INTERNATIONAL STANDARD

ISO 14743

Second edition
2020-01

Pneumatic fluid power — Push-in connectors for thermoplastic tubes

Transmissions pneumatiques — Raccords instantanés pour tubes thermoplastiques

Reference number
ISO 14743:2020(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 4, *Connectors and similar products and components*.

This second edition cancels and replaces the first edition (ISO 14743:2004), which has been technically revised. The main changes compared to the previous edition are as follows:

— new fitting size including inch dimensions has been added;

— new normative references have been added;

— updates on leakages performances and precisions have been added for cyclic endurance with vibration.

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

Introduction

In pneumatic fluid power systems, power is transmitted and controlled through air under pressure within a circuit.

Components are connected through their ports by means of connectors (fittings) and conductors.

Pneumatic fluid power — Push-in connectors for thermoplastic tubes

1 Scope

This document specifies the general requirements and test methods for the design and performance of push-in connectors for use with thermoplastic tubes with outside diameters (OD) from 3 mm to 16 mm including dimensions in inches.

This document is intended to establish uniform methods of testing complete push-in connector assemblies as used in pneumatic fluid power applications. It is not applicable to air braking systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 4759-1, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 8573-1:2010, *Compressed air — Part 1: Contaminants and purity classes*

ISO 10619-1, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 1: Bending tests at ambient temperature*

ISO 16030, *Pneumatic fluid power — Connections — Ports and stud ends*

ANSI/ASME B1.1, *Unified Inch Screw Threads, (UN and UNR Thread Form)*

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose, Inch*

ANSI/ASME B1.20.3, *Dryseal Pipe Threads (Inch)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 apply.

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

4 Working conditions

Push-in connectors shall provide connections from –0,09 MPa [–0,9 bar[1)]] to a working pressure of 1,6 MPa (16 bar) when used at temperatures between –20 °C and +80 °C.

1) 1 bar = 0,1 MPa = 105 Pa; 1 MPa = 1 N/mm^2

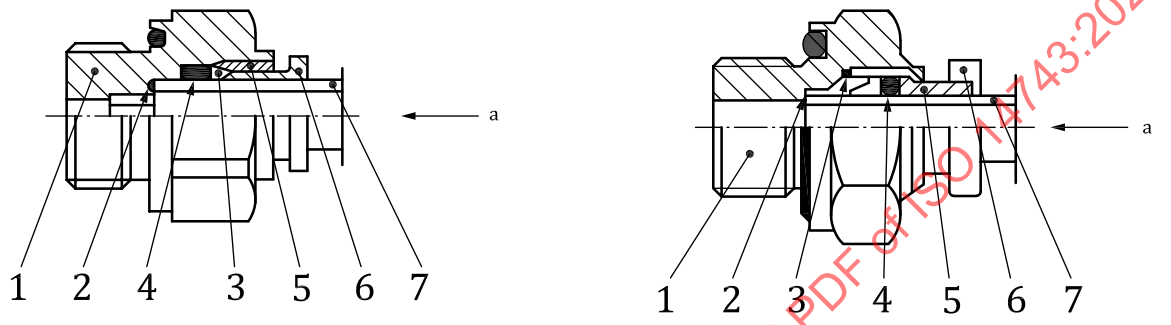
The connector assembly shall meet the performance requirements given in Clause 9 with tubes specified in Annex A and Annex B.

When tubing with a lower rated pressure is used, the maximum working pressure of the tube and connector assembly shall be that of the tubing.

In road vehicles, it is necessary to exercise special care to ensure that these connectors are never used in an air braking system.

5 Features

Design is optional to the manufacturer. Two examples are shown in Figure 1.



a) With sealing system located beyond the locking mechanism

b) With sealing system located in front of the locking mechanism

Key

1	body	5	releasing sleeve
2	tube stop	6	removable button (optional)
3	grab ring of tube	7	tube
4	sealing of tube	a	Entry of the tube.

Figure 1 — Examples of design and description of the features of push-in connectors for use with thermoplastic tubes

6 OD of tube

The OD of the tube shall be chosen from the following range of sizes:

3 mm, 1/8 in (3,17 mm), 4 mm (5/32 in), 6 mm, 1/4 in (6,35 mm), 8 mm (5/16 in), 10 mm, 3/8 in (9,52 mm), 12 mm, 1/2 in (12,7 mm), 14 mm, and 16 mm (5/8 in).

7 Design

7.1 Push-in connector dimensions shown in Figures 2 to 7 shall conform to the dimensions given in Tables 1 to 7.

7.2 Hexagon tolerances across flats shall be in accordance with ISO 4759-1, Grade C. The minimum hexagon across-corner turn diameter of 1,092 times the normal across flats dimension shall be used.

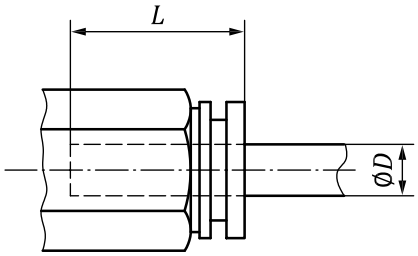
7.3 For connectors with the thread M and G, thread and stud end shall be in accordance with ISO 16030.

For connector with the thread R, thread and stud end shall be in accordance with ISO 7-1.

For connector with NPT thread, thread and stud end shall be in accordance with ANSI/ASME B1.20.1 and ANSI/ASME B1.20.3.

For connector with UNF thread, thread and stud end shall be in accordance with ANSI/ASME B1.1.

