INTERNATIONAL STANDARD

ISO 27127

First edition
2014-07-01

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
ISO 27127:2014(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*.

ISO 27127 is based on EN 13766:2010 with the following modifications to comply with the requirements of ISO/TC 45/SC 1:

— the pressure unit "bar" has been replaced by "MPa (bar)";

— all references to EN or EN/ISO standards were replaced by references to ISO standards wherever possible;

— Clause 2, references have been amended;

— 6.1, Table 2, have been amended (tolerance for ID 150 only, the other tolerances are already sufficient to accommodate the required changes of ID to include inch size mandrels);

— 7.2, Table 3, now requires the change in length and twist to be measured at maximum working pressure instead of proof pressure and Annex D has been amended accordingly;

— 7.4, Table 4, the reference to the test method clause, to determine electrical resistance between fittings according to ISO 8031 has been corrected;

— Clause 10, the marking has been amended according ISO/TC 45/SC 1 remarks.

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 International Standard should be familiar with normal laboratory practice. This International Standard 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 ensure compliance with any national regulatory conditions.

1 Scope

This International Standard 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 International Standard 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 LNG hose assemblies are also specified in EN 1474–2.

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.

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

ISO 8031:2009, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

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

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

ISO 1402:2009, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

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, *Stainless steels for general purposes — Part 3: Wire*

EN 10088-3, *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.

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 ± 3 to +45		−50 ± 3 to +45		−196 ± 5 to +45		−196 ± 5 to +45	

NOTE 1 1 bar = 0,1 MPa.

NOTE 2 Due to pressurization during test and operations, the temperature of the fluid could 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, Table 4, numbers 1,443 6 (X3CrNiMo 17-13-3) or ISO 16143-3, 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, Table 4, numbers 1,443 6 (X3CrNiMo 17-13-3) or ISO 16143-3, Table 1 X2CrNi 19-11, X5CrNiMo 17-12-2, X2CrNiMo 17-12-2;

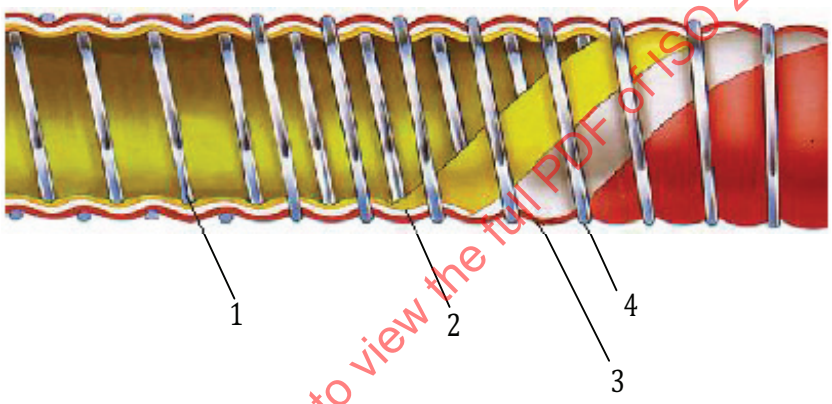
b) **Class B:**

1) an internal wire helix of austenitic stainless steel conforming to EN 10088-3, Table 4, numbers 1,443 6 (X3CrNiMo 17-13-3) or ISO 16143-3, 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, Table 4, numbers 1,443 6 (X3CrNiMo 17-13-3) or ISO 16143-3, Table 1 X2CrNi 19-11, X5CrNiMo 17-12-2, X2CrNiMo 17-12-2.

NOTE By agreement between manufacturer and purchaser, the outer layer may 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 internal 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 $^{+2}_{-1}$ %.

7 Performance requirements of hoses and hose assemblies

7.1 Film and fabric

When tested at the minimum temperature, Type 1: –50 ± 3 °C and Type 2: –196 ± 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 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 maximum working pressure	%	8 %	ISO 1402:2009, 8.2 initial length measured when the hose is pressurized to 0,07 MPa (0,7 bar)

Table 3 *(continued)*

Property	Unit	Requirement	Method
Twist at maximum working pressure	°/m	8	ISO 1402:2009, 8.2 initial reading taken when hose is pressurized to 0,07 MPa (0,7 bar)
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
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)	—	No cracks after 72 h at 40 °C at ×2 magnification	ISO 7326, 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 e.g. epoxy and a metal ferrule which is swaged or crimped.

