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Thermoplastic multi-layer (non-vulcanized) hoses and hose assemblies for the transfer of liquid petroleum gas and liquefied natural gas — Specification

Tuyaux et flexibles multicouches (non vulcanisés) thermoplastiques pour le transfert de gaz de pétrole liquide et de gaz naturel liquéfié — Spécifications

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.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*.

This second edition cancels and replaces the first edition (ISO 27127:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the normative references have been updated and revised (Clause 2);

— the tolerance on the minimum temperature has been removed (Table 1);

— material numbers of helix have been added (Clause 5);

— the tolerance on inside diameter 150 has been modified (Table 2);

— change in length and twist at proof pressure has been modified to maximum working pressure (Clause 7);

— flammability test has been added (Table 3);

— burst pressure has been added (Table 4);

— multi-components adhesive for hoses assemblies has been added (Clause 7);

— the electrical resistance requirement between end fittings has been modified (Clause 7);

— marking of the hose and assembly has been updated (Clause 10);

— in Annex A, thickness has been replaced by outside diameter (equals to the distance between the two plates) and tolerances on test force have been added;

— in Annex D, the beginning of the test has been editorially revised;

— in Annex E, a cycle has been specified and the end of the tests has been editorially revised;

— Annex G on a method of test for flammability has been added;

— in Annex H and Annex I, the tests requirements have been updated.

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.

Thermoplastic multi-layer (non-vulcanized) hoses and hose assemblies for the transfer of liquid petroleum gas and liquefied natural gas — Specification

WARNING — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to determine the applicability of any other restrictions.

1 Scope

This document specifies requirements for two types of thermoplastic multi-layer (non-vulcanized) transfer hoses and hose assemblies for carrying liquefied petroleum gas and liquefied natural gas. Each type is subdivided into two classes, one for onshore duties, and the other for offshore.

— Class A hose is for use onshore.

— Class B hose is for use offshore.

This document is applicable for hose sizes from 25 mm to 250 mm, working pressures from 10,5 bar to 25 bar and operating temperatures from –196 °C to +45 °C, according to class.

NOTE Offshore liquefied natural gas (LNG) hose assemblies are also specified in EN 1474-2. EN 1474-2 does not only specify offshore use, but also ship to shore and other LNG transfer applications.

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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 1402:2021, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 1817:2015, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 7326:2016, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8031:2020, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

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

ISO 10619-2, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*

ISO 16143-3:2014, *Stainless steels for general purposes — Part 3: Wire*

EN 10088-3:2014, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 apply.

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

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

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

4 Classification

Hoses shall be classified as given in Table 1 according to their

— usage:

  — Class A hose is for use onshore,

  — Class B hose is for use offshore,

— working pressure and

— working temperature range.

Table 1 — Pressure and temperature range

Pressure/temperature	Class A Type 1		Class B Type 1		Class A Type 2		Class B Type 2	
	MPa	bar	MPa	bar	MPa	bar	MPa	bar
Maximum working pressure	2,50	25	2	20	1,30	13	1,05	10,5
Proof pressure	3,75	37,5	3	30	1,95	19,5	1,58	15,8
Minimum burst pressure	10	100	10	100	5,20	52	5,25	52,5
Working temperature range (°C)	−50 to +45		−50 to +45		−196 to +45		−196 to +45	

NOTE 1 1 bar = 0,1 MPa.

NOTE 2 Due to pressurization during test and operations, the temperature of the fluid can increase. The indicated temperatures are measured at atmospheric pressure.

5 Materials and construction

Hoses shall be constructed as shown in Figure 1 and shall consist of the following:

a) **Class A:**

  1) an internal wire helix of austenitic stainless steel conforming to EN 10088-3:2014, Table 2, numbers 1.4306, 1.4401, 1.4404 or 1.4436 (X3CrNiMo 17-13-3) or ISO 16143-3:2014, Table 1 X2CrNi 19-11, X5CrNiMo 17-12-2, X2CrNiMo 17-12-2;

2) a multi-ply wall of layers of films and fabrics made of thermoplastics that in combination give the required properties specified in Table 1 and provide a complete seal;

