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Trusted technology, reliable protection and insulation.

3M™ Heat Shrink Tubing and Devices
Product Catalog

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3M™ Heat Shrink Tubing Selection Guide

Product	Material/Typical Applications	Operating Temperature Range	Shrink Temp. (Min.)	Shrink Ratio	Standard Sizes Expanded Diameter	Dielectric Strength (V/mil)	Volume Resistivity (ohm-cm)	Tensile Strength (Psi)
Single-Wall Polyolefin Tubing								
FP-301	**Flexible Polyolefin** General purpose flame retardant insulation for UL, CSA and MIL-DTL-23053/5 applications; cable and component covering. Class 1 = opaque colors; Class 2 = clear.	–55°C to +135°C	212°F 100°C	2:1	3/64" to 4"	900	10^{15}	2400
FP-301VW	**Highly Flame-Retardant, Flexible Polyolefin** Insulation applications, flame-retardant applications requiring UL VW-1 and CSA OFT, fire-resistant wiring.	–55°C to +135°C	212°F 100°C	2:1	3/64" to 4"	900	10^{15}	2400
VFP-876	**Very Flexible Polyolefin** Terminal insulation, low shrink-temperature applications.	–55°C to +135°C	212°F 100°C	2:1	3/64" to 2"	800	10^{14}	2100
SFTW-203	**Very Flexible Polyolefin** Shrink-fit jacketing and insulation of flexible wire bundles and temperature-sensitive components.	–55°C to +135°C	212°F 100°C	3:1	1/16" to 1 1/2"	700	10^{15}	2600
Adhesive-Lined, Polyolefin Tubing								
MW	**Multiple Wall Polyolefin** Insulation, strain relief and sealing of electrical connections, wire splices and components.	–55°C to +110°C	275°F 135°C	2.5:1	1/8" to 1"	900	10^{15}	2200
EPS-200	**Environmental Protection Sleeve** Insulation, strain relief and environmental protection of electrical wire bundles and components.	–55°C to +110°C	250°F 121°C	2:1	1/8" to 2"	800	10^{14}	2100
EPS-300	**Environmental Protection Sleeve** Insulation, strain relief and environmental protection for automotive and marine wire bundles and splices.	–55°C to +110°C	250°F 121°C	3:1	1/8" to 1-1/2"	700	10^{14}	2100
EPS-400	**Environmental Protection Sleeve** Insulation, strain relief and environmental protection for sealing voids in multiple wire bundles for automotive and marine applications.	–55°C to +110°C	250°F 121°C	4:1	.300" to .700"	700	10^{14}	1900
TMW	**Semi-Rigid Multiple Wall Terminal Protection Sleeve** Insulation, strain relief and environmental protection. Uses include the manufacture of heat shrink butt connectors, ring terminals and fork terminals.	–55°C to +110°C	275°F 135°C		.183" to .330"	900	10^{14}	2500
TES SMS	All-Weather, Heat-Shrinkable, Dual Wall, Polyolefin Tubing for Automotive Wire Harnesses.	–55°C to +110°C	250°F 121°C	4:1 4:1	.220" to .700"	500	10^{14}	2450 1900
Special Purpose Tubing								
MFP	**Polyvinylidene Fluoride** Heat-resistant transparent insulation and marking for electronic and appliance applications.	–55°C to 175°C	347°F 175°C	2:1	3/64" to 1"	900	10^{14}	5500
NST	**Modified Neoprene** Insulation and abrasion resistant covering of wiring and cable harnesses. Oil resistant coverings.	–70°C to +121°C	275°F 135°C	2:1	1/8" to 3"	800	10^{12}	2100
VTN-200	**Fluoroelastomer** Synthetic fuel and hydraulic oil resistant applications, high-temperature coverings.	–55°C to +200°C	347°F 175°C	2:1	1/8" to 2"	500	10^{12}	2400
PSTH	**Flexible Elastomeric Polyester** Designed for harsh operating conditions.	–55°C to +150°C	338°F 170°C	2:1	3/16" to 2"	500	10^{14}	2200
Heavy-Duty Tubing								
MDT	**Medium-Duty** Excellent abrasion, corrosion and environmental protection. Flame retardant.	–55°C to +110°C	250°F 121°C	3:1	.400" to 4.30"	500	10^{14}	2400
HDT	**Heavy-Duty** Fabricated from specially formulated cross-linked polyolefin, assuring long-term environmental protection. Highly chemical, abrasion and split resistant.	–55°C to +110°C	250°F 121°C	3:1	.300" to 7.00"	500	10^{14}	2400
BBI	**Bus Bar Tubing**, Designed for insulating rectangular, square, or round bus bar rated 5 kV through 35 kV.	–55°C to +110°C	250°F 121°C		2.38" to 10.28"	550	10^{13}	2200

Note: The materials are rated on a scale of 1–10 for flexibility:
1 = most flexible and 10 = most rigid.
*Material characteristics only.

