BS ISO 5772:2015

BSI Standards Publication

Rubber and plastic hoses and hose assemblies for measured fuel dispensing systems — Specification

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National foreword

This British Standard is the UK implementation of ISO 5772:2015.

The UK participation in its preparation was entrusted to Technical Committee PRI/66, Rubber and plastics tubing, hoses and hose assemblies.

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

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BS ISO 5772:2015

INTERNATIONAL STANDARD

ISO 5772

Second edition
2015-09-15

Rubber and plastic hoses and hose assemblies for measured fuel dispensing systems — Specification

Tuyaux et flexibles en caoutchouc et en plastique pour distribution mesurée de carburants — Spécification

Reference number
ISO 5772:2015(E)

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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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 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*.

This second edition cancels and replaces the first edition (ISO 5772:1998), which has been technically revised to include the following changes:

— working pressure is 16 bar (1,6 MPa) instead of 12 bar (1,2 MPa) but proof pressure and burst pressure remain the same;

— minimum tensile strength of lining and cover has been increased from 7 MPa to 9 MPa;

— extraction of the lining for low temp hoses has been added and the Low Temperature Bending test is to be done at 25 °C with the force to bend specified;

— hose fuel permeation, flammability, assembly flex test, and assembly leak test have been added.

All the annexes form an integral part of this International Standard.

INTERNATIONAL STANDARD **ISO 5772:2015(E)**

Rubber and plastic hoses and hose assemblies for measured fuel dispensing systems — Specification

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This International Standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies minimum requirements for three types of hoses in two categories and two classes of hose assemblies used for measured fuel dispensing, including oxygenated fuels (up to a maximum of 15 % oxygenated compounds).

The assemblies are intended for use at ambient temperatures between −30 °C and +55 °C for normal temperature class and −40 °C and +55 °C for low temperature class at a working pressure up to and including 16 bar (1,6 MPa).

NOTE 1 bar = 0,1 MPa.

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 37, *Rubber, vulcanised or thermoplastic — Determination of tensile stress-strain properties*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1307, *Rubber and plastics hoses — Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses*

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

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

ISO 4649, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

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

ISO 6801, *Rubber or plastics hoses — Determination of volumetric expansion*

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

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

ISO 8033, *Rubber and plastics hose — Determination of adhesion between components*

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*

3 Terms and definitions

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

4 Classification

Hoses for this application shall be divided into the following three types:

a) type 1: textile reinforced;

b) type 2: textile and helical wire reinforced;

c) type 3: fine wire reinforced.

Each type of hose shall be divided into the following two temperature classes:

a) normal temperature class with an ambient working temperature of −30 °C to +55 °C;

b) low temperature class (LT) with an ambient working temperature of −40 °C to +55 °C.

Each type of hose for this application shall be divided into the following two categories:

a) category M: electrically bonded;

b) category Ω: electrically conductive.

Hoses for this application shall be divided into the following two temperature classes:

a) normal temperature class with an ambient working temperature of −30 °C to +55 °C;

b) low temperature class (LT) with an ambient working temperature of −40 °C to +55 °C.

5 Materials and construction

The hose shall consist of the following:

— smooth, fuel resistant lining of rubber or thermoplastic elastomer (TPE);

— suitable reinforcement; related to type;

— non-corrugated, fuel and weather-resistant rubber or TPE cover.

Hose assemblies shall be capable of conducting an electrical charge from coupling to coupling.

When this capability is provided by means of metallic bonding wires, not less than two (metallic) bonding wires shall be embedded in the hose and the metal used shall have a high resistance to fatigue and corrosion.

Hoses with metallic wires for electrical conductivity shall be designated “M” and those using conductive compounds shall be designated “Ω”, the relevant mark being branded on the hose (see Clause 12).

6 Pressure requirements

For all types of hoses, the following shall apply:

a) maximum working pressure: 16 bar (1,6 MPa);

b) proof pressure: 24 bar (2,4 MPa);

c) minimum bursting pressure: 48 bar (4,8 MPa).

