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Flexible hose assemblies in drinking water installations — Functional requirements and test methods

bsi.

National foreword

This British Standard is the UK implementation of EN 13618:2016. It supersedes BS EN 13618:2011 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/504, Water supply.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Flexible hose assemblies in drinking water installations - Functional requirements and test methods

Tuyaux flexibles pour installations d'eau potable - Exigences fonctionnelles et méthodes d'essai

Flexible Schlauchverbindungen in Trinkwasser-Installationen - Funktionsanforderungen und Prüfverfahren

This European Standard was approved by CEN on 15 August 2016.

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European foreword

This document (EN 13618:2016) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 13618:2011.

EN 13618:2016 includes the following significant technical changes with respect to EN 13618:2011:

a) the stress corrosion testing is carried out with ammonium only;

b) requirement ad test method for resistance of seat of female fitting are deleted;

c) in Table 8, specific minimum flow rates and minimum bore diameters are left open;

d) for testing the pressure jumps resistance, detailed specification for DN and applied test pressure are given;

e) new test methods for corrosion resistance and UV resistance are introduced;

f) in Table A.2, the dimensions C are reduced;

g) in hydraulic performance and durability test, the number of impulses is reduced;

h) the recommended surveillance testing of specific functional requirements is introduced.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the requirements and test methods for materials, dimensions and function for flexible hose assemblies for drinking water installations, braided or not, designed for use with drinking water with an allowable maximum operating pressure (PMA) of 1 MPa and maximum operating temperature 70 °C to connect sanitary tap ware, heaters and similar appliances.

NOTE Flexible hose assemblies intended to be used as integral parts of electrical appliances are covered by EN 61770 [1].

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 248, *Sanitary tapware — General specification for electrodeposited coatings of Ni-Cr*

EN 806-2, *Specification for installations inside buildings conveying water for human consumption — Part 2: Design*

EN 1254-2, *Copper and copper alloys — Plumbing fittings — Part 2: Fittings with compression ends for use with copper tubes*

EN 1254-3, *Copper and copper alloys — Plumbing fittings — Part 3: Fittings with compression ends for use with plastics pipes*

EN 1254-4, *Copper and copper alloys — Plumbing fittings — Part 4: Fittings combining other end connections with capillary or compression ends*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1)*

EN ISO 1456, *Metallic and other inorganic coatings — Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium (ISO 1456)*

EN ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation (ISO 9080)*

EN ISO 15875-2, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 2: Pipes (ISO 15875-2)*

EN ISO 15876-2, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 2: Pipes (ISO 15876-2)*

EN ISO 22391-2, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 2: Pipes (ISO 22391-2)*

EN ISO 30013:2011, *Rubber and plastics hoses — Methods of exposure to laboratory light sources — Determination of changes in colour, appearance and other physical properties (ISO 30013:2011)*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

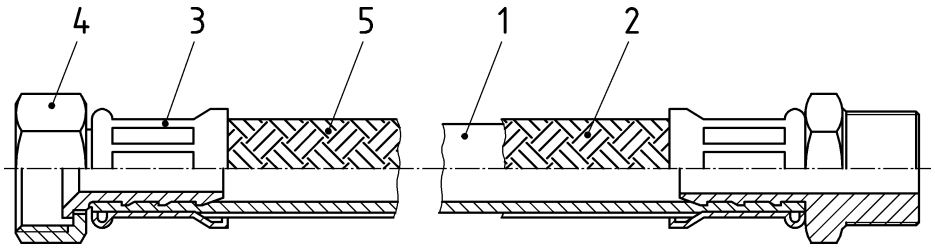
ISO 6957, *Copper alloys — Ammonia test for stress corrosion resistance*

3 Terms and definitions

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

3.1
hose assembly
flexible hose with or without braiding and furnished at one or both ends with a fitting or an integrated flange, or adapted to meet the use of appropriate fittings

Note 1 to entry: See Figure 1:



Key
1 internal hose
2 braiding
3 sleeve
4 fitting
5 outer layer (optional)

Figure 1 — Example of hose assembly components

3.2
internal hose
internal part of the hose assembly

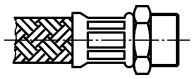
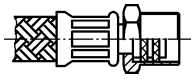
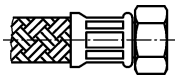
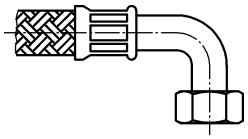
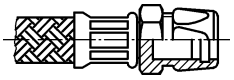
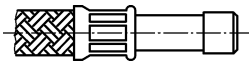
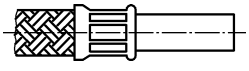
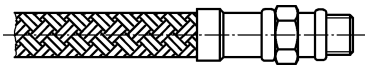
3.3
braiding
external applied reinforcement intended to achieve the pressure resistance and to protect the internal hose from blunt impact, rubbing or constriction, usually achieved with stainless steel or synthetic wires

3.4
sleeve
component used to fix internal hose mechanically to fittings

3.5
fitting
component attached to the end of the flexible hose to facilitate connection to appliances

Note 1 to entry: Examples of shape and designation of the fitting are given in Table 1:

Table 1 — Shape and designation of fittings

Type	Shape	Designation
1		Fixed male fitting in accordance with EN ISO 228-1 or ISO 7-1
2		Revolving male fitting in accordance with EN ISO 228-1 or ISO 7-1
3		Straight female fitting in accordance with EN ISO 228-1 or ISO 7-1
4		Elbow female fitting in accordance with EN ISO 228-1
5		Compression biconical fitting
6		Fitting with plain and short smooth tube with recess
7		Fitting with plain and short smooth tube without recess
8		Metric male thread fitting
9	—	Special applications

4 Requirements

4.1 Materials

4.1.1 General

All materials used shall be chemically compatible with each other and with the water supplied (following the common chemical reaction and/or corrosion knowledge of the materials concerned).

