
**Rubber and plastics hoses,
non-collapsible, for fire-fighting
service —**

Part 1:
Semi-rigid hoses for fixed systems

*Tuyaux en caoutchouc et en plastique, non aplatissables, pour la lutte
contre l'incendie —*

Partie 1: Tuyaux semi-rigides pour systèmes fixes



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Contents

Page

| | |
|---|-----------|
| Foreword..... | iv |
| Introduction | v |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions..... | 2 |
| 4 Classification..... | 2 |
| 4.1 General..... | 2 |
| 4.2 Classification by types (hose construction) | 2 |
| 4.3 Classification by class (materials for lining and cover) | 2 |
| 5 Dimensions, tolerances and maximum mass | 3 |
| 5.1 Inside diameter and maximum mass | 3 |
| 5.2 Length and tolerances on length | 3 |
| 6 Performance requirements of finished hose | 3 |
| 6.1 Hydrostatic requirements | 3 |
| 6.2 Adhesion..... | 4 |
| 6.3 Accelerated ageing | 4 |
| 6.4 Low temperature flexibility | 4 |
| 6.5 Hot surface resistance | 4 |
| 6.6 Ozone resistance | 4 |
| 6.7 Bending and crush resistance | 5 |
| 6.8 UV resistance (xenon arc lamp) | 5 |
| 6.9 Loss in mass on heating | 5 |
| 7 Frequency of testing..... | 5 |
| 8 Type tests | 5 |
| 9 Test report | 5 |
| 10 Recommendation for packaging and storage | 5 |
| 11 Marking | 5 |
| Annex A (normative) Kink pressure test..... | 7 |
| Annex B (normative) Accelerated ageing test | 8 |
| Annex C (normative) Hot surface resistance test..... | 9 |
| Annex D (normative) Bending and crush resistance test | 14 |
| Annex E (normative) Type test and routine test | 16 |
| Annex F (informative) Production test | 17 |
| Bibliography | 18 |

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 4642-1 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

This first edition, together with ISO 4642-2, cancels and replaces ISO 4642:1978 which has been technically revised.

ISO 4642 consists of the following parts, under the general title *Rubber and plastics hoses, non-collapsible, for fire-fighting service*:

- *Part 1: Semi-rigid hoses for fixed systems*
- *Part 2: Semi-rigid hoses (and hose assemblies) for pumps and vehicles*

Introduction

A fixed system is a manually operated unit installed in a building in order to make it possible for the occupants to control and extinguish a small fire. The system consists of fixed units mounted on walls or in cabinets permanently connected to a water supply. The fixed units are composed of a coupling, a valve, a semi-rigid water-filled hose with its support and a nozzle.

Rubber and plastics hoses, non-collapsible, for fire-fighting service —

Part 1: Semi-rigid hoses for fixed systems

1 Scope

This part of ISO 4642 specifies the requirements and test methods for semi-rigid reel hoses for fire-fighting purposes for use with fixed systems. The hoses are intended for use at a maximum working pressure of 1,2 MPa for hoses of 19 mm and 25 mm inside diameter and 0,7 MPa for hoses of 33 mm inside diameter.

Hoses conforming to this part of ISO 4642 are intended for applications where long intervals can occur between the occasions of use, for example on fixed fire hose reels in buildings and other construction works.

This part of ISO 4642 applies exclusively to hoses for fire-fighting purposes intended for use at ambient conditions in non-aggressive or non-corrosive atmospheres within the temperature range $-20\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$.

NOTE 1 Hoses for use at temperatures lower than $-20\text{ }^{\circ}\text{C}$ can be supplied at the request of the purchaser.

NOTE 2 All pressures are expressed in megapascals where $1\text{ MPa} = 10\text{ bar}$.

