

MIL-I-23053D  
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 SUPERSEDING  
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## MILITARY SPECIFICATION

### INSULATION SLEEVING, ELECTRICAL, HEAT SHRINKABLE, GENERAL SPECIFICATION FOR

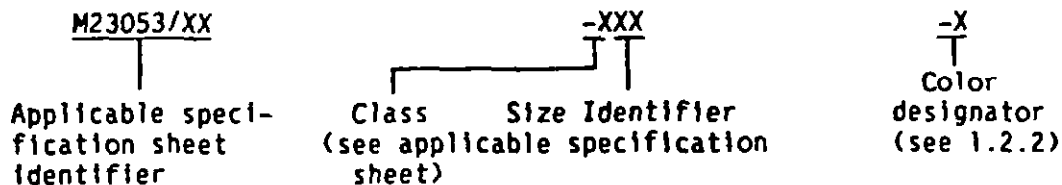
This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. 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. Continuous operating temperature ratings range from  $-80^{\circ}$  to  $+250^{\circ}\text{C}$  ( $-112$  to  $+482^{\circ}\text{F}$ ) (see 6.1).

1.2 Classification. The heat shrinkable sleeving shall be of the applicable military specification sheet, as specified (see 6.2.1).

1.2.1 Part numbers. Part numbers under this specification are coded as follows:



Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 5970

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1.2.2 Color. The color shall be identified in accordance with the following:

<u>Designator</u>	<u>Color</u>	<u>Designator</u>	<u>Color</u>
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		

## 2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

## SPECIFICATIONS

## FEDERAL

O-S-1926	-	Sodium Chloride, Technical.
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-B-640	-	Box, Fiberboard, Corrugated, Triple Wall.
PPP-T-60	-	Tape, Packaging, Waterproof.

## MILITARY

MIL-P-116	-	Preservation, Methods of.
MIL-H-5606	-	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance.
MIL-T-5624	-	Turbine Fuel, Aviation, Grade JP-4.
MIL-L-7808	-	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.
MIL-A-8243	-	Anti-Icing and Deicing-Defrosting Fluid.
MIL-L-23699	-	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
MIL-F-46162	-	Fuel, Diesel, Referee Grade.
MIL-M-81531	-	Marking of Electrical Insulating Materials

(See supplement 1 for applicable specification sheets.)

## STANDARDS

## FEDERAL

FED-STD-228	-	Cable and Wire, Insulated, Methods of Testing.
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MIL-STD-104	-	Limit for Electrical Insulation Color.
MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-120	-	Gage Inspection.
MIL-STD-129	-	Marking for Shipping and Storage.
MIL-STD-147	-	Palletized Unit Loads.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

**2.2 Other publications.** The following documents form a part of this specification to the extent specified herein. The issues of the documents which are DoD adopted shall be the issue listed in the current DoDISS and supplement thereto, if applicable.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 149	-	Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
ASTM D 150	-	A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials.
ASTM D 374	-	Thickness of Solid Electrical Insulation.
ASTM D 412	-	Rubber Properties in Tension.
ASTM D 570	-	Water Absorption of Plastics.
ASTM D 638	-	Tensile Properties of Plastics.
ASTM D 746	-	Brittleness Temperature of Plastics and Elastomers by Impact.
ASTM D 792	-	Specific Gravity and Density of Plastics by Displacement.
ASTM D 876	-	Nonrigid Vinyl Chloride Polymer Tubing Used for Electrical Insulation.
ASTM D 882	-	Tensile Properties of Thin Plastic Sheet.
ASTM D 2671	-	Heat shrinkable Tubing for Electrical use.
ASTM D 3951	-	Commercial Packaging
ASTM G 21	-	Resistance of Synthetic Polymeric Materials to Fungi, Recommended Practice for Determining.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

**2.3 Order of precedence.** In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specifications, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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## 3. REQUIREMENTS

3.1 Specification sheets. The heat shrinkable sleeving requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 First article. When specified in the contract or purchase order, a sample be subjected to first article inspection (see 4.3 and 6.2.1).

3.3 Dimensions and tolerances.

3.3.1 Inside diameter (ID) "as supplied". When tested as specified in 4.6.3.1.1, the "as supplied" ID (unless otherwise specified by the acquisition activity) shall conform to the requirements of the applicable specification sheet.

3.3.2 Inside diameter (ID) and wall thickness after unrestricted shrinkage. When tested as specified in 4.6.3.1.2 and 4.6.3.2, the sleeving ID and wall thickness after unrestricted shrinkage (unless otherwise specified by the acquisition activity) shall conform to the requirements of the applicable specification sheet.

3.3.3 Longitudinal change. When tested as specified in 4.6.4, the longitudinal change shall not exceed the value specified in the specification sheet.

3.3.4 Length. Unit of issue for all sleeveings shall be feet (meters). The sleeving may be supplied as a straight length, on reels or spools.

3.3.4.1 Straight pieces. Unless otherwise specified in the applicable specification sheet, the standard straight piece shall be 4 feet plus/minus 1 inch. (121.9 cm plus/minus 2.5cm).

3.3.4.2 Reels and spools. Unless otherwise specified in the contract or order, sleeving length on reels shall be as specified in Table I. Sleeving lengths on spools shall be as specified by the acquiring activity.

3.4 Properties.3.4.1 As supplied.

3.4.1.1 Heat shock. When tested as specified in 4.6.8, 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.

3.4.1.2 Restricted shrinkage. After testing as specified in 4.6.6.1, the shrunk sleeving shall fit snugly over the mandrel without cracking and shall withstand the voltage application specified in 4.6.6.2.

3.4.1.3 Modulus. See specification sheet for secant modulus or tensile stress as applicable. Testing shall be as specified in 4.6.13.

3.4.1.4 Cold impact. When tested as specified in 4.6.7.2, the sleeving shall meet the requirement of the applicable specification sheet.

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3.4.1.5 Color. The "as supplied" color of the sleeving shall be in accordance with the requirements of MIL-STD-104. MIL-STD-104 does not include any limits for pink and tan colors. Munseil color notations for these colors shall be as follows:

<u>Color</u>	<u>Light limit</u>	<u>Nominal</u>	<u>Dark limit</u>
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

3.4.2 After unrestricted shrinkage. When tested as specified herein and the applicable specification sheet, the sleeving shall conform to the requirements of Table II or the applicable specification sheet.