4.1.2 Chemical and hygienic requirements

All materials coming into contact with water intended for human consumption shall not present a health risk or cause any change in the drinking water in terms of quality, appearance, smell or taste.

Products intended for use in drinking water supply systems should comply with national regulations and testing arrangements, where they exist, that ensure fitness for contact with drinking water.

4.1.3 Hoses

4.1.3.1 Internal hoses

Internal hoses can be made of elastomeric, thermoplastics and plastics materials.

4.1.3.2 Non-braided hoses

Non-braided hoses shall comply with long-term stress requirements in accordance with EN ISO 15875-2, EN ISO 15876-2 and EN ISO 22391-2 when evaluated in accordance with EN ISO 9080.

4.1.4 Fittings and sleeves

Fittings and sleeves with exception of plain end fittings with and without recess shall be manufactured from corrosion-resistant materials.

Sleeves and plain end fittings with and without recess shall be made of corrosion-resistant metallic materials only.

Aluminium materials are not allowed.

4.1.5 Braiding

Braiding shall be made of stainless steel wires or plastics wires/bands.

Braiding made of stainless steel can have integrated plastic wires/bands for colour coding only.

In case of braiding made of plastics materials, the hose assembly shall be UV resistant in accordance with 4.2.3.10.

4.1.6 Sealings

Sealing materials shall demonstrate the compliance with 4.2.

4.2 Functional requirements

4.2.1 General

The separate components and hose assemblies shall comply and be tested to the functional requirements as indicated in Table 2.

The surveillance testing for specific functional requirements is recommended. If the surveillance testing is carried out, this should be done in accordance with Annex C.

Table 2 — List of characteristics for separate components and for hose assemblies

Characteristic	Requirement subclause	Test method clause/subclause
Fittings and sleeves		
Dimensions	4.2.2.1	A.1
Stress corrosion	4.2.2.2	A.2
Resistance to tightening torque of fitting	4.2.2.3	A.3
Resistance to bending	4.2.2.4	A.4
Hose assembly		
Length of hose assembly	4.2.3.1	4.2.3.1
Flow rate	4.2.3.2	B.1
Tensile stress resistance	4.2.3.4	B.3
Leak tightness under internal hydrostatic pressure	4.2.3.3	B.4
Pressure cycling resistance	4.2.3.5	B.5
Resistance to pressure jumps	4.2.3.6	B.6
Temperature cycling resistance	4.2.3.7	B.7
Frost resistance	4.2.3.8	B.10
Resistance to corrosion	4.2.3.9	B.8
Flexibility	4.2.3.11	B.9
UV resistance	4.2.3.10	4.2.3.10

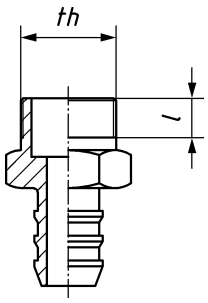
4.2.2 Fittings

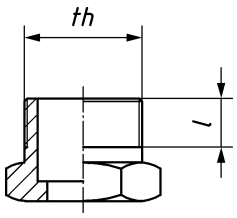
4.2.2.1 Dimensions

Fittings shall comply with the appropriate dimensions as stated in Tables 3, 4 and 5 when checked in accordance with A.1, and with the relevant functional requirements as stated in EN 1254-2, EN 1254-3 and EN 1254-4.

Fittings with push-fit ends and with press end for metallic tubes shall comply with requirements of this standard.

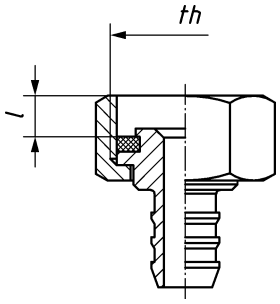
Table 3 — Fixed fittings with external thread





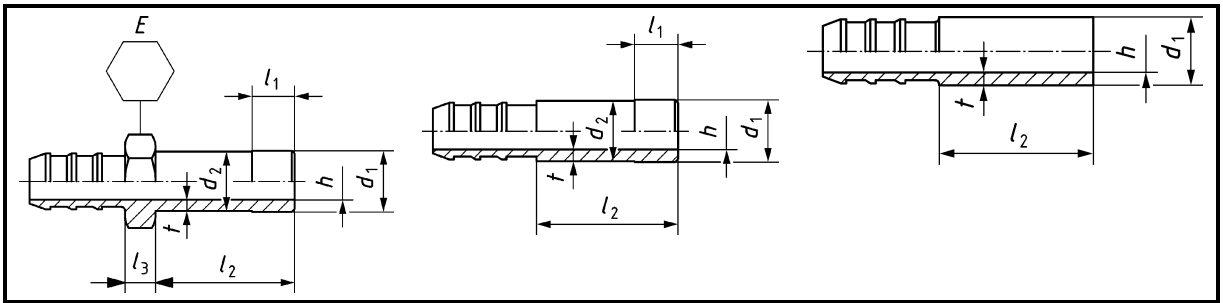
Threading *th* in accordance with		Gauge length in accordance with ISO 7-1	Minimum useful threading length *l* in accordance with EN ISO 228-1
ISO 7-1	**EN ISO 228-1**	mm	mm
R 1/4	G 1/4 B	8,4	6
R 3/8	G 3/8 B	8,8	7
R 1/2	G 1/2 B	11,4	7
R 3/4	G 3/4 B	12,7	8,5
R 1	G 1 B	14,5	9,5
R 5/4	G 5/4 B	16,8	11

