

# SLOVENSKI STANDARD

## SIST EN 4708-102:2018

01-december-2018

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**Aeronavtika - Toplotno skrčljiva cev za utrjevanje, izolacijo in identifikacijo - 102.  
del: Zelo fleksibilen polimer - Delovna temperatura med  $-75\text{ °C}$  in  $150\text{ °C}$  -  
Standard za proizvod**

Aerospace series - Sleeving, heat-shrinkable, for binding, insulation and identification -  
Part 102: Very flexible polymer - Operating temperature -  $75\text{ °C}$  to  $150\text{ °C}$  - Product  
standard

Luft- und Raumfahrt - Wärmeschrumpfender Schlauch zur Befestigung, Isolierung und  
Identifizierung - Teil 102: Hochflexibles Polymer - Temperaturbereich -  $75\text{ °C}$  und  $150\text{ °C}$   
- Produktnorm

Série aérospatiale - Manchons thermorétractables, de jonction, isolement et identification  
- Partie 102 : Polymère très flexible - Températures d'utilisation -  $75\text{ °C}$  à  $150\text{ °C}$  - Norme  
de produit

**Ta slovenski standard je istoveten z: EN 4708-102:2018**

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**ICS:**

49.060	Letalska in vesoljska električna oprema in sistemi	Aerospace electric equipment and systems
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**SIST EN 4708-102:2018**

**en,fr,de**

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EUROPEAN STANDARD

EN 4708-102

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2018

ICS 49.060

English Version

**Aerospace series - Sleeving, heat-shrinkable, for binding,  
insulation and identification - Part 102: Very flexible  
polymer - Operating temperature - 75 °C to 150 °C -  
Product standard**

Série aérospatiale - Manchons thermorétractables, de  
jonction, isolement et identification - Partie 102 :  
Polymère très flexible - Températures d'utilisation - 75  
°C à 150 °C - Norme de produit

Luft- und Raumfahrt - Wärmeschrumpfender Schlauch  
zur Befestigung, Isolierung und Identifizierung - Teil  
102: Hochflexibles Polymer - Temperaturbereich - 75  
°C und 150 °C - Produktnorm

This European Standard was approved by CEN on 8 July 2018.

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.

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.

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, Serbia, 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: Rue de la Science 23, B-1040 Brussels**

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## European foreword

This document (EN 4708-102:2018) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

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 April 2019, and conflicting national standards shall be withdrawn at the latest by April 2019.

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.

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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**EN 4708-102:2018 (E)****1 Scope**

This European Standard specifies the required characteristics for a heat-shrinkable, very flexible polymer sleeving for use in aircraft electrical systems at operating temperatures between  $-75\text{ °C}$  to  $150\text{ °C}$ . This sleeving has very good flexibility, is flame retarded and has a thick wall for mechanical protection. It is suitable for use as cable protection in areas where wiring is subject to contamination by aircraft fuels and hydraulic fluids.

These sleeveings are normally supplied with internal diameters up to 102 mm for shrink ratios of 2:1. They are available in black only.

Sizes other than those specifically listed in this standard may be available. These items shall be considered to comply with this standard if they comply with the property requirements listed in Tables 2, 3 and 4 except for dimensions and mass.

**2 Normative references**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 3909, *Aerospace series — Test fluids and test methods for electrical and optical components and sub-assemblies*

EN 4708-001, *Aerospace series — Sleeving, heat-shrinkable, for binding, insulation and identification — Part 001: Technical specification*

EN ISO 846, *Plastics — Evaluation of the action of microorganisms (ISO 846)*

IEC 60684-1, *Flexible insulating sleeving — Part 1: Definitions and general requirements* <sup>1)</sup>

IEC 60684-2, *Flexible insulating sleeving — Part 2: Methods of test* <sup>1)</sup>

IEC 60757, *Code for designation of colours* <sup>1)</sup>

**3 Terms and definitions**

For the purposes of this document, the terms and definitions given in IEC 60684-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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1) Published by: IEC International Electrotechnical Commission. <http://www.iec.ch/>.

## 4 Required characteristics

### 4.1 Dimensions and mass

See Table 1.