3) an external wire helix of austenitic stainless steel conforming to EN 10088-3:2014, Table 2, numbers 1.4306, 1.4401, 1.4404 or 1.4436 (X3CrNiMo 17-13-3) or ISO 16143-3:2014, Table 1 X2CrNi 19-11, X5CrNiMo 17-12-2, X2CrNiMo 17-12-2;

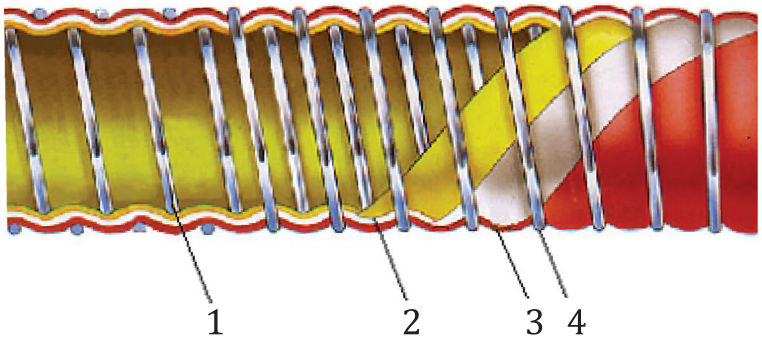
b) **Class B:**

1) an internal wire helix of austenitic stainless steel conforming to EN 10088-3:2014, Table 2, numbers 1.4306, 1.4401, 1.4404 or 1.4436 (X3CrNiMo 17-13-3) or ISO 16143-3:2014, Table 1 X2CrNi 19-11, X5CrNiMo 17-12-2, X2CrNiMo 17-12-2;

2) a multi-ply wall of layers of films and fabrics made of thermoplastics that in combination give the required properties specified in Table 1 and provide a complete seal;

3) an external wire helix of austenitic stainless steel conforming to EN 10088-3:2014, Table 2, numbers 1.4306, 1.4401, 1.4404 or 1.4436 (X3CrNiMo 17-13-3) or ISO 16143-3:2014, Table 1 X2CrNi 19-11, X5CrNiMo 17-12-2, X2CrNiMo 17-12-2.

NOTE By agreement between manufacturer and purchaser, the outer layer can have colour identification.



Key

1 internal wire
2 film
3 fabric
4 external wire

Figure 1 — Section of a typical thermoplastic multilayer hose

6 Dimensions

6.1 Inside diameters, with tolerances and minimum bend radii

When measured in accordance with ISO 4671, the values of the inside diameter of the hose shall conform to Table 2. When tested by the method described in ISO 10619-1, the value of the minimum bend radius shall be as given in Table 2. The hose shall show no sign of permanent deformation of the cross-section, i.e. kinking.

Table 2 — Dimensions and minimum bend radius

Dimensions in millimetres, except where specified as "inch"

Inside diameter		Tolerance	Minimum bend radius
mm	inch		
25	1	±1	150
32	1 1/4	±1	175
38	1 1/2	±1	175
40	1 1/2	±1	200
50	2	±1	200
65	2 1/2	±2	200
75	3	±2	250
80	3	±2	250
100	4	±2	500
125	5	±2	550
150	6	±3	660
200	8	±3	910
250	10	±3	2 500
300	12	±3	2 500

6.2 Tolerance on length

When tested in accordance with ISO 4671 the tolerance on the measured length of delivered hose assemblies shall be +2 % to −1 %.

7 Performance requirements of hoses and hose assemblies

7.1 Film and fabric

When tested at the minimum temperature, Type 1: −50 °C ± 3 °C and Type 2: −196 °C ± 5 °C (and in accordance with ISO 13934-1 or equivalent for fabric testing and ISO 527-1 or equivalent for film testing) samples of film and fabric shall have an elongation at break of not less than 10 %.

7.2 Hoses

When tested in accordance with the methods given in Table 3, the physical properties of the hoses shall conform to the requirements specified in Table 3.