Ultimate Elongation (%)	Longitudinal Change (± %)	Specific Gravity	Flammability	Corrosive Effect	Abrasion Resistance	Flexibility (see note below)	Fuel & Oil Resistance	Solvent Resistance	Resistance To Acids and Alkalis	Applicable Specifications
400	5	1.3	Self-Extinguish meets UL 224 All-Tubing Flame Test (except clear)	Non-Corrosive	Good	3	Good	Exc.	Exc.	SAE-AMS-DTL-23053/5*, Class 1, 2; UL File E-39100; CSA LR38227
400	+1, –10	1.5	Self-Extinguish meets UL 224 VW-1 Test	Non-Corrosive	Good	3	Good	Exc.	Exc.	SAE-AMS-DTL-23053/5*, Class 3; UL File E-39100, VW-1; CSA LR38227, OFT
450	5	1.3	Self-Extinguish meets UL 224 All-Tubing Flame Test	Non-Corrosive	Good	2	Good	Exc.	Exc.	SAE-AMS-DTL-23053/5*, Class 1; UL File E-39100; CSA LR38227
400	5	1.29	Self-Extinguish	Non-Corrosive	Good	3	Good	Good	Exc.	UL File E-48398; CSA LR38227 Meets functional requirements of SAE-AMS-DTL-28053/5, Class 1
400	+1, –10	1.0	Non-Flame Retardant	Non-Corrosive	Good	7	Good	Good	Exc.	SAE-AMS-DTL-23053/4*, Class 1; UL File E-157227; CSA LR38227
450	+1, –5	1.3	Self-Extinguish meets UL 224 All-Tubing Flame Test (jacket)	Non-Corrosive	Good	3	Good	Good	Exc.	SAE-AMS-DTL-23053/4*, Class 2; UL File E-39100; CSA LR38227
450	+1, –15	1.3	Self-Extinguish meets UL 224 All-Tubing Flame Test (jacket)	Non-Corrosive	Good	3	Good	Good	Exc.	UL File E-157227; CSA LR38227
400	+1, –10	1.25	Self-Extinguish	Non-Corrosive	Good	7	Good	Good	Exc.	UL File E-157227; CSA LR38227
400	+1, –10	1.0	Non-Flame Retardant	Non-Corrosive	Good	7	Good	Good	Exc.	UL File E-157227; CSA LR38227
450 350	+0, -10 +0, -10	0.97 1.25	TES Non-Flame Retardant SMS Self-Extinguish	Non-Corrosive Non-Corrosive	Good Good	TES 5 SMS 3	Good Good	Good Good	Exc. Exc.	ESB-M99D56-Ford MS-DB56-Chrysler
350	+1, –10	1.7	Self-Extinguish meets UL 224 VW-1 Test	Non-Corrosive	Exc.	10	Exc.	Exc.	Exc.	Meets performance claims of SAE-AMS-DTL-23053/18*, Class 1; SAE-AMS-DTL-23053/8*; UL File E-39100, VW-1, CSA LR38227 OFT
500	+1, –10	1.3	Self-Extinguish	Non-Corrosive	Exc.	1	Exc.	Good	Exc.	SAE-AMS-DTL-23053/1*, Class 1, 2; UL File E-39100; SC-X-15112
450	+1, –10	1.7	Self-Extinguish	Non-Corrosive	Exc.	4	Exc.	Exc.	Exc.	SAE-AMS-DTL-23053/13*
350	+2, –8	1.6	Self-Extinguish	Non-Corrosive	Exc.	4	Exc.	Exc.	Exc.	SC-X15111C; meets the functional requirements of SAE-AMS-DTL-23053/16*
475	+1, –10	1.28	Self-Extinguish	Non-Corrosive	Good	8	Good	Good	Exc.	SAE-AMS-DTL-23053/15*, Class 2
475	+1, –10	1.28	Self-Extinguish	Non-Corrosive	Good	9	Good	Good	Exc.	SAE-AMS-DTL-23053/15*, Class 1
575	+0, –10	1.20	Self-Extinguish	Non-Corrosive	Good	8	Good	Good	Exc.	ASTM-D-257, 149, 150, 2303; IEC 216; ANSI/IEEE Std C37.20

*Formerly MIL+23053 and MIL-DTL-23058 for sheet number noted after slash mark.

3M Heat Shrink Products

3M™ Heat Shrink Products provide an effective means of applying skintight insulating and protective coverings for a wide variety of electrical, electronic and mechanical applications.

3M is committed to providing its customers with quality, service and quick delivery. Our people are professionally trained in the use of 3M's heat shrink products, so they can assist you with information and guide you to the right product for your specific needs.

Worldwide service

3M products, from tape to test equipment, are respected worldwide for their innovative features and reliable properties. 3M's service includes an excellent product at a fair price, application information, employee and field service training including instruction sheets and technical papers, easy access to 3M personnel through a toll-free number, and laboratory and technical service support from 3M operations worldwide. When you choose 3M, you choose more than a vendor, you choose a premier provider. You'll receive a quality product that will perform reliably and a company that is dedicated to responding to your needs — now and in the future.

Meeting performance requirements

3M heat shrink products offer the important advantages of simple installation, improved performance and long-term reliability. They are abrasion resistant, withstand heat, corrosion, moisture and other hostile environments and offer excellent dielectric properties. Benefits can include cost, size and labor savings as well as enhanced product appearance.

Materials are specifically developed to meet demanding performance requirements and are manufactured under stringent quality-assurance standards. 3M heat shrink products meet or exceed the requirements of most military, commercial and industrial OEM specifications. They have proven their effectiveness in the most demanding environments including outer space, undersea and underground.

In addition to the standard product line, 3M offers the capability to meet special requirements for custom-designed and manufactured heat shrink products. Research, development and testing laboratories exist in combination with complete facilities for production-scale compounding, processing and cross-linking of polymeric materials. 3M also offers technical service and engineering support to assist you in evaluating your specific application needs.

Cross-linking

Products such as 3M Heat Shrink Tubing FP-301 are fabricated from specially modified polyolefin. Cross-linking converts the polyolefin, a meltable or thermoplastic material, into a non-melting, thermoset material and imparts a permanent "memory" to the polyolefin. This permits the material to be supplied in the expanded state and, with the application of heat, shrink to its original size.

In the process, the polyolefin is transformed into an entirely new class of high temperature material with significantly improved properties including increased temperature resistance, improved mechanical properties, solvent and chemical resistance, and thermal stability.

Cross-linking is used to enhance or alter one or more of the physical, chemical or electrical properties of a wide variety of polymers, such as polychloroprene, polyvinylidene fluoride, and other fluoropolymers. The combined application of cross-linking and polymer chemistry leads to the creation of specialized, high-performance heat shrink products offering characteristics that are excellent when compared to the already proven properties of the polymeric base material.

Broad product range

3M offers a range of products based on heat shrink technology, including tubing, solder splice connectors and molded parts.

Product availability

All 3M heat shrink tubing and splicing products and pricing are available through your local 3M distributor.

To contact your local distributor or sales rep, refer to the 800 number listed on the back cover.

3M™ Single-Wall Polyolefin Tubing

- Meets UL/CSA specifications
- Meets military specifications
- Flame retardant
- Abrasion and tear resistant
- Chemical and solvent resistant
- 135°C (275°F) continuous operating temperature
- Easily marked
- Choice of colors and sizes

3M™ Heat Shrink Tubing FP-301

Flexible Polyolefin; Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing FP-301 offers an excellent balance of electrical, physical and chemical properties for a wide variety of industrial and military applications. Rated for 135°C (275°F) continuous operation, all 3M FP-301 tubing is split resistant, mechanically tough, easily marked and resists cold flow.