7.4 Details of contour shall be at the option of the manufacturer if the dimensions given in the Tables are maintained.



Key

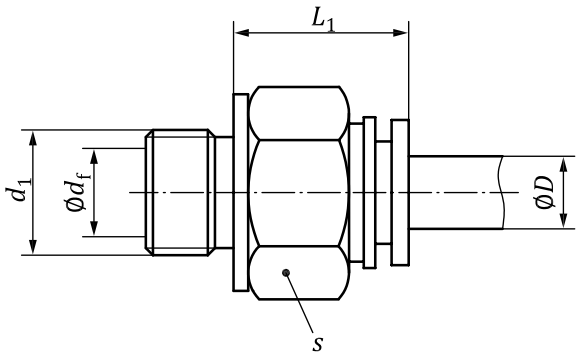
D tube OD

L maximum insertion depth

Figure 2 — Tube insertion depth

Table 1 — Maximum tube insertion depth

Tube OD *D*		**Maximum insertion depth** *L*
in (mm)	mm	mm
1/8 (3,17)	3	16
5/32 (4)	4	18
1/4 (6,35)	6	19
5/16 (8)	8	20
3/8 (9,52)	10	24
1/2 (12,7)	12	33
	14	33
5/8 (16)	16	35



Key

D tube OD

d_1 thread outside diameter

s hexagon socket dimension

L_1 Stud adaptor height

d_f flow diameter

Figure 3 — Stud adaptor (SDS)

Table 2 — SDS dimensions for tube OD in millimetres

Dimensions in millimetres

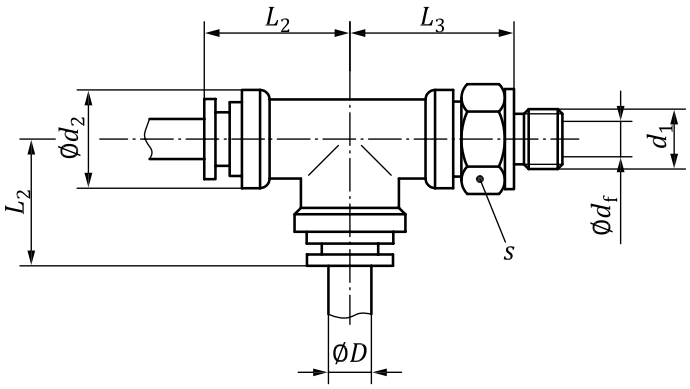
Tube OD D	d_1	L_1 max.	s^a max.	**Flow diameter** d_f min.
3	M3	17	10	1,2
	M5	17	10	1,8
4	M3	22	12	1,2
	M5	22	12	2
	M7	22	12	2,5
	G1/8, R1/8, 1/8NPT	22	14	2,5
	G1/4, R1/4, 1/4NPT	22	19	2,5
	R3/8	22	22	3
6	M5	23	12	2,5
	M7	23	14	3
	M10	23	15	4
	M12	23	17	4
	G1/8, R1/8, 1/8NPT	23	14	4
	G1/4, R1/4, 1/4NPT	23	19	4
	G3/8, R3/8	23	22	4
	G1/2, R1/2	23	26	4
8	M10, M12, G1/8, R1/8, 1/8NPT	24	17	5
	G1/4, R1/4, 1/4NPT	24	19	6
	G3/8, R3/8, 3/8NPT	24	22	6
	G1/2, R1/2	24	26	6
10	G1/4	27	19	7
	G3/8, R3/8, 3/8NPT	27	22	8
	G1/2	27	26	8
	R1/8	27	19	5
	R1/4, 1/4NPT	27	22	7
	R1/2, 1/2NPT	27	26	8
12	G1/4, R1/4	30	22	7
	G3/8, R3/8, 3/8NPT	30	22	9
	G1/2, 1/2NPT	30	26	10
	R 1/2	30	26	9
14	G3/8, R3/8	32	25	9
	G1/2	32	26	11
	R 1/2	32	26	10
16	G3/8, R3/8, 3/8NPT	34	30	9
	G1/2, R1/2, 1/2NPT	34	30	12

[a] Hexagon socket or OD at the choice of the manufacturer.

Table 3 — SDS dimensions for tube OD in inches

Tube OD D in	d_1 mm	L_1 mm max.	s^a mm max.	**Flow diameter** d_f mm min.
1/8	R1/8, 1/16NPT, 1/8NPT	18	14	1,8
	1/4 NPT	18	19	1,8
	10-32 UNF	18	13	1,8
5/32	R1/8, 1/8NPT	22	14	2,5
	R1/4, 1/4NPT	22	20	2,5
	10-32 UNF	22	13	2
1/4	R1/8, 1/8NPT	23	15	4
	R1/4, 1/4NPT	23	19	4
	1/16 NPT	23	14	3
	3/8 NPT	23	22	4
	10-32 UNF	23	14	2
	M5	23	12	2,5
	M7	23	14	4
5/16	R1/8, 1/8NPT	25	17	5
	R1/4, 1/4NPT	25	19	6
	R3/8, 3/8NPT	25	22	6
	R 1/2	25	26	6
3/8	R1/4, 1/4NPT	28	19	7
	R3/8, 3/8NPT	28	22	7
	R1/2, 1/2NPT	28	26	7
	1/8 NPT	28	19	4
1/2	R1/4, 1/4NPT	30	26	6
	R3/8, R1/2, 3/8NPT, 1/2NPT	30	26	7
5/8	G3/8, R3/8, 3/8NPT	34	30	9
	G1/2, R1/2, 1/2NPT	34	30	12

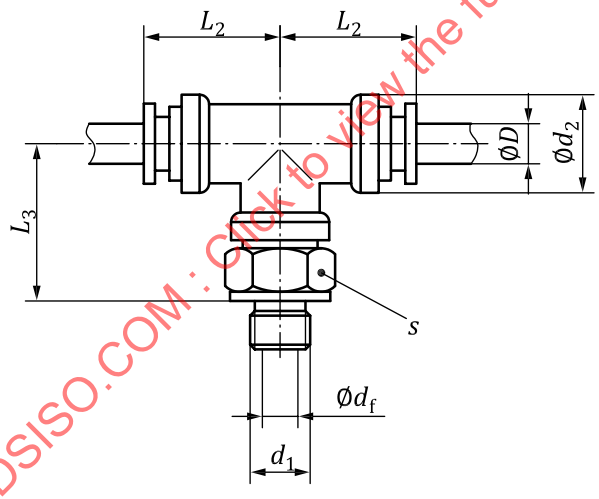
[a] Hexagon socket or OD at the choice of the manufacturer.