Table 4 — Female fittings with nut



Threading *th* in accordance with EN ISO 228-1	Minimum useful threading length *l* mm
G 1/4	4
G 3/8	5
G 1/2	6
G 3/4	7
G 1	8
G 1 1/4	10

Table 5 — Plain end fittings with and without recess



External diameter mm		**Minimum length** l mm			**Wrench size** E	**Inner diameter** h	**Wall thickness** t
d_1	d_2	l_1	l_2	l_3	mm	mm	mm
8 ± 0,1	$7{,}7^{+0{,}05}_{-0{,}1}$	7	25	5	10	≤ 6,3	≥ 0,75
10 ± 0,1	$9{,}7^{+0{,}05}_{-0{,}1}$	7	25	5	11	≤ 8	≥ 0,8
12 ± 0,1	$11{,}7^{+0{,}05}_{-0{,}1}$	7	25	7	13	≤ 10	≥ 0,9
15 ± 0,1	$14{,}7^{+0{,}05}_{-0{,}1}$	10	30	7	17	≤ 13	≥ 1,4
22 ± 0,1	$21{,}7^{+0{,}05}_{-0{,}1}$	10	30	—	—	≤ 19	≥ 1,5

4.2.2.2 Stress corrosion

Brass fittings, including sleeves, shall be free from internal tensional stresses and shall resist the ammonium test described in A.2.

Fittings shall show no evidence of cracking visible when 10-times magnified.

4.2.2.3 Resistance to tightening torque

When tested in accordance with A.3, male fittings and swivel nuts shall resist a tightening torque as specified in Table 6 without evidence of cracks visible when 10-times magnified.

Table 6 — Tightening torque for male fittings and nuts

Threading		**Tightening torque** Nm
ISO 7-1	**EN ISO 228-1**	
R 1/4	G 1/4	30 ± 1
R 3/8	G 3/8	40 ± 2
R 1/2	G 1/2	80 ± 2
R 3/4	G 3/4	100 ± 4
R 1	G 1	120 ± 6
R 5/4	G 5/4	150 ± 8

4.2.2.4 Resistance to bending

When tested in accordance with A.4, fittings shall resist the minimum bending torques as specified in Table 7 without evidence of cracks visible when 10-times magnified.

Table 7 — Minimum bending torque for shanks

Nominal diameter	Minimum bending torque Nm
DN 6	$7{,}5\ ^{+1}_{0}$
DN 8	$10\ ^{+1}_{0}$
DN 10	$15\ ^{+1}_{0}$
DN 13	$20\ ^{+1}_{0}$
DN 15	$30\ ^{+1}_{0}$
DN 18	$35\ ^{+1}_{0}$
DN 20	$40\ ^{+1}_{0}$
DN 25	$45\ ^{+1}_{0}$

4.2.2.5 Special cases

Fittings for hose assemblies intended for special applications, e.g. for direct installation to appliances where dimensional compatibility is not a requirement (for example, direct to a sanitary tap with metric threading in accordance with ISO 68-1 (see [2])), may incorporate dimensional deviations, provided that:

— all requirements of 4.2.3, with the exception of flow rate, are satisfied;

— the manufacturer's literature, including installation instructions supplied with the hose assembly, indicates clearly that it is a special case.

4.2.3 Hose assemblies

4.2.3.1 Length

All hose assemblies shall be manufactured in lengths L measured as shown in Figure 2 from a minimum of 90 mm to a maximum of 2 000 mm.

The actual length compared with the length L declared by the supplier shall be within the following permissible tolerances:

— $L \leq 400$ mm : $^{+10}_{0}$

— 400 mm < $L \leq$ 1 000 mm : $^{+20}_{0}$

— 1 000 mm < $L \leq$ 2 000 : $^{+30}_{0}$

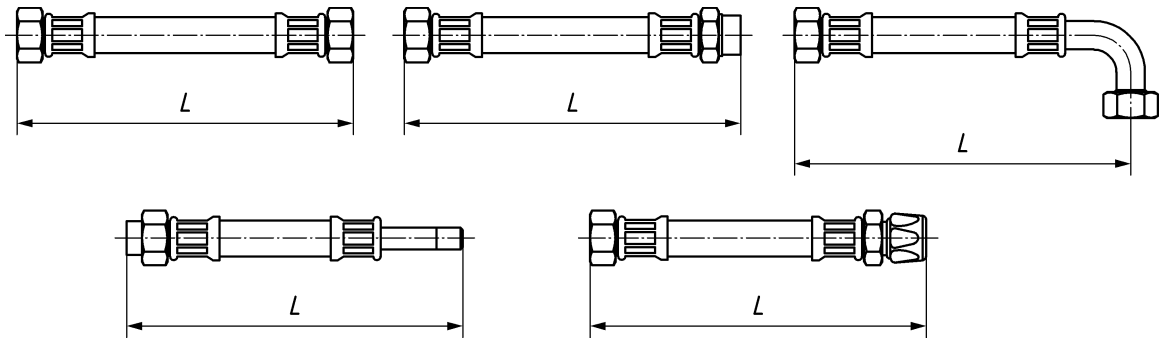


Figure 2 — Reference dimensions for hose length

4.2.3.2 Flow rate

The flow rate of hose assemblies shall comply with the values as indicated in Table 8.