Table 3 — Physical properties of hoses

Property	Unit	Requirement	Method
Proof pressure	MPa (bar)	No leakage or other signs of damage at pressure given in Table 1	ISO 1402 with pressure increase not less than 0,17 MPa/min (1,7 bar/min)
Change in length at proof pressure	%	10	ISO 1402:2021, 8.2 initial length measured when the hose is pressurized to 0,07 MPa (0,7 bar)
Twist at proof pressure	°/m	10	ISO 1402:2021, 8.2 initial reading taken when hose is pressurized to 0,07 MPa (0,7 bar)

Table 3 *(continued)*

Property	Unit	Requirement	Method
Burst pressure	MPa (bar)	≥ Values in Table 1	ISO 1402
Bend	—	No leakage or visible damage when the hose is bent to radius given in Table 2 and subjected to the proof pressure	ISO 10619-1
Crush recovery (max)	%	3	Annex A
Flammability	—	See Annex G.	Annex G
Thermal ageing	—	No leakage at proof pressure given in Table 1	Annex B
Low temperature flexibility	—	Test at minimum temperature given in Table 1	ISO 10619-2
Ozone resistance (cover only) 72 h at 40 °C	—	No cracks at ×2 magnification	ISO 7326:2016, method 3

7.3 End fittings

End fittings and metallic ferrules shall be made from the following materials depending on the type of hose to be used in the assembly:

— Type 1 hose: LT (low temperature) grade carbon steel or stainless steel;

— Type 2 hose: austenitic stainless steel tested in accordance with Annex C.

For all types of end fittings, that part of the fitting that enters the hose and forms the means by which the fitting is connected to the hose shall be provided with scrolls or protrusions on the surface that correspond to the pitch of the internal helix wire of the hose.

7.4 Hose assemblies

Hose assemblies shall be fitted with end fittings as described in 7.3.

End fittings shall be attached to the hose by one of the following methods:

a) by the use of a seal and a metal ferrule which is swaged or crimped;

b) by the use of a thermoset resin or multi-components adhesive e.g. epoxy and a metal ferrule which is swaged or crimped.

Hoses should be assembled by the hose manufacturer.

When tested by the methods given in Table 4, hose assembly shall conform to the requirements specified in Table 4.

When assembled to a hose there shall be electrical continuity between the end fitting and the internal and external wires.

Table 4 — Physical properties of hose assemblies

Property	Unit	Requirements	Method(s)
Proof pressure	MPa (bar)	No leakage or other signs of weakness at pressure given in Table 1	ISO 1402 with pressure increase not less than 0,17 MPa/min (1,7 bar/min)
Bend	—	No leakage or visible damage when the hose is bent to the radius given in Table 2 and is subjected to the proof pressure	ISO 10619-1
Series of hydrostatic tests	MPa (bar) % °/m	≥ Burst pressure given in Table 1 Change in length as in Table 3 Twist as given in Table 3	Annex D
Security of end fitting	MPa (bar)	No leakage at proof pressure given in Table 1	Annex E and ISO 1402
Electrical resistance between end fittings	Ω	≤ 100 Ω per assembly	ISO 8031:2020, 4.8.1 and 5.1
Burst pressure	MPa (bar)	≥ Value given in Table 1	ISO 1402
Leak tightness	—	No leakage of air when subjected to 0,35 MPa (3,5 bar) for 5 min	Annex F

7.5 Electrical continuity

There shall be electrical continuity between both internal and external wires and the end fittings. Manufacturers shall demonstrate by testing or calculation that the measured overall electrical resistance of the hose assembly incorporates both inner and outer wires being part of the circuit.

For the transfer of non-conductive fluids, the use of a hose with a non-polymeric coated internal wire should be considered.

8 Test frequency

Routine tests shall be carried out on each hose assembly and in accordance with Annex H, Table H.1.

It is recommended that batch tests are carried out for every 10 000 m of manufacture or once a year, varying the sizes and types and in accordance with Annex I, Table I.1.

9 Type tests

Type tests shall be carried out to confirm that the hose assembly design, materials, and method of manufacture meet the requirements of this document.

Type tests shall be carried out on at least three sizes of hose including the smallest and largest for each type in the manufacturer's range.

Type tests shall be repeated, and the results recorded, at least every five years or whenever a change in the materials and/or method of manufacture is made.