### 3.5 Storage Life.

3.5.1 Shelf life. The manufacturer shall certify in writing that the sleeving, after storage at the conditions specified in the applicable specification sheet, shall conform to the "as supplied" inside diameter (ID) requirements and the wall thickness and longitudinal change requirements after unrestricted shrinkage (see 4.6.5).

3.5.2 Extension of Shelf Life. The expiration date may be extended by a period of time equal to fifty percent (50%) of the original shelf life for the sleeving if the dimensions are still within specification limits when tested as specified in 4.6.18.

3.6 Clarity stability. The clear sleeving shall not darken appreciably and the protected marking shall be readable through the sleeving, after the exposures specified in 4.6.17.

3.7 Concentricity. When tested as specified in 4.6.3.3 the as supplied concentricity shall not be less than that specified in the specification sheet.

3.8 Workmanship. When examined visually, the sleeving, both before and after shrinkage, shall be free from internal voids, blisters, lumps, dents, tears, pinholes, seams, cracks, foreign matter, or other defect that would be detrimental to fabrication, appearance, or performance. After shrinkage, the sleeving surface shall be smooth and uniform. When the sleeving is of a spirally wound construction or contains a single bonded seam, the overlaps and seams normally associated with these manufacturing techniques shall be accepted.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. The examination and testing of the sleeving shall be classified as follows:

- a. First Article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First Article inspection. First Article inspection shall consist of all the tests in table V and inspections of this specification. The First Article inspection shall be performed on the first lot or order of sleeving furnished under this specification and on any subsequent lot or order when specified by the acquisition activity (see 4.3.1 and 6.2). Instructions for testing and approving the sleeving are located in 6.2.2.

4.3.1 Prior approval. If a contractor has previously delivered an acceptable product meeting the requirements of this specification, First Article inspection may be waived at the discretion of the procuring activity for a period of time not to exceed 2 years.

4.3.2 First Article sample. Unless otherwise specified in the applicable specification sheet or by the acquisition activity, 50 feet of heat shrinkable sleeving of the class and size for which approval is desired shall constitute the First Article sample. Approval of the sample will automatically extend First Article approval to all sizes included in the size range. Table III identifies the size ranges. The First Article sample shall be produced using the same plant facilities intended for the production run.

4.3.2.1 First Article sample identification. The First Article sample shall be plainly identified by securely attached durable tags or labels marked with the following information:

Sample for First Article inspection  
 INSULATION SLEEVING, ELECTRICAL, HEAT SHRINKABLE  
 Name of Manufacturer  
 Product Code Number  
 Date of Manufacture  
 Submitted by (name) (date) for First Article inspection  
 in accordance with the requirements of (give specification  
 sheet number, class, and part number as applicable)

4.3.3 Manufacturer's data. For each acquisition, the manufacturer shall submit two copies of his test report that show the sleeving conforms to the requirements of the specification. The data shall include certification that the sleeving meets or exceeds the shelf life established in the applicable specification sheet.

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#### 4.4 Quality conformance inspection.

4.4.1 Lot formation. Unless otherwise specified, a lot shall consist of all the heat shrinkable sleeving of one specification sheet, class, color and size that has been processed under essentially the same conditions into a finished form from one batch and available for inspection at one time. A batch shall be the quantity of material mixed, blended, or processed in a single operation intended to make the product uniform. If the material cannot be identified by batch, a lot shall consist of sleeving from one specification sheet, class, color and size that has been produced at one plant under essentially the same conditions, processed in a continuous operation and available for inspection at one time.

#### 4.4.2 Sampling.

4.4.2.1 Visual and dimensional inspection of the end item. Samples for this inspection shall be selected in accordance with Inspection Level S-3 of MIL-STD-105. Unless otherwise specified in Table IV, the sample unit shall be 4 feet (1.25 m) of sleeving. Each sample shall be inspected as specified in 4.4.3.1.

4.4.2.2 Physical property tests. A sufficient quantity of the sleeving shall be selected at random from each lot (see 4.4.1) and tested as specified in 4.4.3.2. Sleeving selected and visually inspected as specified in 4.4.3.1 may be used to "make-up" the sample size for the tests.

4.4.2.3 Packaging. A quantity of shipping containers fully prepared for delivery, just prior to closure, shall be selected at random from each lot in accordance with Inspection Level S-2 of MIL-STD-105. The lot size shall be the number of shipping containers.

#### 4.4.3 Inspection and tests.

4.4.3.1 Visual and dimensional inspections. Samples selected in 4.3.2.1 shall be examined for conformance to the requirements in Table IV. The Acceptable Quality Level (AQL) for this inspection shall be as specified in Table IV. The number of determinations on each sample shall be as specified in Table VI.

4.4.3.2 Physical property tests. Test specimens prepared from the sample selected in 4.4.2.2 shall be tested to the requirements of Table VI. The number of specimens tested and reporting of results shall be in accordance with Table V. Nonconformance of the sample to a single requirement shall be cause for rejection of the lot represented by the sample.

4.4.3.3 Packaging inspection. Each sample selected in accordance with 4.4.2.3 shall be examined for the defects specified in Table VII and to all other requirements of Section 5 of this specification. The AQL for this inspection shall be 4.0 percent defective. In addition, shipping containers fully prepared for delivery shall be examined after closing for closure defects.

4.5 Reporting of test results. Table V shall be used to prepare test reports. The number of specimens per test and method of reporting the results shall be as contained therein.



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4.6 Test methods.

4.6.1 Test conditions. Unless otherwise specified herein, the heat shrinkable sleeving and measurement gages shall be conditioned for 4 hours at  $23^{\circ} \pm 2^{\circ}\text{C}$  ( $73.4^{\circ} \pm 4^{\circ}\text{F}$ ) and a relative humidity of  $50 \pm 5$  percent prior to testing. When the sleeving is tested after heat shrinking, conditioning of the sleeving shall take place after completion of the heat shrinking procedure. Unless otherwise specified in the specification sheet, an oven with a circulating air velocity of 100 to 200 feet (30.5 to 61.0 m) per minute shall be used whenever heating is required.

4.6.2 ASTM tests. ASTM tests shall be performed in accordance with ASTM Standard Methods of Test (see 2.2) with any exceptions that may be specified herein or in the specification sheets.

