
Gumene in polimerne cevi ter cevni priključki - Nevezane s fluoroplastiko (npr. PTFE) obložene cevi in cevni priključki za tekoče in plinaste kemikalije - Specifikacija

Rubber and plastics hoses and hose assemblies - Non-bonded fluoroplastic lined (e.g. PTFE) hoses and hose assemblies for liquid and gaseous chemicals - Specification

Gummi- und Kunststoffschläuche und -schlauchleitungen - Fluorkunststoffbeschichtete (z. B. PTFE) Nicht-Verbundschläuche und -schlauchleitungen für flüssige und gasförmige Chemikalien - Anforderungen

Tuyaux et assemblages flexibles en caoutchouc et en matières plastiques - Tuyaux non-liés revêtus de fluoroplastique (par exemple PTFE) pour substances chimiques liquides ou gazeuses - Spécifications

Ta slovenski standard je istoveten z: EN 16643:2016

ICS:

23.040.70 Gumene cevi in armature Hoses and hose assemblies

SIST EN 16643:2016**en,fr,de**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 16643:2016

<https://standards.iteh.ai/catalog/standards/sist/e472bb3a-d090-41b7-bab7-253b7a60c49c/sist-en-16643-2016>

EUROPEAN STANDARD

EN 16643

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2016

ICS 23.040.70

English Version

Rubber and plastics hoses and hose assemblies - Non-bonded fluoroplastic lined (e.g. PTFE) hoses and hose assemblies for liquid and gaseous chemicals - Specification

Tuyaux et flexibles en caoutchouc et en matières plastiques - Tuyaux non-liés revêtus de fluoroplastique (par exemple PTFE) pour substances chimiques liquides ou gazeuses - Spécifications

Gummi- und Kunststoffschläuche und -schlauchleitungen - Fluorkunststoffbeschichtete (z. B. PTFE) Nicht-Verbundschläuche und -schlauchleitungen für flüssige und gasförmige Chemikalien - Anforderungen

This European Standard was approved by CEN on 15 June 2016.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

(standards.iteh.ai)

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

<https://standards.iteh.ai/catalog/standards/sist/e472bb3a-d090-41b7-bab7->

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
European foreword.....	5
Introduction	6
1 Scope.....	7
2 Normative References	7
3 Terms and definitions	8
4 Classification.....	8
5 Hose assembly designs.....	9
6 Materials and construction.....	9
6.1 General.....	9
6.2 Lining.....	9
6.3 Helix wire (optional).....	9
6.4 Electrical bonding wires (optional).....	9
6.5 Braid reinforcement	9
6.6 Cover (optional).....	9
7 Dimensions and tolerances	10
7.1 Diameters, thickness, bend radii, resistance to vacuum and lowest permitted maximum working pressure requirements.....	10
7.2 Concentricity.....	18
7.3 Length of hose assemblies	18
7.3.1 General.....	18
7.3.2 Type SE and Type SC hose assemblies	18
7.3.3 Type C hose assemblies.....	18
8 Physical properties of materials used for hoses and hose assemblies.....	18
8.1 General.....	18
8.2 Materials used for the lining.....	19
8.3 Materials used for the helix wire.....	19
8.4 Materials used for the electrical bonding wires	19
8.5 Materials used for the over-braid reinforcement	19
8.6 Materials used for the cover.....	20
8.7 Materials used for end fittings and couplings.....	20
9 Performance requirements of hoses and hose assemblies.....	20
10 Electrical properties	22
10.1 General.....	22
10.2 Electrical bonding.....	22
10.3 Static-dissipative lining and/or static-dissipative cover.....	22
11 Frequency of testing.....	22
12 Type tests	23
13 Test report.....	23
14 Marking.....	23
14.1 Hoses.....	23
14.2 Hose assemblies.....	23