10 Marking

10.1 Hose marking

Each hose shall be permanently marked at an interval of not greater than 1 m with lettering of a minimum height of 10 mm with at least the following information:

a) the manufacturer's name or identification mark, e.g. XXX;

b) reference number of this document, (i.e. ISO 27127);

c) hose identification (class and type), e.g. Class B — Type 1;

d) inside diameter, e.g. 40 mm;

e) maximum working pressure in MPa and bar; e.g. 1 MPa (10 bar);

f) working temperature range, e.g. −50 to +45 °C (for −50 °C to +45 °C);

g) material of the hose inner liquid barrier layer as referenced in ISO 1043-1 e.g. PP (for polypropylene);

h) quarter and year of hose manufacture, e.g. 4Q/21.

EXAMPLE

XXX — ISO 27127 — Class B — Type 1 — 40 —1 MPa (10 bar)— −50 to +45 °C — PP — 4Q/21

For item b), the hose manufacturer shall use the latest edition of this document; otherwise, the year of publication shall be included in the marking.

10.2 Hose assembly marking

Each hose assembly shall be permanently marked on the ferrule at one end with the following information:

a) assembler's name or identification mark, e.g. XXX;

b) hose assembly serial number;

c) maximum allowable working pressure for the assembly;

d) the test date of the hose assembly;

e) quarter and year of hose assembly manufacture, e.g. 4Q/21.

Annex A
(normative)

Method of test for crush recovery

The following test shall be conducted at room temperature 23 °C ± 3 °C.

Place a test piece of length ≥ 350 mm on a rigid, flat base plate so that it is not taut.

Place a 100 mm square 10 mm thick test plate centrally on the test piece. Measure the original outside diameter (d_1) (equals to the distance between two plates) (see Figure A.1).

Apply test force, *F*, (see Table A.1) to the test plate for a period of 3 min.

The hose outside diameter can be reduced ≤ 15 % at this stage.

Remove the test force and re-measure final outside diameter (equals to the distance between the two plates) (d_2) after 5 min.

The reduction in diameter, d_r, is expressed as a percentage by Formula (A.1):

$$d_r = \frac{d_1 - d_2}{d_1} \times 100 \tag{A.1}$$

where

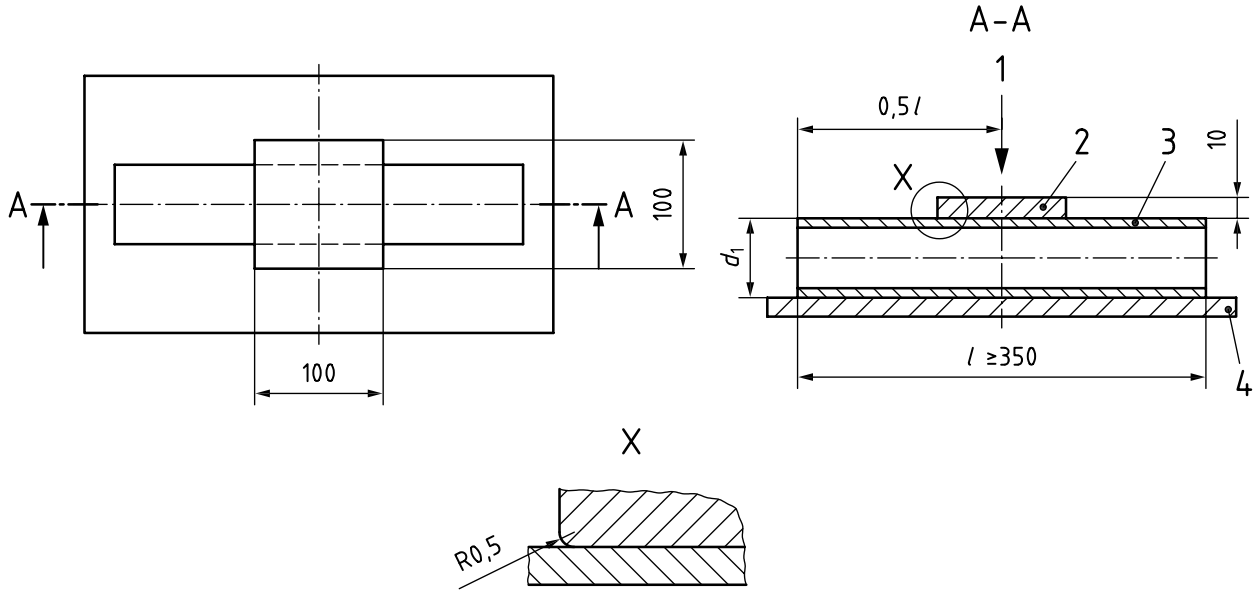
d_1 is the original outside diameter in millimetres (mm);

d_2 is the final outside diameter in millimetres (mm).