4.6.3 Dimensions and tolerances. Micrometer measurements shall be made in accordance with ASTM D 374.

4.6.3.1 Inside diameter (ID).

4.6.3.1.1 ID (as supplied). To measure the ID of the sleeving, select a smooth gage rod that has a diameter equal (plus 0, minus 0.002 inch (plus 0, minus 0.051 mm), or 2 percent, whichever is less) to the minimum acceptable ID of the "as supplied" sleeving. The ID shall be considered acceptable when the gage rod shall pass freely into the sleeving sample without expanding the wall of the sleeving. If the gage rod tends to stick, the gage rod may be dipped in talc or water to facilitate insertion of the rod.

4.6.3.1.2 ID after unrestricted shrinkage. For sleeving shrunk as specified in 4.6.5.1, select a smooth gage rod that has a diameter equal (minus 0, plus 0.002 inch (minus 0, plus 0.051 mm), or 2 percent, whichever is less) to the maximum acceptable sleeving ID after unrestricted shrinkage. The maximum ID dimension of the sleeving shall be considered acceptable when the wall of the sleeving is expanded by the insertion of the gage rod, when there is no visible air space between the end of the sleeving and the rod, or when the gage rod cannot be inserted in the sleeving. For sleeving shrunk as specified in 4.6.5.2, the maximum ID dimension of the sleeving shall be considered acceptable only if the sleeving is snug on the mandrel and there is no air space between the mandrel and the sleeving.

4.6.3.2 Wall thickness. After the unrestricted shrinkage specified in 4.6.5, the wall thickness shall be determined by one of the following methods:

4.6.3.2.1 Micrometer method. After the unrestricted shrinkage specified in 4.6.5, the sleeving shall be slit lengthwise into two hemicylindrical pieces. A smooth gage rod shall be selected, measured and placed in contact with the inside surface of the sleeving. The total thickness of the gage rod plus sleeving wall shall then be measured. The maximum and minimum wall thickness shall be calculated by subtracting the gage rod measurement from the measurement of the gage rod plus sleeving wall.

4.6.3.2.2 Optical method. The wall thickness of the sleeving, after the unrestricted shrinkage specified in 4.6.5, shall be measured with a contour projector as specified in MIL-STD-120 or with a calibrated microscope.



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4.6.3.3 Concentricity. Concentricity shall be determined by using the following formula:

$$C = \frac{100 (W \text{ min.})}{(W \text{ Max.})}$$

Where W min is the minimum wall thickness and W maximum is the maximum wall thickness of the sleeving.

4.6.4 Longitudinal change. The sleeving shall be measured in the "as supplied" condition and after the unrestricted shrinkage specified in 4.6.5. Longitudinal change shall be calculated as percent. Measurements shall be made with an accurate rule.

$L_1$  = original length

$L_2$  = length after unrestricted shrinkage

$$\text{percent change} = \frac{L_2 - L_1}{L_1} \times 100$$

4.6.5 Unrestricted shrinkage. Unrestricted shrinkage shall be determined by one of the following methods:

4.6.5.1 Unsupported method. Lay a 6 inch (15.2 cm) length of the sleeving in a tray of an oven at the temperature and for the time specified in the specification sheet. If the sleeving becomes tacky in the oven, a small amount of powdered talc may be placed on the tray to prevent sticking.

4.6.5.2 Mandrel method. Select a smooth, clean, metallic mandrel that has a diameter equal to the maximum acceptable sleeving ID (after unrestricted shrinkage) minus 0, plus 0.002 inch (minus 0, plus 0.051 mm) or 2 percent, whichever is less. Slip a 6 inch (15.2 cm) length of sleeving on the mandrel and heat in an oven at the temperature and for the time specified in the applicable specification sheet.

4.6.6 Restricted shrinkage. A smooth, clean metallic mandrel of the configuration shown in Figure 1 shall be prepared for each sleeving size. A length of sleeving shall be placed over the mandrel (so that each end of the mandrel is slightly exposed for electrical connections) and shrunk using one of the methods below. Unless otherwise specified, the heat cycle shall be 30 minutes.

4.6.6.1 Shrinkage procedures. Sleeving specimens prepared in accordance with the procedures below shall be conditioned as specified in 4.6.1, then visually examined for cracking and fit. Any cracking of the sleeving or movement away from the mandrel shall be cause for rejection. After examination, the specimens shall be subjected to the voltage withstand test of 4.6.6.2.

4.6.6.1.1 Procedure A. The mandrel shall be at room temperature and the method of heat application to shrink the sleeving shall be optional.

4.6.6.1.2 Procedure B. The mandrel shall be preheated a minimum of 30 minutes in an oven at the temperature specified in the applicable specification sheet. The method of heat application to shrink the sleeving shall be optional.

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4.6.6.1.3 Procedure C. The mandrel shall be inserted into the sleeving at room temperature and placed in an oven for the time and temperature specified in the applicable specification sheet. The oven shall be capable of maintaining a  $\pm 5^{\circ}\text{C}$  ( $\pm 9^{\circ}\text{F}$ ) tolerance from the shrinkdown temperature.

4.6.6.2 Voltage withstand. Tightly wrap the first layer of the outer electrode, a strip of metal foil, around the sleeving specimen. The outer electrode shall conform closely to the shape of the sleeving particularly at the areas A and R shown in Figure 1. Allow sufficient sleeving area at each end to remain unwrapped so that flashover between the mandrel and the foil will not occur. Wrap two more layers of foil over the first wrap allowing a free end of 0.5 inch (12.7 mm) for connection of the electrode. Two thousand volts shall be applied for one minute in accordance with the test procedure of ASTM D 149.

4.6.7 Low temperature properties. Low temperature properties of heat shrinkable sleeving shall be determined as specified in the applicable specification sheet using one of the methods specified below.

4.6.7.1 Low temperature flexibility. For sleeving sizes less than 0.400 inch (10.2 mm) (maximum ID nominal after unrestricted shrinkage), the sleeving shall be shrunk and conditioned as specified in 4.6.5 onto a stranded AWG wire (nearest AWG which is larger than the sleeving max ID nominal after unrestricted shrinkage). For sleeving sizes 0.400 inch (10.2 mm) and larger, a 6 by 0.25 inch (15.2 by .64 cm) longitudinal strip shall be cut from sleeving that has been shrunk and conditioned as specified in 4.6.5. The specimen (strip or sleeving) and a steel mandrel of the size specified in Table VIII shall be conditioned in a cold chamber for 4 hours at the temperature specified in the applicable specification sheet. After completion of the conditioning period and while still in the cold chamber at the specified temperature, the specimen shall be bent around the mandrel through not less than 360 degrees. Unless otherwise specified in the specification sheet, the time to complete the bend shall be  $10 \pm 2$  seconds. Visually examine the sleeving for cracks.