Key

D	tube OD	L_2	elbow and tee (branch or swivel) outer length dimension (from thread axis to perpendicular side connector end)
d_f	flow diameter	L_3	elbow and tee (branch or swivel) outer length dimension (from thread stop end surface to perpendicular side connector tubing axis)
d_1	thread outside diameter	d_2	connector body outer diameter

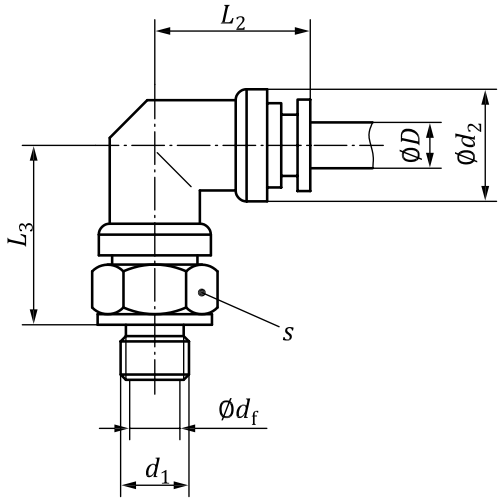
Figure 4 — Swivel male run tee (SWRT)



Key

D	tube OD	L_2	elbow and tee (branch or swivel) outer length dimension (from thread axis to perpendicular side connector end)
d_f	flow diameter	L_3	elbow and tee (branch or swivel) outer length dimension (from thread stop end surface to perpendicular side connector tubing axis)
d_1	thread outside diameter	d_2	connector body outer diameter

Figure 5 — Swivel male branch tee (SWBT)



Key

D	tube OD	L_2	elbow and tee (branch or swivel) outer length dimension (from thread axis to perpendicular side connector end)
d_f	flow diameter	L_3	elbow and tee (branch or swivel) outer length dimension (from thread stop end surface to perpendicular side connector tubing axis)
d_1	thread outside diameter	d_2	connector body outer diameter

Figure 6 — Swivel male elbow (SWE)

Table 4 — Dimensions for SWRTs, SWBTs and SWEs for tube OD in millimetres

Dimensions in millimetres

Tube OD D	d_1	d_2 max.	L_2 max.	L_3 max.	s^a max.	Flow diameter d_f min.
3	M3	10	19	16	6	1,2
	M5	10	19	18	10	1,8
4	M3	10	19	21	12	1,2
	M5	13	21	21	10	2
	M7	13	21	21	12	2,5
	G1/8, R1/8, 1/8NPT	13	21	21	14	2,5
	G1/4, R1/4, 1/4NPT	13	21	21	19	2,5
	R 3/8	13	21	21	22	3
6	M5	13	23	26	12	2,5
	M7	15	23	26	14	2,5
	M10	15	23	26	15	4
	M12	15	23	26	17	4
	G1/8, R1/8, 1/8NPT	15	23	26	14	4
	G1/4, R1/4, 1/4NPT	15	23	26	19	4
	G3/8, R3/8	15	23	26	22	4
	G1/2, R1/2	15	23	26	26	4

[a] Hexagon socket or OD at the choice of the manufacturer.

Table 4 *(continued)*

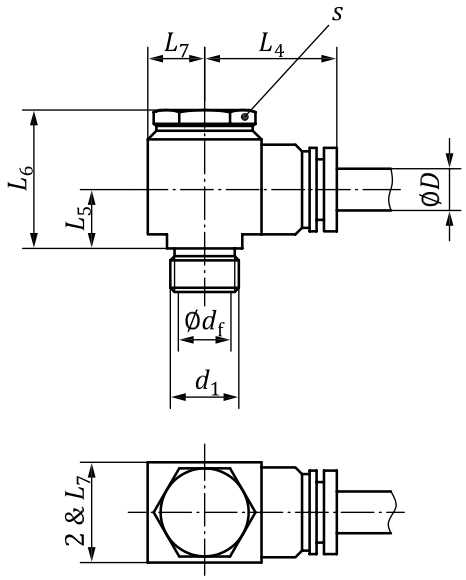
Tube OD D	d_1	d_2 max.	L_2 max.	L_3 max.	s^a max.	**Flow diameter** d_f min.
8	M10, M12	17	26	28	17	5
	M12	17	26	28	17	5
	G1/8, R1/8, 1/8NPT	17	26	28	14	5
	G1/4, R1/4, 1/4NPT	17	26	28	19	6
	G3/8, R3/8, 3/8NPT	17	26	28	22	6
	G1/2, R1/2	17	26	28	26	6
10	G1/4, R1/4, 1/4NPT	22	29	34	19	7
	G3/8, R3/8, 3/8NPT, G1/2	22	29	34	22	8
	R 1/8	22	29	34	26	5
	R1/2, 1/2NPT	22	29	34	26	8
12	G1/4, R1/4	24	32	37	22	7
	G3/8, R3/8, 3/8NPT	24	32	37	22	9
	G1/2, R1/2, 1/2NPT	24	32	37	26	9
14	G3/8, R3/8	26	37	42	25	9
	G1/2, R1/2	26	37	42	26	11
16	G3/8, R3/8, 3/8NPT	29	41	75	30	9
	G1/2, R1/2, 1/2NPT	29	41	75	30	12

[a] Hexagon socket or OD at the choice of the manufacturer.

Table 5 — Dimensions for SWRTs, SWBTs and SWEs for tube OD in inches

Tube OD D in	d_1 mm	d_2 mm max.	L_2 mm max.	L_3 mm max.	s^a mm max.	Flow diameter d_f mm min.
1/8	R1/8, 1/16NPT, 1/8NPT	10	19	21	14	1,8
	10-32UNF	10	19	21	13	1,8
	1/4NPT	10	19	21	19	1,8
5/32	R1/8, 1/8NPT	13	21	23	14	3
	R1/4, 1/4NPT	13	21	23	19	3
	10-32 UNF	13	21	23	13	2
1/4	R1/8	15	23	26	14	4
	R1/4	15	23	26	19	4
	10-32 UNF	15	23	26	14	2
	1/8 NPT	15	23	26	14	4
	1/4 NPT	15	23	26	19	4
	3/8 NPT	15	23	26	22	4
	M7	15	23	26	14	4
5/16	R1/8, 1/8NPT	17	26	28	17	4
	R1/4, 1/4NPT	17	26	28	19	6
	R3/8, 3/8NPT	17	26	28	22	6
	R1/2	17	26	28	26	7
3/8	R1/4, 1/4NPT	22	29	34	19	7
	R3/8, 3/8NPT	22	29	34	22	7
	1/8NPT	22	29	34	19	4
	1/2NPT	22	29	34	26	7
1/2	R1/4, 1/4NPT	24	37	37	22	7
	R3/8, 3/8NPT	24	37	37	22	9
	R1/2, 1/2NPT	24	37	37	26	9,6
5/8	G3/8, R3/8, 3/8NPT	29	41	75	30	9
	G1/2, R1/2, 1/2NPT	29	41	75	30	12

[a] Hexagon socket OD the manufacturer.