2 Normative references

The following referenced documents are indispensable for the application 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 176:2005, *Plastics — Determination of loss of plasticizers — Activated carbon method*

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

ISO 4672:1997, *Rubber and plastics hoses — Sub-ambient temperature flexibility tests*

ISO 7326:2006, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

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

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

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance*

3 Terms and definitions

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

3.1

semi-rigid hose

hose that maintains its round cross-section even when unpressurized

4 Classification

4.1 General

All types and classes of hose shall be so flexible that they can be rolled and kept on a drum of minimum diameter 200 mm for 19 mm inside diameter and 25 mm inside diameter hose and of minimum diameter 280 mm for 33 mm inside diameter hose.

Hoses shall be one of two types distinguished by their construction. Each hose type shall be further divided into classes distinguished by the materials used for lining and cover.

4.2 Classification by types (hose construction)

4.2.1 Type A hoses shall consist of:

- a) a seamless rubber or plastics lining;
- b) a textile reinforcement with or without a rigid spiral helix;
- c) a rubber or plastics cover.

4.2.2 Type B hoses shall consist of:

- a) a seamless rubber or plastics lining;
- b) a circular woven textile reinforcement with a rigid spiral helix;
- c) an uncovered or rubber or plastics cover.

4.3 Classification by class (materials for lining and cover)

The hose types shall be further subdivided into six classes dependent on the materials used in their construction, in accordance with Table 1.

Table 1 — Classes and materials

| Class | Lining material | Cover material |
|--------------|------------------------|-----------------------|
| 1 | rubber | rubber |
| 2 | plastics | plastics |
| 3 | rubber | plastics |
| 4 | plastics | rubber |
| 5 | rubber | no cover |
| 6 | plastics | no cover |

5 Dimensions, tolerances and maximum mass

5.1 Inside diameter and maximum mass

The inside diameter of the hose, when measured in accordance with ISO 4671, shall conform to the requirements given in Table 2. The mass per metre length of the hose shall be in accordance with Table 2.

Table 2 — Inside diameter, tolerances on inside diameter and maximum mass per unit length

| Inside diameter mm | Tolerances for inside diameter mm | Mass per unit length kg/m | |
|-----------------------|--------------------------------------|------------------------------|----------------|
| | | Type A max. | Type B max. |
| 19 | -0,5 to +1,0 | 0,75 | 0,25 |
| 25 | ± 1,0 | 0,90 | 0,35 |
| 33 | -1,0 to +1,5 | 1,00 | 0,50 |

5.2 Length and tolerances on length

The total length of hose supplied shall be in accordance with the purchaser's requirements and shall be stated in metres. Tolerance on length shall be in accordance with ISO 1307.

6 Performance requirements of finished hose

6.1 Hydrostatic requirements

6.1.1 Deformation under maximum working pressure

The dimensional stability of the hose, when tested in accordance with ISO 1402, shall conform to the requirements given in Table 3. The length of the test piece shall be 1 m.

For 19 mm and 25 mm inside diameter hoses, the initial test pressure shall be 0,07 MPa and the final test pressure shall be 1,2 MPa. For 33 mm inside diameter hose, the initial test pressure shall be 0,07 MPa and the final test pressure shall be 0,7 MPa.

The twist shall be no greater than 30° m^{-1} for type A. For type B, the twist may be greater than 30° m^{-1} but in this case it shall only be in a direction which closes the coupling and shall be stated in the test report.

Table 3 — Change in length and external diameter

| | Tolerances for type A | Tolerances for type B |
|-----------------------------|-----------------------|-----------------------|
| | % | % |
| Change in length | 0 to +7,5 | 0 to +5,0 |
| Change in external diameter | 0 to +7,5 | 0 to +5,0 |

6.1.2 Deformation under proof pressure

A proof pressure hold test shall be carried out on three hose lengths each of 1 m in accordance with ISO 1402. The proof pressure shall be as given in Table 4 and, on examination during the test, the test pieces shall not show any evidence of leakage, cracking, abrupt distortion or other signs of failure.

