BS EN 1947:2014

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Fire-fighting hoses — Semi-rigid delivery hoses and hose assemblies for pumps and vehicles

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National foreword

This British Standard is the UK implementation of EN 1947:2014. It supersedes BS EN 1947:2002 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/17/8, Hydrants, hoses and associated water delivery equipment.

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

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Fire-fighting hoses - Semi-rigid delivery hoses and hose assemblies for pumps and vehicles

Tuyaux de lutte contre l'incendie - Tuyaux de refoulement semi-rigides et flexibles pour pompes et véhicules

Feuerlöschschläuche - Formstabile Druckschläuche und Einbände für Pumpen und Feuerwehrfahrzeuge

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Foreword

This document (EN 1947:2014) has been prepared by Technical Committee CEN/TC 192 “Fire and Rescue Service Equipment”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2015 and conflicting national standards shall be withdrawn at the latest by January 2015.

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

This document supersedes EN 1947:2002+A1:2007.

This revised standard now references EN 15889:2011, *Fire-fighting hoses - Test methods,* which includes the test methods formerly in annexes within EN 1947.

Requirements for semi-rigid hoses for use with fixed systems are given in EN 694; those for non-percolating layflat hoses for fixed systems are given EN 14540.

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Introduction

These semi-rigid delivery hoses are used by the fire service and incorporates those hoses used manually to control and extinguish fires.

The hose requires to be fitted with couplings to form a hose assembly which is fitted onto reels on fire fighting vehicles.

1 Scope

This European Standard specifies the requirements and test methods for semi-rigid hoses for use on fire-fighting vehicles and trailer pumps. The hoses are intended for use at a maximum working pressure of 1,5 MPa for normal pressure hoses (category I) and 4,0 MPa for high pressure hoses (category II). The hoses are further subdivided into types and classes (see Clause 4).

This European Standard applies to hoses for fire-fighting purposes intended for use at ambient conditions within the temperature range −20 °C to +60 °C.

NOTE 1 Hoses for use at ambient temperatures below −20 °C can be supplied if they have been tested at the specified lower temperature in accordance with 6.5 and identified by their marking in Clause 8 h).

Hoses conforming to this standard are intended for use with fire hose couplings conforming to the relevant national standards for couplings.'

Requirements are also given for hose assemblies (see Clause 9) where these are fitted by the hose manufacturer.

NOTE 2 All pressures are expressed in megapascals. 1 MPa = 10 bar.

2 Normative references

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

EN 15889:2011, *Fire-fighting hoses - Test methods*

EN ISO 176:2005, *Plastics - Determination of loss of plasticizers - Activated carbon method (ISO 176:2005)*

EN ISO 1307, *Rubber and plastics hoses - Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses (ISO 1307:2006)*

EN ISO 1402, *Rubber and plastics hoses and hose assemblies - Hydrostatic testing (ISO 1402:2009)*

EN ISO 4671:2007, *Rubber and plastics hoses and hose assemblies - Methods of measurement of the dimensions of hoses and the lengths of hose assemblies (ISO 4671:2007)*

EN ISO 7326:2008, *Rubber and plastics hoses - Assessment of ozone resistance under static conditions (ISO 7326:2006)*

EN ISO 8033, *Rubber and plastics hoses - Determination of adhesion between components (ISO 8033:2006)*

EN ISO 8330, *Rubber and plastics hoses and hose assemblies - Vocabulary (ISO 8330:2007)*

EN ISO 10619-2:2011, *Rubber and plastics hoses and tubing - Measurement of flexibility and stiffness - Part 2: Bending tests at sub-ambient temperatures (ISO 10619-2:2011)*

3 Terms and definitions

For the purposes of this document the following term and definition apply, together with those for working pressure, proof pressure and burst pressure given in EN ISO 8330.

3.1
semi-rigid hose
hose which maintains its round cross-section even when unpressurised

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 12 mm inside diameter, 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 categories distinguished by the maximum working pressure. Each hose shall be further divided into one of three types distinguished by its construction, and then into six classes distinguished by the materials used for lining and cover.