The hose assemblies are considered to comply with this requirement, when the measured flow rate, when tested in accordance with B.1, is in compliance with Table 8 (for DN 6 to DN 13) or when the minimum diameter of bore is met (for DN 15 to DN 25).

Table 8 — Dimensions of fitting holes and minimum flow rates

Nominal size	**Minimum flow rate** l/min	**Minimum diameter of bore** mm
DN 6	16	—
DN 8	28	—
DN 10	45	—
DN 13	60	—
DN 15	—	12,5
DN 18	—	15
DN 20	—	17
DN 25	—	20

4.2.3.3 Leak tightness under internal hydrostatic pressure

When tested in accordance with B.4 to an internal water pressure of 3,0 MPa, the hose assemblies shall not show signs of any leakage.

4.2.3.4 Tensile stress resistance

When tested in accordance with B.3, hose assemblies shall be resistant to a tensile stress as given in Table 9. During and after this test, the hose assembly shall show no leakage or other damage.

Table 9 — Tensile stress values

Nominal size	Tensile stress N
DN 6	600
DN 8	600
DN 10	800
DN 13	1 100
DN 15	1 500
DN 18	2 100
DN 20	2 500
DN 25	3 400

4.2.3.5 Pressure cycling resistance

When tested in accordance with B.5, hose assemblies shall withstand a pressure cycling in the range from 0,5 MPa to 3,0 MPa.

4.2.3.6 Resistance to pressure jumps

When tested in accordance with B.6 for nominal size up to DN 15 at a pressure of 0,5 MPa and for nominal size greater than DN 15 at a pressure of 3,0 MPa, hose assemblies shall resist to pressure jump for 200 impulses.

4.2.3.7 Resistance to temperature cycling

When tested in accordance with B.7 after 5 000 cycles, hose assemblies shall not show any sign of damage and leakage.

4.2.3.8 Frost resistance

When tested in accordance with B.10, hose assemblies shall not show any sign of damage and leakage.

4.2.3.9 Resistance to corrosion

When tested in accordance with B.8, hose assemblies shall not show any corrosion defect when inspected in accordance with method described in EN ISO 1456.

4.2.3.10 UV resistance

When exposed to UV radiation in accordance with EN ISO 30013:2011, Method B, cycle 3, with an energy dose of 25 MW/m^2, the hose assembly with plastics braiding shall comply with the resistance to pressure jumps in accordance with 4.2.3.6.

4.2.3.11 Flexibility

When tested in accordance with B.9 under the conditions as given in Table 10, the ovality to be measured shall not exceed 15 %.

Table 10 — Bending radius, length of specimen and tensile force

Nominal size	Internal radius *R* mm	Length of test specimen *L* mm	Tensile force for hose assemblies N	
			General	For plastics hoses without braiding
DN 6	25	400 to 450	15	45
DN 8	30	400 to 450	15	55
DN 10	35	500 to 550	20	200
DN 13	45	600 to 660	30	300
DN 15	60	700 to 770	35	500
DN 18	70	800 to 880	45	Not applicable
DN 20	80	900 to 1 000	50	Not applicable
DN 25	100	1 100 to 1 200	65	Not applicable

5 Designation

Flexible hose assemblies complying with this European Standard shall be designated with at least the following:

a) name of the product (e.g. flexible hose assembly);

b) reference to this standard (EN 13618);

c) nominal pressure of 10 bar (PN);

d) design temperature 70 °C in accordance with EN 806-2, in °C;

e) nominal diameter (DN);

f) length *L*, in mm (see 4.2.3.1);

g) type of fitting (see Table 1).

EXAMPLE Hose assembly, for PN of 10 bar maximum operating temperature 70 °C, nominal diameter 10 mm, length 300 mm, equipped at the ends with fittings of type 1 and type 2 in accordance with Table 1.

Hose assembly EN 13618 **— PN 10 — 70 °C — DN 10 — L 300 — fitting types 1 and 2**

NOTE 10 bar = 1,0 MPa.

6 Marking

Products complying with this European Standard shall be marked permanently and legibly with at least the following information:

— name or trademark of the manufacturer or supplier;

— at least the last two digits of the production year;

— maximum operating temperature 70 °C.

Internal hoses shall be marked with the name or trademark of the manufacturer or supplier and date of production.

Annex A
(normative)

Tests on fittings

A.1 Dimensions and thread control

The control of the dimensions shall be carried out by using appropriate gauges graduated in millimetre or subdivisions thereof, for the values indicated in 4.2.2.1. The thread measurement shall be carried out by go-not-go gauges. The test results shall be compared with 4.2.2.1.

A.2 Ammonium test

The ammonium test shall be carried out in accordance with ISO 6957 at pH ≤ 9. The results to be obtained are indicated in 4.2.2.2.

A.3 Tightening test

A.3.1 Test samples

Ten samples shall be taken for each type in accordance with Table 1.