Table 4 — Maximum working pressure, proof pressure and minimum burst pressure

| Inside diameter | Maximum working pressure MPa | Proof pressure MPa | Minimum burst pressure MPa |
|-----------------|---------------------------------|-----------------------|-------------------------------|
| 19 mm and 25 mm | 1,2 | 2,4 | 4,2 |
| 33 mm | 0,7 | 1,4 | 2,45 |

6.1.3 Minimum burst pressure

A burst pressure test shall be carried out in accordance with ISO 1402 on the three test pieces used for the deformation under proof pressure test, until the hose bursts.

None of the test pieces shall burst at a pressure less than that given in Table 4.

6.1.4 Kink pressure

When tested in accordance with Annex A, the test piece shall neither burst nor show any visible signs of defect before or after pressurizing at 1,2 MPa for 19 mm and 25 mm inside diameter hoses and at 0,7 MPa for 33 mm inside diameter hose.

6.2 Adhesion

When tested in accordance with ISO 8033, the adhesion between all components shall be not less than 1,5 kN/m for type A hoses and 1,0 kN/m for type B hoses. Dependant on the construction of the hose, the test piece in either case shall be decided by the test laboratory in accordance with ISO 8033.

6.3 Accelerated ageing

When tested in accordance with Annex B, the three test pieces subjected to the burst pressure test shall conform to the requirements of 6.1.3. The mean of the burst pressure test results shall not decrease by more than 25 % from the initial mean burst value determined from the results obtained in 6.1.3.

The resultant adhesion of the fourth test piece shall be in accordance with the requirements of 6.2.

NOTE There is no limitation on the increase in the values of these properties.

6.4 Low temperature flexibility

The test shall be carried out in accordance with Clause 4, Method B of ISO 4672:1997, using a mandrel of outside diameter equal to $12 \times$ the inside diameter of the hose. After bending the hose round the mandrel through 180° for (10 ± 2) s at a temperature of $(-20 \pm 2)^\circ\text{C}$, or lower if requested, it shall not show any signs of breaking or cracking and shall meet the proof pressure requirement given in Table 4.

6.5 Hot surface resistance

For all types and classes, when tested in accordance with Annex C at a test temperature of $(200 \pm 2)^\circ\text{C}$, in none of the four tests shall leakage occur less than 60 s after application of the filament rod.

6.6 Ozone resistance

After carrying out an ozone resistance test in accordance with 8.1, Method 1 of ISO 7326:2006 for all inside diameter sizes and types, the hose lining and cover shall not show any signs of cracking. The lining shall be examined by slitting the hose wall.

6.7 Bending and crush resistance

When tested in accordance with Annex D at a temperature of (23 ± 2) °C, the ratio $T:D$ shall not exceed 1,20.

6.8 UV resistance (xenon arc lamp)

NOTE A test for resistance to UV and requirements based on ISO 11758 will be added at the first revision of this part of ISO 4642, when more experience has been acquired.

6.9 Loss in mass on heating

When tested in accordance with 6.2, Method B of ISO 176:2005, the lining and cover materials shall not show a loss in mass greater than 4 %.

7 Frequency of testing

The minimum frequency of testing shall conform to the schedule given in Annex E.

Routine tests are hose tests carried out on every manufactured length of finished hose.

Production tests are those carried out per batch per the schedule in Annex F.

8 Type tests

Type testing is carried out in order to confirm that all the materials, construction and test requirements of this part of ISO 4642 have been met by the method of manufacture and hose design.

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

9 Test report

A test report shall be supplied if requested by the customer.

10 Recommendation for packaging and storage

Details of packaging and storage are given in ISO 8331.

11 Marking

Each length of hose shall be legibly and permanently marked with the following minimum information, at least twice per length, at both ends, for type B hoses and along the whole length at minimum intervals of 2 m for type A hoses:

- a) manufacturer's name or trademark;
- b) number of this part of ISO 4642, i.e., ISO 4642-1;
- c) hose type, class and inside diameter in millimetres;
- d) maximum working pressure in bar;

ISO 4642-1:2009(E)

- e) quarter and year of manufacture;
- f) test temperature if lower than -20 °C (see 6.4);
- g) approval number and certifying body or its reference, where applicable.