4.6.7.2 Cold impact. Impact determinations shall be conducted in accordance with ASTM D 746 Procedure A, using specimens prepared as specified in ASTM D 876. Temperature shall be as specified in the applicable specification sheet.

4.6.8 Heat shock (as supplied). A 6 inch (15.2 cm) length of the sleeving (or a 6 by 0.5 inch (15.2 by 1.3 cm) strip cut longitudinally from sleeving that has a nominal ID greater than 0.5 inch (12.7 mm) as supplied) shall be placed in an oven for 4 hours at the temperature specified in the specification sheet. The specimen may be suspended vertically in the oven by means of a piece of wire attached to a hole in the specimen. While in the oven and after removal from the oven, the specimen shall be examined for evidence of cracking, flowing, or dripping. The specimen shall then be conditioned as specified in 4.6.1 and bent through 360 degrees in two to four seconds over the steel mandrel specified in Table VIII. The specimen shall then be visually examined for conformance to 3.4.1.1.

4.6.9 Heat resistance. The sleeving shall be heat shrunk and conditioned as specified in 4.6.5.1. A suitable number of 6 inch (15.2 cm) lengths of the sleeving shall then be placed in an oven at the temperature and for the time specified in the specification sheet. After removal from the oven, the

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sleeving shall be conditioned as specified in 4.6.1. The sleeving shall then be tested for conformance to the ultimate elongation, tensile strength, and dielectric strength requirements (as applicable) of the specification sheet.

4.6.10 Corrosion. Prior to corrosion testing, the sleeving sample shall be heat shrunk and conditioned as specified in 4.6.5. The corrosion test procedure(s) specified in the applicable specification sheet shall be followed.

4.6.10.1 Corrosion in contact with copper. A six inch (15.2 cm) length of shrunk sleeving shall be slid over a straight, clean, bare copper conductor. For sleeving of 0.25 inch (6.4 mm) inside diameter and smaller (maximum ID after unrestricted shrinkage), a single conductor shall be used; for larger sleeving, a twisted bundle of several conductors shall be used, each AWG 18 or smaller. The specimens on the conductor shall be heated in an air-circulating oven for the time and at the temperature specified in the applicable specification sheet. The specimens shall then be removed from the oven, cooled, and conditioned in accordance with 4.6.1. The sleeving shall be slit open and the copper examined for pitting and blackening. The sleeving shall be considered noncorrosive only if the copper is not pitted or blackened. Darkening of the copper due to normal air oxidation shall not be cause for rejection.

4.6.10.2 Copper mirror corrosion. For sizes 0.400 inch (10.2 mm) and larger (maximum ID nominal after unrestricted shrinkage), a 0.25 by 1 inch (6.4 by 25.4 mm) strip shall be cut longitudinally from the shrunk sleeving. For sizes smaller than 0.400 inch (10.2 mm) (maximum ID nominal after unrestricted shrinkage), a number of pieces of shrunk sleeving having an area of approximately 0.25 square inch (6.4 square mm) shall be used. The strip or pieces of sleeving shall be placed in the bottom of a clean, dry 0.5 by 12 inch (1.3 by 30.5 cm) test tube. A copper glass mirror about 0.25 by 1 inch (6.4 by 25.4 mm) and a calibrated thermometer shall be suspended 6 to 7 inches (15.2 by 17.8 cm) above the bottom of the test tube by means of a fine, clean copper wire attached to a cork that has been wrapped in clean aluminum foil. A second clean test tube containing only the mirror and thermometer shall be used as a control. The lower 2 inches (5.1 cm) of the test tube shall be immersed in an oil bath at the temperature and for the time specified in the applicable specification sheet. The temperature of that portion of the test tube containing the copper mirror shall be below 60°C (140°F). After removal from the oil bath and cooling to room temperature, visually examine the mirror for corrosion by placing it on a white background in good light. Evidence of corrosion shall be the removal of the copper film from any part of the mirror as evidenced by the white background showing through. Disregard removal of copper from the bottom 0.063 inch (1.6 mm) of the mirror. Discoloration of the copper film or reduction of its thickness should not be considered corrosion. The mirrors shall be vacuum deposited copper with a thickness equal to  $10 \pm 5$  percent transmission of normal light of 5000 Angstroms. They shall be stored in a vacuum and shall be used only if no oxide film is present and the copper is not visually damaged or contaminated.

4.6.11 Fluid resistance. The sleeving shall be heat shrunk and conditioned as specified in 4.6.5. A suitable number of 6 inch (15.2 cm) lengths of sleeving shall be totally immersed in each of the six fluids specified in Table IX. The volume of the fluid shall be not less than 20 times that of the sleeving. After 24 hours immersion at  $24^\circ \pm 3^\circ\text{C}$  ( $75^\circ \pm 5^\circ\text{F}$ ), the sleeving shall be lightly wiped and then conditioned for 45

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plus/minus 15 minutes at room temperature. The sleeving from each of the test fluids shall then be tested for conformance to the tensile strength, ultimate elongation, and dielectric strength (as applicable) of the specification sheet.

**4.6.12 Odor.** The sleeving shall be heat shrunk and conditioned as specified in 4.6.5. Place a quantity of shrunk sleeving that has an approximate area of 10 square inches (64.5 square cm) (measured on one side) in an airtight steel container. Place the sleeving and container in an oven for 24 hours at the temperature which is specified in the specification sheet as the maximum continuous operating temperature for the sleeving. After 24 hours, cool to room temperature, open the container, and carefully smell any odor that may be present. A pungent odor shall be cause for rejection.

**4.6.13 Modulus.**

**4.6.13.1 Secant modulus (as supplied).** Full sections of sleeving shall be tested when the maximum ID as supplied is 0.25 inch (6.4 mm) or less. For larger sizes, a 0.25 inch (6.4 mm) strip shall be cut longitudinally from the sleeving. No metal plugs are necessary when testing full sections of the sleeving. The testing procedure and percent strain shall be as specified in the specification sheet.