Table A.1 — Test force

Nominal bore	Test force *F* N
≤ 50	1 500 ± 10
> 50	2 000 ± 20

Dimensions in millimetres



Key

1 test force, *F*
2 test plate
3 test piece
4 baseplate

Figure A.1 — Arrangement for crush recovery test

Annex B
(normative)

Method of test for thermal ageing

Fill a hose assembly with water, excluding all air, and cap both ends.

Heat the test piece at the maximum working temperature appropriate to the type as given in Table 1 for 200 h.

Keeping the hose assembly at the maximum working temperature, raise the internal pressure to 1,5 times the maximum working pressure (as given in Table 1) for a period of 15 min.

Annex C
(normative)

Method of test of fittings subjected to low temperatures

C.1 General

Where impact tests are required, Charpy V-notch tests shall be performed in accordance with ISO 148-1. Tests shall be conducted at the minimum operating temperature. The impact energy requirements shall be met in the base material, heat affected zone, and weld metal if present.

C.2 Specimen size

Where the component is greater than 10 mm thick, the specimen size shall be 10 mm × 10 mm and the impact energy shall be 40 J. Where the base material is less than 10 mm thick, the energy requirements shall be as given in Table C.1. Where test pieces at least 5 mm wide cannot be obtained, the material shall not be subjected to impact testing.

Table C.1 — Impact requirements for sub-sized Charpy V-notched specimen if base material is less than 10 mm thick

Specimen geometry (mm)	10 × 10	10 × 7,5	10 × 5
Minimum impact energy (J)	40	32	28

Annex D
(normative)

Sequence of hydrostatic tests

The following sequence of tests shall be carried out on a hose assembly for type testing.

a) Measure the electrical resistance between end fittings in accordance with ISO 8031:2020, 4.8 (the hose assembly is empty). It shall meet the requirement defined in Table 4.

b) Fill the hose assembly with liquid and maintain the hose at a pressure of 0,07 MPa (0,7 bar) for the time given in ISO 1402:2021, 8.2.

c) Mark and measure the hose in accordance with ISO 1402:2021, 8.2.

d) Raise the pressure at a rate of at least 0,17 MPa/min (1,7 bar/min) to the maximum working pressure appropriate to the type of the hose, see Table 1.

e) Re-measure the marks in e) and determine the increase/decrease in length and the twist. They shall meet the requirements defined in Table 3.

f) Examine the assembly. No leakage, cracking, abrupt distortions, or other signs of failure shall occur.

g) Release the pressure, bend the hose to the appropriate radius given in Table 2.

h) Raise the pressure at a rate of at least 1,7 bar/min to the proof pressure appropriate to the type of the hose (see Table 1).

i) Release the bend in the hose, increase the temperature of the liquid to 45 °C ± 5 °C and increase the pressure over a period of at least 15 min to the minimum burst pressure for the type of hose and hold for a further 15 min. No leakage or failure of the hose assembly shall occur.

j) Release the pressure, cool down the suitable liquid to a temperature of −50 °C ± 3 °C for type 1 hoses or −196 °C ± 5 °C for type 2 hoses.

k) Reapply the pressure [at temperature stated in point i)] at a rate not less than 1,7 bar/min until the hose assembly bursts. Record the burst pressure value. It shall meet the requirement defined in Table 4.