NOTE Hoses should be assembled by the hose manufacturer.

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

Table 4 *(continued)*

Property	Unit	Requirements	Method(s)
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	No reduction of electrical resistance between end fittings ≤2,5 Ω/m for sizes less than 50 mm. ≤1,0 Ω/m for the 50 mm size and above sizes	ISO 8031:2009, 4.8.1 and 5.1
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.

8 Test frequency

Routine tests shall be carried out on each hose assembly and in accordance with Annex G.

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 H.

9 Type tests

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

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 assembly 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. MAN Ltd;

b) number and year of this International Standard, (i.e. ISO 27127:2014);

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;

f) working temperature range;

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

h) quarter and year of hose manufacture.

EXAMPLE MAN Ltd — ISO 27127:2014 — Class B — Type 1 — 40 — 2 MPa (20 bar) — −50 + 45 °C — PP — 4Q/13

10.2 Hose assembly marking

Each hose assembly shall be permanently marked on the ferrule at one end with all the information given in 10.1 and in addition:

a) hose assembly serial number;

b) last test date of the hose assembly;

c) quarter and year of hose assembly manufacture, e.g. 4Q/13.

Annex A
(normative)

Crush recovery test

The following test shall be conducted at room temperature (23 ± 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 distance between two plates (d_1) (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 the distance between the two plates (d_2) after 5 min.

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

$$d_r = \frac{d_1 - d_2}{d_1} \times 100 \qquad \text{(A.1)}$$

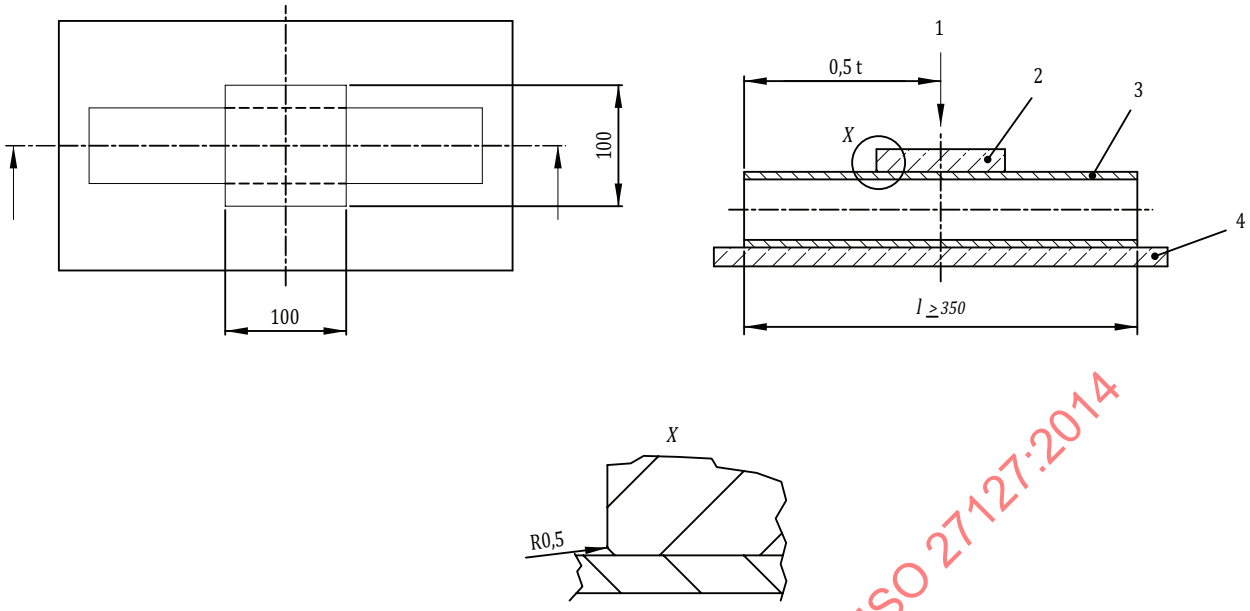
where

d_1 is the original thickness in millimetres (mm);

d_2 is the final thickness in millimetres (mm).

