

AEROSPACE STANDARD

AS23053™
REV. C

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Superseding A23053B

Insulation Sleeving, Electrical, Heat Shrinkable,
General Specification for

(Federal Supply Class 5970)

RATIONALE

Editorial corrections and introduction of the dielectric breakdown voltage as an alternate characteristic and testing method to dielectric strength.

1. SCOPE

1.1 Form

This specification establishes the requirements for various types and colors of electrical insulating sleeving that will shrink to a predetermined size upon the application of heat. This specification includes provisions for demonstrating compliance with qualification requirements (see Section 4 and 7.3), in process inspection, and statistical process control inspections (see 4.4). The continuous operating temperature ranges for the sleeving classes covered by this specification are from -112 to +482 °F (-80 to +250 °C). The continuous operating temperature range for each sleeving class is given in the applicable detail specification.

1.2 Classification

The heat shrinkable sleeving class shall be defined and specified in the applicable detail specification.

1.3 Color

The color shall be identified in accordance with the following:

Table 1

Designator	Color	Designator	Color
0	Black	7	Violet (Purple)
1	Brown	8	Gray (Slate)
2	Red	9	White
3	Orange	C	Clear
4	Yellow	P	Pink
5	Green	T	Tan
6	Blue		

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Documents

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2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS1424	Fluid, Aircraft Deicing/Anti-Icing, SAE Type I
AIR1351	Manufacturers' Identification of Aerospace Electrical and Electronic Wiring Devices and Accessories
AIR7930	Dimensional Life of Heat-Shrinkable Sleeve
AS23053/1*	Insulation Sleeving, Electrical, Heat Shrinkable, Crosslinked Chlorinated Polyolefin, Flexible
AS23053/2*	Insulation Sleeving, Electrical, Heat Shrinkable, Polyvinyl Chloride, Semi Rigid, Crosslinked and Non-Crosslinked
AS23053/3*	Insulation Sleeving, Electrical, Heat Shrinkable, Polyvinyl Chloride, Semi Rigid, Crosslinked and Non-Crosslinked
AS23053/4*	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Dual-Wall, Outer Wall Crosslinked
AS23053/5*	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible, Crosslinked
AS23053/6*	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Semi-Rigid, Crosslinked
AS23053/7*	Insulation Sleeving, Electrical, Heat Shrinkable Polyethylene Terephthalate, Non-Crosslinked
AS23053/8*	Insulation Sleeving, Electrical, Heat Shrinkable, Polyvinylidene Fluoride, Semi-Rigid, Crosslinked
AS23053/10*	Insulation Sleeving, Electrical, Heat Shrinkable, Silicone Rubber, Flexible
AS23053/11*	Insulation Sleeving, Electrical, Heat-Shrinkable Fluorinated Ethylene Propylene, Non-Crosslinked
AS23053/12*	Insulation Sleeving, Electrical, Heat Shrinkable Polytetrafluoroethylene
AS23053/13*	Insulation Sleeving, Electrical, Heat Shrinkable, Fluoroelastomer, Flexible
AS23053/14*	Insulation Sleeving, Electrical, Heat Shrinkable Ethylene-Tetrafluoroethylene Fluoropolymer, Semi-Rigid
AS23053/15*	Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Heavy-Wall, Coated, Flexible, Outer Wall Crosslinked
AS23053/16*	Insulation Sleeving, Electrical, Heat Shrinkable, Crosslinked, Elastomeric Polyolefin, Flexible
AS23053/17*	Insulation Sleeving, Electrical, Heat Shrinkable, Flame Retarded, Modified Polyolefin, Flexible, Crosslinked

AS23053/18* Insulation Sleeving, Electrical, Heat Shrinkable, Modified Fluoropolymer, Crosslinked

AS23053/19* Insulation Sleeving, Electrical, Heat shrinkable, Modified Fluoropolymer, Crosslinked, 200 °C

* AS23053 detail specifications. Detail specification document numbers assigned to follow the numbers of previous specifications AMS-DTL-23053, MIL-I-23053, MIL-DTL-23053, and AMS-I-23053 (see 7.2 and 7.6).