NOTE The hose may be coloured by agreement between the purchaser and the manufacturer.

4.2 Classification by types (hose construction)

Type A hoses shall consist of:

a) a seamless rubber or plastics lining;

b) a textile spiral or braided reinforcement;

c) a rubber or plastics cover.

Type B hoses shall consist of:

d) a seamless rubber or plastics lining;

e) a circular woven textile reinforcement with a rigid spiral helix;

f) an uncovered or rubber or plastics cover.

Type C hoses shall consist of:

g) a seamless rubber or plastics lining;

h) any suitable reinforcement;

i) a rubber or plastics cover.

NOTE Whilst the construction of types A and C hoses may be similar or even identical, the performance requirements differ for the following: burst and proof pressure, adhesion, hot surface resistance, crush resistance.

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 the 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

4.4 Classification by category

All hoses shall be divided into two categories dependent on the maximum working pressure in accordance with Table 2.

Table 2 — Maximum working pressure, proof pressure and minimum burst pressure

Pressure Mpa	Category I Types A and B Classes 1 to 6	Category II Types A and B Classes 1 to 6	 Type C Classes 1 to 6
Maximum working pressure	1,5	4,0	4,0
Proof pressure	3,0	6,0	8,0
Minimum burst pressure	4,5	10,0	12,0

EXAMPLE: A type C hose, constructed using a rubber lining and rubber cover and which has a maximum working pressure of 4,0 MPa, a proof pressure of 8,0 MPa and a minimum burst pressure of 12,0 MPa is classified as II/C/1.

5 Dimensions, tolerances and maximum mass

5.1 Inside diameter and maximum mass

The inside diameter of the hose and tolerances, when measured in accordance with EN ISO 4671 using any suitable method stated in Clause 4 of that standard, shall conform to the requirements given in Table 3. The mass per metre length of the hose shall be in accordance with Table 3.

Table 3 — 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	
	Types A and C	Type B	Types A and C max.	Type B max.
12	0 to + 0,6	—	0,30	—
19	0 to + 0,9	0 to + 1,5	0,75	0,25
25	0 to + 1,2	0 to + 1,5	0,90	0,35
33	0 to + 1,6	0 to + 2,0	1,00	0,50

5.2 Length and tolerances on length

The total length of hose supplied shall be stated in metres. Tolerance on length shall be in accordance with EN ISO 1307.

5.3 Concentricity

When tested in accordance with 8.2, Method 2 of EN ISO 4671:2007, the variation from concentricity measured between inside and outside diameters shall not exceed the following values:

Types A and C 1,5 mm

Type B 0,4 mm

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 EN ISO 1402, shall conform to the requirements given in Table 4. The length of the test piece shall be 1 m.

For category I hoses the initial test pressure shall be 0,07 MPa and the final test pressure shall be 1,5 MPa. For category II hoses the initial test pressure shall be 0,07 MPa and the final test pressure shall be 4,0 MPa.

The twist shall be not greater than 30°/m for types A and C. For type B the twist may be greater than 30°/m but in this case it shall only be in a direction which closes the coupling and shall be stated in the test report.

Table 4 — Change in length and external diameter

	Tolerances for types A, B and C %
Change in length	0 to +7,5
Change in external diameter	0 to +7,5

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 EN ISO 1402. The proof pressure shall be as given in Table 2 and on examination during the test, the test pieces shall not show any evidence of leakage, cracking, abrupt distortion or other signs of failure.

6.1.3 Minimum burst pressure

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

It is not necessary to increase the pressure above the minimum burst value to burst the hose. It is sufficient to increase the pressure to the required minimum burst pressure stated in Table 2 in order to pass this test requirement. This should be stated in the Test Report.

Each of the test pieces shall not burst at a pressure less than that given in Table 2.

6.1.4 Kink pressure

When tested in accordance with EN 15889:2011, Annex C, at a pressure of 1,5 MPa for category I hoses and at 4,0 MPa for category II hoses, the test piece for any sign of leakage or damage prior to releasing the pressure.