**4.6.13.2 Tensile stress.** Full sections of sleeving shall be tested when the maximum ID of the sleeving to be tested is 0.25 inch (6.4 mm) or less. For larger sizes, a 0.25 inch (6.4 mm) strip shall be cut longitudinally from the sleeving. No metal plugs are necessary when testing full sections of sleeving. The testing procedure and percent strain shall be as specified in the applicable specification sheet. One inch (2.5 cm) bench marks and 2 inch (5.1 cm) initial jaw separation shall be used. A break at a bench mark or outside the gage length shall be cause for retest.

**4.6.14 Tensile strength and ultimate elongation.** The sleeving shall be heat shrunk and conditioned as specified in 4.6.5. Full sections of sleeving shall be tested when the maximum ID, after unrestricted shrinkage, is 0.25 inch (6.4 mm) or less. For larger sizes, cut a 0.25 inch (6.4 mm) strip longitudinally from the sleeving. No metal plugs are necessary when testing full sections of sleeving. The test procedure for tensile strength and ultimate elongation shall be as specified in the specification sheet. One inch (2.5 cm) bench marks and 2 inch (5.1 cm) initial jaw separation shall be used. Testing speed shall be as specified in the specification sheet. A break at a bench mark or outside the gage length shall be cause for retest.

**4.6.15 Flammability.** One of the following tests shall be performed as specified in the specification sheet. Sleeving that passes test C has better flame resistant properties than sleeving that passes either test A or B; and sleeving that passes test B has better flame resistant properties than sleeving that passes test A.

**4.6.15.1 Test A.** An 18 inch (0.46 m) specimen of sleeving shall be shrunk as specified in 4.6.6, sample preparation A or B, onto a 21 inch (0.53 m) metal rod. The outside diameter of the metal rod shall be the maximum recovered inside diameter of the sleeving specified in the applicable specification sheet. The specimen so prepared shall be tested in accordance with FED-STD-228, Method 5221 for vertical flammability. Brown scorching or soot on the indicator flag shall not be cause for rejection.

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4.6.15.2 Test B. A 22 inch (0.56 m) specimen of sleeving shall be shrunk as specified in 4.6.5 and tested in accordance with ASTM D 876.

4.6.15.3 Test C. A 26 inch (0.66 m) length of heat shrinkable sleeving shall be shrunk on a 0.015 to 0.032 inch (0.38 by 0.81 mm) spring steel music wire. There shall be an air gap between the wire and shrunk down sleeving. The specimen shall then be mounted in the same manner and test equipment described in 4.6.15.1. The sleeving shall be mounted by clamping the top so there shall be no chimney effect. There shall also be a flat horizontal layer of untreated surgical cotton placed on the floor of the enclosure (entered under the specimen 9-1/2 inches (24.1 cm) below the point of flame application). The specimen so prepared shall then be tested in accordance with FED-STD-228, Method 5221 for vertical flammability, with the following exceptions:

4.6.15.3.1 Test C procedure. The valve supplying gas to the burner shall be opened to apply the flame to the specimen automatically. The valve shall be held open for 15 seconds, closed for as little as 15 seconds, opened for 15 seconds, etc., for a total of five 15 second applications of the gas flame to the specimen with as little as 15 seconds between applications. In no case shall the gas flame be reapplied to the specimen until any flaming or glowing of the specimen from the previous application of the gas flame ceases of its own accord even though waiting for the specimen to cease flaming or glowing may result in more than 15 seconds between applications of the gas flame. The duration of flaming or glowing of the specimen after each removal of the gas flame shall be recorded.

4.6.15.3.2 Test C observation. Note shall be made and recorded whether any flaming or glowing particles or flaming drops fall from the specimen. If more than 25 percent of the indicator flag is burned away or charred (brown scorching and soot shall be ignored) after all of the five applications of flame or if flaming or glowing particles or flaming drops fall from the specimen at any time and ignite the cotton (flameless charring of the cotton shall be ignored), the specimen shall be judged to have conveyed flame. Any specimen which continues to flame or glow from one flame application longer than one minute shall not be acceptable.

4.6.16 Color stability. A 4 inch (10.2 cm) specimen of sleeving, shrunk as specified in 4.6.5, shall be placed in an air-circulating oven for the time and at the temperature specified in the applicable specification sheet. After removal from the oven, the specimens shall be cooled, conditioned in accordance with 4.6.1, and examined for conformance to the color requirement of the specification sheet.

4.6.17 Clarity stability. A four inch specimen of clear tubing shall be shrunk, as specified in Procedure A of 4.6.6, onto a marked insulated wire. After shrinkdown, the marking shall be legible through the sleeving. The sleeving shall then be exposed for the time and temperature specified in the applicable specification sheet. Conformance to 3.6 and the applicable specification sheet shall be noted.

4.6.18 Extension of Shelf Life Expiration Date. The following examination shall be performed to determine if an expired shelf life date may be extended:

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The as-supplied inside diameter shall be measured in accordance with 4.6.3.1.1. The specimens shall be fully shrunk using the time and temperature specified for unrestricted shrinkage in the specification sheet for the sleeving under examination. Cool the specimen to room temperature and measure the inside diameter in the same manner as before, and the recovered wall thickness in accordance with 4.6.3.2. The measured dimensions shall be compared to the requirements given in Table I of the specification sheet.

## 5. PACKAGING

5.1 Preservation-packaging. Preservation-packaging shall be Level A or Industrial, as specified (see 6.2.1).

5.1.1 Level A.

5.1.1.1 Cleaning. Heat shrinkable insulation sleeving shall be cleaned in accordance with MIL-P-116, Process C-1.

5.1.1.2 Drying. Heat shrinkable insulation sleeving shall be dried in accordance with MIL-P-116.

5.1.1.3 Unit packaging. Heat shrinkable insulation sleeving shall be packaged Method III in accordance with MIL-P-116 and shall be furnished in straight lengths, in coils, on spools, in spool or reel type packages, or in center dispensing coil type packages. Only identical insulation sleeving (type, class, size, color, etc.) shall be contained in any one coil, spool, spool or reel type package, or center dispensing coil type package. Unless otherwise specified (see 6.2.1), there shall be no more than 3 lengths of sleeving on a spool, in a spool or reel type package, or in a center dispensing coil type package; and the length of any piece shall be not less than 25 percent of the total footage on each spool or in each package. Unless otherwise specified (see 6.2.1), a quantity of sleeving considerably less than the manufacturer's standard quantity normally wound on a spool, in a spool or reel type package, or in a center dispensing coil type package may be supplied in a coil of one continuous length.

