diameter max.	Bore[2] min.	max.		min.		min.	
	mm	mm	mm	kPa	bar	kPa	bar	kPa	bar
03	2	6	2	13 750	138	20 650	207	55 150	552
04	3	7	2,5	13 750	138	20 650	207	55 150	552
05	4	9,9	3	13 750	138	20 650	207	55 150	552
06	5,5	13	3,5	13 750	138	20 650	207	55 150	552
08	7	13,5	5	12 000	120	18 000	180	48 000	480
10	8,5	16,5	6,4	11 000	110	16 500	165	44 000	440
12	11	20,5	9,1	9 600	96	14 500	145	38 600	386
16	14	27	11,6	8 300	83	12 400	124	33 000	330
20	17,5	31,5	14,4	7 200	72	10 700	107	29 000	290
25	23	38	19,3	5 500	55	8 300	83	22 000	220
32	30	47	23,4	3 800	38	5 700	57	15 200	152
40	36	57	32	3 000	30	4 500	45	12 000	120
50	48	70	42	2 400	24	3 600	36	9 600	96
63	60	85	55	1 800	18	2 700	27	7 200	72

1) For pressure requirements at elevated temperature, multiply the value by the factor given in table 2.

2) Minimum inside diameter through the elbow bend area may be 85 % of the value given due to ovality.

Table 2 — Factor for correcting pressure requirements at elevated temperature (see table 1)

Material	Austenitic chrome/nickel steel stabilized for carbide precipitation													
Operating temperature, °C	20	50	100	150	200	250	300	350	400	450	500	550	600	650
Correction factor	1	0,91	0,84	0,78	0,73	0,69	0,65	0,62	0,6	0,58	0,57	0,57	0,56	0,55

4.3 Design and construction

The hose assembly shall consist of a convoluted, stabilized, corrosion-resistant steel, pressure-carrying tube, suitable for the intended use, and uniform in size and wall thickness. The hose assembly shall be reinforced with stabilized corrosion-resistant steel braided wire and shall have stabilized corrosion-resistant steel end fittings and nuts. End fittings shall be attached to the hose by welding. The end fitting outlet design shall mate with applicable end fittings.

4.3.1 End fittings

The hose-to-fitting joint shall be welded in a suitable manner meeting the requirements specified in this International Standard. It is recommended that fitting joints be kept to a minimum to reduce potential leakage paths. The mass of type 2 fittings shall not exceed the values given in table 4. Type 1 fitting masses shall be as given on the approved drawing.

4.3.2 Hose

4.3.2.1 Inner tube construction

In the case of type 1 hoses, the inner tube shall be an annular or helical, convoluted flexible tube made from welded stabilized austenitic stainless steel.

In the case of type 2 hoses, the inner tube shall be an annular, convoluted flexible tube of seamless or butt-welded and redrawn construction using stabilized austenitic stainless steel.

For either type, the inner tube shall be uniform in size and quality, and free from pitting and other defects.

There shall be no inner tube splices on hose assemblies shorter than or equal to 1 m in length. One splice is allowed for each additional metre of hose assembly length. Splices are undesirable, but, if required, shall be low-profile welds in accordance with 4.3.3 and figure 1. After welding, the convolutes shall be closed as shown in figure 1.

4.3.2.2 Reinforcement

The reinforcement shall be a suitable braided construction using stabilized austenitic stainless steel wire in such a manner as to meet the requirements specified in this International Standard. There shall be no splices, missing loops, kinks or broken wires in the braid wire reinforcement.

4.3.3 Welds

All welds shall be fusion welds suitable for the intended use. Filler wire, if required, shall be compatible with the weld material used. Equivalent supplier or other comparable welding specifications may be substituted subject to prior approval by the purchaser.

4.3.4 Heat treatment

If stress-relieving of austenitic stainless steel welds is required to meet corrosion and embrittlement resistance, the joints shall be stress-relieved at 895 °C ± 15 °C for 2 h ± 0,25 h.

4.4 Dimensions, masses and ratings

4.4.1 Hose diameter

The inside diameter of the convoluted hose and the outside diameter of the braid covering shall be as given in table 1.

4.4.2 Bend radius

The requirements for the minimum bend radius of hoses shall be as given in table 3. The bend radius shall be measured to the centreline of the hose.

4.4.3 Assembly length

Hose assembly lengths shall be as specified on the applicable product standard or drawing.

4.4.4 Masses

Maximum masses of type 2 hose assemblies, with standard 37° or 24° fittings, shall be as given in table 4. Maximum masses for type 1 hose assemblies and for type 2 hose assemblies with other fittings shall be stipulated on the supplier's drawing when presented to the purchaser for approval.