EXAMPLE Man – ISO 4642-1-A-2-19-912-2Q/2006.

Annex A (normative)

Kink pressure test

A.1 Principle

This tests the hose for leakage or damage in a kinked test piece held under pressure.

A.2 Test piece

The test piece shall be a 2,0 m length of hose.

A.3 Apparatus

A.3.1 Source of hydrostatic pressure, with water as the test medium, capable of maintaining a pressure of 1,2 MPa for 19 mm inside diameter and 25 mm inside diameter hose and of 0,7 MPa for 33 mm inside diameter hose.

A.4 Procedure

Connect the test piece to the pressure source and fill with water, expelling all air before securely clamping the free end of the hose. Maintain a pressure of 0,07 MPa in the test piece while bending it through 180° at a point approximately midway along its length. Tie the free end of the hose back on itself, as close as possible to the secure end, so as to form a sharp kink, ensuring that the tie does not prevent subsequent expansion of the diameter of the test piece.

Raise the pressure in the test piece to that given in 6.1.4 over a period of 60 s. Maintain the pressure for 1 min. Examine the test piece for any sign of leakage or damage prior to releasing the pressure.

A.5 Test report

The test report shall include the following information:

- a) a full description of the hose tested;
- b) a reference to this part of ISO 4642, i.e., ISO 4642-1:2008;
- c) any evidence of leakage or damage observed;
- d) the date of the test.

Annex B (normative)

Accelerated ageing test

B.1 Test pieces

Four test pieces, each of 1 m length, shall be tested.

NOTE It is preferred that the test pieces be taken from the hose adjacent to the original burst and adhesion test pieces.

B.2 Procedure

Age the test pieces in air for 7 d at a temperature of (70 ± 1) °C in a temperature-controlled oven as specified in ISO 188.

After ageing, subject three of the test pieces to the burst pressure test as given in 6.1.3.

Subject the remaining test piece to the adhesion test as given in 6.2.

Annex C (normative)

Hot surface resistance test

C.1 Test piece

The test piece shall be a sample of hose approximately 0,5 m in length.

Mark the test piece in four places at approximately 90° intervals, circumferentially. In the case of layflat hose, the marked positions shall be such that two of the marks are coincident with the flat edges of the hose.

NOTE This sampling procedure is designed to eliminate eccentric covers.

C.2 Apparatus

C.2.1 Filament rod, consisting of an electrically heated spiral resistance wire with a resistance of approximately 80 Ω wound around a ceramic tube of diameter 21 mm and enclosed in a tube of quartz glass containing a mass fraction of at least 95 % SiO₂ (silicon dioxide) and fitted with a brass sleeve (see Figure C.3)¹⁾. An example of the design is given in Figure C.1.

C.2.2 Temperature controller and recorder, capable of restoring the set temperature within 15 s of commencement of the test and maintaining the set temperature within the specified limits.

C.2.3 Thermocouple, type J or K (i.e. not twisted together), jacketed type, diameter 1,5 mm.

C.2.4 Loading weight, designed to press the filament rod (C.2.1) against the vertically mounted test piece with a force, F , equal to 4 N (see Figure C.2).

C.2.5 Cabinet or small enclosure, to eliminate local air movement in the vicinity of the test piece and filament rod.

1) The filament rod can be obtained from Thermal Quarz-Schmelze GmbH, Postfach 130309, D-65201 Wiesbaden-Schierstein, Germany (immersion heater, article No. 7801). This information is given for the convenience of users of this part of ISO 4642 and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