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D149 Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

ASTM D150 Standard Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation

ASTM D374/D374M Standard Test Methods for Thickness of Solid Electrical Insulation (Metric)

ASTM D570 Standard Test Method for Water Absorption of Plastics

ASTM D746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

ASTM D876 Standard Test Methods for Non-rigid Vinyl Chloride Polymer Tubing used for Electrical Insulation

ASTM D2671 Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use

ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

2.1.3 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 846 Plastics - Evaluation of the action of microorganisms

ISO 9001 Quality management systems - Requirements

ISO 10012 Measurement management systems - Requirements for measurement processes and measuring equipment

2.1.4 National Conference of Standards Laboratories (NCSL) Publications

Available from NCSL International, 2995 Wilderness Place, Suite 107, Boulder, CO 80301, Tel: 303-440-3339, www.ncsli.org.

NCSL Z540.3 Requirements for the Calibration of Measuring and Test Equipment

2.1.5 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

A-A-694	Sodium Chloride, Technical
MIL-DTL-83133	Turbine Fuels, Aviation, Kerosene Types, NATO F-34 (JP-8), NATO F-35, and JP-8+100
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO code Number O-156
MIL-STD-104	Limit for Electrical Insulation Color
SD-6	Provisions Governing Qualification

2.2 Definitions

2.2.1 QUALIFICATION INSPECTION

Qualification inspection is a process that demonstrates that a component is capable of fully conforming to all the requirements defined in a standard. Qualification inspection includes definition of the measurements, tests, analysis, and associated data which provides consistent rationale for acceptance of a particular supplier's design as meeting the standard requirements typically prior to acquisition by the purchaser.

2.2.2 QUALIFIED PRODUCTS LIST (QPL)

A qualified products list is a list of suppliers whose products have been evaluated to a defined process and who are authorized to provide those products to a purchaser upon request. When a qualified products list is specified, only approved suppliers are authorized to provide products under the part number defined in the component standard. A qualified products list is established by a qualifying activity.

2.2.3 QUALIFYING ACTIVITY (QA)

The qualifying activity, for U.S. Department of Defense procurement purposes, is the Naval Air Systems Command (Code 4.4.5.3), 48298 Shaw Road, Bldg. 1461, Patuxent River, MD 20670. Application for qualification tests shall be made in accordance with provisions governing qualification in SD-6 (see 2.1.5).

2.2.4 QUALITY CONFORMANCE INSPECTION

Quality conformance inspection is a process which includes measurements, non-destructive tests, analysis, and associated data that will provide verification that a particular individual component continually conforms to the requirements defined in the standard.

2.2.5 PURCHASER

A purchaser is an individual or group of individuals that can issue a purchase order.

2.2.6 SUPPLIER

A supplier is a manufacturer which has design and production control of the processes used to produce a component.

2.2.7 REBRAND SUPPLIER

A rebrand supplier is a manufacturer or distributor approved by the qualified supplier and the qualifying activity to sell the original supplier's product as the rebrand supplier's own product defined by the rebrand supplier part number. A rebrand supplier is also known as a private labeler.

2.2.8 DATE OF MANUFACTURE

The date at which the sleeving is expanded to its final "as supplied" ID.

3. REQUIREMENTS

3.1 Detail Specifications

In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or detail specifications), the text of this document takes precedence. Nothing in the document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3.2 Dimensions and Tolerances

Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

3.2.1 Inside Diameter (ID)

3.2.1.1 As Supplied

When determined in accordance with 5.3.1, the "as supplied" ID shall conform to the requirements of the applicable detail specification.

3.2.1.2 After Unrestricted Shrinkage

When determined in accordance with 5.3.2, the sleeving ID after unrestricted shrinkage shall conform to the requirements of the applicable detail specification.