Annex E
(normative)

Method of test for fitting security

The following test procedure shall be used for type 1 and type 2 hose assemblies as given in Table 1, provided that the test equipment is suitable for the appropriate specified type of test liquid. For type 1 hoses, use refrigerated methylated spirit at −50 °C ± 5 °C and for type 2 hoses, use liquid nitrogen at −196 °C.

a) Use an assembly having a length of at least 4 diameters free hose.

b) Connect hose to test equipment designed for one of the above-mentioned test liquids.

c) Thermocouples can be used on the inside of the hose for a clear indication of the liquid level.

d) Lay the hose in horizontal position (see Figure E.1).

e) Make sure that the hose can elongate during pressurizing, by using wheels or other transport equipment.

f) Measure the electrical resistance between end fittings in accordance with ISO 8031:2020, 4.8.

g) Start to fill the hose with one of the above-mentioned test liquids.

h) When hose is filled completely with the appropriate test liquid given above, start to pressurize the hose to the maximum working pressure given in Table 1.

i) Keep the hose on the maximum working pressure, given in Table 1, for 30 min.

j) Empty the hose and heat up the hose by using a hot air blower until ambient temperature.

k) Test the hose on leakage with nitrogen gas at the proof pressure given in Table 1. Any leakage can be detected by checking on pressure drop.

l) Re-measure the electrical resistance between the end fittings in accordance with ISO 8031 and note any axial movement of either end fitting relative to the hose; compare results with measurement mentioned under f).

m) Empty the hose.

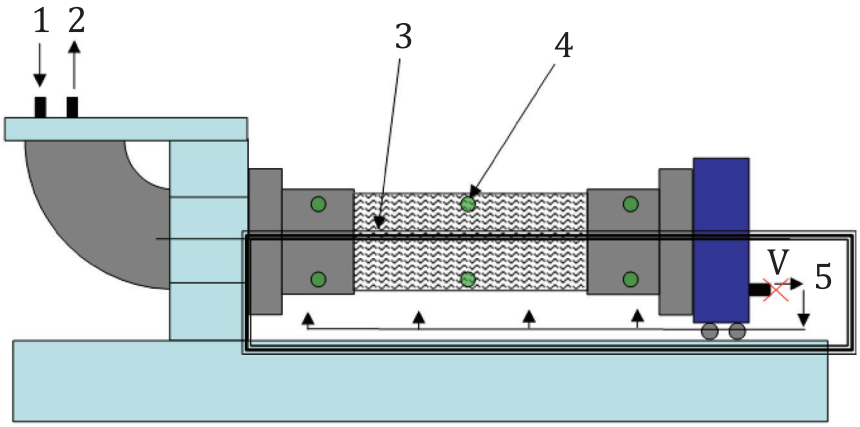
n) A minimum of 20 cycles from step g) until m) is required; the next cycle can be started when the hose is back at ambient temperature.

o) After completing 20 cycles, empty and dry the hose.

p) Fill the hose with water.

q) When the hose is filled completely with water, bring the hose at a rate not less than 1,7 bar/min to the proof pressure specified in Table 1 and maintain for 15 min in accordance with ISO 1402. No leakage or failure of the hose assembly shall occur.

r) Increase the pressure at a rate not less than 1,7 bar/min until the hose assembly bursts in accordance with ISO 1402. Record the burst pressure value. It shall meet the requirement defined in Table 4.



Key

1 test liquid inlet (connected to test pump)
2 vapour outlet (connected to test pump)
3 insulated trough
4 thermocouples (6 in total, indicated by ⬣)
5 test liquid/vapour outlet and valve (indicated by ✕)
V vapour flow, indicated by arrows

Figure E.1 — Arrangement for fitting security test

Annex F
(normative)

Method of test for leak tightness

Apply a pneumatic pressure of 0,35 MPa (3,5 bar) to the hose assembly and either submerge the assembly in a water bath or apply a solution of soap and water over the entire surface.

Ignore any immediate evidence of bubbling.

Hold the pressure for 5 min and note any continuous evidence of bubbling.

Annex G
(normative)

Method of test for flammability

Bend the hose test piece into a U-shape of radius as indicated in Figure G.1.

Fill the test piece with liquid F of ISO 1817:2015 (flash point 55 °C, heating power 42 MJ/kg).

Expose the test piece to a naked flame from a Bunsen burner of ≈ 10 mm pipe diameter for a period of 3 min, with the airflow to the burner shut off.

The distance between the burner and test piece shall be indicated in Figure G.1.

