INTERNATIONAL STANDARD

ISO 7314

Third edition
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Aerospace — Fluid systems — Metal hose assemblies

Aéronautique et espace — Systèmes de fluides — Tuyauteries flexibles métalliques

Reference number
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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7314 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 7314:1994), which has been technically revised.

Aerospace — Fluid systems — Metal hose assemblies

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 for conveying air and other 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 2 and 3. 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 normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC 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 Terms and definitions

For the purposes of this International Standard, the terms and 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 that, concerning hose construction and end-fitting attachment method, is identical to specimens that have been tested and that 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 to the applicable specifications and the requirements specified in this International Standard.

4.3 Design and construction

4.3.1 General

The hose assembly shall consist of a convoluted, stabilized, pressure-carrying tube, in corrosion-resistant steel, 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.

4.3.2 End fittings

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

Table 1 — Masses for type 2 hose assemblies with standard 37° or 24° fittings

Hose nominal size	Maximum masses			
	Hose	Standard end fittings		
		g		
DN	g/cm	Straight	45° elbow	90° elbow
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	–	–	–

4.3.3 Hose

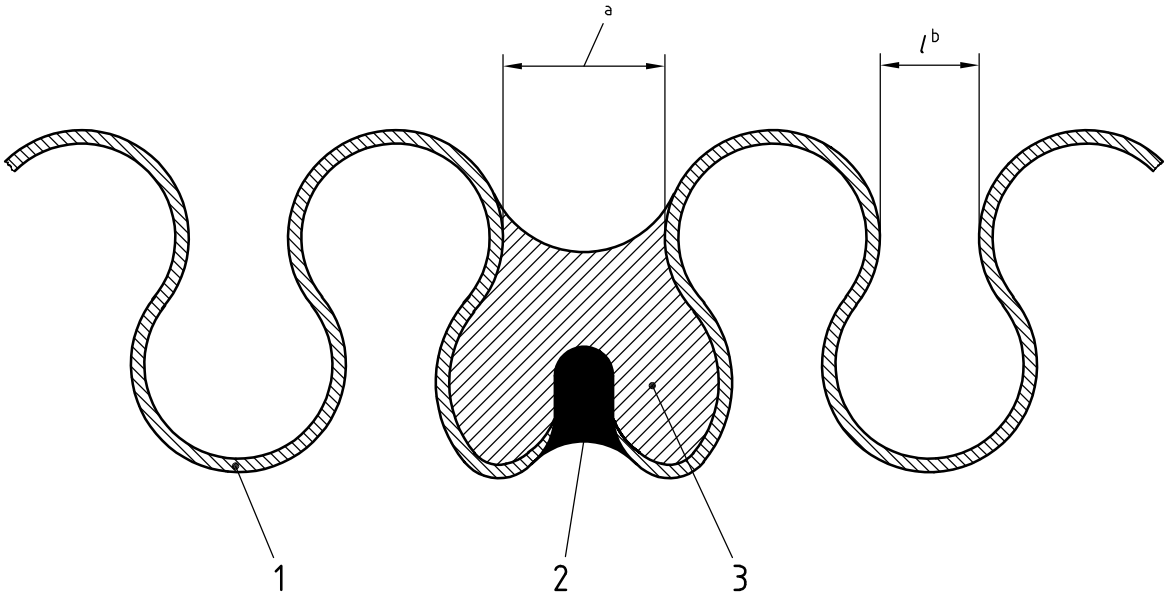
4.3.3.1 Inner tube construction

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 4.3.4 and Figure 1. After welding, the convolutions shall be closed as shown in Figure 1.



Key

1 Convoluted metal hose inner tube

2 Fusion weld

3 High-temperature braze alloy

a Maximum 5 *l*.

b Normal convolution spacing specified by supplier design.

Figure 1 — Inner tube splice configuration

4.3.3.2 Reinforcement

The reinforcement shall be a suitably 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.

4.3.4 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.

4.3.5 Heat treatment

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

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 2.