A.3.2 Procedure

A.3.2.1 Male fittings

a) Screw the fitting, without any sealing washer, into the steel nut as described in Table A.1.

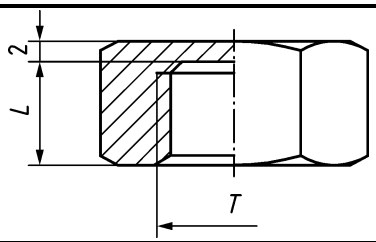
b) Gradually apply the tightening torque as stated in Table 6.

c) Release the fitting.

d) Examine the fitting for evidence of failures or cracks visible when 10-times magnified.

Table A.1 — Test cap dimensions

Dimensions in millimetres



T		*L*
EN ISO 228-1	**ISO 7-1**	
G1/4	R1/4	The length *L* of the steel nut shall be three quarters of the threading length of the male fitting.
G3/8	R3/8	
G1/2	R1/2	
G3/4	R3/4	

A.3.2.2 Swivel nuts

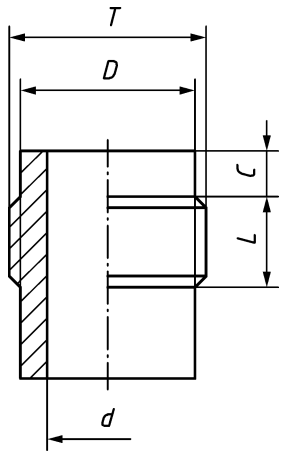
a) Screw the swivel nut, without any sealing washer, onto the steel rod as described in Table A.2.

b) Gradually apply a torque as stated in Table 6.

c) Release the nut.

d) Examine the nut for evidence of failures or cracks visible when 10-times magnified.

Table A.2 — Test bolt dimensions



T EN ISO 228-1	*D*[a] mm	*C*[a] mm	*L*[a] mm	*d*[a] mm
G1/4 B	11	2	7	8,5
G3/8 B	14,5	2	7	10,5
G1/2 B	18	3	9	12,5
G3/4 B	23,5	3	9	14,5

[a] All dimensions with tolerance ± 0,1 mm.

A.4 Bending test

A.4.1 Test samples

Ten samples shall be taken for each type in accordance with Table 1.

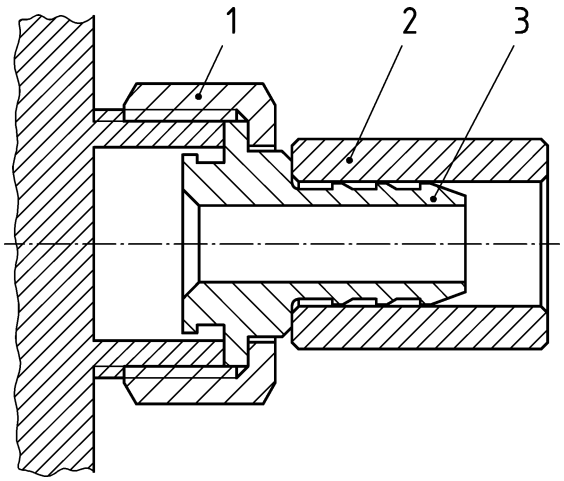
A.4.2 Procedure

A.4.2.1 Male fittings and swivel nuts

a) Screw the fitting, without any sealing washer, to a solid fixture as shown in Figure A.1 in two examples.

b) Slip over the shank a steel tube having a wall thickness of at least 2 mm and an inner diameter 0,05 mm larger than the outer diameter of the shank itself, as shown in Figure A.1.

c) Continuously apply a force to the steel tube to submit the shank to a torque not less than the one stated in Table 7 within 2 s. The force is maintained for 30 s.



Key

1 female fitting
2 steel pipe
3 male fitting

Figure A.1 — Placing of tube on shank

d) Release the swivel nut.

e) Check the fitting for evidence of cracks visible when 10-times magnified. Distortions without cracks do not constitute failure.

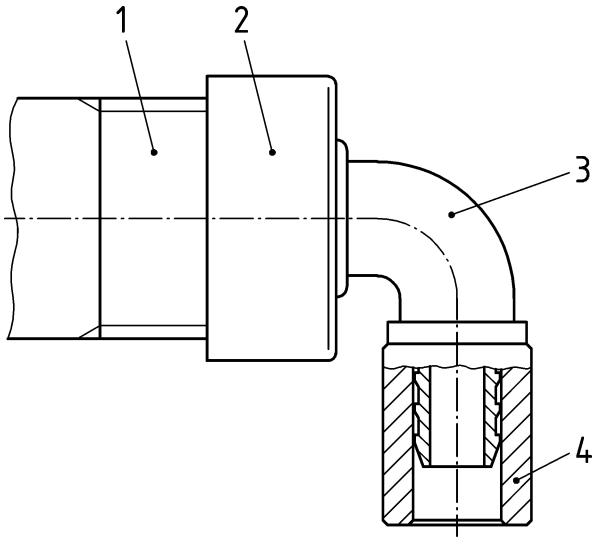
A.4.2.2 Elbow fittings

a) The coupling tube is firmly attached by its coupling nut, without any sealing washer, to a fixed mandrel as shown in Figure A.2.

b) A steel tube, having a wall thickness of at least 2 mm and an inner diameter 0,2 mm larger than the outer diameter of the coupling tube, is slipped over the coupling tube as shown in Figure A.2.

c) A force is applied to the steel tube so that the coupling tube is subjected to a bending moment of 10 Nm which is attained in 2 s. The force is maintained for 30 s.