Table A.1 — Test force

Nominal bore	Test force, F N
≤ 50	1 500
> 50	2 000



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;

b) maintain the hose at a pressure of 0,07 MPa (0,7 bar) for the time given in ISO 1402:2009, 8.2;

c) raise the pressure at a rate of at least 0,17 MPa/min (1,7 bar/min) to the proof pressure appropriate to the type of the hose, see Table 1 and hold pressure for 5 min (according ISO 1402:2009, 8.1) and examine the assembly for leakage, cracking, abrupt distortions, or other signs of failure

d) release the pressure and wait for 5 min

e) raise the pressure to 0,07 MPa (0,7 bar) maintain it for the time given in ISO 1402:2009, 8.2; mark and measure the hose in accordance with ISO 1402:2009, 8.2;

f) 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;

g) re-measure the marks in e) and determine the increase/decrease in length and the twist;

h) release the pressure, bend the hose to the appropriate radius given in Table 2, and repeat c) above;

i) release the bend in the hose and increase the pressure over a period of at least 15 min to the appropriate minimum burst pressure for the type of hose and hold for a further 15 min; check the electrical resistance between fittings;

j) release the pressure, cool the assembly to –50 ± 3 °C for type 1 hoses or –196 ± 5 °C for type 2 hoses and reapply the pressure at a rate not less than 0,17 MPa/min (1,7 bar/min) until the hose assembly bursts; record the burst pressure value.

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 (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;

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;

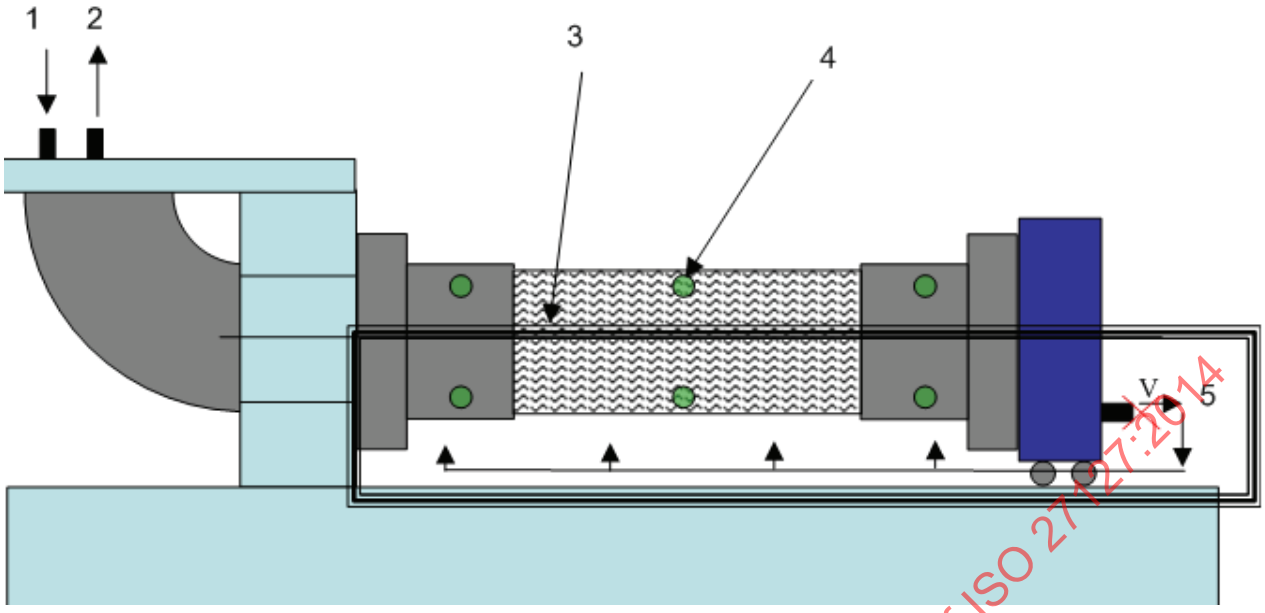
k) test the hose on leakage with nitrogen gas at the proof pressure given in Table 1; any leakage can be detected by checking on pressure drop;

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) minimum of 20 cycles is required; the next cycle can be started when the hose is back at ambient temperature.

After completing 20 cycles test for leakage at ambient temperature using water at the proof pressure as per Table 1 and in accordance with ISO 1402, a burst test will be required, minimum burst pressure as per Table 1 in accordance with ISO 1402. The burst test shall be done with water at ambient temperature.

During testing no leakage is allowed.



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.