7 Dimensions and tolerances

7.1 Internal diameters and bend radii

When measured in accordance with ISO 4671, the internal diameter of the hose shall comply with the values given in Table 1.

When measured in accordance with ISO 10619–1, the minimum bend radii for each diameter of hose shall comply with the values given in Table 1.

Table 1 — Nominal bore, internal diameter, tolerance, and bend radii

Nominal bore	Internal diameter mm	Tolerance mm	Bend radius mm
12	12	±0,8	60
16	16		80
19	19		100
21	21,0	±1,25	130
25	25,0		150
32	32,0		175
35	35,0		200
38	38,0		225
40	40,0		225
50	50,0		275

7.2 Minimum thickness of lining and cover

When measured in accordance with ISO 4671, the thickness of the lining shall not be less than 1,6 mm. The thickness of the cover shall not be less than 1,0 mm.

7.3 Concentricity

When determined in accordance with ISO 4671, the concentricity, based on a total indicator reading between the internal diameter and the outside surface of the cover, shall not exceed 1,0 mm.

7.4 Tolerance on cut lengths

For cut lengths, the tolerances on length shall be according to ISO 1307. The length of a hose assembly shall be measured from sealing face to sealing face of the end fittings with a tolerance from the nominal length of ±1 %.

8 Physical properties

8.1 Compounds

When tested in accordance with the methods in Table 2, the physical properties of the compounds used for the lining and cover shall comply with the values given in Table 2. Tests shall be carried out either on samples taken from the hose or from moulded vulcanised sheets at a thickness of 2 mm or moulded test pieces, vulcanised to the same cured state as the production hoses.

Table 2 — Physical properties of compounds

Property	Unit	Requirement		Test piece[a]	Test method
		Rubber	TPE		
Tensile strength Lining and cover, min.	MPa	9	12	Test piece cut from hose or from test sheet	ISO 37
Elongation at break Lining and cover, min.	%	250	350		
Accelerated ageing — Tensile strength change, max. Lining and cover	%	20	10		ISO 188 (air oven method) 14 days at (70 ± 1) °C
— Elongation at break change, max. Lining and cover	%	−35	−20		
Resistance to liquids	%				ISO 1817 70 h at 40 °C in oxygenated fuel type 3
Lining swell max.		+70			
Lining swell max.		+25			ISO 1817 70 h at 100 °C in oil No 3
Lining extracted matter Normal temperature class max.		+10			ISO 1817 70 h at 40 °C in oxygenated fuel type 3 then dry 24 h at 100 °C
Lining extracted matter Low temperature class max.		+15			
Cover swell max.		+100			ISO 1817 70 h at 23 °C in Liquid B
Low temperature resistance to lining and cover at −30 °C (or −40 °C if required)	—	No cracks under ×10 magnification			Annex A
Abrasion resistance Cover compound max.	mm^3	500		Test piece from moulded test sheet of cover compound	ISO 4649 Method A

[a] It is necessary that the test report indicated the source of the test piece.

8.2 Finished hose

When tested in accordance with the methods in Table 3, the physical properties of the finished hose shall comply with the values given in Table 3.