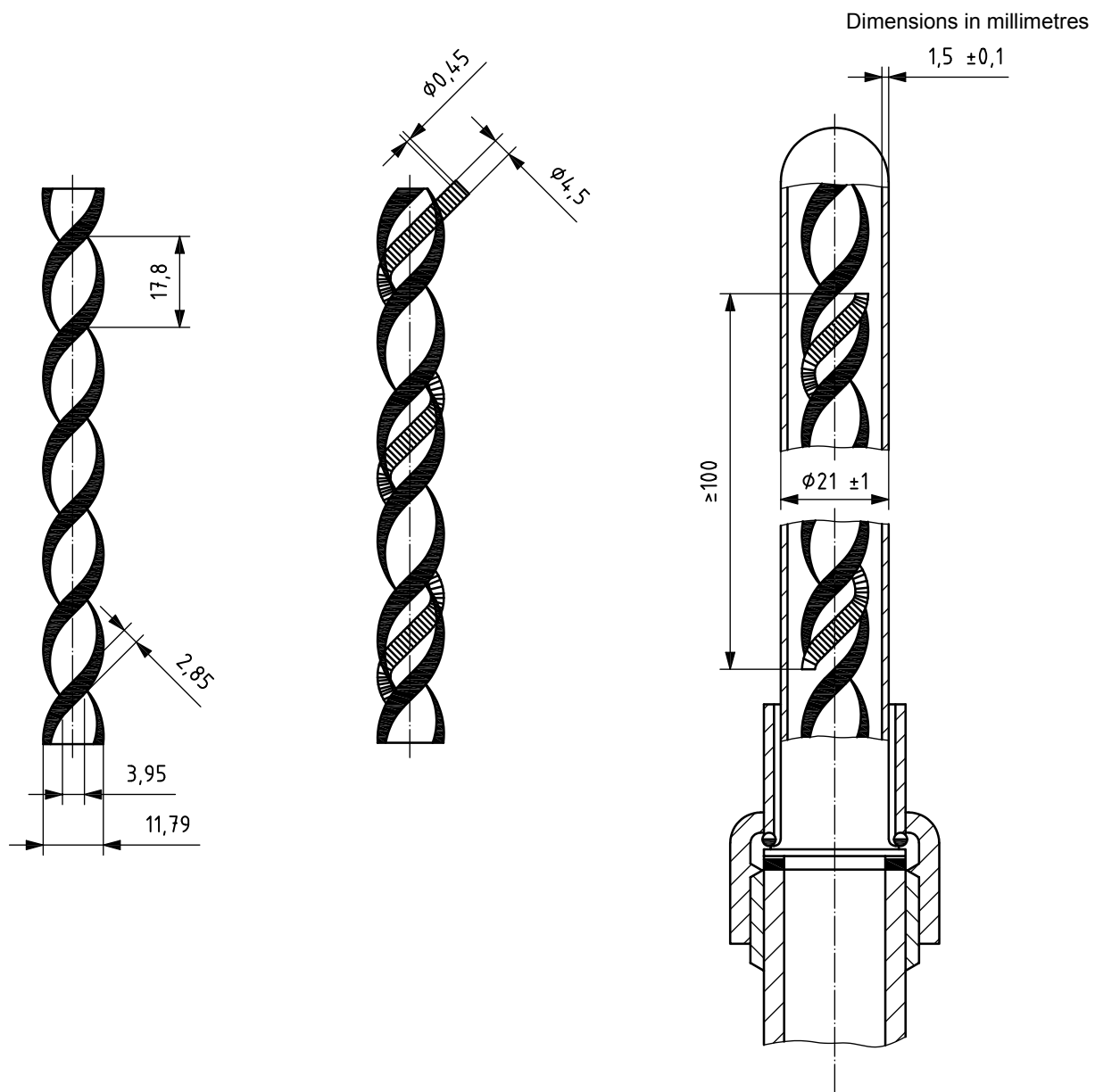
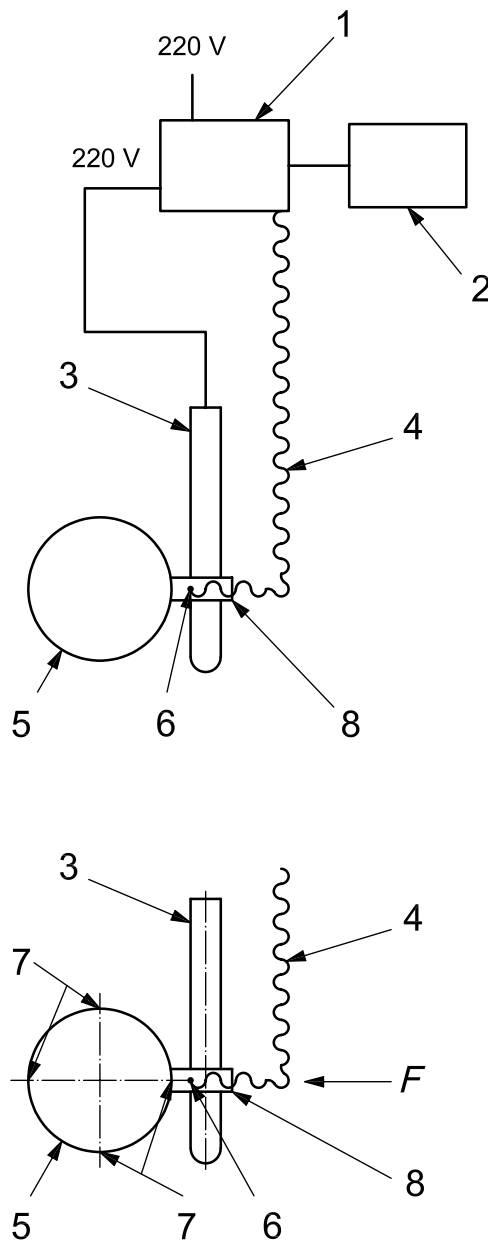