5.1.1.3.1 Straight lengths. Straight lengths shall be bundled and shall be firmly tied or taped at each end.

5.1.1.3.2 Coils. Coils of heat shrinkable insulation sleeving shall be uniform, compact, and of sufficient diameter to prevent creasing or kinking of the sleeving. Each individual coil shall be firmly tied, taped, or otherwise secured at a minimum of three places equidistantly spaced around the circumference of the coil.

5.1.1.3.3 Spools. Unless otherwise specified (see 6.2.1), spools shall be of a type, size, construction, and material normally used for the product in good industry practice. The heat shrinkable insulation sleeving shall be evenly wound on spools in accordance with good industry practice to obtain uniformity, compactness, and nesting of successive turns and layers. The end of the sleeving shall be secured by a suitable means to prevent unwinding.

5.1.1.3.4 Spool or reel type packages. Spool or reel type packages for containing and dispensing heat shrinkable insulation sleeving shall be of fiberboard, plastic, or composition material and shall be completely self-contained protective units or boxes from which the sleeving can be withdrawn



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without disassembly of the unit or box. The construction of the package shall be such as to provide either a stationary or movable spool or reel within the unit or box. The end of the heat shrinkable insulation sleeving shall be secured to prevent unwinding.

**5.1.1.3.5 Center dispensing coil type package.** Center dispensing coil type package shall be of the type, size, construction, and material normally used for the product in good industry practice. Generally, this package is a corrugated fiberboard box with a perforated disc in one side. When dispensing is desired, the disc is removed and the end of the sleeving is withdrawn through the hole. Continuous dispensing is made from the inside circumference of the coil of sleeving packaged in the box.

**5.1.2 Industrial.** Heat shrinkable insulation sleeving shall be packaged in accordance with ASTM D3951.

**5.2 Packing.** Packing shall be Level A, B, or Industrial, as specified (see 6.2.1). Exterior containers shall be of minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practical.

**5.2.1 Level A.** Heat shrinkable insulation sleeving packaged as described in 5.1 shall be packed in fiberboard containers conforming to:

- a. PPP-B-636, Class Weather Resistant, Style RSC, special requirement. In lieu of the closure and waterproofing requirements in the appendix of PPP-B-636, closures and waterproofing shall be accomplished by sealing all seams, corners, and manufacturer's joint with an exterior waterproof tape, 2 inches (5.1 cm) minimum width, conforming to PPP-T-60. Banding (reinforcing requirements) shall be applied in accordance with the appendix to PPP-B-636 using tape banding only.
- b. PPP-B-640, Class 2, Style RSC, closure and reinforcing shall be in accordance with the appendix therein. When more than one coil or spool is packed to a shipping container, the coils or spools shall be separated both vertically and horizontally by fiberboard sheets.

**5.2.2 Level B.**

**5.2.2.1 Straight lengths, coils, spools.** Straight lengths, coils, and spools of heat shrinkable sleeving shall be packed in containers conforming to PPP-B-636, Class-Domestic, Style RSC, special requirement or PPP-B-640, Class 1. Closure and reinforcing shall be in accordance with the applicable container specification.

**5.2.2.2 Spool or reel type package or center dispensing coil type package.** Packages as described in 5.1.1.3.4 and 5.1.1.3.5 generally do not require additional packing for shipment since the unit package may serve also as the shipping container; however, to facilitate handling, loading, etc., small packages may be packed as described in 5.2.2.1.

**5.2.3 Industrial.** Heat shrinkable insulation sleeving shall be packed in accordance with ASTM D3951.



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5.3 Unitized loads. Unitized loads should be used when practical and shall be commensurate with the level of packing stated in the contract or order (see 6.2.1). MIL-STD-147 shall be used when loads are palletized.

5.4 Marking. Coils, packages, shipping containers, and unitized loads shall be marked in accordance with MIL-STD-129.

5.4.1 Additional markings.

- a. Date manufactured.
- b. Expiration date.
- c. Lot, batch, or control number.
- d. Special marking as required in the specification sheet.
- e. Other markings required by the contract or order.

6. NOTES

6.1 Intended use. Heat shrinkable sleeving is intended for use as a snug-fitting electrical insulator over wire bundles, splices, cables, cable harnesses, bus bars, connectors and terminals, metal or fibrous tubing, hydraulic line couplers, high voltage tubes, flexible wave guides and rectifier leads, as extra insulation over hot spot areas, and as a cable blast shield in rocket launching. Specific property values in Section 3 and in the specification sheets should be evaluated for the particular use intended. When a complete moistureproof seal is required, the manufacturer may recommend the use of a suitable sealant at the ends of the sleeving. Heat shrinkable sleeving can be marked before shrinking and be used to identify materials that cannot be marked directly such as unjacketed wire, shielded wire, thermocouple wires, multiconductor cable, asbestos, and fiberglass. Markings shall be in accordance with procedures in MIL-M-81531. It should be noted that the wall thickness dimension in the specification sheet or manufacturer's data sheet refers to the sleeving after unrestricted shrinkage; if shrinkage is restricted by the object to be enclosed, wall thickness will be less. Specification sheet (The particular uses for heat shrinkable sleeving are dependent upon the specific properties described by the individual specification sheets). General end use applications follow:

/1: Intended for use on heavy duty cables or harness systems such as ground support.

/2 and /3: Inactive for new design. Shall not be used in any application when outgassing is a problem.

/4: For one step potting, encapsulation, or moisture sealing and corrosion protection of electrical components or terminations.

/5: Used for light duty harness jackets, wire color coding, marking, or identification.

/6: Used for wire identification, marking, or strain relief.

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- /17: Used for light duty wire identification and component covering.
- /18: Used for wire or termination strain relief at elevated temperatures.
- /19: Cancelled.
- /110: Used for high or low temperature applications or where ablation resistance in high blast flame is required.
- /111: Used where strain relief is necessary at high temperatures.
- /112: Used at high temperatures where resistance to flame is important to protect high temperature cable, components, and terminations.
- /113: Use in elevated temperature applications or where exposure to elevated temperature solvents is expected.
- /114: Used as component and electronic lead strain relief where low expansion ratios are satisfactory. Operates over fairly wide temperature range.
- /115: Used for repair of heavy duty cables, splice covers.
- /116: Used on heavy duty cables and harness systems, which see high levels of physical abuse, and requires resistance to fuels and oils coupled with high and low temperature extremes.
- /117: Used for see through wire identification where flame resistant properties are required.