3M FP-301 tubing meets AMS-DTL-23053/5* Class 1 & 2 requirements. It is UL Recognized and CSA Certified at 600 volts at 125°C (257°F) (UL File No. E-39100; CSA No. 38227).

3M FP-301 tubing is rated for continuous operation from –55°C (–67°F) to 135°C (275°F) and withstands elevated temperatures to 300°C (572°F) for short periods. Minimum shrink temperature for all 3M FP-301 tubing is 100°C (212°F).

Typical applications

3M FP-301 tubing is typically used as a shrink-fit electrical insulation over cable splices and terminations. It is also used for lightweight wire harness covering, wire marking, wire bundling, component packaging and fire-resistant covering.

Shrink ratio

3M FP-301 polyolefin tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its as-supplied internal diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

High expansion-ratio 3M FP-301 tubing meeting AMS-DTL-23053/5* Class 1 requirements for overexpansion is available subject to factory quotation.

Colors

Class 1 (flame retardant): black. Class 2 (non-flame retardant): clear. Also available in Class 1: blue, green, red, white and yellow. Price, minimum order quantity and lead times will vary for these, however.

Standard packaging

Four-foot lengths, large spools (21" diameter) and small spools (8-1/2" diameter).

Ordering information

Order 3M FP-301 tubing by product name, size equivalent to expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the item to be covered. *Example: FP-301 tubing, 1/4", 4 ft., white.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. † (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
3/64	.046	(1,17)	.023	(0,58)	.016	(0,41)
1/16	.063	(1,60)	.031	(0,79)	.017	(0,43)
3/32	.093	(2,36)	.046	(1,17)	.020	(0,51)
1/8	.125	(3,18)	.062	(1,57)	.020	(0,51)
3/16	.187	(4,75)	.093	(2,36)	.020	(0,51)
1/4	.250	(6,35)	.125	(3,18)	.025	(0,64)
3/8	.375	(9,53)	.187	(4,75)	.025	(0,64)
1/2	.500	(12,70)	.250	(6,35)	.025	(0,64)
3/4	.750	(19,05)	.375	(9,53)	.030	(0,76)
1	1.000	(25,40)	.500	(12,70)	.035	(0,89)
1-1/2	1.500	(38,10)	.750	(19,05)	.040	(1,02)
2	2.000	(50,80)	1.000	(25,40)	.045	(1,14)
3	3.000	(76,20)	1.500	(38,10)	.050	(1,27)
4	4.000	(101,60)	2.000	(50,80)	.055	(1,40)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
SAE-AMS-DTL-23053/5*†, Class 1, 2; UL File E-39100; CSA LR38227

Physical	
Tensile Strength	2400 PSI
Ultimate Elongation	400%
Longitudinal Change	±5%
Secant Modulus (2%)	13,000 PSI
Specific Gravity	1.3 (Black) .93 (Clear)
Heat Aging (336 hrs. @ 175°C)	Elongation 175%
Heat Shock (4 hrs. @ 250°C)	No dripping, cracking, passes mandrel wrap test
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish meets UL 224 All-Tubing Flame Test (Class 1 only)

Electrical	
Dielectric Strength	900 V/mil
Volume Resistivity	10^{15} ohm-cm

Chemical	
Corrosive Effect	Non-corrosive
Solvent Resistance	
Tensile Strength	1000 PSI
Dielectric Strength	400 V/mil
Water Absorption	0.2%
Fungus Resistance	Non-nutrient

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Formerly MIL+23053/5 and MIL-DTL-23053/5
† Product meets functional but not dimensional requirements

3M™ Heat Shrink Tubing Kits FP-301

Heat Shrink Tubing Kits and Refill Packs; Shrink Ratio 2:1

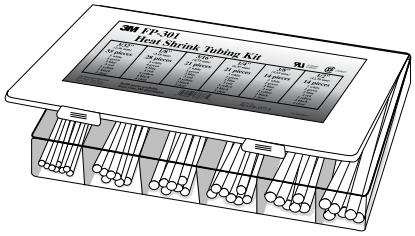
Product Description

The 3M Heat Shrink Tubing Kits FP-301 are a versatile assortment of flexible polyolefin heat shrink tubing. The kits are available in two different types: Assorted Colors or Black only. Each box is 7" x 11" x 2 1/2" (177.7 × 279.3 × 63.4 mm) of rugged translucent plastic with product and installation information on the cover. Both heat shrink kits allow an engineer, designer or technician to have a complete selection of popular sizes and colors for small projects and product development programs.

The **Assorted Color Kit** has a total of 133 pieces and contains seven colors: black, red, white, yellow, blue, green and clear. The Assorted Color Kit contents, by expanded diameter, are listed in the chart below.

The **Black Kit** contains 102 pieces, all of 6 inch (152.4 mm) lengths. The Black Kit contents, by expanded diameter, are listed in the chart below.

Each diameter has a corresponding refill pack that allows the customer to repurchase a single package of a specific diameter to replenish the kit. 3M FP-301 tubing is a 2:1 shrink ratio polyolefin heat-shrinkable tubing that is widely used in a variety of electronic and electrical applications.



Assorted Colors Kit

Description	Size	Pieces
FP-301	3/32" (2,36 mm)	35
FP-301	1/8" (3,18 mm)	28
FP-301	3/16" (4,75 mm)	21
FP-301	1/4" (6,35 mm)	21
FP-301	3/8" (9,53 mm)	14
FP-301	1/2" (12,70 mm)	14

Assorted Colors* 6" Refill Packs

Ordering Size	Quantity	Packs/Carton
3/32" (2,36 mm)	35 pieces	10
1/8" (3,18 mm)	28 pieces	10
3/16" (4,75 mm)	21 pieces	10
1/4" (6,35 mm)	21 pieces	10
3/8" (9,53 mm)	14 pieces	10
1/2" (12,70 mm)	14 pieces	10

* 7 different colors in each pack

Black Kit

Description	Size	Pieces
FP-301	3/16" (4,8 mm)	30
FP-301	1/4" (6,4 mm)	28
FP-301	3/8" (9,6 mm)	20
FP-301	1/2" (12,7 mm)	14
FP-301	3/4" (19,1 mm)	6
FP-301	1" (25,4 mm)	4

Black 6" Refill Packs

Ordering Size	Quantity	Packs/Carton
3/16" (4,75 mm)	30 pieces	10
1/4" (6,35 mm)	26 pieces	10
3/8" (9,53 mm)	24 pieces	10
1/2" (12,70 mm)	20 pieces	10
3/4" (19,05 mm)	14 pieces	10
1" (25,40 mm)	10 pieces	10

3M™ Heat Shrink Tubing FP-301VW

Flexible Polyolefin; Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing FP-301VW has the same excellent balance of electrical, physical and chemical properties as 3M FP-301 tubing and is specially engineered for excellent flame resistance.