Figure C.1 — Example of suitable filament rod design



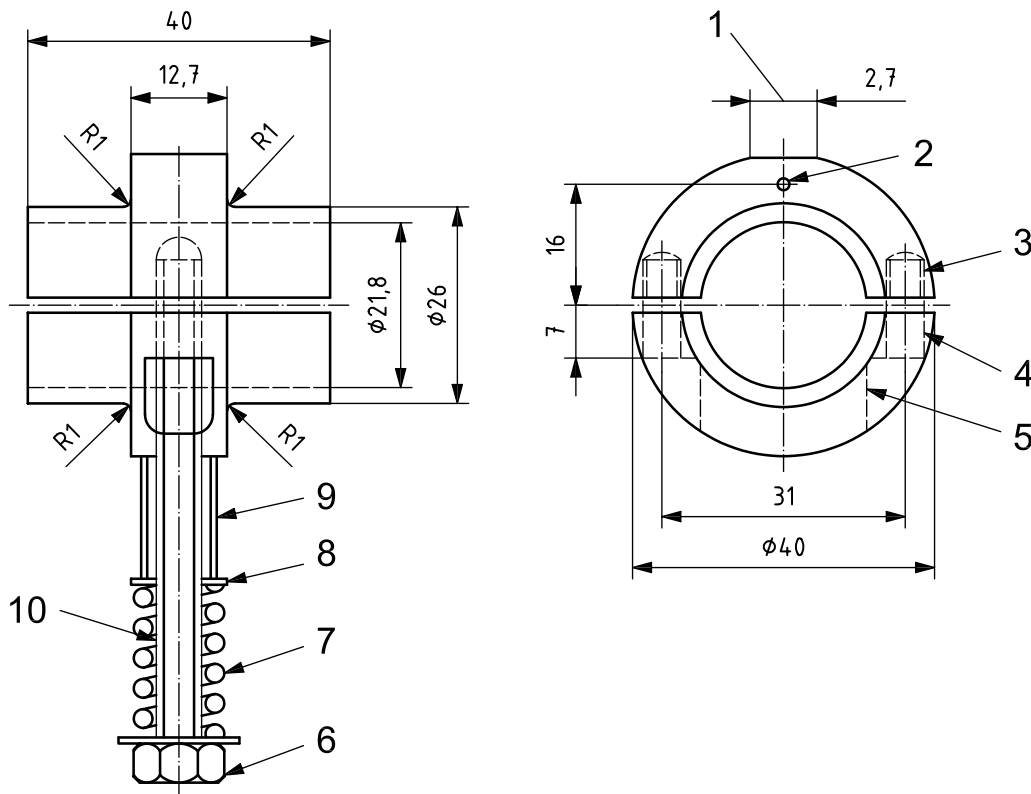
Key

- 1 temperature controller
- 2 recorder or computer
- 3 filament rod
- 4 thermocouple, type J or K
- 5 hose
- 6 point of measuring
- 7 testing areas
- 8 contact point