**Table 1 — Dimensional and mass requirements**

Size code	Internal diameter mm		Recovered wall thickness mm	Mass per unit length max. g/m
	Expanded min.	Recovered max.		
3,2/1,6	3,2	1,6	0,75 ± 0,20	10,3
4,8/2,4	4,8	2,4	0,85 ± 0,20	16,5
6,4/3,2	6,4	3,2	0,90 ± 0,20	21,6
9,5/4,8	9,5	4,8	1,00 ± 0,25	32,8
12,7/6,4	12,7	6,4	1,20 ± 0,30	54,0
19,0/9,5	19,0	9,5	1,45 ± 0,35	92,8
25,4/12,7	25,4	12,7	1,80 ± 0,45	154
38,0/19,0	38,0	19,0	2,40 ± 0,50	290
51,0/25,4	51,0	25,4	2,80 ± 0,50	432
76,0/38,0	76,0	38,0	3,20 ± 0,60	724
102,0/51,0	102,0	51,0	3,60 ± 0,70	1 083

### 4.2 Conditions of test

Unless otherwise specified, the sleeving shall be shrunk in a forced air circulation oven for (5 ± 1) min at 200 °C ± 5 °C prior to testing.

### 4.3 Tests

See Table 2.

Table 2 — Tests (1 of 3)

Designation of the test	IEC 60684-2 Clause or Subclause	Requirements	Remarks
Dimensions	3		See Clause 33.
– internal diameter	3.1.2	Table 1	
– wall thickness	3.3.2	Table 1	
– concentricity	3.3.3		
• expanded		65 % min.	
• recovered		85 % min.	
Density	4	Not applicable	See Clause 38.
Heat shock	6		Heat at 215 °C ± 5 °C
Tensile strength	19.1 and 19.2	8 MPa min.	
Elongation at break	19.1 and 19.2	200 % min.	
Longitudinal change	9	0 % to – 10 % max.	Heat the expanded sleeving at 200 °C ± 5 °C for (5 ± 1) min.
Bending after heating	13	Not applicable	See Clauses 6, 39 and 50.
Bending at low temperature	14	No cracks shall be visible	Condition at – 75 °C ± 3 °C. For strips, the mandrel shall be no more than 10 times the wall thickness. Full section sleeving is tested unfilled and the mandrel shall be no more than 10 times the outer diameter.
Dimensional stability during storage	16	The dimensions shall be as specified in Table 1.	—
Tensile strength	19.1 and 19.2	12 MPa min.	Use a jaw separation rate of 100 mm/min. Below 6,5 mm diameter test as sleeving, at 6,5 mm diameter and above test as dumb-bells.
Elongation at break	19.1 and 19.2	350 % min.	
Secant modulus at 2 % elongation	19.5	Between 10 MPa and 35 MPa	
Breakdown voltage	21	Table 3	—
Volume resistivity	23		—
– at ambient temperature	23.5.2	10 <sup>8</sup> Ω·m min.	
– after damp heat	23.5.4	10 <sup>7</sup> Ω·m min.	



Table 2 — Tests (2 of 3)

Designation of the test	IEC 60684-2 Clause or Subclause	Requirements	Remarks
Flame propagation Time of burning Length burned	26 Method C	30 s max. 75 mm max.	—
Oxygen Index	27	Not applicable	—
Transparency	28	Not applicable	—
Corrosion resistance (Tensile strength and Elongation)	32	Not applicable	See Clause 33.
Copper corrosion	33	None above the allowable 8 % max.	Heat for (16 ± 0,5) h at 150 °C ± 3 °C
Colour fastness to light	34	The colour contrast between the exposed and unexposed parts of the specimens shall be equal to or less than that of the fastness standard.	Fastness standard No. 5
Resistance to selected fluids	36		Use the fluids and test temperatures specified in Table 4.
Tensile strength Elongation at break	19.1 and 19.2 19.1 and 19.2	8 MPa min. 200 % min.	Immersion time (24 ± 1) h
Thermal endurance	37	Not applicable	See Clause 50.
Mass per unit length	38	Table 1	—
Heat ageing Tensile strength Elongation at break	39 19.1 and 19.2 19.1 and 19.2	10 MPa min. 200 % min.	Heat at 160 °C ± 3 °C
Water absorption	40	1,5 % max.	—
Restricted shrinkage Visual	41	No cracking or splitting	Heat at 150 °C ± 3 °C Perform the visual determination only
Colour stability to heat	42	Not applicable	See Clause 34.
Smoke Index	43	Not applicable	—
Toxicity	44	Not applicable	—
Halogen content	45	Not applicable	—
Acid gas generation	46	Not applicable	—