Table 3 — Physical properties of hoses

Property	Unit	Requirement	Test piece	Test method
Proof pressure at 24 bar	—	No leakage or other signs of weakness nor abrupt twisting	Full length of hose	ISO 1402 Proof test pressure
Burst pressure, min.	bar	48	Short length cut from hose	ISO 1402 Burst pressure
Volumetric expansion, max. — Type 1 and Type 2 — Type 3	%	2 1	At least 1 m cut from hose	ISO 6801 Test pressure 3 bar
Adhesion between components on — Un-aged hose, min. — Aged hose, min.	N/mm	2,4 1,8	Short length cut from hose	ISO 8033/Annex B
Ambient temperature bending	—	$T \geq 0{,}8$ D D No kinking or deformation greater than 20 % of the outside diameter		ISO 10619–1 Nominal diameter C = 10 × nominal bore
Low temperature flexibility		No cracks or breaks Maximum bending force 180 N	Annex C, Reference hose with nominal bore 16, 19 or 21	Annex C
Change in length at proof pressure	%	0 to +5	Full length of hose	ISO 1402
Ozone resistance of cover	—	No cracks under ×2 magnification	Short length cut from hose	ISO 7326 168 h at 40 °C, 50 pphm, relative humidity (55 ± 10) % and elongation 20 %
Fuel permeation of hose max. Normal temperature class Low temperature class	ml/(m·day)	12 18	2 m test piece cut from hose Reference hose with nominal bore 16, 19 or 21	Annex D
Electrical resistance max. Category Ω Category M	Ω	1×10^6 1×10^2	Equivalent to the length of hose assembly	ISO 8031:2009, Method 4.5, 4.6, or 4.7 ISO 8031:2009
Flammability	—	*a) Burning with a naked flame to cease within 20 s of removal of the burner;* *b) no further glowing visible 2 min after removal of the burner;* *c) hose shall show no sign of leakage*	*Length of assembly to suit test rig*	Annex E

8.3 Hose assembly

When tested in accordance with the methods in Table 4, the physical properties of the hose assembly shall comply with the values given in Table 4.

Table 4 — Physical properties of hose assemblies

Property	Unit	Requirement	Test piece	Test method
Pull-off test	—	No movement of end fitting after removal of force	Short length of hose assembly	Annex F
Proof pressure at 24 bar	—	No leakage or other signs of weakness	Full length of hose assembly	ISO 1402 Proof test pressure
Electrical resistance max. Category M Category Ω	Ω/assembly	 1×10^2 1×10^6		 ISO 8031:2009 ISO 8031:2009, Method 4.8
Leak test		No leakage		Annex H
Flex test	—	No defects after 18 000 cycles No leakage after 50 000 cycles max. The electrical resistance shall meet the requirements given above.		Annex G

9 End fittings

The following requirements shall be fulfilled:

— end fittings shall be designed for the pressure ratings according to Clause 6;

— end fittings shall be designed so that, where used for their intended purpose, they do not adversely affect in-service reliability of the hose due to sharp edges or burrs;

— parallel thread;

— end fittings with thread sealing (e.g. with PTFE-band) are not permitted;

— materials of the thread-bearing parts: corrosion-resistant metallic materials at the option of the manufacturer; control screw threads shall not be made from aluminium;

— surfaces that come into contact with the conductive layers of the fuel hose shall be metallically conductive; anodised surfaces and surfaces with insulating layer are not permitted; end fitting components that are in contact with the lining or the cover of the fuel hose shall have secure, electrically conductive, metallic contact when assembled.

There are two types of end fittings that may be used, re-usable and non-reusable.

10 Frequency of testing

Type testing and routine testing and the minimum frequency of such tests shall be as specified in Annex I.

Type tests are those tests carried out in order to obtain product approval.

Routine tests are those carried out on each length of hose or hose assembly.

Production tests are those tests, specified in Annex J, which should preferably be carried out to control the quality of manufacture. The frequencies specified in Annex J are given as a guide only.

11 Type tests

Type testing is carried out in order to confirm that all the material, construction, and test requirements of this International Standard have been met by the method of manufacture and hose or hose assembly design.

Type testing shall be repeated at a minimum of every five years or whenever a change in the method of manufacture or materials occurs.

12 Marking

12.1 Hoses

The hose shall be marked legibly and indelibly during the manufacturing process. Marking shall be repeated at least at 2 m intervals, and shall at least include the following information:

a) manufacturer's name or identification, e.g. XYZ;

b) reference to this International Standard, i.e. ISO 5772;

c) type of hose (1, 2, or 3);

d) category of hose, i.e. M or Ω;

e) temperature class e.g. LT (low temperature);

NOTE For hoses for normal temperature class, no special marking is required.

f) nominal bore, e.g. 19;

g) maximum working pressure, in bar or MPa or both, e.g. 16 bar (1,6 MPa);

h) quarter and year of manufacture, e.g. 3Q15.