Table 2 — Dimensions and performance requirements for hose assemblies

Hose nominal size DN	Hose		Fitting Bore [a] min.	Operating pressure at 20 °C [b] max.		Proof pressure at 20 °C [b] min.		Proof pressure at 20 °C [b] min.	
	Inside diameter min.	Outside diameter max.							
	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	15	5	12 000	120	18 000	180	48 000	480
10	8,5	18	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

[a] For ball check diameter see 4.4.2.

[b] For pressure requirements at elevated temperature, multiply the value by the factor given in Table 3.

Table 3 — Factor for correcting pressure requirements at elevated temperature (see Table 2)

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

4.4.2 Assembly internal diameter

When bent to the appropriate minimum static bend radius as specified in Table 4, 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. When elbow fitting is used, the diameter of the sphere shall be 85 % of the appropriate minimum internal diameter of the end fittings as specified in Table 2, to accept some elbow ovality.

4.4.3 Bend radius

The requirements for the minimum bend radius of hoses shall be as given in Table 4. The bend radius shall be measured to the centreline of the hose.

Table 4 — Minimum centreline bend radius

Hose nominal size DN	Minimum bend radius mm			
	Type 1 hose assembly		Type 2 hose assembly	
	Static	Dynamic	Static [a]	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

[a] No flexure in service.

4.4.4 Assembly length

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

4.4.5 Masses

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

4.5 Performance

4.5.1 General

The hose assembly operating proof and burst pressure ratings and minimum bend radius, as given in Tables 2 and 4 respectively, shall be verified by proving that the performance requirements of 4.5.2 to 4.5.9 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.

4.5.2 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 5.4.1.

4.5.3 Proof pressure test

The hose assembly shall withstand the applicable proof pressure, specified in Table 2, at room temperature (i.e. at 20 °C) without leakage or evidence of any permanent deformation or malfunction that would affect hose assembly installation, removal or use when tested in accordance with 5.4.2.

4.5.4 Corrosion test

The hose assembly shall be capable of withstanding the proof pressure requirements specified in 4.5.3 after 50 immersion cycles in a 35 g/l sodium chloride (NaCl) solution in accordance with 5.4.3.

4.5.5 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 4.5.3, after vibration testing in accordance with 5.4.4.

4.5.6 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 4.5.3, after 50 000 combination flexure/pressure cycles in accordance with 5.4.5.

4.5.7 Repeated torque test

The hose assembly end fitting shall be capable of sealing and withstanding the proof pressure requirements specified in 4.5.3, after 15 installations on a mating fitting in accordance with 5.4.6. The fitting nut shall be free enough to permit turning on the elbow or insertion by hand.

4.5.8 Cold test

The hose assembly shall show no evidence of leakage when tested in accordance with 5.4.7.

4.5.9 Thermal shock test

The hose assembly shall show no evidence of leakage when tested in accordance with 5.4.8.

4.5.10 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 2, when tested in accordance with 5.4.9.

4.5.11 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 5.4.10.

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

4.7.1 General

The hose assemblies shall be marked for identification in accordance with the requirements of 4.7.2 and 4.7.3.

4.7.2 Fittings

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

4.7.3 Assemblies

Each assembly shall bear permanent identification markings that include, at least, the following details:

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

b) the manufacturer's complete 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.

4.8 Workmanship

4.8.1 General

Workmanship shall be of such quality as to ensure that hose assemblies furnished in accordance with this International Standard are free from 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.

4.8.2 Dimensions and tolerances

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

4.8.3 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

5.1.1 General

The supplier is responsible for the performance of all quality assurance provisions as specified in this International Standard. Accurate records of testing shall be kept by the supplier and shall be available to the purchaser, on

request, for inspection. The supplier's test data, subject to the approval by the purchaser, shall be considered adequate for product qualification.

5.1.2 Rejection and retest

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

5.1.3 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

5.3.1 Qualification inspections

5.3.1.1 General

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

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.

5.3.1.2 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 6.

5.3.1.3 Test schedule and sequence

The test specimens shall be subjected to qualification tests in the order indicated in Table 7.