3M FP-301VW tubing meets AMS-DTL-23053/5*, Class 3 requirements. It is UL Recognized and CSA Certified at 600 volts at 125°C (UL File Nos. E-39100 and VW-1; CSA No. 38227, OFT).

3M FP-301VW tubing is rated for continuous operation from –55°C (–67°F) to 135°C (275°F) and withstands elevated temperatures to 300°C (572°F) for brief periods. Minimum shrink temperature for all 3M FP-301VW tubing is 100°C (212°F).

Typical applications

3M FP-301VW tubing is ideal for fire-resistant coverings of components and flammable wire assemblies.

Shrink ratio

3M FP-301VW tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its as-supplied internal diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery. High expansion ratios are available subject to factory quotation.

Colors

Standard color is black. Also available in blue, clear, green, red, white and yellow. Price, minimum order quantity and lead time will vary for these, however.

Standard packaging

Four-foot lengths or large spools. Cut pieces available subject to factory quotation.

Ordering information

Order 3M FP-301VW tubing by product name, size equivalent to expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the item to be covered. Example: FP-301VW tubing, 1/4", 4 ft., white.

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
3/64	.046	(1,17)	.023	(0,58)	.016	(0,41)
1/16	.063	(1,60)	.031	(0,79)	.017	(0,43)
3/32	.093	(2,36)	.046	(1,17)	.020	(0,51)
1/8	.125	(3,18)	.062	(1,57)	.020	(0,51)
3/16	.187	(4,75)	.093	(2,36)	.020	(0,51)
1/4	.250	(6,35)	.125	(3,18)	.025	(0,64)
3/8	.375	(9,53)	.187	(4,75)	.025	(0,64)
1/2	.500	(12,70)	.250	(6,35)	.025	(0,64)
3/4	.750	(19,05)	.375	(9,53)	.030	(0,76)
1	1.000	(25,40)	.500	(12,70)	.035	(0,89)
1-1/2	1.500	(38,10)	.750	(19,05)	.040	(1,02)
2	2.000	(50,80)	1.000	(25,40)	.045	(1,14)
3	3.000	(76,20)	1.500	(38,10)	.050	(1,27)
4	4.000	(101,60)	2.000	(50,80)	.055	(1,40)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
SAE-AMS-DTL-23053/5*, Class 3; UL File E-39100, VW-1; CSA LR38227, OFT

Physical	
Tensile Strength	2400 PSI
Ultimate Elongation	400%
Longitudinal Change	+1, –10%
Secant Modulus (2%)	13,000 PSI
Specific Gravity	1.5
Heat Aging (168 hrs. @ 175°C)	Elongation (175% min)
Heat Shock (4 hrs. @ 250°C)	No dripping, cracking, passes mandrel wrap test
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish meets UL 224VW-1 Test

Electrical	
Dielectric Strength	900 V/mil
Volume Resistivity	10^{15} ohm-cm

Chemical	
Corrosive Effect	Non-corrosive
Solvent Resistance	
Tensile Strength	1000 PSI
Dielectric Strength	400 V/mil
Water Absorption	0.2%
Fungus Resistance	Non-nutrient

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Formerly MIL+23053/5 and MIL-DTL-23053/5

3M™ Heat Shrink Tubing VFP-876

Very Flexible Polyolefin; Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing VFP-876 is one of the most flexible of the heat-shrinkable, polyolefin tubings. Rated at 135°C (275°F), 3M VFP-876 tubing has been engineered to offer a low shrink temperature of 100°C (212°F). This allows the tubing to shrink rapidly, thereby minimizing heat exposure and possible damage to sensitive substrate materials or components.

3M VFP-876 tubing meets AMS-DTL-23053/5*, Class 1; and AMS-3587 and is UL Recognized (UL File No. E-39100). It is rated for continuous operation from –55°C (–67°F) to 135°C (275°F) and withstands elevated temperatures to 300°C (572°F) for brief periods.

Typical applications

The extra flexibility and low shrink temperature of 3M VFP-876 tubing make it ideal for shrink-fit jacketing and insulation of flexible wire bundles and sensitive components.

Shrink ratio

3M VFP-876 tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its as-supplied internal diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery. High expansion-ratio 3M VFP-876 tubing is available subject to factory quotation.

Standard colors

3M VFP-876 tubing (flame retardant)–black, white and yellow. Other colors and clear available subject to factory quotation.

Standard packaging

Four-foot lengths or large spools. Cut pieces available subject to factory quotation.

Ordering information

Order 3M VFP-876 tubing by product name, size equivalent to expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the item to be covered. *Example: VFP-876 tubing, 1/4", 4 ft., white.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
3/64	.046	(1,17)	.023	(0,58)	.016	(0,41)
1/16	.063	(1,60)	.031	(0,79)	.017	(0,43)
3/32	.093	(2,36)	.046	(1,17)	.020	(0,51)
1/8	.125	(3,18)	.062	(1,57)	.020	(0,51)
3/16	.187	(4,75)	.093	(2,36)	.020	(0,51)
1/4	.250	(6,35)	.125	(3,18)	.025	(0,64)
3/8	.375	(9,53)	.187	(4,75)	.025	(0,64)
1/2	.500	(12,70)	.250	(6,35)	.025	(0,64)
3/4	.750	(19,05)	.375	(9,53)	.030	(0,76)
1	1.000	(25,40)	.500	(12,70)	.035	(0,89)
1-1/2	1.500	(38,10)	.750	(19,05)	.040	(1,02)
2	2.000	(50,80)	1.000	(25,40)	.045	(1,14)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
SAE-AMS-DTL-23053/5*, Class 1; UL File E-39100; CSA LR38227