4.5 Performance

The hose assembly minimum bend radius and operating, proof and burst pressure ratings, as given in tables 1 and 3, shall be verified by proving that the performance requirements of 4.5.1 to 4.5.8 are met or exceeded, through qualification testing as specified in clause 5. Compliance with performance requirements shall be maintained by adherence to the quality assurance provisions specified in clause 5.

4.5.1 Examination of product

Each assembly shall conform dimensionally and materially to the applicable product standard or drawing and to all requirements of this International Standard when examined in accordance with 5.6.1.

4.5.2 Proof pressure test

The hose assembly shall withstand the applicable proof pressure, specified in table 1, at room temperature (i.e. at 20 °C), without leakage or evidence of permanent deformation or malfunction, that would affect hose assembly installation, removal or use when tested in accordance with 5.6.2.

4.5.3 Corrosion test

The hose assembly shall be capable of withstanding the proof pressure requirements specified in 4.5.2 after 50 immersion cycles in a 35 g/l sodium chloride (NaCl) solution in accordance with 5.6.3.

4.5.4 Vibration test

The hose assembly shall have no broken braid wire and shall be capable of withstanding, without leakage, the proof pressure requirements specified in 4.5.2, after vibration testing in accordance with 5.6.4.

4.5.5 Flexure/pressure cycling endurance test

The hose assembly shall have no broken braid wire and shall be capable of withstanding the proof pressure requirements specified in 4.5.2, after 50 000 combination flexure/pressure cycles in accordance with 5.6.5.

4.5.6 Repeated torque test

The hose assembly end fitting shall be capable of sealing and withstanding the proof pressure requirements specified in 4.5.2, after 15 installations on a mating fitting in accordance with 5.6.6. The fitting nut shall be free enough to permit turning on the elbow or insertion by hand.

4.5.7 Cold test

The hose assembly shall show no evidence of leakage when tested in accordance with 5.6.7.

4.5.8 Thermal shock test

The hose assembly shall show no evidence of leakage when tested in accordance with 5.6.8.

4.5.9 Burst pressure test

The hose assembly shall not rupture and shall show no sign of leakage at any pressure up to the burst pressure specified in table 1, when tested in accordance with 5.6.9.

4.5.10 Strauss test (stress corrosion)

There shall be no evidence of fissures, or intergranular or transgranular corrosion of the weld specimen when tested in accordance with 5.6.10.

4.6 Part numbering of interchangeable parts

All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable.

4.7 Product identification

The hose assemblies shall be marked for identification in accordance with the requirements of 4.7.1 and 4.7.2.

4.7.1 Fittings

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

4.7.2 Assemblies

Each assembly shall bear permanent identification markings that include, as a minimum, the following details:

a) the manufacturer's name, trademark or code number;

b) the complete manufacturer's part number;

c) the complete specification control number;

d) the pressure test symbol "PT";

e) the date of hose assembly manufacture (month and year), or serial number (if any);

f) for qualification samples, the words "DO NOT REUSE" and the test specimen number.

Table 3 — Minimum centreline bend radius

Dimensions in millimetres

Hose nominal size DN	Minimum bend radius			
	Type 1 hose assembly		Type 2 hose assembly	
	Static	Dynamic	Static[1]	Dynamic
03	100	200	—	—
04	100	200	—	—
05	100	200	50	100
06	100	200	50	100
08	125	250	65	130
10	150	300	75	150
12	175	350	100	200
16	200	400	115	230
20	235	470	125	250
25	310	620	150	300
32	370	740	175	350
40	450	900	225	450
50	550	1 100	275	550
63	700	1 400	350	700

1) No flexure in service.

Table 4 — Masses for type 2 hose assemblies with standard 37° or 24° fittings

Hose nominal size DN	Maximum masses			
	Hose	Standard end fittings		
		Straight	45° elbow	90° elbow
	g/cm	g		
05	1,5	20	20	20
06	2	23	23	23
08	2,5	27	29	29
10	3	32	36	36
12	4,2	55	59	64
16	5,3	82	91	100
20	6,5	163	177	186
25	9	218	259	291
32	12	358	413	449
40	19	486	507	552
50	24	768	810	845
63	35	—	—	—

4.8 Workmanship

Workmanship shall be of such quality as to assure 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.

4.8.1 Dimensions and tolerances

All dimensions and tolerances, as specified on the applicable product drawings and specifications, shall be complied with.

4.8.2 Cleaning

The hose assemblies shall be cleaned according to the general commercial practice of the manufacturer to remove oil, grease, dirt or any other foreign material, both internal or external to the hose, unless otherwise specified on the product standard or drawing.