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 6)
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 6)

Table 6 — Values for l_1 and l_2

Hose nominal size DN	l_1 mm		l_2 mm	
	Hose assembly			
	Type 1	Type 2	Type 1	Type 2
03	179	—	740	—
04	183	—	744	—
05	187	108	748	434
06	191	112	752	438
08	233	144	917	540
10	285	168	1 082	611
12	333	215	1 047	776
16	372	254	1 420	886
20	459	285	1 656	965
25	597	345	2 148	1 142
32	719	403	2 552	1 327
40	876	523	3 086	1 573
50	1 073	652	3 754	2 027
63	1 361	802	4 748	2 540

NOTE l_1 and l_2 are calculated using the following equations where r_1 and r_2 represent static bend radii:

$$l_1 = \frac{\pi \times r_1}{2} + (4 \times \mathrm{DN}) + 10$$

$$l_2 = \pi \times r_2 + (4 \times \mathrm{DN}) + 100$$

5.3.2 Quality conformance inspections

5.3.2.1 Individual tests (functional tests)

Each hose assembly shall be subjected (100 % inspection) to the following:

a) an examination of the product, performed in accordance with 5.4.1;

b) the proof pressure test, performed in accordance with 5.4.2.

5.3.2.2 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:

a) the proof pressure test, performed in accordance with 5.4.2;

b) the burst pressure test, performed in accordance with 5.4.9;

c) the Strauss test, performed in accordance with 5.4.10.

Table 7 — Test schedule and sequence for qualification testing (order of tests to be read from left to right)

Test specimen No.	Examination of product (see 5.4.1)	Proof pressure test (see 5.4.2)	Corrosion test (see 5.4.3)	Proof pressure test	Vibration test (see 5.4.4)	Proof pressure test	Flexure/ pressure cycling endurance test (see 5.4.5)	Repeated torque test (see 5.4.6)	Cold test (see 5.4.7)	Thermal shock test (see 5.4.8)	Proof pressure test	Burst pressure test (see 5.4.9)	Strauss test (see 5.4.10)
1	×	×			×	×		×			×	× [a]	
2	×	×			×	×						× [a]	
3	×	×						×			×	×	×
4	×	×						×			×	×	×
5	×	×	×	×	× [b]	×					×	× [a]	
6	×	×	×	×			×				×	× [a]	
7	×	×					×				×	× [a]	
8	×	×							×	×	×	× [a]	
9	×	×							×	×	×	× [a]	

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

[b] For nominal sizes up to DN 16 only.

5.3.2.3 Periodic control tests

The flexure/pressure test as laid down in Table 7 shall be performed in accordance with 5.4.5, 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.

5.4 Test methods

5.4.1 Examination of product

Inspect the hose assemblies visually and dimensionally to determine compliance with the applicable hose assembly standard and examine them for compliance with the requirements of clause 4.

5.4.2 Proof pressure test

Lay the hose horizontally on a flat surface so that one end is free to move.

Submit the hose assemblies to a proof pressure test under water at room temperature by applying the appropriate pressures specified in Table 2 with air or nitrogen being used as the test medium. Maintain pressure for 5 min. After testing, thoroughly dry all hose assemblies. For individual tests (functional tests) only, maintain the pressure for 1 min. Water may be used as the test medium if specifically required by the control authority; in this case, the hose assembly is not under water.

5.4.3 Corrosion test

Test specimens No. 5 and 6, as indicated in Table 7, shall be subjected to a corrosion test.

a) Pressurize the hose assembly to the operating pressure specified in Table 2 and maintain this pressure for the steps described in b) to d).

b) Immerse the hose assembly in a 35 g/l sodium chloride (NaCl) solution at 20 °C ± 5 °C for 8 min to 10 min.

c) Air-dry for the remainder of 1 h.

d) Repeat the steps described in b) and c) for a total of 50 times.