Physical	
Tensile Strength	2100 PSI
Ultimate Elongation	450%
Longitudinal Change	±5%
Secant Modulus (2%)	13,000 PSI
Specific Gravity	1.3
Heat Aging (168 hrs. @ 175°C)	Elongation (200% min)
Heat Shock (4 hrs. @ 250°C)	No dripping, cracking, passes mandrel wrap test
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish meets UL 224 All-Tubing Flame Test

Electrical	
Dielectric Strength	800 V/mil
Volume Resistivity	10^{14} ohm-cm

Chemical	
Corrosive Effect	Non-corrosive
Solvent Resistance	
Tensile Strength	750 PSI
Dielectric Strength	400 V/mil
Water Absorption	0.2%
Fungus Resistance	Non-nutrient

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Formerly MIL+23053/5 and MIL-DTL-23053/5

3M™ Heat Shrink Tubing SFTW-203

Very Flexible Polyolefin; Shrink Ratio 3:1

Product description

3M Heat Shrink Tubing SFTW-203 is a 3:1 shrink ratio tubing that offers an excellent balance of electrical, physical and chemical properties for a wide variety of industrial and military applications. 3M SFTW-203 tubing is made of very flexible, heat-shrinkable polyolefin which is mechanically tough, chemically resistant, and can be easily surface printed.

3M SFTW-203 tubing has been engineered to offer a low shrink temperature of 100°C (212°F). This allows the tubing to shrink rapidly, and minimizes heat exposure and possible damage to temperature sensitive substrates.

3M SFTW-203 tubing meets the performance requirements of AMS-DTL-23053/5* Class 1 and is UL Recognized (File No. E48398) for flame retardance. It is rated for continuous operation from –55°C (–67°F) to 135°C (275°F), and withstands elevated temperatures of 300°C (572°F) for brief periods.

Typical applications

The extra flexibility and low shrink temperature of 3M SFTW-203 tubing make it ideal for shrink-fit jacketing and insulation of flexible wire bundles and temperature sensitive components. The 3:1 shrink ratio makes 3M SFTW-203 tubing the insulation of choice for end terminations where the connector body is larger than the cable and for repair applications where the tubing must be slid over a connector. 3M SFTW-203 tubing can also be used to insulate an oversized component in line to the wiring.

Shrink ratio

3M SFTW-203 tubing has a 3:1 shrink ratio. When freely recovered, the tubing will shrink to 33% of its as-supplied internal diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

Standard colors

Black.

Standard packaging

Boxes of four-foot lengths, or large spools. Cut pieces subject to factory quotation.

Ordering information

Order 3M SFTW-203 tubing by product name, size equivalent to expanded inner diameter, color, and package type. Always order the largest size that will shrink-fit snugly over the item to be covered. *Example: SFTW-203 tubing, 1/2", black, 4 ft. lengths.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
1/16	.059	(1,5)	.020	(0,5)	.018	(0,45)
1/8	.118	(3,0)	.039	(1,0)	.022	(0,55)
1/4	.236	(6,0)	.079	(2,0)	.026	(0,65)
3/8	.354	(9,0)	.118	(3,0)	.030	(0,75)
1/2	.472	(12,0)	.157	(4,0)	.030	(0,75)
3/4	.709	(18,0)	.236	(6,0)	.033	(0,83)
1	.945	(24,0)	.315	(8,0)	.039	(1,00)
1-1/2	1.535	(39,0)	.512	(13,0)	.045	(1,15)

Note: Dimensions in inches are approximate.

Typical Properties

UL File E48398; CSA LR 38227; Meets functional requirements of SAE-AMS-DTL 23053/5, Class 1

Physical	
Tensile Strength	2600 PSI
Ultimate Elongation	400%
Longitudinal Change	±5%
Secant Modulus (2% elongation)	8700 PSI
Specific Gravity	1.29
Heat Shock (4 hrs. @ 250°C)	No dracking. flowing or dripping
Water Absorption	0.2%
Heat Aging (168 hrs. @ 158°C)	Elongation 350%
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self extinguishing

Electrical	
Dielectric Strength	700 V/mil
Volume Resistivity	10 ohm-cm

Chemical	
Corrosive Effect	Non-corrosive
Solvent Resistance	
Tensile Strength	1100 PSI
Dielectric Strength	400 V/mil
Fungus Resistance	Inert

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

3M™ Adhesive-Lined Tubing

- Outer wall provides abrasion resistance
- Inner wall helps form environmental seal against moisture penetration
- Meets UL/CSA specifications
- Meets military specifications
- Flame retardant
- Choice of shrink ratios

3M™ Heat Shrink Tubing MW

Adhesive-Lined Semi-Rigid Polyolefin; Shrink Ratio 2.5:1

Product description

3M Heat Shrink Tubing MW is a semi-rigid, 110°C (230°F) heat-shrinkable polyolefin tubing that is co-extruded and selectively cross-linked to provide an integral, meltable inner wall.

When heated in excess of 135°C (275°F), the inner meltable wall of the tubing is simultaneously softened and forced by the shrink action into intimate contact with all underlying surfaces, interstices and small voids. Upon cooling, the 3M MW tubing provides a tough protective and insulating barrier, highly resistant to penetration by moisture and the attack of chemicals and solvents.

3M MW tubing is rated for continuous operation at temperatures from –55°C (–67°F) to 110°C (230°F) and will withstand higher operating temperatures for brief periods. Adhesive reflow will occur at temperatures above 80°C (176°F).

Typical applications

Applications for 3M MW tubing include braided-shield pigtails, electrical wiring, mechanical assemblies, electronic components, electrical wire splices, breakouts, connections, solder joints, delicate wire terminations, end-sealing of electrical cables and rigid tubings.

For installations that may require rework, retrofit or repair in the field, 3M MW tubing offers the extra advantage of easy removability. For circuit and component identification purposes, the tubings readily accept marking by means of print-wheel or hot-stamp techniques.

Shrink ratio

3M MW tubing has a 2.5:1 shrink ratio. When fully recovered, the tubing will shrink to 40% of its original diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

Colors

Standard color is black. Also available in blue, clear, red, white and yellow. Price, minimum order quantity and lead time will vary for these, however.

Standard packaging

Four-foot lengths. Cut pieces and other lengths (including spooled) are available subject to factory quotation.