F = force

Figure C.2 — Point of contact of filament rod with hose (seen from above)

Dimensions in millimetres



Key

- 1 flat
- 2 hole $\varnothing 1,6 \times 10$
- 3 tap M5 $\times 6$
- 4 drill $\varnothing 5,5$
- 5 mill $\varnothing 9$
- 6 M5 nut
- 7 compression spring
- 8 M5 washer
- 9 tube spacer
- 10 threaded bar, 5 mm

Figure C.3 — Detail of brass metal sleeve

C.3 Procedure

Couple the test piece in a vertical position, fill it with water at a test temperature of $(15 \pm 5) ^\circ\text{C}$, expelling all air, and subject it to a pressure of 0,7 MPa.

At ambient temperature, adjust the test piece and the sleeve on the filament rod such that the flat side of the sleeve is in contact with one of the marks on the test piece.

Swing the filament rod away from the test piece, switch on the temperature controller and adjust to the test temperature (see 6.5). Maintain and record the test temperature throughout the tests.

Press the filament rod against the mark on the test piece with a force of 4 N.

For semi-rigid hose, after 60 s remove the rod and examine the test piece for leaks.

If a leak occurs in less than the specified time period, stop the test and record the time to failure.

If no leak occurs, repeat the test at the further three marked test positions after ensuring that the sleeve contact area is clean.

C.4 Test report

The test report shall include the following information:

- a) a full description of the hose tested;
- b) a reference to this part of ISO 4642, i.e., ISO 4642-1:2008;
- c) all test results, whether there were any leaks, failures or exposure of the reinforcement and the burst value in seconds;
- d) the temperature at which the test was carried out;
- e) the date of the test.

Annex D
(normative)

Bending and crush resistance test

D.1 Test piece

The test piece shall be a length of hose not less than 1 m. A minimum of two test pieces shall be tested.

D.2 Procedure

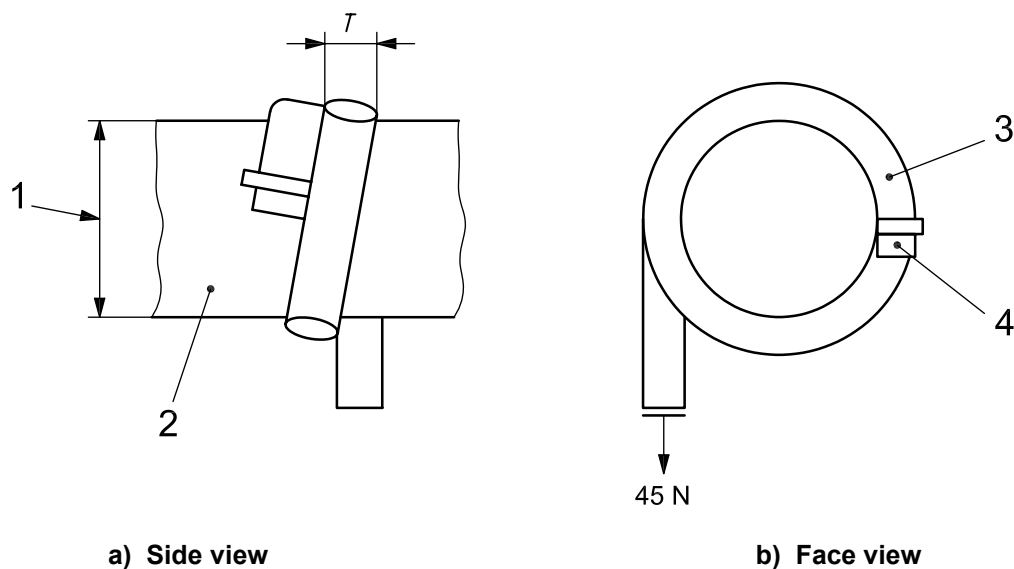
Determine, in accordance with ISO 4671, the average outside diameter of the hose, D , in millimetres, using a suitable measuring instrument.