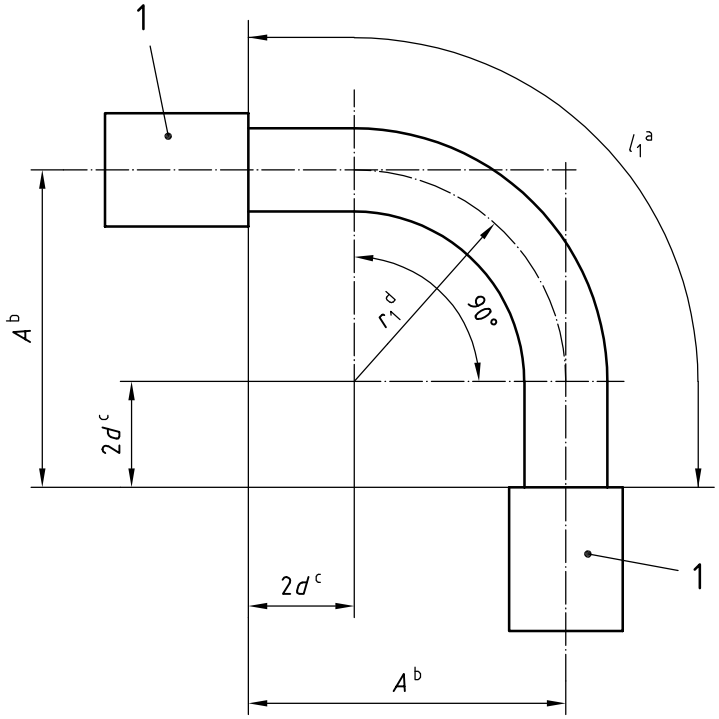
e) Proof test the hose assemblies in accordance with 5.4.2.

f) Without removing salt or cleaning the hose, continue testing by following the sequence laid down in Table 7.

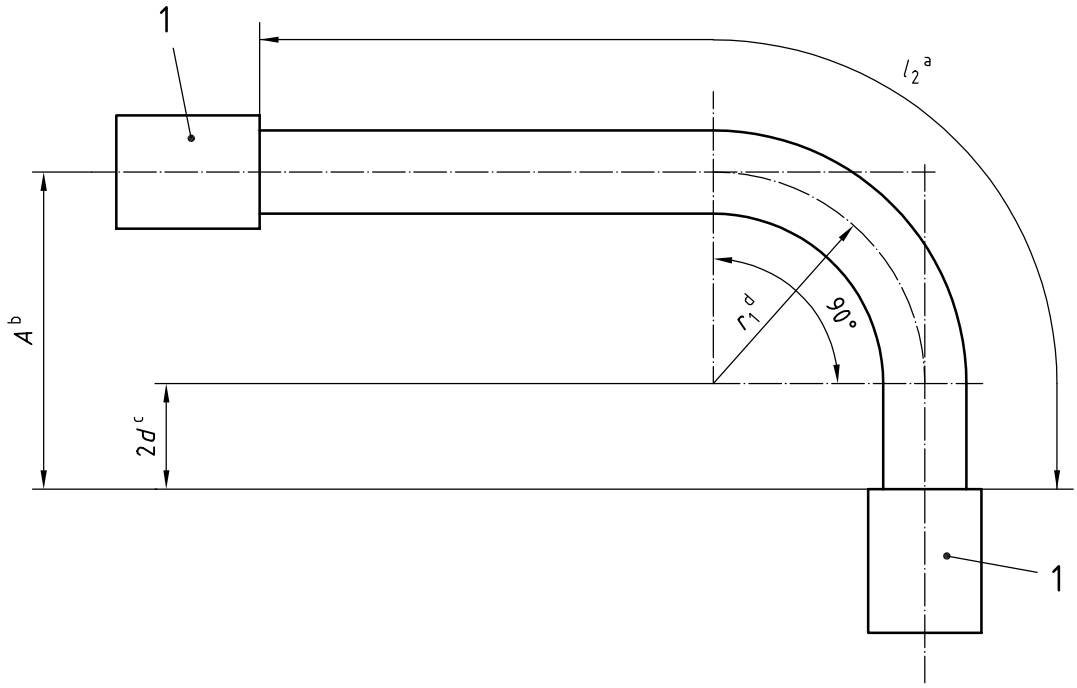
5.4.4 Vibration test

Test specimens Nos. 1, 2 and 5, as indicated in Table 7, shall be subjected to the vibration test.