Ordering information

Order 3M MW tubing by product name, size equivalent to the expanded inside diameter, package type and color. Other sizes are available subject to factory quotation. Always order the largest size that will shrink snugly over the item to be covered. *Example: MW tubing, 1/4", 4 ft., black.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Total Recovered Wall Thickness (Nominal)		Meltable Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
1/8	.125	(3,18)	.023	(0,58)	.038	(0,97)	.020	(0,51)
3/16	.187	(4,75)	.060	(1,52)	.043	(1,09)	.025	(0,64)
1/4	.250	(6,35)	.080	(2,03)	.047	(1,19)	.027	(0,69)
3/8	.375	(9,53)	.13	(3,43)	.050	(1,27)	.030	(0,76)
1/2	.500	(12,70)	.195	(4,95)	.055	(1,40)	.035	(0,89)
3/4	.750	(19,05)	.313	(7,95)	.065	(1,65)	.040	(1,02)
1	1.000	(25,40)	.400	(10,16)	.075	(1,91)	.040	(1,02)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
SAE-AMS-DTL-23053/4,* Class 1; UL File E-157227; CSA LR38227

Physical	
Tensile Strength	2200 PSI
Ultimate Elongation	400%
Longitudinal Change	+1, –10%
Secant Modulus (2%)	27,000 PSI
Specific Gravity	1.0
*Heat Aging (168 hrs. @ 175°C)	Elongation 175%
Heat Shock (4 hrs. @ 250°C)	No dripping,. flowing, cracking
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking

Electrical	
Dielectric Strength	900 V/mil
Volume Resistivity	10 ohm-cm

Chemical	
Corrosive Effect	Non-corrosive
Fungus Resistance	Non-nutrient
Water Absorption	0.1%
Fluid Resistance	Excellent
JR4 Skydrol 600 Solution Gasoline	> 1500 PSI
Hydraulic Fluid	@ 600 V/mil

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Outer wall only.
** Formerly MIL+23053/4 and MIL-DTL-23053/4

3M™ Heat Shrink Tubing EPS-200

Adhesive-Lined Flexible Polyolefin; Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing EPS-200 is a 2:1 thin-wall tubing offering the advantages of integral adhesive-lined construction. The tubing is made from a flame-retardant, flexible polyolefin with a thin layer of special thermoplastic adhesive. The heat-shrinkable outer wall is selectively cross-linked while maintaining the high flow and excellent adhesion of the inner sealant liner.

When heated in excess of 121°C (250°F), 3M EPS-200 tubing rapidly shrinks to a skintight fit, forcing the melted adhesive lining to flow and cover the substrate. The adhesive forms a flexible bond with a wide variety of rubbers, plastics and metals. Upon cooling, the adhesive solidifies forming a durable, non-drying, flexible and water resistant barrier. 3M EPS-200 tubing is rated for operation at –55°C (–67°F) to 110°C (230°F). Adhesive reflow will occur at temperatures above 80°C (176°F).

Typical applications

3M EPS-200 tubing offers convenient protection of electronic components, wire splices or bundling of wires. Automotive, truck and marine wiring splices and connections are quickly and easily protected from harsh environments.

Shrink ratio

3M EPS-200 tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its original diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

Colors

Standard color is black. Clear, red and yellow also are available. Price, minimum order quantity and lead time will vary for these, however. (Clear tubing is not flame retardant.)

Standard packaging

Four-foot lengths. Cut pieces and other lengths (including spooled) are available subject to factory quotation.

Ordering information

Order 3M EPS-200 tubing by product name, size equivalent to the expanded inside diameter, package type and color. Other sizes are available subject to factory quotation. Always order the largest size that will shrink snugly over the item to be covered. *Example: EPS-200 tubing, 3/8", 4 ft., black.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Total Recovered Wall Thickness (Nominal)		Meltable Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
1/8	.125	(3,18)	.063	(1,60)	.027	(0,68)	.004	(0,10)
3/16	.187	(4,75)	.093	(2,36)	.027	(0,68)	.004	(0,10)
1/4	.250	(6,35)	.125	(3,18)	.030	(0,76)	.005	(0,13)
3/8	.375	(9,53)	.187	(4,75)	.031	(0,79)	.005	(0,13)
1/2	.500	(12,70)	.250	(6,35)	.032	(0,81)	.006	(0,15)
3/4	.750	(19,05)	.375	(9,53)	.037	(0,94)	.006	(0,15)
1	1.000	(25,40)	.500	(12,70)	.046	(1,17)	.008	(0,20)
1-1/2	1.500	(38,10)	.750	(19,05)	.049	(1,24)	.008	(0,20)
2	2.000	(50,80)	1.000	(25,40)	.060	(1,52)	.015	(0,38)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
SAE-AMS-DTL-23053/4**, Class 2; UL File E-39100; CSA LR38227

Physical

Tensile Strength	2100 PSI
Ultimate Elongation	450%
Longitudinal Change	+1, –5%
Secant Modulus (2%)	17,000 PSI
Specific Gravity	1.3
*Heat Aging (168 hrs. @ 175°C)	Elongation 175%
Heat Shock (4 hrs. @ 225°C)	No dripping,. flowing, cracking
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish meets UL 224 All-Tubing Flame Test (jacket)

Electrical

Dielectric Strength	800 V/mil
Volume Resistivity	10 ohm-cm

Chemical

Corrosion Resistance (Copper mirror)	Non-corrosive
Fungus Resistance	Non-nutrient
Water Absorption	0.3%
Fluid Resistance	Excellent

Adhesive

Peel Strength, pli	
Polyethylene	30
PVC	10
Lead	15
Aluminum	40
Corrosive Effect (Copper mirror)	Non-corrosive

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Outer wall only.
** Formerly MIL+23053/4 and MIL-DTL-23053/4

3M™ Heat Shrink Tubing EPS-300

Adhesive-Lined Flexible Polyolefin; Shrink Ratio 3:1

Product description

3M Heat Shrink Tubing EPS-300 is a thin-wall tubing offering the advantages of integral, adhesive-lined construction. The tubing is made from flame-retardant, flexible polyolefin with an internal layer of special thermoplastic adhesive. The heat-shrinkable outer wall is selectively cross-linked, while the adhesive maintains high flow and excellent adhesion characteristics.