## 6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification, applicable specification sheet, and sleeving class.
- b. Part number (including color designation) (see 1.2.2).
- c. Quantity, total footage (unit of issue = feet).
- d. Sleeving length on reels, spools, etc., or straight length if other than specified in 3.3.4.2
- e. Dielectric constant (only if required for a special application) and frequency at which dielectric constant is measured (see 3.4.2).
- f. Specific gravity if required (see 3.4.2).
- g. Tests specified by the acquisition activity (see applicable specification sheet).
- h. Waiver or requirement for number of individual lengths on a spool if required for a specific type of sleeving (see 5.1.1.3).

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- i. Levels of packaging and packing (see 5.1 and 5.2).
- j. Type, size, construction, and material of spool if other than specified (see 5.1.1.3.2).
- k. First Article approval, if required (see 4.3).

6.2.2 Contracts or orders shall specify the following provisions for First Article inspection (see 4.3).

6.2.2.1 Whether First Article inspection is required. When a contractor is in continuous production of the sleeving from contract to contract, consideration should be given to waive the First Article inspections within the time limitations specified in 4.3.1. If inspection is required, indicate: (at the contractor's plant or Government or commercial laboratory).

- b. Scheduling of First Article inspection. As soon as practicable during the course of the contract, the contractor shall prepare for First Article testing. Prior to the start of testing, the contractor shall notify the acquisition activity in sufficient time to allow representation during the tests.
- c. That the approval of First Article samples or the waiving of the First Article inspection shall not relieve the contractor of his obligation to fulfill all other requirements of the specifications and contract.

6.3 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement ABC-NAVY-STD-17, Electrical Insulating Materials. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.4 Cross-reference. Cross-reference data, when applicable, is located in the individual specification sheets.

## Custodians

Army - ER  
Navy - AS  
Air Force - 85

## Review activities

Army - EA, MI, MU  
Navy - EC  
Air Force - 80  
DLA - GS

## Preparing activity:

Navy - AS

(Project 5970-0577)

## User activities

Army - ME  
Navy - MC, SH

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TABLE I. Reel lengths.

ID, as supplied, inch (mm)	Minimum length, feet (m)
.015 to 0.63 (.38 to 1.60)	500 (152.4)
.064 to .499 (1.60 to 12.7)	200 (61.0)
.500 to 1.00 (12.7 to 25.4)	100 (30.5)
over 1.00 (over 25.4)	50 (15.2)

TABLE II. Properties after unrestricted shrinkage.

Characteristics	Requirement	Test method
Color	MIL-STD-104 <u>3/</u>	Visual inspection
Color stability	Conform to "as received" limits	4.6.16
Clarity stability	3.6 and specification sheet	4.6.17
Specific gravity	Specification sheet	ASTM D 792
Dielectric constant	Specification sheet	ASTM D 150
Odor	No pungent odor	4.6.12
Fungus resistance	Specification sheet	ASTM G-21
Tensile strength	Specification sheet	4.6.14
Ultimate elongation	Specification sheet	4.6.14
Dielectric strength	Specification sheet	ASTM D 2671
Volume resistivity	Specification sheet	ASTM D 876
Low temperature flexibility	Specification sheet	4.6.7
Corrosion	Specification sheet	<u>1/</u>
Heat resistance	Specification sheet	4.6.9

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TABLE II. Properties after unrestricted shrinkage. - Continued

Characteristics	Requirement	Test method
Water absorption	Specification sheet	ASTM D 570, 24hrs at 230°C <u>2/</u>
Flammability	Specification sheet	4.6.15
Fluid resistance	Specification sheet	4.6.11
Sealing efficiency	MIL-I-23053/4	MIL-I-23053/4

1/ See specification sheet for test method.

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

3/ For pink and tan color limits see 3.3.1.5.

TABLE III First Article size ranges

Size range	I.D. (mm), inch, as supplied
1	.000 to .045 (.000 to 1.15 mm)
2	.046 to .186 (1.16 to 4.74mm)
3	.187 to .999 (4.75 to 25.39mm)
4	1.00 to 4.00 (25.4 to 101.6mm)
5	All larger sizes

TABLE IV. Visual and dimensional inspection.

Inspection	Requirement	AQL, percent defective
Workmanship, as supplied:	3.8	2.5
ID	3.3.1	1.0
Straight length size <u>1/</u>	3.3.4	1.0
Spool, coil length <u>2/</u>		<u>3/</u>
Concentricity	3.7	1.0
After unrestricted shrinkage:		
ID	3.3.2	1.0
Wall thickness	3.3.2	1.0
Longitudinal change	3.3.3	1.0
Color	3.4.1.5	Zero defect

1/ The lot size shall be the number of straight lengths; the sample unit--one straight length.

## MIL-I-230530

- 2/ The lot size shall be the number of spools, coils, etc.; the sample unit--one spool.
- 3/ If the average length per spool of the selected samples is less than the quantity per spool specified in the contract or order, the lot represented by the sample shall be rejected.

TABLE V. First Article Inspection

Property	Require- ment	Number of determinations per samples	Results reported as	
			Pass or fail <u>1/</u>	Average of multiple determina- tions <u>2/</u>
Inside diameter, as supplied	3.3.1	Two	X	
Inside diameter, after, unrestricted shrinkage	3.3.2	Two	X	
Wall thickness, after, unrestricted shrinkage	3.3.2	Two	X	
Longitudinal change	3.3.3	Two	X	
Minimum straight length size	3.3.4	One	X	
Tubing length on a spool, coil, etc.	3.3.4	One		X
Color	3.4.1.5	One	X	
Color stability	3.4.2	Three	X	
Clarity stability	3.6	Three	X	
Concentricity	3.7	Three	X	
Workmanship	3.8	One	X	
Specific gravity	3.4.2	Three		X
Dielectric constant	3.4.2	Three		X
Fungus resistance	3.4.2	Three	X	
Corrosion	3.4.2	Three	X	
Odor	3.4.2	Three	X	
Tensile strength	3.4.2	Five		X
Ultimate elongation	3.4.2	Five		X
Dielectric strength	3.4.2	Five	X	
Volume resistivity	3.4.2	Three	X	
Low temperature flexibility	3.4.2	Three	X	
Heat resistance	3.4.2	<u>3/</u>		<u>3/</u>
Water absorption	3.4.2	Three		<u>X</u>
Flammability	3.4.2	Three	X	
Fluid resistance	3.4.2	<u>3/</u>		<u>3/</u>
Sealing efficiency	3.4.2	Three	X	
Heat shock	3.4.1.1	Three	X	
Restricted shrinkage	3.4.1.2	Three	X	
Shelf life	3.5.1	Three	X	
Shelf life extension	3.5.2	Three	X	X
Cold impact	3.4.1.4	Three	X	
Modulus	3.4.1.3	Five		X