For angled coupling tubes, two tests are carried out on separate samples. In one test the moment is applied in the direction of the angle and in the other test it is applied in the opposite direction.



Key

1 fixed mandrel
2 coupling nut
3 coupling tube
4 steel tube

Figure A.2 — Detail for applying the bending moment to coupling tubes

Annex B
(normative)

Hose assembly tests

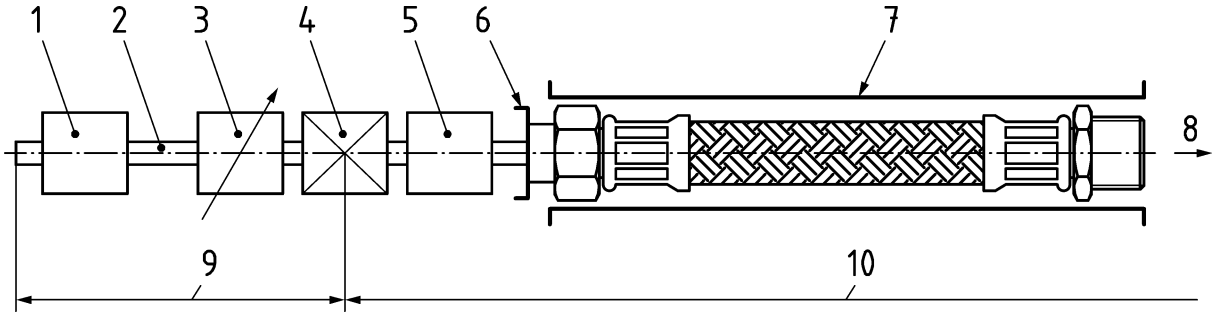
B.1 Flow rate test

B.1.1 Test samples

Three samples, each 300 mm long, shall be taken for each DN type.

B.1.2 Procedure

a) Connect the samples in a horizontal position to the supply and test circuits. A pipe or other system may be used to support the hose assembly during the test (see Figure B.1). The supply and test circuits shall be capable of delivering a flow rate of at least 1,5-times the flow rate of the hose assembly under test.



Key

1 means to supply and to maintain a pressure of (0,3 ± 0,02) MPa
2 pipe
3 device to measure the flow rate with an accuracy of ± 2 % of the test value
4 shut-off valve
5 pressure gauge with an accuracy of ± 1 % of the test value
6 hose assembly connector
7 support to maintain the hose assembly in a straight and horizontal position
8 free outlet
9 supply circuit
10 test circuit

Figure B.1 — Test apparatus

b) Apply a pressure of (0,3 ± 0,02) MPa with cold water at temperature of (20 ± 5) °C.

c) Measure the flow rate after stabilization.

d) Record the result and compare with 4.2.3.2, Table 8.

B.2 Ageing treatment by hot storage

B.2.1 Test samples

15 samples shall be taken for each DN type.

B.2.2 Procedure

a) Fill the samples with water and apply a pressure of (1,2 ± 0,05) MPa and maintain this pressure during the entire treatment.

   Store the samples for 168 h at a temperature of $90\,^{+1}_{-3}$ °C.

b) Cool down the samples to temperature of (20 ± 5) °C and replace the gaskets, if applicable.

B.3 Tensile test

B.3.1 Test samples

Three samples shall be taken for each DN type and treated for ageing in accordance with B.2.

B.3.2 Procedure

a) The test shall be conducted at ambient temperature of (20 ± 5) °C.

b) Fix the samples to a dynamometer capable of a tensile speed of 3,3 mm/s.

c) Subject the samples to a tensile force as indicated in Table 9, maintain this force for a period of (60 ± 1) min and check the samples for failures, damage and whether the fittings are loosened from their seat.

d) Release the samples and fill them with water.

e) Apply a pressure of (1,6 ± 0,1) MPa at a rate of 0,1 MPa/s, maintain this pressure for at least 1 min and check the samples for failures, damage and leakage and whether the fittings are loosened from their seat in axial direction.

B.4 Hydrostatic pressure test

B.4.1 Test samples

Three samples shall be taken for each DN type and treated for ageing in accordance with B.2.

B.4.2 Procedure

a) Fill the samples with water at a temperature:

   1) of $90\,^{+1}_{-3}$ °C for braided flexible hose assemblies;

   2) of $70\,^{+1}_{-3}$ °C for non-braided flexible hose assemblies; and

   maintain this temperature during the test.

b) Apply pressure at a rate of 0,1 MPa/s until (3 ± 0,1) MPa is reached and maintain this pressure for (60 ± 1) min.

c) Examine the samples for failures, damage and leakage and whether the fittings are loosened from their seat in axial direction, and record the results.

B.5 Hydraulic performance and durability test

B.5.1 Test samples

Three samples shall be taken for each DN type and treated for ageing in accordance with B.2.

B.5.2 Test conditions

The test shall be carried out with water maintained at a temperature of $90\,^{+1}_{-3}$ °C for braided flexible hose assemblies and of $70\,^{+1}_{-3}$ °C for non-braided hose assemblies.