When heated in excess of 121°C (250°F), 3M EPS-300 tubing rapidly shrinks to a skintight fit, forcing the melted adhesive to flow and cover the substrate. The adhesive forms a flexible bond with a wide variety of rubbers, plastics and metals. Upon cooling, the adhesive solidifies, forming a durable, non-drying, flexible and water resistant barrier. 3M EPS-300 tubing is rated for operation at –55°C (–67°F) to 110°C (230°F). Adhesive reflow will occur at temperatures above 80°C (176°F).

Typical applications

3M EPS-300 tubing offers excellent environmental protection for electronic components, wire splices, wire bundles and harness breakouts. Automotive, truck and marine wire splices and harness breakouts are also quickly and easily protected from a variety of harsh environments.

Shrink ratio

3M EPS-300 tubing has a 3:1 shrink ratio. When freely recovered, the tubing will shrink to 33% of its original diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

Colors

Standard colors are black and red. Clear, white and yellow are available by special order. Price, minimum order quantity and lead time will vary for these, however.

Clear tubing is not flame retardant or UL approved.

Standard packaging

Four-foot lengths. Cut pieces and other lengths (including spooled) are available subject to factory quotation.

Ordering information

Order 3M EPS-300 tubing by product name, size equivalent to the expanded inside diameter, package type and color. Other sizes are available subject to factory quotation. Always order the largest size that will shrink snugly over the item to be covered. *Example: EPS-300 tubing, 1/2", 4 ft., black.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Total Recovered Wall Thickness (Nominal)		Meltable Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
1/8	.125	(3,18)	.040	(1,02)	.040	(1,02)	.020	(0,51)
3/16	.187	(4,75)	.062	(1,57)	.040	(1,02)	.020	(0,51)
1/4	.250	(6,35)	.080	(2,03)	.040	(1,02)	.020	(0,51)
3/8	.375	(9,53)	.120	(3,05)	.055	(1,40)	.025	(0,62)
1/2	.500	(12,70)	.160	(4,06)	.070	(1,78)	.030	(0,76)
3/4	.750	(19,05)	.250	(6,35)	.085	(2,16)	.035	(0,89)
1	1.000	(25,40)	.320	(8,13)	.100	(2,54)	.040	(1,02)
1-1/2	1.500	(38,10)	.510	(12,95)	.100	(2,54)	.040	(1,02)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
UL File E-157227; CSA LR38227

Physical	
Tensile Strength	2100 PSI
Ultimate Elongation	450%
Longitudinal Change	+1, –15%
Secant Modulus (2%)	17,000 PSI
Specific Gravity	1.3
*Heat Aging (168 hrs. @ 175°C)	Elongation 175%
Heat Shock (4 hrs. @ 225°C)	No dripping,. flowing, cracking
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish meets UL 224 All-Tubing Flame Test (jacket

Electrical	
Dielectric Strength	700 V/mil
Volume Resistivity	10^{14} ohm-cm
Chemical	
Corrosive Resistance (Copper mirror)	Non-corrosive
Fungus Resistance	Non-nutrient
Water Absorption	0.3%
Fluid Resistance	Excellent
Adhesive	
Peel Strength, pli	
Polyethylene	30
PVC	10
Lead	15
Aluminum	40
Corrosive Effect (Copper mirror)	Non-corrosive

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Outer wall only.
** Formerly MIL+23053/4 and MIL-DTL-23053/4

3M™ Heat Shrink Tubing EPS-400

Adhesive-Lined Semi-Rigid Polyolefin; Shrink-Ratio 4:1

Product description

3M Heat Shrink Tubing EPS-400 is a semi-rigid tubing offering the advantages of integral, adhesive-lined construction. The tubing is made from flame-retardant, flexible polyolefin with an internal layer of special thermoplastic adhesive. The heat-shrinkable outer wall is selectively cross-linked, while the adhesive maintains high flow and excellent adhesion characteristics.

When heated in excess of 121°C (250°F), 3M EPS-400 tubing rapidly shrinks to a skintight fit, forcing the melted adhesive to flow and cover the substrate. Upon cooling, the adhesive solidifies, forming a durable, non-drying, flexible and water resistant barrier. 3M EPS-400 tubing is rated for operation at –55°C (–67°F) to 110°C (230°F). Adhesive reflow will occur at temperatures above 80°C (176°F).

Typical applications

3M EPS-400 tubing offers excellent environmental protection for electronic components, wire splices, wire bundles and harness breakouts. Automotive, truck and marine wire splices and harness breakouts are also quickly and easily protected from a variety of harsh environments.

Shrink ratio

3M EPS-400 tubing has a 4:1 shrink ratio. When freely recovered, the tubing will shrink to 25% of its as-supplied diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

Standard color

Black.

Standard packaging

Four-foot lengths. Cut pieces are available subject to factory quotation.

Ordering information

Order 3M EPS-400 tubing by product name, size equivalent to the expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the item to be covered. *Example: EPS-400 tubing, .300", 4 ft., black.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Recovered Melt Wall (Nominal)		Recovered Outer Wall (Minimum)	
in.	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
.300	.300	(7,62)	.060	(1,52)	.033	(0,84)	.028	(0,71)
.350	.350	(8,89)	.080	(2,03)	.038	(0,97)	.033	(0,84)
.450	.450	(11,43)	.105	(2,67)	.043	(1,09)	.053	(1,35)
.700	.700	(17,78)	.175	(4,45)	.060	(1,52)	.055	(1,40)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
UL File E-157227; CSA LR38227

Physical	
Tensile Strength	1900 PSI
Ultimate Elongation	400%
Longitudinal Change	+1, –10%
Secant Modulus (2%)	33,000 PSI
Specific Gravity	1.25
*Heat Aging (168 hrs. @ 175°C)	Elongation 175%
Heat Shock (4 hrs. @ 225°C)	No dripping, flowing, cracking
*Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish

Electrical	
Dielectric Strength	700 V/mil
Volume Resistivity	10^{14} ohm-cm

Chemical	
Corrosion Resistance (Copper mirror)	Non-corrosive
Fungus Resistance	Non-nutrient
Water Absorption	0.3%
Fluid Resistance	Excellent

Adhesive	
Peel Strength, pli	
Polyethylene	30
PVC	10
Lead	15
Aluminum	40
Corrosive Effect (Copper mirror)	Non-corrosive

Material testing performed to MIL-DTL-23053/4. Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Outer wall only.