Key

D	tube OD	L_4	male banjo elbow length outer dimension (from thread axis to perpendicular side connector end)
d_f	flow diameter	L_5	male banjo elbow length outer dimension (from thread stop end surface to perpendicular side connector tubing axis)
d_1	thread outside diameter	L_6	male banjo elbow height (from thread stop end surface)
s	hexagon socket dimension	L_7	male banjo elbow half width

Figure 7 — Male banjo elbow (BJE) connectors

Table 6 — Dimensions for BJE connectors for tube OD in millimetres

Dimensions in millimetres

Tube OD D	d_1	L_4 max.	L_5 max.	L_6 max.	L_7 max.	s[a] max.	Flow diameter d_f min.
3	M3	20	10	22	5	6	1,2
	M5	20	10	25	8	10	1,8
4	M5	24	10	25	8	10	2
	M7	24	12	26	9	12	2,5
	G1/8, R1/8	24	12	26	9	14	3
6	M5, M7, G1/8	24	12	26	9	14	4
	G1/4, R1/4	24	12	26	11	19	4
	R1/8	24	12	26	9	14	2,5
8	G1/8, R1/8	26	14	29	11	14	5,5
	G1/4, R1/4	32	14	32	11	19	6
	G3/8, R3/8	32	14	32	13	23	6

[a] Hexagon socket or OD at the choice of the manufacturer.

Table 6 *(continued)*

Tube OD D	d_1	L_4 max.	L_5 max.	L_6 max.	L_7 max.	s^a max.	**Flow diameter** d_f min.
10	G1/4, R1/4	39	14	34	13	23	7,5
	G3/8, R3/8	39	16	39	13	23	8
	G1/2	39	16	39	15	27	8
12	G3/8, R3/8	44	16	39	15	23	10
	G1/2, R1/2	44	16	42	17	27	10
	R1/4	44	16	39	15	23	7

[a] Hexagon socket or OD at the choice of the manufacturer.

Table 7 — Dimensions for BJE connectors for tube OD in inches

Tube OD D in	d_1 mm	L_4 mm max.	L_5 mm max.	L_6 mm max.	L_7 mm max.	s^a mm max.	Flow diameter d_f mm min.
1/8	10-32UNF	20	10	22	8	10	1,8
5/32	1/8NPT	24	12	26	9	14	3
	10-32UNF	24	10	25	8	12	2
1/4	1/8 NPT	26	14	26	9	14	4
	1/4 NPT	26	14	27	9	19	4
	3/8 NPT	32	14	29	11	23	4
	10-32UNF	26	14	26	9	12	2
5/16	1/8 NPT	29	14	29	11	14	5,5
	1/4 NPT	32	14	32	11	19	6
3/8	1/4 NPT	39	16	34	13	23	7
	3/8 NPT	39	16	39	13	23	7

[a] Hexagon socket or OD at the choice of the manufacturer.

8 Marking

Each push-in connector shall be permanently marked with the minimum following information:

a) manufacturer's/supplier's name or trademark;

b) the OD of the tube which it is to be used with the push-in connector.

9 Performance requirements and testing

9.1 General

9.1.1 This clause establishes minimum qualification requirements for tensile load, pressure capabilities, leakage, connection forces, disconnection forces and cyclic endurance (impulse) for pneumatic push-in connectors for use with thermoplastic tubes.

9.1.2 Unless otherwise specified, tests shall be conducted at room temperature (23 °C ± 5 °C) and relative humidity level of 65 % ± 5 %.

9.1.3 Unless otherwise specified, a tolerance of ±5 % applies to all test characteristics.

9.2 Test samples

9.2.1 Three test samples shall be subjected to the proof and burst pressure tests; six test samples shall be subjected to all other tests.

9.2.2 Prior to testing, the tube sample shall be a minimum of two weeks (336 h) old.

9.2.3 Test samples shall consist of a push-in connector connected to the test tubing defined in Annex A and Annex B. Except for 9.6 and 9.7, the tubes for the test samples shall be cut to provide a length that is

20 times the OD of the tube between the two ends of the connectors when connected. The tubes shall be connected in accordance with the connector manufacturer's specification.

9.2.4 Prior to testing, each connector to be tested shall be connected and disconnected four times and then connected a fifth time so that testing can be conducted.

9.3 Tensile test

9.3.1 Procedure

9.3.1.1 The test shall be conducted under unpressurised conditions.

9.3.1.2 The test sample shall be placed in a tensile machine and fixture so that the samples and end fixtures are co-linear. One end of the test sample shall be stationary, and the opposite end shall be attached to the moving member of the test apparatus. A tensile load shall be applied at a rate of 1 mm/s along the axis of the test specimen.

9.3.2 Pass/fail criteria

The test sample shall withstand the minimum tensile load shown in Table 8 without separation from the connector.

Table 8 — Minimum tensile load for tensile test

Tube OD, *D*, mm	3	4	6	8	10	12	14	16
Tube OD, *D*, in (mm)	1/8 (3,17)	5/32 (4)	1/4 (6,35)	5/16 (8)	3/8 (9,52)	1/2 (12,7)	–	5/8 (16)
Minimum tensile load for polyamide (PA) tube, *N*	60	70	120	170	250	300	300	350
Minimum tensile load for polyurethane (PU) tube, *N*	25	50	100	150	200	200	250	300

9.4 Pressure at maximum temperature test (for PA tubing only)

9.4.1 Description

The test under 1,5 times maximum allowed working pressure (MAWP) at maximum temperature is conducted with PA tubing, as specified in Annex A, and is intended to evaluate the ability of the connector to be functional and disconnected after this test.

9.4.2 Apparatus

The test apparatus consists of a source of pressure and chamber temperature.