6.2 Adhesion

The hose shall be tested in accordance with EN ISO 8033 the adhesion between all components shall be not less than 1,5 kN/m for type A hoses, 1,0 kN/m for type B hoses and 2,0 kN/m for type C.

The test method shall be dependant on the construction of the hose.

6.3 Accelerated ageing

The hose shall be tested in accordance with EN 15889:2011, D.2.

After ageing, subject three test pieces to the burst pressure test as specified in 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.

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

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

6.4 Abrasion resistance

NOTE Abrasion tests are specific to different hose constructions and/or materials. Two procedures with different values are therefore specified here to avoid unfair discrimination. In addition, it is important to note that the requirements, revolutions as given in Table 5 and double strokes as given in Table 6, cannot be correlated.

6.4.1 Abrasion resistance of class 5 and class 6 hoses

When tested in accordance with EN 15889:2011, Annex E, and using the number of revolutions given in Table 5, at least four of the five test pieces shall not burst on being subjected to the maximum working pressure given in Table 2.

Table 5 — Abrasion resistance of uncovered hose (classes 5 and 6)

Inside diameter mm	**Number of revolutions**
12, 19, 25 and 33	300

6.4.2 Abrasion resistance of classes 1, 2, 3 and 4 hoses

When tested in accordance with EN 15889:2011, Annex F, the average number of double strokes completed before burst shall be not less than that given in Table 6.

Table 6 — Abrasion resistance of covered hose (classes 1, 2, 3 and 4)

Inside diameter mm	**Minimum number of double strokes before burst**
12, 19, 25 and 33	120

6.5 Low temperature flexibility

The test shall be carried out in accordance with Clause 5, Method B of EN ISO 10619-2:2011 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 ± 2) °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 2.

6.6 Hot surface resistance

When tested in accordance with EN 15889:2011, Annex H at a test temperature of (300 ± 10) °C for types A and B and of (400 ± 10) °C for type C, in none of the four tests shall the test piece show signs of leakage within 60 s from the application of the filament rod or on removal of this filament rod after the specified period.

6.7 Ozone resistance

For all diameter and types of hoses when tested in accordance with EN ISO 7326:2008, 7.1, method 1, neither the inside or the cover of the hose shall show any signs of visible cracks. The lining shall be examined by slitting the hose wall.

6.8 Bending and crush resistance

When tested in accordance with EN 15889:2011, Annex K, at a temperature of (23 ± 2) °C, the ratio T/D shall not exceed 1,20.

6.9 UV-resistance (xenon arc lamp)

NOTE A test for resistance to UV and requirements based on EN ISO 30013 will be added at the revision of this standard, when more experience has been acquired.

6.10 Loss in mass on heating

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

6.11 Deformation under crushing (type C only)

When tested in accordance with EN 15889:2011, Annex J, the test piece shall allow the free passage of a ball of the diameter specified in Table 7.

Table 7 — Deformation under crushing

Inside diameter mm	Crush dimension, outside diameter mm	Minimum force N	Ball diameter mm
12	6	500	10
19	9,5	500	16
25	12,5	500	21
33	16	500	27

7 Frequency of testing

Type tests and Production tests shall be carried out as detailed in Annex B.

Batch tests as given in Annex C shall be carried to control the quality of the product. They are for guidance only.

8 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 types A and C hoses:

a) the manufacturer's name or trademark;

b) the number and date of this standard;

c) the hose category;

d) type, class;

e) inside diameter in mm;

f) maximum working pressure in MPa (bar);

g) the quarter and year of manufacture;

h) the test temperature if lower than −20 °C (see 6.5);

i) the approval number and certifying body or its reference, where applicable.

EXAMPLE: Man-EN 1947:2014–1-A-2–19–1,5 (15bar) - 2Q/2014

9 Hose assemblies

Where the hose couplings are fitted by the hose manufacturer, they conform to any relevant national standards or legal requirements of the country of use.