EXAMPLE XYZ/ISO 5772/1/M/LT/19/16/3Q15

12.2 End fittings

The fittings shall be marked with the manufacturer's trademark and according to their purpose with the wording "reusable" (alternatively "R") or non "re-reusable" (alternatively "NR"), respectively.

12.3 Hose assemblies

The information detailed in 12.1 shall appear in full at least once on each hose assembly. The fitting shall be marked with the name or the trademark of the assembler and the date of the assembling, e.g. 3Q14. In case of re-assembly, the fitting shall be marked with the name or trademark of the re-assembler and date of the assembling, e.g. 3Q14.

Annex A
(normative)

Test method for determination of low temperature resistance at -30 °C (for normal temperature class) and -40 °C (for low temperature class)

A.1 Apparatus

A.1.1 Two moving plates, able to reciprocate between (50 ± 1) mm and (25 ± 1) mm apart.

A.1.2 Cabinet capable of being maintained at (−30 ± 2) °C or (−40 ± 2) °C, in which the plates can be moved.

A.2 Test piece

A dumb-bell of Type 2 according to ISO 37.

A.3 Test temperature

The test shall be conducted at one of the following temperatures:

— 30 °C ± 2 °C;

— 40°C ± 2 °C.

A.4 Test method

The test piece shall be placed between the plates according to Figure A.1, separated at (50 ± 1) mm and at the test temperature.

After 30 min, the plates shall be pressed to (25 ± 1) mm apart during 5 s. Hold for 5 s and then release to (50 ± 1) mm during 5 s.

This cycle shall be repeated a further nine times, i.e. for a period of approximately 5 h.

Any appearance of cracking shall be reported.

A.5 Test report

The test report shall include the following particulars:

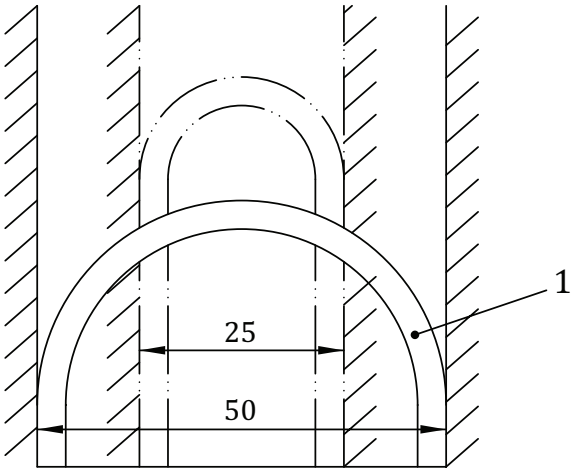
a) reference to this International Standard, i.e. ISO 5772;

b) dimensions of the test specimens;

c) test temperature;

d) condition of the samples after the test;

e) date of the test.



Key

1 dumb bell test piece

Figure A.1 — Arrangement for low temperature resistance test

Annex B
(normative)

Method for the determination of adhesion between components after fuel ageing

B.1 Apparatus

The apparatus for measuring the adhesion shall be as specified in ISO 8033. In addition, a suitable cabinet should be available to condition the test piece at (20 ± 5) °C.

B.2 Test piece

Cut a piece of 300 mm length from the hose. No test shall be carried out less than 24 h after the hose has been manufactured.

B.3 Test method

The sample sealed on one end and the hose shall be filled with liquid B according to ISO 1817 and the top lightly capped.

The sample shall be conditioned at (20 ± 5) °C for (168 +2/-0) h.

The sample shall be emptied and the minimum adhesion between components (liner/reinforcement, cover reinforcement and between layers of reinforcement) shall be determined.by the method outlined in ISO 8033.

B.4 Test report

The test report shall include the following particulars:

a) reference to Annex B of this International Standard, i.e. ISO 5772:2015, Annex B;

b) manufacturing date of the sample;

c) adhesion values between the components (cover reinforcement and line);

d) date of the test.