Clamp one end of the test piece on to a rigid drum of diameter 200 mm for 19 mm inside diameter and 25 mm inside diameter hoses and of diameter 280 mm for 33 mm inside diameter hose and wind 1,5 turns round the drum (see Figure D.1). The hose shall not show any visible signs of kinking.

Load the free end of the test piece with a force of 45 N. After 5 min determine the greatest outer dimension, T , in millimetres, of the part of the test piece which is touching the drum.

Measure the outside diameter of the major axis of the hose while the hose is still wound round the drum.

Calculate the ratio $T:D$.



Key

- 1 diameter of the drum
- 2 drum
- 3 clamp
- 4 test piece

Figure D.1 — Bending and crush resistance test

D.3 Test report

The test report shall include the following information:

- a) a full description of the hose tested;
- b) a reference to this part of ISO 4642, i.e., ISO 4642-1:2008;
- c) the mean value of the test result, ratio $T:D$;
- d) whether kinking is observed;
- e) the date of the test.

Annex E (normative)

Type test and routine test

Table E.1 gives the minimum frequencies for the tests specified in this part of ISO 4642.

Type approval tests are those tests carried out to determine that the hose design and methods of manufacture meet the full requirements of this part of ISO 4642. They should be repeated whenever the hose construction or the materials are modified, or every three years, whichever occurs first.

Routine tests are those tests to be carried out on every manufactured length of hose.

Table E.1 — Recommended minimum frequencies for tests

| Dimension/property under test (with reference to relevant subclause) | Type test | Routine test |
|---|-----------|--------------|
| Inside diameter (5.1) | × | × |
| Tolerance on length (5.2) | × | × |
| Maximum mass (5.1) | × | — |
| Change in length at maximum working pressure (6.1.1) | × | — |
| Change in external diameter at maximum working pressure (6.1.1) | × | — |
| Twist at maximum working pressure (6.1.1) | × | — |
| Proof pressure (6.1.2) | × | × |
| Minimum burst pressure (6.1.3) | × | — |
| Kink pressure (6.1.4) | × | — |
| Adhesion (6.2) | × | × |
| Accelerated ageing (6.3) | × | — |
| Low temperature flexibility (6.4) | × | — |
| Bending and crush resistance (6.7) | × | — |
| Ozone resistance (6.6) | × | — |
| Hot surface resistance (6.5) | × | — |
| Loss in mass on heating (6.9) | × | — |

Annex F (informative)

Production test

Production tests are those tests to be carried out on hose or sample hose from each batch manufactured.

A batch is defined as either maximum 10 000 m of hose or 6 000 m of lining and/or cover plastic compound.

Table F.1 gives the recommended tests for production testing.

Table F.1

| Dimension/property under test (with reference to relevant subclause) | Batch test |
|---|------------|
| Inside diameter (5.1) | × |
| Tolerance on length (5.2) | × |
| Maximum mass (5.1) | × |
| Change in length at maximum working pressure (6.1.1) | × |
| Change in external diameter at maximum working pressure (6.1.1) | × |
| Twist at maximum working pressure (6.1.1) | × |
| Proof pressure (6.1.2) | × |
| Minimum burst pressure (6.1.3) | × |
| Kink pressure (6.1.4) | × |
| Adhesion (6.2) | × |
| Accelerated ageing (6.3) | — |
| Low temperature flexibility (6.4) | — |
| Bending and crush resistance (6.7) | — |
| Ozone resistance (6.6) | — |
| Hot surface resistance (6.5) | — |
| Loss in mass on heating (6.9) | — |

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