9.4.2.1 Source of pressure

The apparatus that will be used for the pressure test at maximum temperature shall be source of pressure with gauges and piping, capable to apply to the sample 1,5 times MAWP within the ±5 % general requirement tolerance. The test fluid applied shall be water.

9.4.2.2 Temperature chamber

The test apparatus consists of a temperature chamber capable to maintain the test sample during the specified time at the temperature required within the ±5 % tolerance accuracy.

9.4.3 Procedure

Plug one end of the test specimen and mount it in the apparatus with the plugged end unrestrained. Apply a pressure of 1,5 times MAWP to the test specimen and hold for 1 h at +80 °C.

9.4.4 Pass/fail criteria

The tube shall be disconnected from the connector. The connection under test shall not exhibit any visual deformation or visual evidence of leakage after being subjected to the test.

9.5 Proof and burst pressure test (for PA tubing only)

9.5.1 Description

The proof and burst pressure test is conducted with PA tubing, as specified in Annex A, and is intended to evaluate the ability of the connector to retain the tubing at a proof pressure of 1,5 times the rated pressure and at a minimum burst pressure of three times the rated pressure.

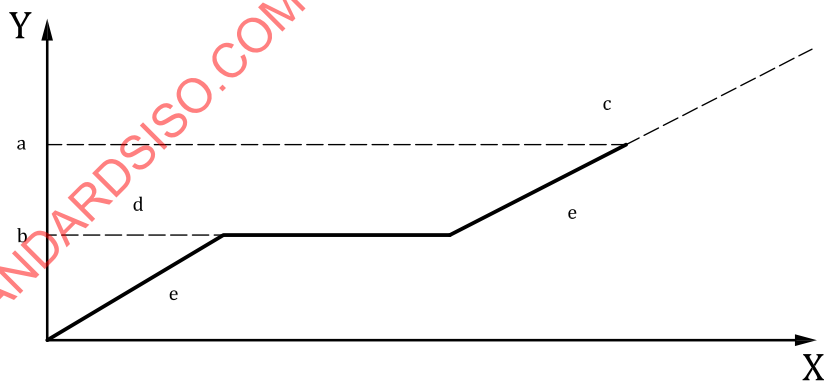
9.5.2 Apparatus

The test apparatus consists of a source of pressure and the necessary gauges and piping. The test fluid shall be water.

9.5.3 Procedure

9.5.3.1 Plug one end of the test specimen and mount it in the apparatus with the plugged end unrestrained. Apply a proof pressure of 1,5 times the rated pressure to the test specimen and hold for a minimum of 30 s.

9.5.3.2 Increase pressure at a constant rate of 0,1 MPa/s to 0,2 MPa/s (1 bar/s to 2 bar/s) to reach the specified minimum burst pressure, i.e. three times the rated pressure. See Figure 8 for a typical pressure trace for the proof and burst pressure test.



Key

X time
Y pressure
a 3 times the rated pressure.
b 1,5 times the rated pressure.
c Minimum burst pressure.
d Proof pressure.
e 0,1 MPa/s to 0,2 MPa/s.

Figure 8 — Typical pressure trace for proof and burst pressure test

9.5.4 Pass/fail criteria

9.5.4.1 The connection under test shall not exhibit any visual deformation or visual evidence of leakage after being subjected to the proof pressure for a minimum of 30 s.

9.5.4.2 The connection under test shall not fail after being subjected to the minimum burst pressure.

9.6 Connecting force test

9.6.1 Apparatus

Use a compression test machine and gauge to measure forces.

9.6.2 Procedure

Mount the threaded end of the connector into a stationary fixture. Insert the tube into the connector by applying a compression load with the compression test machine set at a rate of 1 mm/s, and measure and record the maximum connecting force.

9.6.3 Pass/fail criteria

The force needed to connect shall not exceed the value given in Table 9 for the relevant tube OD.

Table 9 — Maximum connecting and disconnecting forces

Tube OD, *D*, mm	3	4	6	8	10	12	14	16
Tube OD, *D*, in (mm)	1/8 (3,17)	5/32 (4)	1/4 (6,35)	5/16 (8)	3/8 (9,52)	1/2 (12,7)	–	5/8 (16)
Maximum connecting force, *N*	35	45	60	80	100	130	130	160
Maximum disconnecting force, *N*	30	40	50	60	70	80	80	100

9.7 Disconnecting force test

9.7.1 Apparatus

Use a tensile test machine and gauge to measure forces.

9.7.2 Procedure

Apply a permanent load on the connector's releasing mechanism according to the manufacturer's recommendation. Apply a tensile load with the tensile test machine set at a rate of 1 mm/s, and measure and record the maximum disconnecting force.

9.7.3 Pass/fail criteria

The force needed to disconnect shall not exceed the value given in Table 9 for the relevant tube OD.

9.8 Leakage test (to be performed before disconnecting)

9.8.1 Description

This test is intended to evaluate leakage after a test sample has been subjected to various temperatures and pressures.

9.8.2 Apparatus

9.8.2.1 The tube and connector shall be installed as shown in Figure 9 in a temperature cabinet capable of controlling the temperature within the ranges specified in Figures 10 and 11. Figure 9 is an example for straight fitting. In case of other shape model, the fixing devise should be adapted.

9.8.2.2 The radius of the bend in the tubing shall be in accordance with Table A.1 for PA tubing and Table B.1 for PU tubing.

9.8.2.3 The length of the tube, *L*, shall be calculated from Formula (1):

$$L = 2\,L_{\text{real}} + \pi(R + 0{,}5\,D) \tag{1}$$

where

L_{real} is the actual insertion depth of the test sample, in millimetres (see Figure 2 for an illustration of this dimension);

R is the minimum bending radius from Table A.1 or Table B.1, in millimetres;

D is the OD of the tubing, in millimetres.

9.8.2.4 The distance between the ports, A, shall be calculated from Formula (2):

$$A = 2R + D \quad (2)$$

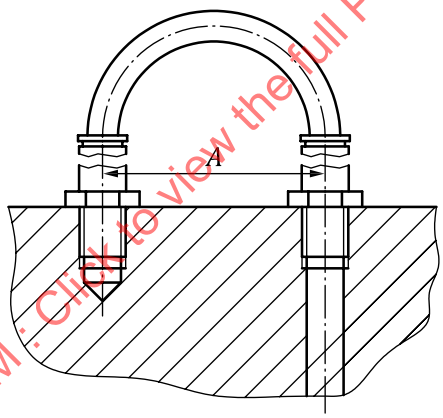
where

R is the minimum bending radius from Table A.1 or Table B.1, in millimetres;

D is the OD of the tubing, in millimetres.