3.2.2 Wall Thickness

The wall thickness after unrestricted shrinkage shall be determined in accordance with 5.3.3 and shall conform to the requirement in the detail specification.

3.2.3 Longitudinal Change

When tested as specified in 5.4, the longitudinal change shall not exceed the value specified in the detail specification.

3.2.4 Concentricity

When tested as specified in 5.3.4, the "as supplied" concentricity shall not be less than that specified in the detail specification.

3.2.5 Unit of Issue

Unit of issue for all sleeving shall be feet (meters). The sleeving shall be supplied as a straight piece, coiled, on reels or spools.

3.2.5.1 Straight Pieces

Unless otherwise specified in the applicable detail specification, the standard straight piece unit of issue shall be 4 feet +2/-0 inches (121.9 cm +5/-0 cm).

3.2.5.2 Reels, Spools, and Coils

Unless otherwise specified in the purchaser's contract or order (see 7.3.d), sleeving length on reels shall be as specified in Table 2.

Table 2 - Reel lengths ^{1/}

ID, As Supplied Inches (Millimeters)	Min Length Feet (Meters)	Number of Lengths Max	Shortest Length Min Feet (Meters)
0.015 to 0.063 (0.38 to 1.60)	500 (152.3)	3	125 (38.1)
0.064 to 0.499 (1.60 to 12.7)	200 (61.0)	3	50 (15.2)
0.500 to 1.00 (12.7 to 25.4)	100 (30.5)	3	25 (7.6)
Over 1.00 (Over 25.4)	50 (15.2)	2	13 (4)

^{1/} As reel length increases above minimum footage, the number of individual lengths permitted shall be increased proportionately. When this calculation results in a fraction of 1/2 or less, round down to the lower number.

3.2.5.3 Altered Length Sleeves

An altered length sleeve shall be defined as straight sleeves that are cut-to-length intended for sale in lengths not defined herein. Altered length sleeves shall be cut from bulk sleeves as defined herein (i.e., spooled or straight) which the bulk sleeve and the producer/rebrander are listed on the latest version of QPL and in good standing. Sellers of altered length sleeves shall be permitted to reference the QPL military part number designation when in compliance with the following:

- Altered length sleeves shall be made from bulk sleeves listed on QPL and from a producer/rebrander on the QPL and in good standing.
- Altered length sleeve label and/or marking when applicable shall be as follows:

CAGE Code-QPL military part number-QPL source CAGE code-altered length in inches/(millimeters).

e.g., xxxxx-M23053/5-106-4-nnnnn-2.00/(50.8)

where:

xxxxx: CAGE code where cutting is done

M23053/5-106-4: QPL military part designation

nnnnn: CAGE Code of the QPL sleeve source

2.00/(50.8): Cut length in inches/(millimeters). Part number length is for reference only and shall not be used for inspection.

Significant figures of cut-lengths shall be at altered-length-sleeve-producer's discretion based on the cut length. Note: When altered length operation is done by a QPL source, xxxxx is equal to nnnnn.

- The declared dimensional life for the altered length sleeve shall be equal to the original producer's declared dimensional life (see 3.6.2).
- The cut edge shall be clean and free of cut-edge imperfections, visible without any magnification, that may become a split nucleation point.
- Altering operation shall not change the properties of the original sleeve except for the length of unrecovered sleeves.

- f. Altered length items shall be subject to acceptance inspection per 4.9.3.c. Any loose recovery over the diameter d, a failure to fit over the “A” section of the test mandrel, and/or any evidence of a split after the recovery shall be considered as a failure. Any sleeves cut between passing result to failing result shall be non-conforming. Alteration shall not continue until the root cause(s) and corrective action(s) is implemented and verified.
- g. Sources cutting QPL listed sleeves for sale shall notify the qualifying activity the intent indicating the detail specification number(s), the class(es) and the qualified sleeve(s), source CAGE code(s) of bulk sleeve listed on QPL every 36 months or bulk sleeve source change, whichever is sooner. Sleeve producers and rebranders listed on QPL and in good standing shall be exempt from this notification requirement when cutting CAGE code is same as the source CAGE code.
- h. Altered length sleeve delivery form factor (i.e., bulk packed, tape mounted, etc.) and/or formed to a specific shape for end user application shall be outside of the scope of this specification.