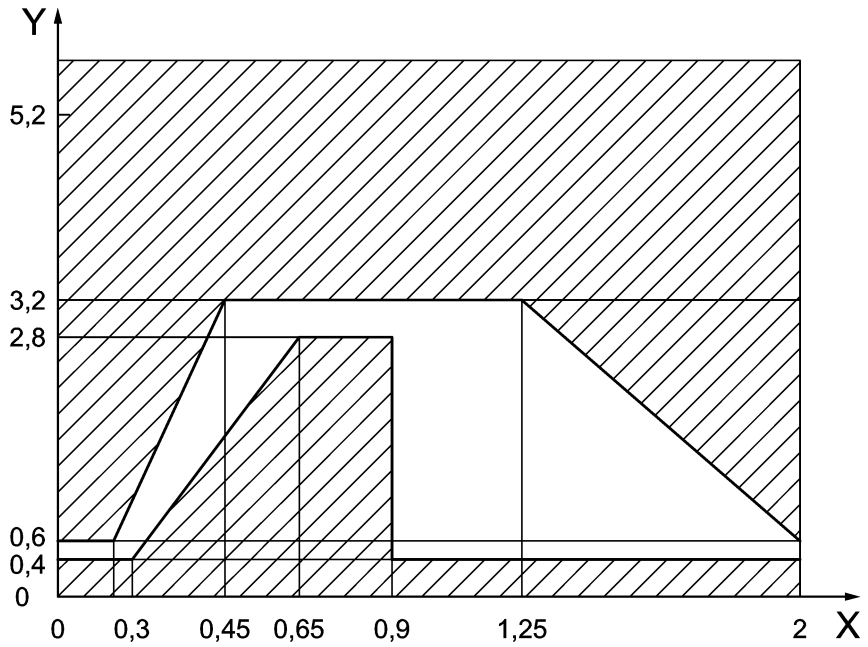
B.5.3 Procedure

a) Connect the samples to a test rig which is able to generate impulses as in Figure B.2, where the pressure line shall stay within the white area.

b) Generate a total of 25 000 impulses.

c) During the test, examine the hose for detachment, cracks and leakage visible when 6-times magnified.

d)



Key

X time (in s)

Y pressure (in MPa)

Figure B.2 — Impulses

B.6 Test of resistance to pressure jumps

B.6.1 Test samples

Three samples shall be taken for each DN type and treated for ageing in accordance with B.2.

B.6.2 Test conditions

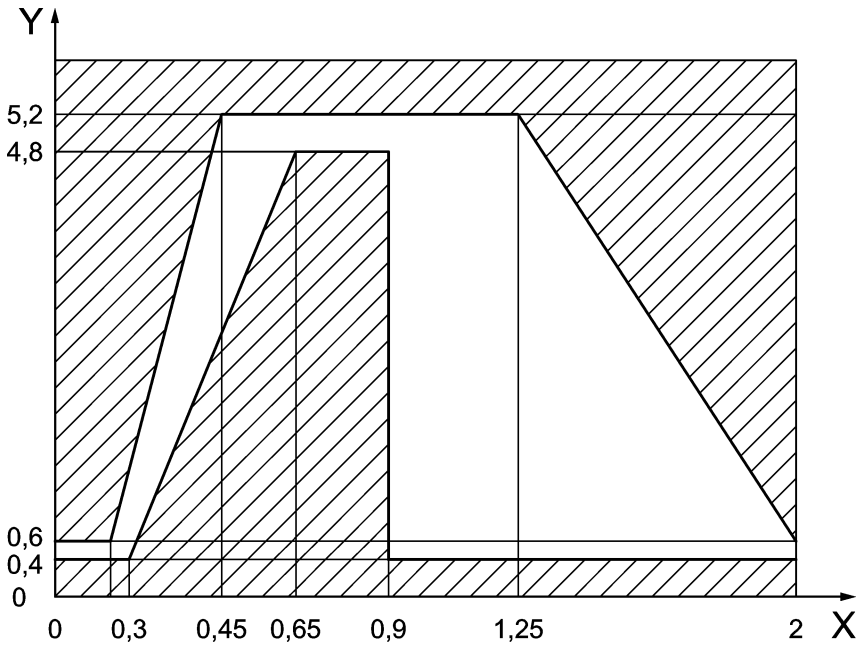
The tests shall be carried out with water maintained at a temperature of $90\,^{+1}_{-3}$ °C for braided flexible hose assemblies and of $70\,^{+1}_{-3}$ °C for non-braided hose assemblies.

B.6.3 Procedure

a) Connect the samples to an installation which is able to generate pressure jumps as in Figure B.3, where the pressure line shall stay within the white area.

b) Generate 200 pressure jumps.

c) During the test examine the hose for detachment, cracks and leakage visible when 6-times magnified.



Key

X time (in s)

Y pressure (in MPa)

Figure B.3 — Pressure jumps

B.7 Temperature cycling test

B.7.1 Test samples

Three samples shall be taken for each DN type and treated for ageing in accordance with B.2.

B.7.2 Procedure

a) Connect the samples to a system able to produce the following conditions:

   1) constant pressure of (1 ± 0,05) MPa;

   2) supply of water at a temperature of (20 ± 5) °C for 5 min and then water at a temperature of (90 ± 3) °C for 5 min as one cycle.

b) After 5 000 cycles stop the test.

c) Apply a pressure of (1,6 ± 0,1) MPa at a rate of 0,1 MPa/s, maintain this pressure for 1 min and examine the samples on failures, damage and leakage and whether the fittings are loosened from their seat in axial direction, and record the results.