9.8.2.5 Various methods may be used to measure the leakage of the assembly; such as pressure drop in a specific volume or by a mass flowmeter.

9.8.2.6 Compressed air purity classes ISO 8573-1:2010, Table 1, Class 3 shall be used.



Key

A distance between the ports, in mm

NOTE See 9.8.2.1 for information on shape fitting and fixing devise.

Figure 9 — Example of test assembly for leakage test and locations of leakage measurement sites

9.8.3 Procedure

9.8.3.1 Subject the test sample to the temperature cycle defined in Figure 10 (for PA tubing) and Figure 11 (for PU tubing), within a tolerance of ±2 °C. The rate of temperature increase and decrease depends on the person performing the test, as long as the requirements of Figures 10 and 11 are met.

9.8.3.2 When each point labelled P_1 is reached, apply pressure at 0,1 MPa (1 bar), 0,6 MPa (6 bar) and –0,09 MPa (–0,9 bar), then measure and record the leakage rate at each pressure level for the assembly.

9.8.3.3 When the point labelled P_2 and P_3 are reached, apply pressure at 0,1 MPa (1 bar) and 0,6 MPa (6 bar), then measure and record the leakage rate at each pressure level for the assembly.

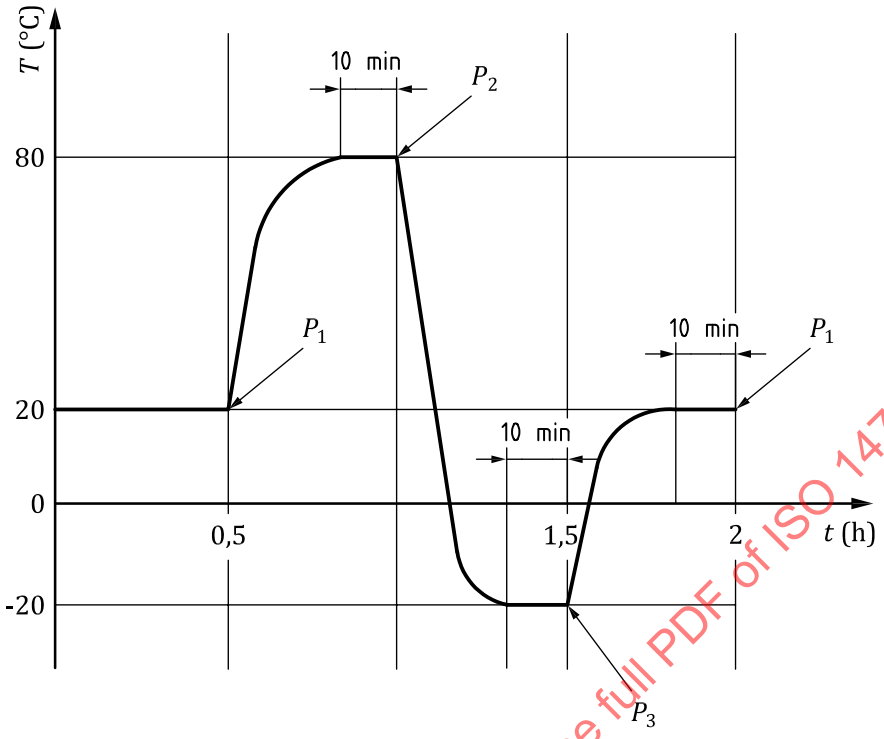


Figure 10 — Temperature cycle trace for PA tubing

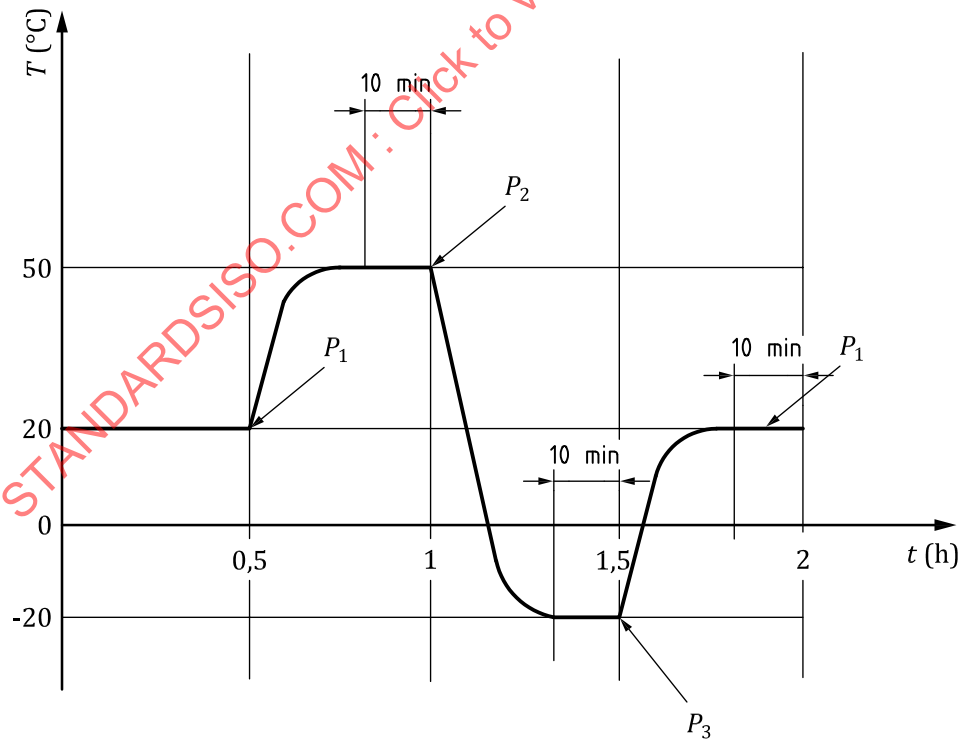


Figure 11 — Temperature cycle trace for PU tubing

9.8.4 Pass/fail criteria

The values in Table 10 are for a straight fitting assembly as shown in Figure 9. For other assemblies that contain additional tube connections factor, Table 10 values proportionately.