a) Mount the test specimens Nos. 1 and 2 as shown in Figure 2 a) and specimen No. 5 as shown in Figure 2 b). Pressurize the specimens to the maximum operating pressure at a temperature of 400 °C (see Tables 2 and 3), with air or nitrogen being used as the test medium. Stabilize the hose temperature at 400 °C ± 15 °C. Fix one end of the specimen and vibrate the other end.



a) Mounting for test specimen Nos. 1 and 2



b) Mounting for test specimen No. 5

Key

1 Fitting

a See Table 6

b $A = (r_1 + 2d) \pm 10\ \%$

c d is the nominal inside diameter of the hose

d r_1 is the minimum fixed position (static) bend radius (see Table 4)

Figure 2 — Mounting arrangements for vibration test

b) Vibration shall be included in three mutually perpendicular axes, one axis at a time, as follows:

1) one axis parallel to the plane of the specimen and the centreline of the free end fitting;

2) one axis parallel to the plane of the specimen and the centreline of the fixed end fitting;

3) one axis perpendicular to the plane of the specimen.

Vibration testing consists of the following three operations:

i) resonance search;

ii) resonant dwell;

iii) sinusoidal cycling.

Testing shall be conducted in the order indicated. The required vibration test envelope is as follows:

I) 5 Hz to 30 Hz with an amplitude of $\pm$ 0,38 mm;

II) 30 Hz to 53 Hz with an acceleration of $\pm$ 1,5 g;

III) 53 Hz to 100 Hz with an amplitude of $\pm$ 0,13 mm;

IV) 100 Hz to 350 Hz with an acceleration of $\pm$ 5 g;

V) 350 Hz to 490 Hz with an amplitude of $\pm$ 0,01 mm;

VI) 490 Hz to 1 000 Hz with an acceleration of $\pm$ 10 g.

c) The test shall be performed in accordance with the detail test requirements specified in the applicable industry standards, with the following exceptions:

1) frequency scan rates during resonance search shall be 2 octave/min or slower;

2) several accelerometers shall be installed at appropriate locations on the test item to measure resonances during resonance search conditions. If this is not possible (e.g. due to accelerometer mass effects), a vibration-shaker synchronized strobe light shall be used to select specimen responses;

3) the test specimen shall be vibrated during resonant dwell for 1×10^6 cycles or 8 h, whichever occurs first, at each resonance in a given axis. If more than four resonances are encountered along any one axis, the four most severe resonances shall be chosen for the dwell test;

4) when resonance dwell testing cannot be conducted in a particular axis due to lack of resonance, a sinusoidal cycling test shall be conducted for a total of 8 h at a cycling rate proportional to frequency at a level 1,15 times the applicable test envelope;

5) the sinusoidal cycling test shall be conducted between the frequency limits 5 Hz to 1 000 Hz back to 5 Hz at the vibration test envelope levels for a test duration of 1,5 h per axis. Cycling time (5 Hz to 1 000 Hz back to 5 Hz) shall be 15 min;

6) vibration test envelope tolerances shall be as follows:

— acceleration and displacement amplitude: $\pm$ 10 %;

— frequency: $\pm$ 5 %;