B.8 Corrosion resistance test

B.8.1 Test samples

Three hose assemblies shall be taken for each materials combination.

B.8.2 Procedure

The test is carried out in accordance with EN ISO 1456 and the samples shall be inspected as specified in EN 248.

B.9 Bending test

B.9.1 Test samples

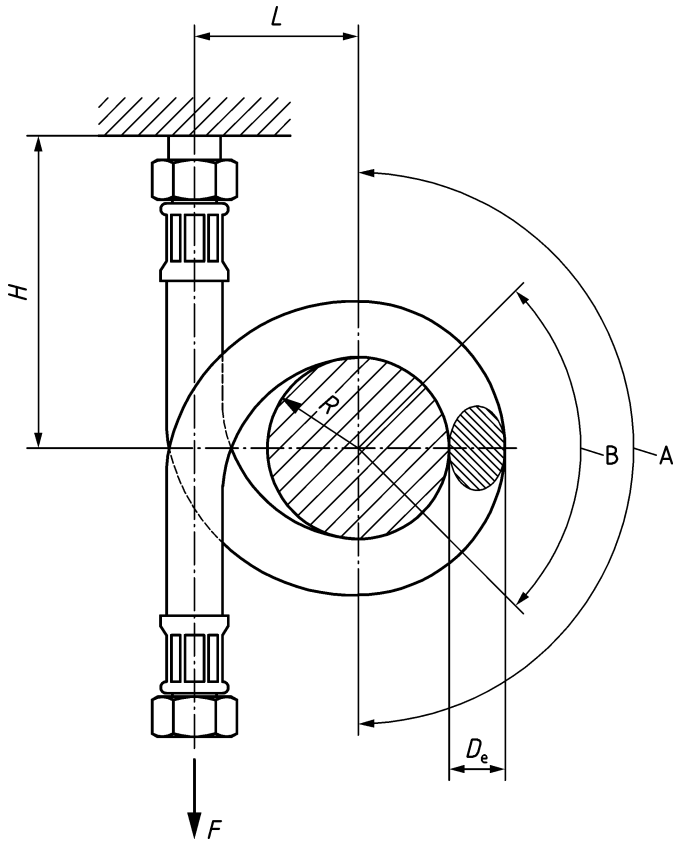
Three samples shall be taken for each DN (see Table 10).

B.9.2 Procedure

a) Arrange the samples according to length so that the clamping height H is approximately half-way between the free hose assembly ends. The distance L shall be fixed so that the free hose assembly lengths are axially oriented under load. The bending radius is defined for each nominal size in Table 10.

b) Apply a tensile force in accordance with Table 10, with the hose assembly resting against half the circumference (zone A in Figure B.4) of the test specimen.

c) Determine the ovality as the smallest outside diameter D_e of the hose assembly in the middle area (zone B in Figure B.4) of the bending loop by intermediate bending from three measured values.



Key

L distance to allow the axial orientation of free hose ends under load
H clamping height
R minimum bending radius
D_e smallest outside hose diameter at maximum ovality
F tensile force
A zone A
B zone B

Figure B.4 — Bending test arrangement

d) The ovality, in percent, shall be calculated from Formula (B.1)

$$0 = \left(D_a - D_e\right) / D_a \cdot 100 \quad \text{(B.1)}$$

where

D_a is the outside diameter of the hose assembly before the bending test, in mm;

D_e is the minimum outside diameter of the hose assembly at the point of maximum ovality, in mm.

The result shall comply with 4.2.3.11.

B.10 Test of resistance to frost

B.10.1 Test samples

Three samples shall be taken for each DN (see Table 10).

B.10.2 Procedure

a) Place the samples in a straight position in a refrigerating room with a temperature of (–20 ± 2) °C for a period of not less than 8 h.

b) Remove the hoses from the refrigerating room and immediately bend the hose for (4 ± 1) s, over an angle of 180° on a spindle with an external diameter of 10-times the external diameter of the hose.

c) Bring the hose back to room temperature.

d) Examine the hose for deformations and cracks on braiding and fittings visible when 6-times magnified, and record the results.

e) Apply a pressure of (1,6 ± 0,1) MPa at a rate of 0,1 MPa/s, maintain this pressure and examine the samples on leakages for 1 min.

Annex C
(informative)

Surveillance testing

The purpose of surveillance testing is to demonstrate the ability of the manufacturer to manufacture products which continuously meet the requirements given in Table C.1.

Table C.1 — Surveillance testing

Characteristic	Requirement clause	Test method clause	Frequency
Fittings and sleeves			
— Dimensions	4.2.2.1	A.1	According to internal procedure of the manufacturer
Hose assembly			
— Length	4.2.3.1	4.2.3.1	According to internal procedure of the manufacturer
— Tensile stress resistance	4.2.3.4	B.3	According to internal procedure of the manufacturer
— Leak tightness under internal hydrostatic pressure	4.2.3.3	B.4	Once a year
— Pressure cycling resistance	4.2.3.5	B.5	Once a year
— Resistance to pressure jumps	4.2.3.6	B.6	Once a year
— Resistance to corrosion	4.2.3.9	B.8	Once a year

Bibliography

[1] EN 61770, *Electric appliances connected to the water mains — Avoidance of backsiphonage and failure of hose-sets (IEC 61170)*

[2] ISO 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

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