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TABLE V. First Article inspection. - Continued

- 1/ Nonconformance of one determination shall constitute failure of the sample. A description or the numerical point of the failure shall also be recorded.
- 2/ All values on which the average is based shall be recorded.
- 3/ Sample must pass all requirements in the specification sheet. See tensile strength, ultimate elongation and dielectric strength (as applicable) for number of determinations per sample and reporting of results.

TABLE VI. Physical Property Tests. 1/

Property	Test
Tensile and Elongation	4.6.14
Low Temperature Flex or Cold Impact	4.6.7
Heat Shock	4.6.8
Secant Modulus or Tensile Stress	4.6.13
Flammability	4.6.15
Color Clarity	4.6.17

- 1/ The acquisition activity, at its option, may require conformance to any additional requirements specified herein.

TABLE VII. Packaging inspection.

Examine	Defect
Packaging	Not level required by contract or purchase order. Material or construction not as specified.
Packing	Not level required by contract or purchase order. Material or construction not as specified. Any nonconforming component, incomplete closures, inadequate strapping, bulged or damaged containers.
Count	Less than specified or indicated quantity per shipping container.
Markings	Warning labels or marking missing. Omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.



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TABLE VIII. Mandrel sizes for bend tests.

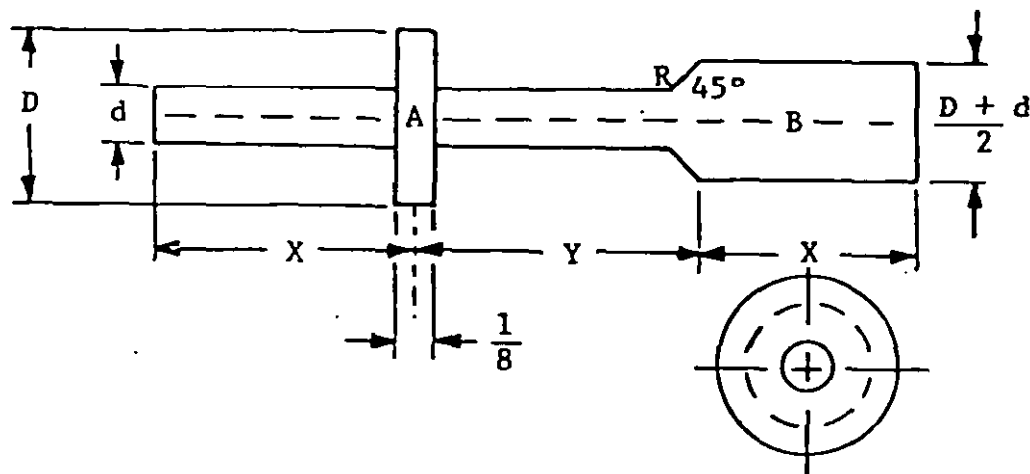
Nominal sleeving ID (maximum, after unrestricted shrinkage), inches (mm)	Mandrel diameter 1/, inches (mm)
0.023 to 0.125 (.60 - 3.2)	5/16 plus/minus 0.002 (7.9 plus/minus .05)
0.126 to 0.250 (3.2 - 6.4)	3/8 plus/minus 0.003 (9.5 plus/minus .08)
0.251 to 1.000 (6.4 - 25.4)	7/16 plus/minus 0.004 (11.1 plus/minus .10)
1.001 to 2.000 (25.4 - 50.8)	7/8 plus/minus 0.005 (22.2 plus/minus .13)
2.001 to 3.000 (50.8 - 76.2)	1 plus/minus 0.005 (25.4 plus/minus .13)
3.001 to 4.000 (76.2 -101.6)	1-1/8 plus/minus .005 (31.8 plus/minus .13)

1/ Unless otherwise specified in the specification sheet.

TABLE IX. Test fluids.

Fluid	Conforming to
Hydraulic fluid, petroleum base	MIL-H-5606
JP-4	MIL-T-5624
Lubricating oil	MIL-L-7808
Lubricating oil	MIL-L-23699
5 percent NaCl	O-S-1926
Deicing fluid	MIL-A-8243

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$d$  = max. I. D. of sleeving, nominal, after unrestricted shrinkage  $^{+5}_{-0}$  percent.

$D$  = min. I.D., nominal, of "as supplied" sleeving  $^{+0}_{-5}$  percent.

$A$  = That part of the mandrel shaped as shown with a width of  $\frac{1}{8}$  inch and a diameter  $D$ .

$B$  = That part of the mandrel shaped as shown with a  $45^\circ$  angel between the  $\frac{D + d}{2}$  and  $d$  dimensions.

All edges involved in this mandrel shall have no burrs.

Section B can be provided with a longitudinal V-groove to allow easy cutting off of the sample with a Knife or razor blade after the testing is complete.

Max. I.D. of sleeving (nominal) after unrestricted shrinkage in inches	Mandrel section in inches	
	X	Y
Less than 0.050 1/	0.5	0.25
0.050 to 0.125	0.5	0.25
0.126 to 0.374	1	0.5
0.375 to 2.000	2	2
2.001 to 3.000	3	3
3.001 to 4.000	4	4
4.001 to 5.000	5	5

1/ For sleeving sizes less than 0.050 I. D. inch (after unrestricted shrinkage), a straight cylindrical mandrel shall be made with an O.D. equal to  $D$ .

Figure 1. Restricted shrinkage mandrel

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-I-23053D		2. DOCUMENT TITLE INSULATION SLEEVING, ELECTRICAL, HEAT SHRINKABLE GENERAL SPECIFICATION FOR	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
3b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		8. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		9. DATE OF SUBMISSION (YYMMDD)	

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

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82 MAR

PREVIOUS EDITION IS OBSOLETE.