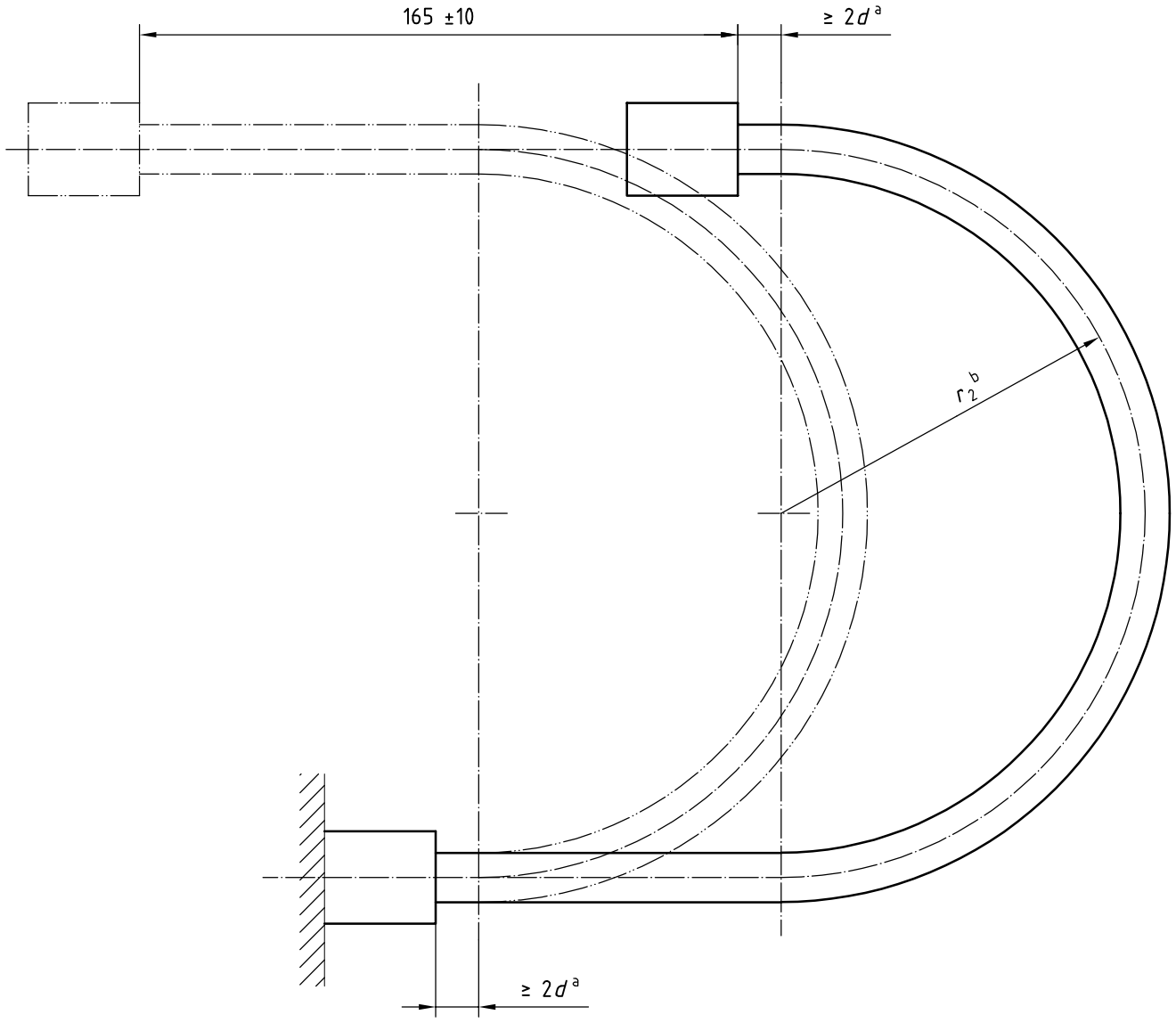
7) motion of the vibrator table shall be sinusoidal with not more than 10 % distortion.

When the vibration test has been completed, subject each specimen to the proof pressure test specified in 5.4.2.

5.4.5 Flexure/pressure cycling endurance test

a) Mount test specimens Nos. 6 and 7, as indicated in Table 7, for flexure/pressure cycling as shown in Figure 3. One end shall be fixed; the other end shall be movable and shall be capable of a reciprocating motion along the hose axis.

Dimensions in millimetres



a d is the nominal inside diameter of the hose

b r_2 is the minimum fixed position (static) bend radius (see Table 4)

Figure 3 — Mounting arrangement for flexure/pressure cycling endurance test

b) Subject the movable end to the test at a rate of 50 cycles/min to 70 cycles/min for a total of 50 000 flexure cycles. One flexure cycle shall be defined as the movement from one extreme, as shown in Figure 3, to the other and back to the starting position. Simultaneously with the hose flexure, subject the hose to cyclical internal hose pressure at a rate of 20 cycles/min to 22 cycles/min ranging from 50 % (or less) to 100 % of the applicable operating pressure, as specified in Table 2.