Annex C
(normative)

Test method for the determination of low temperature flexibility on a sample of finished hose

C.1 Apparatus

The test arrangement shall be in accordance with Figure C.1. The diameter of the mandrel and the lever shall comply with the bore diameter of the hose.

Plug mandrel and lever into the hose at a depth as shown in Figure C.1.

C.2 Test piece

The test hose length shall be (265 +2/-0) mm.

C.3 Conditioning of test piece and apparatus

The un-aged hose and the test apparatus shall be conditioned at a temperature of (−30 ± 2) °C for a period of 24 h prior to the testing. Other temperatures may be used as required.

C.4 Test method

The un-aged hose and the test apparatus shall be conditioned at a temperature of (−30 ± 2) °C for a period of 24 h prior to the testing. A suitable measuring instrument (spring balance, ring dynamometer) shall be fixed to the end of the lever to determine force, *F*, in Newtons.

The hose shall be bent, at (−30 ± 2) °C, through 90° around the bending device, against any curvature that might arise during manufacturing, by means of the tensile force on the measuring instrument, during 2 s to 4 s. The maximum force, *F*, (in Newtons) applied shall be recorded.

C.5 Test report

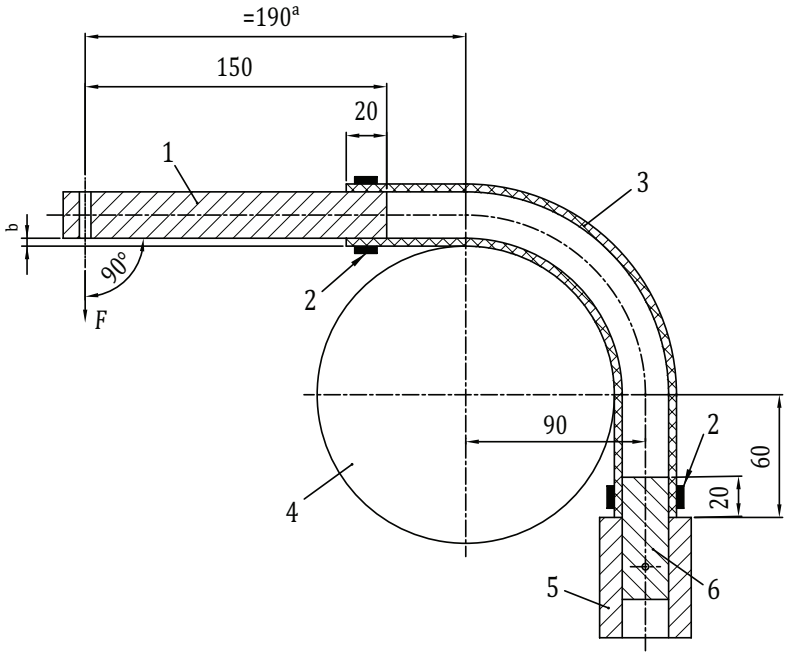
The test report shall include the following:

a) reference to the Annex C of this International Standard, i.e. ISO 5772:2015, Annex C;

b) manufacturing date of the hose sample;

c) force, in Newtons, required to bend the sample around the mandrel;

d) date of the test.



Key

1 lever
2 clamp
3 hose
4 bending device, Ø = 150 mm
5 holding device for mandrel
6 mandrel
a Length, depending on hose outer diameter.
b Parallel.

Figure C.1 — Test arrangement for low temperature flexibility test

Annex D
(normative)

Test method for the determination of fuel permeation

D.1 Apparatus

Graduated pipette with minimum capacity of 100 ml.

D.2 Test piece

Two metre sample of hose.

D.3 Test method

A 2 m sample of fuel hose, closed at one end, shall be fitted with a graduated pipette with a minimum capacity of 100 ml and shall be filled without bubbles with test fuel liquid C according to ISO 1817. The sample shall be conditioned for a period of 48 h (for swelling) suspended vertically at standard atmosphere 23/50 according to Table D.1 and Table D.2. The fuel hose shall be drained and refilled with fresh test fuel liquid C in accordance with ISO 1817 up to a gauge mark. This value shall be recorded.