15	Storage and admissible storage time	24
Annex A (normative)	Test frequency for type tests and routine tests	25
Annex B (informative)	Production acceptance tests.....	27
Annex C (normative)	Proof pressure test for fluoroplastic lining	28
Annex D (informative)	Couplings and fittings.....	29
D.1	General	29
D.2	Fluoroplastic lined end fittings	29
Annex E (normative)	Yield orientation index	30
Annex F (normative)	Weep test.....	31
F.1	General	31
F.2	Test pieces.....	31
F.3	Apparatus.....	31
F.4	Test method.....	31
Annex G (informative)	Resistance to chemicals conveyed	32
Annex H (informative)	Permeability to gas.....	33
H.1	General	33
H.2	Test pieces.....	33
H.3	Apparatus	33
H.4	Test method.....	33
Annex I (normative)	Flame resistance test	36
I.1	Test pieces.....	36
I.2	Apparatus	36
I.3	Test method.....	36
Annex J (normative)	Hose flexibility – Rolling U test	38
J.1	General	38
J.2	Test pieces.....	38
J.3	Apparatus	38
J.4	Test method.....	38
Annex K (informative)	Environmental checklist.....	41
Bibliography	43
Tables		
Table 1	— Dimension requirements, Type SE lining hoses without and with cover.....	11
Table 2	— Maximum working pressure requirements, Type SE lining hoses without and with cover for two typical braid reinforcements	12
Table 3	— Dimension requirements, Type SC lining hoses without and with cover	13
Table 4	— Maximum working pressure requirements, Type SC lining hoses without and with cover for three typical braid reinforcements.....	14
Table 5	— Dimension requirements for manufacturing method 1, Type C lining hoses without and with cover.....	15
Table 6	— Dimension requirements for manufacturing method 2, Type C lining hoses without and with cover.....	16

EN 16643:2016 (E)

Table 7 — Maximum working pressure requirements, Type C lining hoses without and with cover for three typical braid reinforcements	17
Table 8 — Physical properties of fluoroplastic lining.....	19
Table 9 — Performance requirements of hoses and hose assemblies.....	21
Table A.1 — Test frequency for type tests and routine tests.....	25
Table B.1 — Production acceptance tests.....	27
Table H.1 — Helium test pressures and average helium permeation rates for Type SC hose linings.....	34
Table J.1 — Rolling U test movement.....	38
Table K.1 — Environmental checklist.....	42

Figures

Figure H.1 — Arrangement for helium permeation test.....	35
Figure I.1 — Arrangement for flammability test.....	37
Figure J.1 — Rolling U test piece	39
Figure J.2 — Typical arrangement of Rolling U test equipment.....	40

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 16643:2016

<https://standards.iteh.ai/catalog/standards/sist/e472bb3a-d090-41b7-bab7-253b7a60c49c/sist-en-16643-2016>

European foreword

This document (EN 16643:2016) has been prepared by Technical Committee CEN/TC 218 "Rubber and plastics hoses and hose assemblies", 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 February 2017, and conflicting national standards shall be withdrawn at the latest by February 2017.

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

Annexes A, C, E, F, I and J are normative. Annexes B, D, G, H and K are informative.

WARNING - Persons using this European Standard should be familiar with normal laboratory practice. This 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.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

[SIST EN 16643:2016](https://standards.iteh.ai/catalog/standards/sist/e472bb3a-d090-41b7-bab7-253b7a60c49c/sist-en-16643-2016)

<https://standards.iteh.ai/catalog/standards/sist/e472bb3a-d090-41b7-bab7-253b7a60c49c/sist-en-16643-2016>

EN 16643:2016 (E)**Introduction**

This document has been prepared to provide minimum acceptable requirements for the satisfactory performance of non-bonded flexible fluoroplastic lined hoses and hose assemblies with various types of reinforcement, for each chemical substance conveyed.

**iTeh STANDARD PREVIEW
(standards.iteh.ai)**

SIST EN 16643:2016

<https://standards.iteh.ai/catalog/standards/sist/e472bb3a-d090-41b7-bab7-253b7a60c49c/sist-en-16643-2016>

1 Scope

This European Standard specifies requirements for three types of non-bonded fluoroplastic lined hoses and hose assemblies with convoluted or smooth linings designed to convey liquid or gaseous chemical substances, hereinafter termed the “chemicals conveyed”. These hoses and hose assemblies can be used for pharmaceutical, biotechnology and industrial applications as detailed in Clause 5.

The hose assemblies are intended for use with chemicals conveyed in the temperature range of -70°C to $+260^{\circ}\text{C}$ and for a working pressure up to 205 bar¹⁾.