5 Quality assurance provisions

5.1 Supplier's responsibility

The supplier is responsible for the performance of all quality assurance provisions as specified in this International Standard. Accurate records of the testing shall be kept by the supplier and shall be available, on request, to the purchaser for inspection. The supplier's test data, subject to the approval of the purchaser, shall be considered adequate for product qualification.

5.1.1 Rejection and retest

Rejected hose or hose assemblies shall not be submitted for reinspection without full particulars being supplied concerning previous rejection and measures taken to overcome the defects.

5.1.2 Defects on items already accepted

If the investigation of the rejection indicates that the defect(s) causing the rejection may exist in hose assemblies previously supplied to the purchaser, the contractor shall advise the purchaser of this condition, the method for identifying these parts and the corrective action or disposition of the defective parts.

5.2 User's responsibility

The user shall establish adequate inspection procedures to ensure that all requirements of this International Standard are met. Emphasis shall be placed on the following aspects:

a) compliance with configuration and end fitting;

b) length;

c) markings;

d) pressure test performance.

5.3 Classification of inspections

The examination and testing of these hose assemblies shall be classified as:

a) qualification inspections (see 5.4);

b) quality conformance inspections (see 5.5).

5.4 Qualification inspections

The qualification inspections outlined in this International Standard are intended to qualify a manufacturer's hose construction and end fitting attachment method only.

The configuration of the outlet parts shall be as described on the product standard or drawing. A number shall be assigned for each attachment method and hose construction used for qualification. The attachment method and hose shall be fully described in the test report by design standard drawings. All other end connections shall also be considered qualified, provided that the hose and hose attachment method have not been altered.

5.4.1 Test specimens

Nine flexible metal hose assemblies of each size shall be used for qualifying performance of the manufacturer's product. They shall be standard hose assemblies, as defined in table 5, according to the manufacturer's assembly drawing(s).

Specimens Nos. 1 to 4 shall be of length l_1 and Nos. 5 to 9 of length l_2, specified in table 7.

5.4.2 Test schedule and sequence

The test specimens shall be subjected to qualification tests in the order indicated in table 6.

5.5 Quality conformance inspections

Quality conformance inspections shall consist of the following tests:

a) individual tests (100 % inspection) (see 5.5.1);

b) sampling tests (see 5.5.2);

c) periodic control tests (see 5.5.3).

5.5.1 Individual tests (functional tests)

Each hose assembly shall be subjected to the following:

a) an examination of the product, performed in accordance with 5.6.1;

b) the proof pressure test, performed in accordance with 5.6.2.

5.5.2 Sampling tests

A hose assembly, selected at random from a production run when the supplier has manufactured a cumulative total of no more than 6 000 hose assemblies made to the specifications of this International Standard, shall be subjected to the following tests:

a) the proof pressure test, performed in accordance with 5.6.2;

b) the burst pressure test, performed in accordance with 5.6.9;

c) the Strauss test, performed in accordance with 5.6.10.

5.5.3 Periodic control tests

The flexure/pressure test as laid down in table 6 shall be performed in accordance with 5.6.5, except that the test shall be carried out at room temperature on two hose assemblies when a supplier has manufactured a cumulative total of no more than 9 000 hose assemblies made to the specifications of this International Standard.

Table 5 — Test specimen configurations

Test specimen No.	End fitting configuration	Hose assembly length
1 2	Straight-to-straight	Actual gauge point to gauge point length equal to l_1 (see table 7)
3 4	45° elbow to 90° elbow	305 mm long with elbows in line
5 6 7 8 9	Straight-to-straight	Actual gauge point to gauge point length equal to l_2 (see table 7)

Table 6 — Test schedule and sequence for qualification testing (order of tests to be read from left to right)

Test specimen No.	Examination of product (see 5.6.1)	Proof pressure test (see 5.6.2)	Corrosion test (see 5.6.3)	Proof pressure test	Vibration test (see 5.6.4)	Proof pressure test	Flexure/pressure cycling endurance test (see 5.6.5)	Repeated torque test (see 5.6.6)	Cold test (see 5.6.7)	Thermal shock test (see 5.6.8)	Proof pressure test	Burst pressure test (see 5.6.9)	Strauss test (see 5.6.10)
1	x	x			x	x		x			x	x[1]	
2	x	x			x	x						x[1]	
3	x	x						x			x	x	x
4	x	x						x			x	x	x
5	x	x	x	x	x[2]	x					x	x[1]	
6	x	x	x	x			x				x	x[1]	
7	x	x					x				x	x[1]	
8	x	x							x	x	x	x[1]	
9	x	x							x	x	x	x[1]	

1) The assemblies need not meet minimum requirements, but all test data should be accurately recorded and included in the test report.

2) For nominal sizes up to DN 16 only.