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# Aerospace electrical requirements — Sleeves and moulded shapes — Specifications for aircraft use

*Exigences électriques pour équipements aérospatiaux — Gaines et pièces moulées d'isolation — Spécification pour utilisation sur aeronef*



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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

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This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 1, *Aerospace electrical requirements*.



 

# Introduction

This document has been drawn up by ISO/TC 20/SC 1 and IEC/SC 15C in order to create a list of IEC and other standards for insulation and/or mechanical/environmental protection sleeves and heat shrink moulded shapes suitable for use on aircraft. The range of sleeves includes heat shrink, extruded (non-heat shrink) and textile. The list draws primarily upon IEC 60684 series for flexible insulating sleeving. IEC 60684 series is an ongoing programme and new standards are being added periodically.

# Aerospace electrical requirements — Sleeves and moulded shapes — Specifications for aircraft use

## 1 Scope

This document brings together, in a single list, those standards for insulation and/or mechanical/environmental protection sleeves and heat shrink moulded shapes that have been determined as being suitable for use on aircraft. The range of sleeves includes heat shrink, extruded (non-heat shrink) and textile.

## 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.

IEC 60684-1, *Flexible insulating sleeving — Part 1: Definitions and general requirements*

## 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

## 4 List of standards

Table 1 gives the list of standards together with information on usage or any limitations for aircraft applications.

**Table 1 — List of applicable standards**

| Standard | Description | Usage, notes and related national specifications (informative) |
|---|---|---|
| IEC 60684–1 | Flexible insulating sleeving — Definitions and general requirements | Top level technical specification |
| IEC 60684–2 | Flexible insulating sleeving — Methods of test | Test methods |
| IEC 60684–3-116/118 | Flexible insulating sleeving — Extruded polychloroprene | Used for areas of occasional contamination by mineral oils, petroleum fuels, and mineral or castor oil based hydraulic fluids.<br>See also BS 4G 198-1 Type 1 |
| IEC 60684–3-121/124 | Flexible insulating sleeving — Extruded silicone | Oil and hydraulic fluid resistant. Not for contact with fuels.<br>See also BS 4G 198-1 Type 4 |
| IEC 60684–3-136 | Flexible insulating sleeving — Extruded fluorosilicone | Oil, hydraulic fluid and fuel resistant.<br>See also BS 4G 198-1 Type 3 |

**Table 1** *(continued)*

| Standard | Description | Usage, notes and related national specifications (informative) |
|---|---|---|
| IEC 60684–3-145/147 | Flexible insulating sleeving — Extruded PTFE | Slip-on sleeves suitable for identification of electric cables and insulated equipment wires. Resistant to fuels, lubricants and hydraulic fluids, including ester-based lubricants and ester-based hydraulic fluids.<br>See also BS 3G 198-2 Type 7 |
| IEC 60684–3-165 | Flexible insulating sleeving — Extruded polyolefin, flame retarded, limited fire hazard | This sleeving is flexible, flame retarded and suitable for use in areas where smoke, gases or corrosive by-products would constitute a particular hazard. |
| IEC 60684–3-211 | Flexible insulating sleeving — Heat shrink, ratio 2:1, semi-rigid, polyolefin | This sleeving is semi-rigid and flame retarded. It is suitable where strain relief and mechanical support are required. It is available in colours and transparent. The transparent sleeving is not flame retarded.<br>See also:<br>BS 4G 198-3 Type 11C<br>AMS DTL 23053/6 |
| IEC 60684–3-212 | Flexible insulating sleeving — Heat shrink polyolefin sleevings | Type A and C sleevings are flexible and flame retarded. They are suitable for general purposes. It is available in colours and transparent. The transparent sleevings, type B and D are not flame retarded. All four types are available in 2:1 and 3:1 shrink ratios.<br>See also:<br>BS 4G 198-3 Type 11B<br>AMS DTL 23053/5<br>VG 95343-5 Type A and B |
| IEC 60684–3-216 | Flexible insulating sleeving — Heat shrink, ratio 2:1/3:1, limited fire hazard | This sleeving is flexible, flame retarded and emits minimum smoke, gases and corrosive by-products when exposed to fire. It is available with various wall thicknesses and also in a higher shrink ratio according to the application and degree of mechanical protection required. It is suitable for use (e.g. as cable protection) in areas where smoke, gases or corrosive by-products would constitute a particular hazard.<br>See also:<br>BS 4G 198-3 Type 15<br>VG 95343-5 Type L |