NOTE 1 This standard sets out requirements for these hoses and hose assemblies to ensure that users are not exposed to danger from fire or explosion and that the environment is protected against contamination or damage.

NOTE 2 Other working pressures than those given above can be agreed with the manufacturer provided the physical properties of the hose assembly materials conform to Clause 8, the hose and hose assembly performance requirements conform to Clause 9 and the hose assembly electrical properties conform to Clause 10.

NOTE 3 Other diameters than those given in this standard can be agreed with the manufacturer provided the physical properties of the hose assembly materials conform to Clause 8, the hose and hose assembly performance requirements conform to Clause 9 and the hose assembly electrical properties conform to Clause 10.

NOTE 4 This standard also provides guidance on the storage of hose assemblies (Clause 15).

NOTE 5 The attention of users is drawn to Annex G concerning the working temperature range which can be affected by the chemical(s) to be conveyed in the hoses and hose assemblies.

NOTE 6 The attention of users is drawn to Annex G concerning the selection of materials for lining, helix wire (if applicable), electrical bonding wire (if applicable), braid reinforcement and cover (if applicable) related to the chemical(s) to be conveyed by the hoses and hose assemblies.

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

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

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

EN ISO 7233, *Rubber and plastics hoses and hose assemblies — Determination of resistance to vacuum (ISO 7233)*

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

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

1) 1 bar = 0,1 MPa.

EN 16643:2016 (E)

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

EN ISO 12086-2, *Plastics — Fluoropolymer dispersions and moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties (ISO 12086-2)*

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

3 Terms and definitions

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

NOTE In this document the word “fitting” has been used; this is, in some cases, interchangeable with the word “coupling”.

3.1 non-bonded

hose construction where different layers in the hose wall (e.g. lining, braid reinforcement and cover) are not chemically bonded together

3.2 Grade I

hose assembly constructed so that it is electrically insulating e.g. $>10^8 \Omega$ per assembly between end fittings, AND $>10^8 \Omega$ between lining and end fittings AND $>10^8 \Omega$ between cover and end fittings

4 Classification

Hoses and hose assemblies for this application shall be divided into three types according to how the hose fluoroplastic lining is constructed/formed:

- Type SE smoothbore (externally smooth): the hose lining is internally and externally smooth (parallel) in this document referred to as Smoothbore (externally smooth).
- Type SC smoothbore (externally convoluted): the hose lining is internally smooth and externally convoluted in this document referred to as Smoothbore (externally convoluted).
- Type C convoluted or corrugated: hose lining is internally and externally convoluted with the convolution running helically to the lining axis.

Hoses and hose assemblies for this application shall be divided into eight grades:

- Grade I: electrically insulated (no electrical bonding AND no static-dissipative layers),
- Grade M: electrically bonded without static-dissipative lining or cover,
- Grade Ω -L: static-dissipative lining without electrical bonding,
- Grade Ω -C: static-dissipative cover without electrical bonding,
- Grade Ω -CL: static-dissipative cover and lining without electrical bonding,
- Grade M/ Ω -L: electrically bonded and static-dissipative lining,
- Grade M/ Ω -C: electrically bonded and static-dissipative cover,

- Grade M/ Ω -CL: electrically bonded and static-dissipative cover and lining.

5 Hose assembly designs

Hose assemblies are designed as follows:

- design A Conformity to the demands of pharmaceutical and biotechnological industry of all hose assembly components,
- design B Conformity to the demands of pharmaceutical and biotechnological industry of all parts of the hose assembly in contact with the product,
- design C for industrial purposes only.

6 Materials and construction

6.1 General

All types of hoses covered by this standard shall consist of a fluoroplastic (e.g. PTFE) lining with an over-braided reinforcement. Optionally a helix wire may be incorporated between the lining and braid reinforcement if the lining construction permits e.g. linings with external convolutions. Where electrical bonding is required between metallic end fittings in conjunction with no helix wire and plastic braid reinforcement, separate electrical bonding wires may be used situated between the lining and braid reinforcement. Optionally a cover or some other type of outer layer may be added to protect the over-braided reinforcement.

6.2 Lining

The lining shall be uniform in quality and form and shall be free from porosity, holes, foreign inclusions and other defects which would impair the expected use.

In circumstances where a hose lining can become electro-statically charged, a static-dissipative lining shall be used.