The amount of fuel diffusing through the fuel hose after a period of (72 ± 2) h at standard atmosphere 23/50 and without adding fuel in the meantime shall be determined, by noting the reduction in volume in the pipette. Record this value will be V1.

The amount evaporated through the pipette opening during the test period by carrying out a blank test under the same conditions shall be determined, deducting this loss of volume from that recorded for the test sample. Record this value as V2.

Table D.1 — Standard atmospheres for conditioning and/or testing

Designation	**Temperature** °C	**Relative humidity** %	**Pressure** kPa	**Remarks**
23/50	23	50	Between 86 and 106	Recommended atmosphere
27/65	27	65		For tropical countries
20/65	20	65		Used in certain fields of application

Table D.2 — Tolerances

Tolerances	Temperature °C	Relative humidity %
Ordinary (normal) tolerances (wide tolerances)	±2	±5[a]
Reduced tolerances (close tolerances)	±1	±2[a]

[a] The resultant limits of relative humidity are therefore:

— ordinary (normal) tolerances: 45 % to 55 % and 60 % to 70 %;

— reduced tolerances: 48 % to 52 % and 63 % to 67 %.

D.4 Expression of results

The rate of permeation X in ml/m/day shall be determined as given in Formula (D.1):

$$X = V_1 - V_2 / L \times T \tag{D.1}$$

where

L is the length of the test sample, in metres (2 m);

T is the time of the test, in days (3 d).

D.5 Test report

The test report shall include the following:

a) reference to the Annex D of this International Standard, i.e. ISO 5772:2015, Annex D;

b) manufacturing date of the hose sample;

c) permeation of the test sample in ml/m/day;

d) date of the test.

Annex E
(normative)

Test method for flammability

E.1 Apparatus

Bunsen Burner, stopwatch, and suitable clamps to hold the test assembly as shown in Figure E.1.

E.2 Test piece

Hose assembly with both ends capped.

E.3 Test method

The hose test piece shall be bent into a U-shape of radius according to Figure E.1. The test piece shall be filled with liquid F according to ISO 1817. The test piece shall be exposed 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 according to Figure E.1. The hose sample shall be deemed to be non-flammable if

— it ceases to burn with a naked flame within 20 s on removal the burner, and

— there are no further glowing visible 2 min after removing the burner flame.

On completion of the test, the hose test piece shall show no sign of leakage with the test fluids.

E.4 Test report

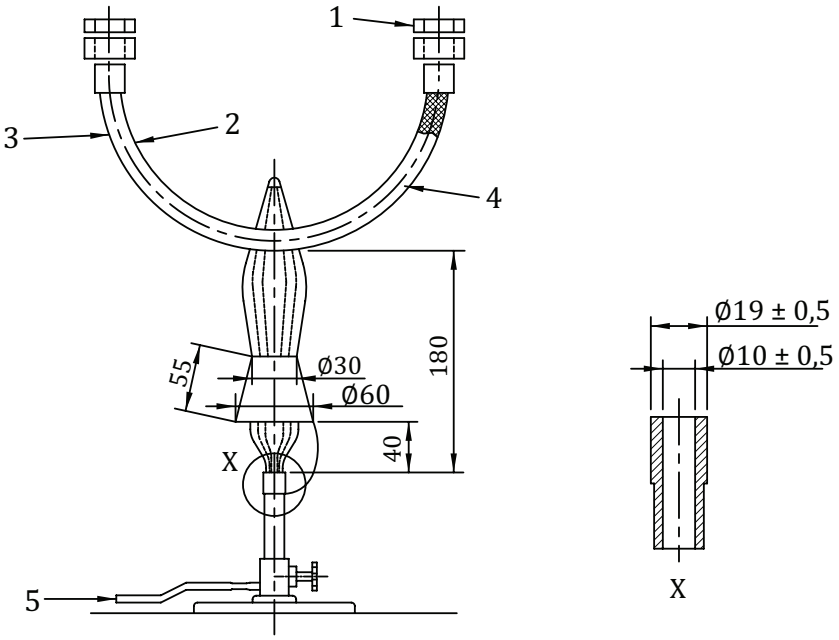
The test report shall include the following:

a) reference to the Annex E of this International Standard, i.e. ISO 5772:2015, Annex E;

b) manufacturing date of the hose sample;

c) if the assembly ceased to burn after 20 s, with no visible glow after 2 min and the absence of fluid leaking from the hose assembly;

d) date of the test.



Key

1 cap
2 bending radius = 10 to 15 times of outside diameter
3 hose assembly
4 liquid F in accordance with ISO 1817
5 propane (LPG) H 50 mbar

Figure E.1 — Arrangement for flammability test

Annex F
(normative)

End-fitting pull-off test

F.1 Apparatus

Test rig capable of producing and holding a tensile force of 2 000 N for at least 30 s with a jaw speed of (75 ± 5) mm/min.

F.2 Test piece

The test sample shall be a hose assembly of a length to fit the test equipment, prepared under the same manufacturing conditions and by the same manufacturing processes as used for actual assemblies. The test samples shall be prepared at the beginning and end of a batch of assemblies and, in addition, when the 100th assembly is made if the batch is larger than 100 units. This test frequency of 100 units only applies for non-reusable fittings.

F.3 Test method

The test sample shall be mounted in a test rig and a tensile force of 2 000 N shall be applied at the extremities of the assembly and held for 30 s. The force shall be built up by moving apart the jaws of the test rig at a rate of (75 ± 5) mm/min.

Each test assembly shall be discarded on completion of the test.

If a sample fails this test, the preceding 100 hose assemblies shall be deemed as not complying with this International Standard and subject to further investigation.

F.4 Test report

The test report shall include the following:

a) reference to the Annex F of this International Standard, i.e. ISO 5772:2015, Annex F;

b) manufacturing date of the hose sample;

c) note any movement of the fitting after the removal of the force;

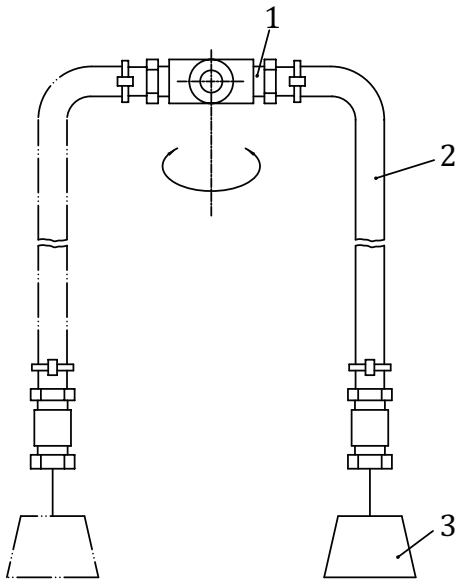
d) date of the test.

Annex G
(normative)

Test method for fatigue strength under reversed bending stress (flex test)

G.1 Apparatus

Testing rig shall be in accordance with Figure G.1. If found necessary, the dead weight may be guided to prevent swinging. The length of the hose assembly shall be approximately 1 m.



Key

1 centre of rotation of coupling
2 hose assembly, pressurized
3 dead weight

Figure G.1 — Testing rig

G.2 Test pieces

The length of the hose assembly shall be approximately 1 m.

G.3 Test method

The test specimen shall be fitted to the testing rig according to Figure G.1. A dead weight having a mass of 5 kg shall be attached to the free end of the assembly. A pressure of 2 bar using fuel liquid C in accordance with ISO 1817 shall be applied. The testing rig shall be moved to and fro at room temperature thereby, the hose shall be flexed through 180° relative to the coupling. One complete cycle is two rotations through 180°. The minimum flexing rate shall be two complete cycles per minute. The number of cycles to be carried out shall be according to Table 4.