**Table 1** *(continued)*

| Standard | Description | Usage, notes and related national specifications (informative) |
|---|---|---|
| IEC 60684–3-240/243 | Flexible insulating sleeving — Heat shrink PTFE | This sleeving is milk-white translucent. It is suitable for use where resistance to chemicals and high temperature performance are required. It is flame resistant and has a low or high shrink ratio depending on type.<br>See also:<br>BS 3G 198-4 Type 21A/21B<br>AMS DTL 23053/12 |
| IEC 60684–3-246 | Flexible insulating sleeving — Heat shrink, ratio 2:1, polyolefin, dual wall, not flame retarded | As these are non flame retarded, they are non-preferred items.<br>Careful consideration is given to the design application before use, e.g. proximity to hot or flammable components.<br>See also:<br>AMS DTL 23053/4 Class 1 |
| IEC 60684–3-248 | Flexible insulating sleeving — General purpose, heat-shrinkable, dual wall polyolefin sleeving, flame retarded, shrink ratios 2:1, 3:1, 4:1 | These dual wall sleevings have flame retarded jackets and meltable liners for environmental sealing.<br>See also:<br>AMS DTL 23053/4 Class 3 shrink ratio 3:1 |
| IEC 60684–3-271 | Flexible insulating sleeving — Heat shrink, ratio 2:1, elastomer, fluid resistant, flame retarded | This sleeving has very good flexibility, is flame retarded and has a thick wall for mechanical protection. It is for use as cable protection in areas where wiring is subject to contamination by aircraft fuels and hydraulic fluids. The standard available colours are black or red.<br>See also:<br>BS 4G 198-3 Type 10A<br>AMS DTL 23053/16<br>VG 95343-5 Type D |
| IEC 60684–3-340/342 | Flexible insulating sleeving — Expandable braided polyethylene terephthalate textile sleeving, uncoated | This sleeving is constructed so that it expands when compressed longitudinally. It has an open weaved construction manufactured from polyethylene terephthalate monofilament yarns. It is used to provide mechanical protection up to temperatures of 130 °C. |
| IEC 60684–3-343/345 | Flexible insulating sleeving — Expandable braided ethylene chlorotrifluoroethylene textile sleeving, uncoated | This sleeving is constructed so that it expands when compressed longitudinally. It has an open weaved construction manufactured from ethylene chlorotrifluoroethylene monofilament yarns. It is used to provide mechanical protection up to temperatures of 155 °C. |

**Table 1** *(continued)*

| Standard | Description | Usage, notes and related national specifications (informative) |
|---|---|---|
| IEC 60684–3-300 | Flexible insulating sleeving — Glass textile fibre sleeving, braided, uncoated | This braided sleeving is constructed of E type glass yarn suitable for use up to temperatures of 350 °C. It is used to provide mechanical protection. |
| IEC 60684–3-400/402 | Flexible insulating sleeving — Glass textile sleeving with silicone elastomer coating | This sleeving is E type glass, braided or knitted construction with a continuous silicone elastomer coating. It is used to provide electrical insulation and mechanical protection and is suitable for temperatures up to 180 °C.<br>See also:<br>MIL I 3190 Type 5 grade A and C1 |
| IEC 60684–3-403/405 | Flexible insulating sleeving — Glass textile sleeving with acrylic coating | These sleevings are E type glass braided or knitted construction with a continuous acrylic coating and differentiated by their breakdown voltage. They are suitable for temperatures up to 155 °C.<br>See also:<br>MIL I 3190 Type 6 grade A,B and C1 |
| IEC 60684–3-420/422 | Flexible insulating sleeving — Polyethylene terephthalate textile sleeving with acrylic based coating | These sleevings are constructed from polyethylene terephthalate yarns using either braided or knitted construction with a continuous acrylic based coating and differentiated by their breakdown voltage. They are suitable for temperatures up to 155 °C.<br>See also:<br>MIL I 3190 Type 2 |
| EN 6049–003 | Braided, tubular, expandable sleeving | This sleeving is constructed from meta-aramid fibres provided with water repelled protection and is used for mechanical protection over electrical cable and cable bundles. |
| EN 6049–004 | Braided, tubular, high expandable sleeving | This sleeving is constructed from meta-aramid fibres provided with water repelled protection and is used for mechanical protection over electrical cable and cable bundles. |
| EN 6049–005 | Textile wraparound sleeving | This sleeving is constructed from meta-aramid fibres provided with water repelled protection and is used for mechanical protection over electrical cable and cable bundles. |
| EN 6049–006 | Woven self-wrapping sleeving | This sleeving is constructed from meta-aramid fibres provided with water repelled protection and is used for mechanical protection over electrical cable and cable bundles. |