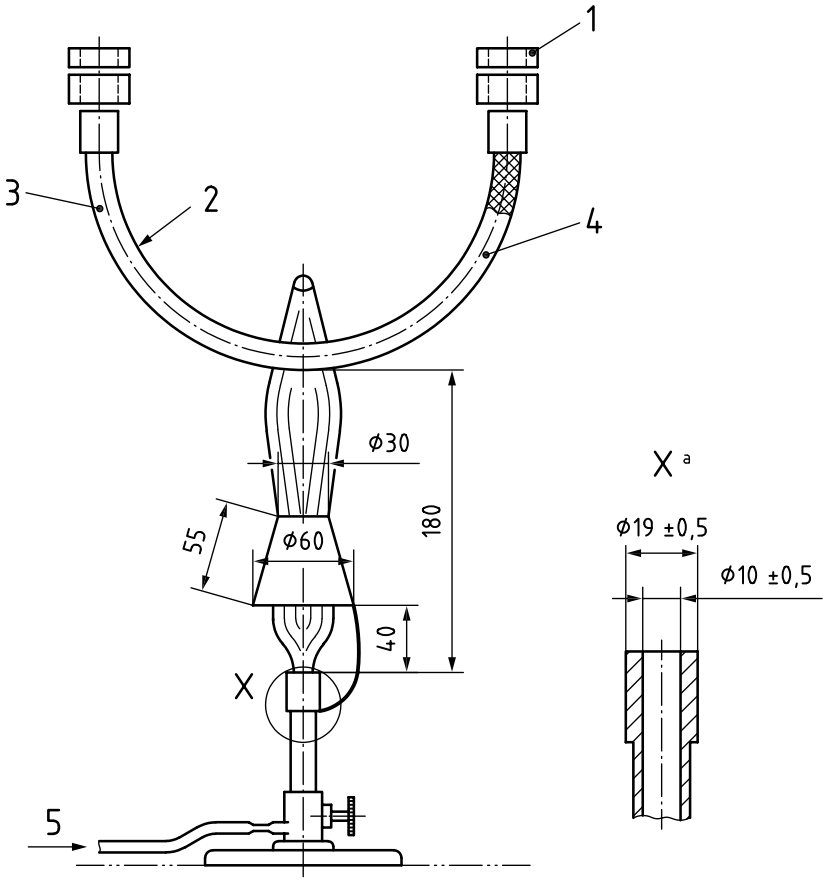
The hose test piece shall be deemed to be non-flammable if

a) it ceased to burn with a naked flame after 20 s of the removal of the burner, and

b) there is no further glowing visible 120 s after removing the burner flame.

On completion of the test the hose test piece shall be impervious to the test fluid when visually examined.

Dimensions in millimetres



Key

1 cap
2 bending radius is 10 times to 15 times outside diameter
3 hose assembly
4 liquid F in accordance with ISO 1817:2015
5 propane (LPG) ≈ 0,005 MPa (0,05 bar)
[a] Cross-section of detail.

Figure G.1 — Arrangement for flammability test

Annex H
(normative)

Type and routine tests for hoses and hose assemblies

Table H.1 — Type and routine tests for hoses and hose assemblies

Property	Type tests	Routine tests
Hose film and fabric		
Elongation	X	N/A
Hose		
Diameter	X	X
Crush recovery	X	N/A
Fuel resistance	X	N/A
Ozone	X	N/A
Thermal ageing	X	N/A
Flammability	X	N/A
Low temperature flexibility	X	N/A
Bend	X	N/A
Hose assemblies		
Proof pressure	X	X
Sequence of hydrostatic tests	X	N/A
Security of end fittings	X	N/A
Change in length	X	X
Burst	X	N/A
Twist	X	X
Electrical resistance	X	X
Leak tightness	X	N/A
X = test carried out; N/A = test not applicable.		

Annex I
(informative)

Batch tests for hoses and hose assemblies

Table I.1 — Batch tests for hoses and hose assemblies

Property	Batch
Hose	
Bend	X
Hose assemblies	
Burst pressure	X
X = Test carried out.	

Bibliography

[1] ISO 10619-3, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 3: Bending tests at high and low temperatures*

[2] EN 1474-2, *Installation and equipment for liquefied natural gas — Design and testing of marine transfer systems — Part 2: Design and testing of transfer hoses*

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