G.4 Test report

The test report shall, in addition to the number of cycles achieved, include the following information:

a) reference to Annex G of this International Standard, i.e. ISO 5772:2015, Annex G;

b) manufacturing date of the hose sample/assembly;

c) any visible defects, such as splitting of the hose cover, bubbling of the cover, separation of the cover or the reinforcing plies, or damage to the lining; loosening of the hose from the end fittings or any leakage between the hose and the end fittings;

d) any deviation from the maximum permissible electrical resistance specified in Table 4 when tested to the relevant method as specified in ISO 8031:2009;

e) date of the test.

Annex H
(normative)

Test method for the determination of leakage (leak test)

Each hose assembly shall be subjected to an air pressure of 3,5 bar (0,35 MPa). The ends of the hose assembly which include the fittings and at least 100 mm of hose shall be immersed in a container of water at ambient temperature for a minimum period of 30 s.

Observe any leakage at the interface of the hose and the fittings.

Annex I
(normative)

Test frequency for type tests and routine tests

The minimum frequency of test for type tests and routine tests shall be as specified in Table I.1.

Table I.1 — Test frequency for type tests and routine tests

Property	Type test	Routine test
Compound		
Tensile strength and elongation at break, lining and cover	X	N.A.
Accelerated ageing	X	N.A.
Swelling in fuel, lining and cover	X	N.A.
Extracted matter from lining fuel hose	X	N.A.
Low temperature resistance	X	N.A.
Abrasion of the cover	X	N.A.
Hose		
Adhesion between components	X	N.A.
Ambient temperature bending	X	N.A.
Low temperature flexibility	X	N.A.
Measurement of internal diameter	X	X
Measurement of thickness (lining and cover)	X	X
Proof pressure	X	X
Change in length (at proof pressure)	X	N.A.
Burst pressure	X	N.A.
Ozone resistance of cover	X	N.A.
Electrical resistance	X	X
Flammability	X	N.A.
Fuel permeation	X	N.A.
Volumetric expansion	X	N.A.
Bend radius	X	N.A.
Hose assembly		
Proof pressure	X	N.A.
Leak test	X	X
Electrical resistance	X	X
Pull-off test	See Annex F	See Annex F
Flex test	X	N.A.
X = test to be carried out N.A. = not applicable		

Annex J
(informative)

Test frequency for production acceptance tests

The frequency of test for production acceptance tests should be as specified in Table J.1. It should be noted that this is only a recommendation. These tests are carried out per batch or 10 batches as indicated in Table J.1. A batch is defined as either 5 000 m of hose or 2 000 kg of lining and/or cover compound or 1 000 hoses assemblies.

Table J.1 — Test frequency for production acceptance tests

Property	Production acceptance tests	
	Per batch	Per 10 batches
Tensile strength and elongation at break, lining and cover	X	X
Accelerated ageing	N.A.	X
Swelling in fuel, lining and cover	N.A.	X
Extracted matter from lining fuel hose	N.A.	X
Low temperature resistance	N.A.	X
Abrasion of the cover	N.A.	X
Hose		
Adhesion between components	X	X
Ambient temperature bending	N.A.	X
Low temperature flexibility	N.A.	X
Measurement of internal diameter	X	X
Measurement of thickness (lining and cover)	X	X
Proof pressure	X	X
Change in length (at proof pressure)	N.A.	X
Burst pressure	N.A.	X
Ozone resistance of cover	N.A.	X
Electrical resistance	N.A.	X
Flammability	N.A.	X
Fuel permeation	N.A.	X
Volumetric expansion	N.A.	X
Bend radius	N.A.	N.A.
Hose assembly		
Leak test	X	X
Proof pressure	N.A.	X
Electrical resistance	X	X
Pull-off test	See Annex F	See Annex F
Flex test	N.A.	N.A.
X = test to be carried out N.A. = not applicable		

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[1] ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

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