Table 10 — Maximum allowable leakage rate (ANR)

Temperature, °C, **± 2 °C**	PA tubing	–20	+20	+80
	PU tubing	–20	+20	+50
Maximum ANR, cm^3/min	at 0,10 MPa (1 bar) and 0,6 MPa (6 bar)	2	1	1
	at –0,09 MPa (–0,9 bar)	—	1	—
	Figures 10 and 11, temperature cycle measuring point	P_3	P_1	P_2

9.9 Cyclic endurance (impulse) test with vibration (for PA tubing only)

9.9.1 Description

This test is intended to evaluate the endurance of a tube and connector assembly under vibration and pressure pulsating conditions. This test applies only to PA tubing.

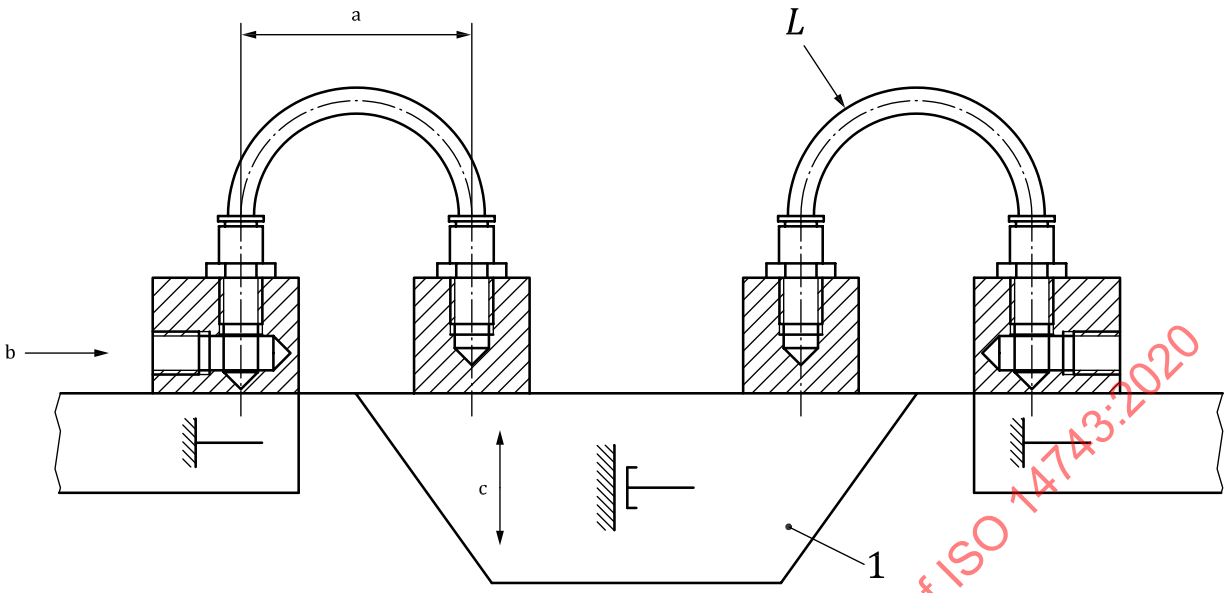
9.9.2 Apparatus

9.9.2.1 Equipment capable of vibrating one end of the test sample in accordance with the requirements of 9.9.3.2 and Figures 12 and 13 shall be provided.

9.9.2.2 A mass flowmeter to measure the leakage rate shall be provided.

9.9.3 Procedure

9.9.3.1 Mount one end of the test assembly on the static support and the other end on the vibration head (see Figure 12), making sure that the tubing is bent at the minimum bending radius specified in Annex A with a tolerance of +0 / –10 %. The length of the tubing sample shall ensure that the tubing is not bent to a radius smaller than the minimum bending radius specified in Annex A during displacement, as calculated in paragraph 9.8.2.3.



Key

1 vibration system

L length of tube

a Distance between fittings (2× minimum bending radius).

b Threaded connection for inlet pressure.

c Direction of vibration.

Figure 12 — Vibration test mounting diagram

9.9.3.2 Using dry air, pressurise the test sample at 0 MPa (0 bar) and 0,6 MPa (6 bar) with a square wave pressure signal with frequency 0,1 Hz and duty cycle 50 % (Ton = 5 s – Toff = 5 s). Subject the test sample to vibration with a constant displacement of 20 mm peak-to-peak at a frequency from 5 Hz to 17,2 Hz, then to a constant acceleration of 117,7 m/s^2 at a frequency up to 500 Hz with a sweep rate of 1 octave/minute (see Figure 13). Each test sample shall be subjected to vibration for 40 sweeps (about 8 h) in each direction (X and Y axes).

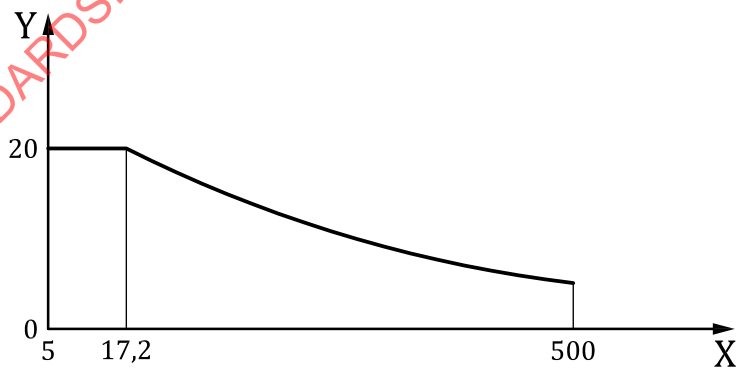


Figure 13 — Peak-to-peak displacement vs. frequency

9.9.3.3 For each measurement point of the leakage rate, stabilise the pressure at 0,6 MPa (6 bar) for 1 min to take the first leakage rate measurement, then stabilise the pressure at 0,1 MPa (1 bar) for 1 min to take the second measurement, and then complete the cycle until the next measurement points are reached. Each measurement shall be taken during the last 10 s of the pressure-stabilisation interval. The

mechanical vibration cycle shall be paused during this time. Three measurements points are fixed: at the beginning of the vibration, at half of the vibration cycle (after 20 sweeps, about 4 h), at the end (after 40 sweeps).