The test shall be carried out at room temperature and the fluid medium may be water or other hydraulic fluid.

c) When the 50 000 flexure cycles have been completed, subject all three specimens to the proof pressure test specified in 5.4.2. After proof pressure testing, subject all specimens to the burst pressure test specified in 5.4.9.

5.4.6 Repeated torque test

5.4.6.1 General

Six end fittings, as defined by the purchaser, shall be installed on test specimens Nos. 1, 3 and 4, as indicated in Table 7, and shall be subjected to the repeated torque test.

5.4.6.2 Lubrication

Lubricate all adaptor-to-hose fitting threads and contact surfaces with oil prior to application of torque.

5.4.6.3 Application of torque

Assemble the hose fittings to be qualified on a mating fitting of the same material classification and having an end configuration in accordance with drawings, as applicable. Tighten the coupling nut to the appropriate maximum installation torque value for each size and material, and then loosen. Repeat the sequence 15 times.

The hose nipple should be restrained while applying torque to the components to prevent gaulling of the sealing surfaces. It is recommended that a torque handle be used. Installation torque values shall be given on the supplier's print or other supporting documentation.

5.4.6.4 Functional acceptance test

After application of torque, as specified in 5.4.6.2, and removal from the fitting, the coupling nut shall be free enough to permit turning on the hose nipple by hand. In addition, it should be capable of holding proof pressure for 5 min without leakage. (The test medium used shall be consistent with the applicable intended use.)

5.4.7 Cold test

Test specimens Nos. 8 and 9, as indicated in Table 7, shall be subjected to the cold test.

Place the hose, open-ended, in a refrigerated room and let the temperature stabilize at − 55 °C for 1 h. Then wind the hose alternately 10 times in one direction and 10 times in the other around a mandrel with a diameter equal to twice the bend radius given in Table 4 minus the outside diameter of the hose to be tested.

5.4.8 Thermal shock test

The specimens Nos. 8 and 9, as indicated in Table 7, shall be subjected to the thermal shock test.

Place the hose, open-ended, in an oven the temperature of which is maintained at + 650 °C ± 20 °C for 15 min. Then withdraw the hose from the oven and plunge it into water at ambient temperature. Repeat the operation a further four times.

5.4.9 Burst pressure test

All test specimens shall be subjected to an internal pressure burst test. The test shall be conducted at room temperature (20 °C $^{+12}_{-5}$ °C) and water or another hydraulic fluid may be used as the test medium. Extend the specimen straight with one end connected to a pressure source and the other end free to move. Increase the pressure in 680 kPa increments starting with an initial pressure of 3 400 kPa below the rated burst pressure for the hose assembly. Allow for a minimum of 1 min between each subsequent pressure increase. Record the pressure at which the hose ruptures.

Failure of test specimens Nos. 1, 2, 5, 6, 7, 8 and 9 to comply with the requirements laid down in 4.5.10 shall not be cause for rejection. Test specimens Nos. 3 and 4 shall comply with the requirements of 4.5.10.

5.4.10 Strauss test

A test for intergranular attack in the weld zone (weld plus heat-affected area) of the stainless steel tube on each end of test specimens Nos. 3 and 4, as indicated in Table 7 shall be conducted in accordance with industrial standards.

6 Preparation for delivery

6.1 Closures

High-density plastic (polypropylene) closures shall be used to the maximum extent possible. Anodized aluminium caps and plugs shall be used if the above-mentioned high-density plastic is not available.

6.2 Packaging

Packaging shall be as thorough and secure as possible in order to ensure delivery of assemblies in a clean and undamaged condition.

6.3 Marking of containers

6.3.1 General

Interior and exterior containers shall be marked in accordance with applicable standards.

6.3.2 Packaging date

The date of packaging shall be marked on all interior and exterior containers.

Bibliography

[1] ISO 8153:—[1)], *Aerospace — Fluid systems and components — Terminology for hose assemblies*

1) To be published.

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