**Table 1** *(continued)*

| Standard | Description | Usage, notes and related national specifications (informative) |
|---|---|---|
| EN 6049–007 | Self-wrapping mechanical and electrical protective sleeve | This sleeving is constructed from meta-aramid fibres provided with water repelled protection and is used for mechanical protection over electrical cable and cable bundles. Provides a degree of electrical arc protection under specified conditions. |
| EN 6049–008 | Self-wrapping shielded (EMI) protective sleeve with nickel copper braid | This sleeving is constructed from meta-aramid fibres provided with water repelled protection and is used for mechanical protection over electrical cable and cable bundles. Includes an internal nickel plated copper braid for EMI protection. |
| EN 6049–009 | Self-wrapping fire protection sleeve | This sleeving is constructed so as to be a flexible self-wrapping fire protection sleeves for electrical cable and cable bundles, providing improved 360 °C fire resistance to electrical harnesses. |
| EN 4674–003 | Self-wrapping shielding (EMI) protective sleeve — Open sleeve — Inside pressurized area — EMI protection 5 kA | This sleeving is constructed from nickel plated copper strands and polyphenylene sulphide (PPS) monofilament to be installed inside pressurized areas on electrical cables or cable bundles as a flexible 5 kA self-wrapping shielding (EMI) protection sleeve. |
| EN 4674–004 | Self-wrapping shielding (EMI) protective sleeve — Open sleeve — Outside pressurized area — EMI protection 10 kA | This sleeving is constructed from nickel plated copper strands and polyphenylene sulphide (PPS) monofilament to be installed outside pressurized areas on electrical cables or cable bundles as a flexible 10 kA self-wrapping shielding (EMI) protection sleeve. |
| IEC 60684–3-TBD | Flexible insulating sleeving — Heat shrink marker sleeves | See also BS 4G 198-3. |
| IEC 62329–1 | Heat shrinkable moulded shapes — Definitions and general requirements | Definitions and general requirements |
| IEC 62329–2 | Heat-shrinkable moulded shapes — Methods of test | Test methods<br>VG 95343-2 |
| IEC 62329–3-100 | Heat-shrinkable moulded shapes — Specification requirements for shape dimensions, material requirements and compatibility performance — Heat-shrinkable moulded shape dimensions | Heat shrinkable moulded shape dimensions<br>VG 95343-6/7/8/9/28/29/30 |

**Table 1** *(continued)*

| Standard | Description | Usage, notes and related national specifications (informative) |
|---|---|---|
| IEC 62329–3-101 | Heat-shrinkable moulded shapes — Specification requirements for shape dimensions, material requirements and compatibility performance — Heat-shrinkable moulded shapes, polyolefin, semi-rigid, limited fire hazard, material requirements and system performance | Heat shrinkable moulded shapes, polyolefin, semi-rigid, limited fire hazard, material requirements and system performance<br>See also:<br>BS G 198-5 Type DF |
| IEC 62329–3-102 | Heat-shrinkable moulded shapes — Specification requirements for shape dimensions, material requirements and compatibility performance — Heat-shrinkable elastomeric moulded shapes, semi-rigid, material requirements and system performance | Heat shrinkable elastomeric moulded shapes, semi-rigid, material requirements and system performance<br>See also:<br>BS G 198-5 Type DF<br>VG 95343-6, 18 and 19 |
| SAE AS 5258 | System compatibility specification | Complete system requirements |