The security of the hose assembly shall be tested in accordance with Annex A. There shall be no sign of leakage or movement of the hose from the coupling.

In some circumstances it is not the manufacturer who supplies the hose complete with couplings attached. In this case, the purchaser should be aware that this is outside the scope of this standard, and should ensure by other means that the security of the hose assembly has been tested.

Annex A
(normative)

Test for hose assemblies

A.1 Test piece

The assembled hose, complete with couplings, shall be used as the test piece.

A.2 Procedure

Raise the pressure to proof pressure as given in Table 2 and maintain for 1 min, examining during this time for any coupling movement or leaks.

Release the pressure and allow the assembly to relax for 1 min, then raise the pressure again to proof pressure as given in Table 2, maintain for a further 1 min and examine carefully for coupling movement or leaks.

Release the pressure and re-examine.

A statistically based sampling plan may be used to provide evidence that hoses in a given batch conform to this requirement.

Annex B
(normative)

Frequencies of testing (type test and production test)

Table B.1 gives the frequencies for the tests specified in this standard.

Type tests are those tests carried out to determine that the hose design and methods of manufacture meet the full requirements of the standard. They shall be repeated whenever the hose construction or the materials are modified. Repeat type tests shall be carried out every five years unless it can be confirmed by the manufacturer that no changes have been made during this period.

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

Table B.1 – Frequencies of testing

Dimension/property under test (with reference to relevant clause)	**Type test**	**Production test**
Inside diameter (5.1)	**X**	**X**
Concentricity of hose cover wall (5.3)	**X**	**X**
Maximum mass (5.1)	**X**	-
Change in length at maximum working pressure (6.1.1)	**X**	-
Change in external diameter at maximum working pressure (6.1.1)	**X**	-
Twist at maximum working pressure (6.1.1)	**X**	-
Proof pressure (6.1.2)	**X**	-
Minimum burst pressure (6.1.3)	**X**	**-**
Kink pressure (6.1.4)	**X**	-
Adhesion (6.2)	**X**	**-**
Accelerated ageing (6.3)	**X**	-
Abrasion resistance (6.4)	**X**	-
Low temperature flexibility (6.5)	**X**	**-**
Hot surface resistance (6.6)	**X**	-
Ozone resistance (6.7)	**X**	-
Bending and crush resistance (6.8)	**X**	-
Loss in mass on heating (6.10)	**X**	-
Deformation under crushing (6.11)	**X**	-
Hose assembly (where applicable) (Clause 9)	**X**	**X**[a]
[a] See last paragraph of A.2.		
NOTE X to be tested.		

Annex C
(informative)

Frequencies of testing (batch test)

Batch tests are those tests to be carried out on a hose or sample of hose from every batch manufactured.

Table C.1 - Frequencies of testing

Dimension/property under test (with reference to relevant clause)	**Batch test**
Inside diameter (5.1)	**X**
Concentricity of hose cover wall (5.3)	**X**
Maximum mass (5.1)	**X**
Change in length at maximum working pressure (6.1.1)	**X**
Change in external diameter at maximum working pressure (6.1.1)	**X**
Twist at maximum working pressure (6.1.1)	**X**
Proof pressure (6.1.2)	**X**
Minimum burst pressure (6.1.3)	**X**
Kink pressure (6.1.4)	**X**
Adhesion (6.2)	**X**
Accelerated ageing (6.3)	-
Abrasion resistance (6.4)	-
Low temperature flexibility (6.5)	-
Hot surface resistance (6.6)	-
Ozone resistance (6.7)	-
Bending and crush resistance (6.8)	**-**
Loss in mass on heating (6.10)	**-**
Deformation under crushing (6.11)	-
Hose assembly (where applicable) (Clause 9)	**X**
NOTE X to be tested.	

Bibliography

EN 694, *Fire-fighting hoses — Semi-rigid hoses for fixed systems*

EN 14540, *Fire-fighting hoses — Non-percolating layflat hoses for fixed systems*

EN ISO 9001, *Quality management systems - Requirements (ISO 9001:2008)*

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

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