3.3 Properties

3.3.1 As Supplied

3.3.1.1 Heat Shock

When tested as specified in 5.8, the sleeving shall show no sign of cracking, flowing, or dripping. After bending through 360 degrees, the sleeving shall show no sign of cracking except that side cracking of the flattened sleeving shall not be cause for rejection.

3.3.1.2 Restricted Shrinkage

After testing as specified in 5.6, the shrunk sleeving shall fit snugly over the mandrel without cracking and shall withstand the voltage application specified in 5.6.2.c.

3.3.1.3 Modulus

See detail specification for secant modulus or tensile stress requirement as applicable. Testing shall be as specified in 5.12.

3.3.1.4 Cold Impact

When tested as specified in 5.7.2, the sleeving shall meet the requirement of the applicable detail specification.

3.3.2 After Unrestricted Shrinkage

When tested as specified herein and the applicable detail specification, the sleeving shall conform to the requirements of Table 3 or the applicable detail specification.

Table 3 - Properties after unrestricted shrinkage

Characteristics	Requirement	Test Method
Color	Detail specification	MIL-STD-104 <u>1/</u>
Color stability	Conform to “as received” limits	5.15
Clarity stability	3.4 and detail specification	5.16
Specific gravity	Detail specification	ASTM D792
Dielectric constant	Detail specification	ASTM D150
Fungus resistance	Detail specification	5.17
Tensile strength	Detail specification	5.13
Ultimate elongation	Detail specification	5.13
Dielectric strength	Detail specification	ASTM D2671
Volume resistivity	Detail specification	ASTM D876
Low temperature flexibility	Detail specification	5.7.1
Corrosion	Detail specification	<u>2/</u>
Heat resistance	Detail specification	5.9
Water absorption	Detail specification	ASTM D570, 24 hours at 23 °C <u>3/</u>
Flammability	Detail specification	5.14
Fluid resistance	Detail specification	5.11
Sealing efficiency	Detail specification	AS23053/4
Dielectric strength <u>4/</u>	Detail specification	ASTM D2671
Dielectric breakdown voltage <u>4/</u>	Detail specification	5.19

1/ For pink and tan color limits, see 3.3.3.

2/ See detail specification for test method.

3/ When testing small (ID) sleeving, special care shall be taken to remove all surface water from the inner wall before reweighing.

4/ Dielectric strength or dielectric breakdown voltage shall be tested as required in the applicable detail specification.

3.3.3 Color and Marking

The after unrestricted shrinkage color of the sleeving shall be in accordance with the requirements of MIL-STD-104. MIL-STD-104 does not include limits for pink and tan colors. Munsell color notations for these colors shall be as follows:

Table 4 - Munsell color notations

Color	Light Limit	Nominal	Dark Limit
Pink	3.75R—6.5/9.0	2.5R—6.0/7.0	1.25R—5.5/6.0
Tan	5YR—5.5/6.0	5YR—5.0/5.0	5YR—4.5/4.0

Marking (part number, supplier name, etc.) is not required on the sleeve. Unless otherwise specified by the purchaser or in detail specification, marking is required on the shipping spool label or the smallest unit container and shall be as follows:

- a. AS23053 insulation sleeving part number. Example as shown:

M23053/4 - 1 01 - 1
 | | | |
 Color code designator (see 1.3)
 Size identifier (see detail specification)
 Class (see detail specification/use 0 when unspecified)
 SAE part number designator (M), basic and detail specification number

- b. Supplier or rebrand supplier name (see 2.6) and CAGE code as registered on AIR1351.
- c. Production code number.
- d. Date of manufacture.
- e. Dimensional life.