6.3 Helix wire (optional)

Any helix wire (if applicable) shall be wrapped around the outside of the fluoroplastic lining to prevent contact with the medium conveyed within the hose.

6.4 Electrical bonding wires (optional)

Any electrical bonding wires (if applicable) shall be wrapped around the outside of the fluoroplastic lining to prevent contact with the medium conveyed within the hose. See 10.2 b.

6.5 Braid reinforcement

The reinforcement shall consist of an over-braid of suitable metallic or non-metallic materials. Multiple layers of reinforcement may be used including combinations of separate metallic and non-metallic layers.

NOTE In low pressure applications Tube Only (TO) assemblies could be used. Consult assembly manufacturer for details.

6.6 Cover (optional)

The cover (if applicable) can be a solid flexible outer layer (pricked or non-pricked) or spirally wrapped wire or spirally wrapped plastic strip and shall be designed to withstand mechanical damage. For

EN 16643:2016 (E)

resistance to environmental effects due to weather and short-term external chemical exposure a solid flexible outer cover should be used.

In circumstances where a hose cover can become electro-statically charged, a static-dissipative cover shall be used.

7 Dimensions and tolerances**7.1 Diameters, thickness, bend radii, resistance to vacuum and lowest permitted maximum working pressure requirements**

The inside and minimum outside diameters of hoses, minimum thickness of lining, minimum thickness of cover (where applicable), minimum bend radius and resistance to vacuum (capability to withstand an internal vacuum without damage as specified in Table 9) shall conform to the values given in Table 1, Table 3, Table 5 or Table 6 (depending on lining type). Minimum bend radius shall be equal to or less than the values given in Table 1, Table 3, Table 5 or Table 6 (depending on lining type). Maximum working pressures (MWP's) shall be equal to or greater than the values given in Table 2, Table 4 or Table 7 (depending on lining type).

Type C hoses may exhibit differences in flow rate and flexibility for a given nominal bore size and these differences are primarily influenced by inside diameter and shape of the convolutions. To provide scope for manufacturers to tailor flexibility and flow rates for a given nominal bore size Tables for two forms of Type C hose are provided in Tables 5 and 6, which are referred to as manufacturing methods 1 and 2 respectively. These manufacturing methods could be proprietary and therefore are not described or specified within this standard. To obtain specific flow rate and flexibility data the hose manufacturer should be consulted.

(standards.iteh.ai)

SIST EN 16643:2016

<https://standards.iteh.ai/catalog/standards/sist/e472bb3a-d090-41b7-bab7-253b7a60c49c/sist-en-16643-2016>

Table 1 — Dimension requirements, Type SE lining hoses without and with cover

Nominal bore	Inside diameter mm	Tolerance mm	Outer Layer	Minimum thickness mm		Outside ^a diameter mm min.	Bend radius mm min.	Resistance ^b to vacuum bar
				lining	cover			
3,2	3,1	±0,1	Braid	0,6	-	5,3	40	-0,9
			Cover		0,4	6,1		
5	4,7	±0,2	Braid	0,6	-	7	60	
			Cover		0,4	7,8		
6,3	6,3	±0,4	Braid	0,6	-	8,4	80	
			Cover		0,5	9,4		
8	8	±0,6	Braid	0,6	-	10	100	
			Cover		0,5	11		
10	10	±0,9	Braid	0,6	-	11,7	130	
			Cover		0,6	12,9		
13	13	±1,1	Braid	0,7	-	14,8	170	
			Cover		0,6	16		
16	16	±1,1	Braid	0,7	-	18	200	
			Cover		0,8	19,6		
19	19	±1,2	Braid	0,7	-	21,1	230	
			Cover		0,8	22,7		
25	25	±1,2	Braid	0,9	-	27,6	320	
			Cover		0,8	29,2		

^a Minimum outside diameter assumes one layer of stainless steel braid reinforcement and minimum lining thickness shown, with and without cover. For other braid reinforcement materials and/or multiple braid reinforcement layers and/or thicker lining consult hose manufacturer for outside diameter and tolerances.

^b Ability to withstand the internal vacuum specified and shall conform to the requirements specified in Table 9. For resistance to vacuum at higher temperatures consult hose manufacturer.