9.9.4 Pass/fail criteria

The total leakage rate for all six test samples, at room temperature, shall not exceed 3 cm^3/min.

10 Designation

10.1 Connectors shall be designated by an alphanumeric code to facilitate ordering. The connector style letter symbol (see 10.2), followed by a hyphen, the OD of the tube with which they are to be connected, each separated by a small "x", then the threaded ends designation and finally "ISO 14743". See Table 13 for an example.

10.2 The letter symbol designation of the connector shall have two parts: the connection end type immediately followed by the shape of the connector. The following letter symbols given in Table 11 and 12 shall be used.

Table 11 — Connector end type

Connector end type	Symbol
Swivel	SW
Banjo	BJ
Bulkhead	BH
Plug	PL
Port	P
Stud	SD
Tube end	TE

Table 12 — Shape

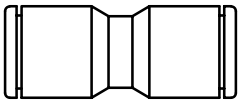
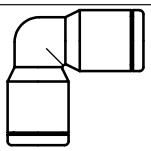
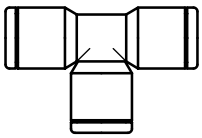
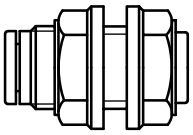
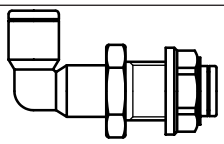
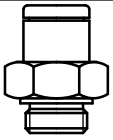
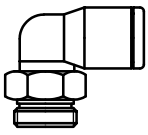
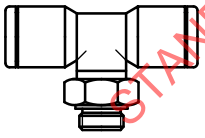
Shape	Symbol
Straight	S
Elbow	E
Tee	T
Run tee	RT
Branch tee	BT
Cross	K
Y	Y

10.3 Stud connectors and port connectors shall be designated by specifying the tube to be connected first, then the thread size for the stud or port end.

10.4 Tube ends shall be designated by specifying the tube to be connected first, then the tube end size.

10.5 Table 13 gives examples of designations.

Table 13 — Examples of designation

	S-6 ISO 14743 S-6×4 ISO 14743
	E-6 ISO 14743
	T-6 ISO 14743
	Y-6 ISO 14743 Y-6×4 ISO 14743
	BHS-6 ISO 14743
	SWBHE-6 ISO 14743
	SDS-6×G 1/8 ISO 14743
	SWE-1/4×M7 ISO 14743
	SWBT-6×M7 ISO 14743

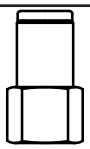
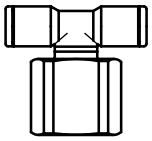
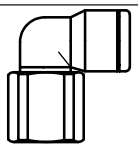
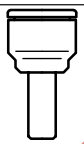
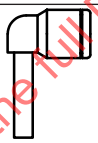
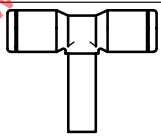
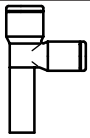
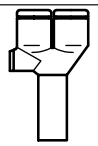
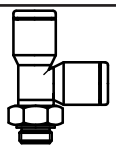
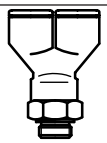
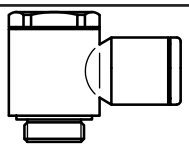
	SWPS-3/8×1/2NPT ISO 14743
	SWPBT-6×G1/8 ISO 14743
	SWPE-6×G1/8 ISO 14743
	TES-6×4 ISO 14743
	TEE-6 ISO 14743
	TEBT-6 ISO 14743
	TERT-6 ISO 14743
	TEY-1/4 ISO 14743
	TE-6 ISO 14743

Table 13 *(continued)*

	SWRT-6×M7 ISO 14743
	SWY-6×M7 ISO 14743

	BJE-6×G 1/8 ISO 14743

11 Identification statement (reference to this document)

Use the following statement in test reports, catalogues, and sales literature when electing to comply with this document:

"Pneumatic push-in connectors in accordance with ISO 14743, *Pneumatic fluid power — Push-in connectors for thermoplastic tubes*".

Annex A
(normative)

PA tubes for testing

A.1 Scope

This annex defines the dimensions, tolerances, rated pressures and test method for determining the rated pressure of PA tubes used for testing pneumatic push-in connectors defined in this document.

This annex is applicable to tubes with OD between 3 mm and 16 mm, inclusive (tubes in inches are included). The rated pressures of the tubes vary according to the temperatures at which they are to be used, which range from –20 °C to +80 °C.

NOTE The mechanical characteristics of PA tubes allow a connector to be anchored on the outside of the tubing wall; the ODs defined in this annex, except for the diameter 3 mm, have been chosen from the range of ODs of rigid tubes given in ISO 4397.

A.2 Material requirements

The material shall be homogeneous, and the tubes shall not present any defects in appearance. Tubes intended for general use are manufactured from plasticised polyamide. Normalised material, heat- and light-stabilised, 57 Shore D minimum is recommended.

A.3 Dimensions and tolerances

Dimensions of tubes shall be in accordance with Tables A.1 and A.2. Each dimension shall be measured at its minimum and maximum in the same cross-section. Both of these measured values shall fall within the tube outside diameter tolerance given in Tables A.1 and Table A.2.

Table A.1 — Dimensions and tolerances for PA tubes in millimetres for testing

Dimensions in millimetres

Tube OD D		**Wall thickness** e		**Tube inside diameter** d_{min}	**Minimum bending radius at 23 °C[a]**
nom.	tol.	nom.	tol.	ref.	
3	±0,08	0,6	±0,08	1,8	15
4	±0,08	0,75	±0,08	2,5	20
6	±0,08	1	±0,08	4	35
8	±0,08	1	±0,08	6	55
10	±0,08	1,25	±0,08	7,5	75
12	±0,1	1,5	±0,08	9	75
14	±0,1	1,5	±0,08	11	100
16	±0,1	1,5	±0,08	13	115

NOTE Ovality is included in general tolerances.

[a] The method of determining the bending radius is in accordance with ISO 10619-1.