3M™ Heat Shrink Tubing TMW

Adhesive-Lined Translucent Semi-Rigid Polyolefin

Product description

3M Heat Shrink Tubing TMW is a semi-rigid, translucent heat-shrinkable polyolefin tubing that is co-extruded and selectively cross-linked with an integral, meltable inner wall.

When heated in excess of 135°C (275°F), the adhesive inner wall of the tubing is softened and forced by the shrinking action of the outer wall into contact with all underlying surfaces and small voids. The adhesive forms a flexible bond with a wide variety of rubbers, plastics and metals. Upon cooling, 3M TMW tubing provides a tough, protective and insulating barrier, highly resistant to penetration by moisture, chemicals and solvents.

3M TMW tubing is rated for continuous operation at temperatures from –55°C (–67°F) to 110°C (230°F) and will withstand higher operating temperatures for brief periods. Adhesive reflow will occur at temperatures above 80°C (176°F).

Typical applications

The primary application for 3M TMW tubing is in the manufacture of heat shrink butt connectors, disconnects, ring terminals and fork terminals. Other applications include braided-shield pigtails, mechanical assemblies, electronic components, electrical wire splices, breakouts, solder joints, delicate wire terminations and end-sealing of electrical cables.

3M TMW tubing can withstand the crimping force of standard crimp tools without puncture or splitting during heat recovery. The tubing remains round when cut, making it ideal for use in high speed processing and assembly equipment.

Standard colors

3M TMW tubing is available color coded by diameter. Please see chart below.

Standard packaging

3M TMW tubing is supplied in cut pieces. Standard lengths are available in 10,000 piece cartons, other lengths and diameters are available subject to factory quotation.

Ordering Information

Order 3M TMW tubing in the size equivalent to the expanded inside diameter required. Always order the largest size that will shrink snugly over the component to covered. Non-standard diameters and cut lengths are available subject to factory quotation. *Example: TMW Red tubing 183-1.500.*

Typical Properties

Applicable Specification – UL File E-157227; CSA LR38227

Physical

Tensile Strength	2500 PSI
Ultimate Elongation	400%
Longitudinal Change	+1, –10%
Secant Modulus (2%)	32,000 PSI
Specific Gravity	1.0
*Heat Aging	168 hrs. @ 175°C Elongation 175%
*Heat Shock (4 hrs. @ 250°C)	No dripping, cracking, flowing
*Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking

* Outer wall only.

Electrical

Dielectric Strength	900 V/mil
Volume Resistivity	10^{14} ohm-cm

Chemical

Corrosive Effect	Non-corrosive
Solvent Resistance	
Tensile Strength	1000 PSI
Dielectric Strength	400 V/mil
Water Absorption	0.1%
Fungus Resistance	Non-nutrient
Fluid Resistance	
Gasoline	>600 PSI
Hydraulic Fluid @JP4	600 V/mil
Skydrol 600	

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

Standard Sizes and Dimensions (without adhesive)

Product Number/Color	Expanded I.D.(Minimum)		Recovered I.D. (Maximum)		Total Recovered Wall Thickness (Nominal)		Meltable Recovered Wall (Nominal)		Standard Cut Length		Cut Length Tolerance (+/-)	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
TMW.183×3/4-Red-Bulk	0.183	(4,65)	0.060	(1,52)	0.049	(1,24)	0.018	(0,46)	0.750	(19,05)	0.020	(0,51)
TMW.183×1.5-Red-Bulk	0.183	(4,65)	0.060	(1,52)	0.049	(1,24)	0.018	(0,46)	1.500	(38,10)	0.030	(0,76)
TMW.220×3/4-Blue-Bulk	0.220	(5,59)	0.070	(1,78)	0.049	(1,24)	0.018	(0,46)	0.750	(19,05)	0.020	(0,51)
TMW.220×1.5-Blue-Bulk	0.220	(5,59)	0.070	(1,78)	0.049	(1,24)	0.018	(0,46)	1.500	(38,10)	0.030	(0,76)
TMW.255×7/8-Yellow-Bulk	0.255	(6,47)	0.095	(2,41)	0.059	(1,50)	0.018	(0,46)	0.875	(22,22)	0.020	(0,51)
TMW.255×1.7-Yellow-Bulk	0.255	(6,47)	0.095	(2,41)	0.059	(1,50)	0.018	(0,46)	1.700	(43,18)	0.030	(0,76)
TMW.330-1" Pink	0.330	(8,38)	0.165	(4,19)	0.059	(1,50)	0.018	(0,46)	1.000	(25,40)	0.020	(0,51)
TMW.330-1.85" Pink	0.330	(8,38)	0.165	(4,19)	0.059	(1,50)	0.018	(0,46)	1.850	(46,99)	0.030	(0,76)

Note: Dimensions in inches are approximate.

3M™ Heat Shrink Tubing TES

Adhesive-Lined Semi-Rigid Clear Polyolefin for Automotive Applications; Shrink Ratio 4:1

All-Weather, Heat-Shrinkable, Dual Wall, Polyolefin Tubing for Automotive Wire Harnesses

- Semi-rigid polyolefin
- Provides excellent strain relief
- Functional over wide temperature range
- Puncture resistant
- Resistant to salt water, automotive fluids and corrosive chemicals

Product Description

3M Heat Shrink Tubing TES is a co-extruded, dual wall product. It is a composite of a polyolefin shrinkable outer wall and a thermoplastic adhesive inner wall. 3M TES tubing resists degradation when exposed to typical automotive and marine environments, such as severe vibration, extreme temperature changes, moisture or automotive fluids.

Typical Application

Semi-rigid 3M TES tubing is ideal for applications requiring moisture sealing, mechanical protection and strain relief.

The adhesive layer is compatible with typical wire insulation and is intended for moisture sealing and insulation of automotive, RV, truck, trailer, tractor, heavy equipment and marine wire splices, in-line components, fusible links and terminals.

This clear tubing is ideal for applications requiring inspection of the underlying weld or component.

Shrink Ratio

3M TES tubing has a 4:1 shrink ratio. When fully recovered, the tubing will shrink to 25% of its original diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

Standard Color

3M TES tubing is supplied in clear and is color-coded by diameter with printed squares to aid in identification.

Standard Packaging

Cut pieces and four-foot lengths. See price pages for standard lengths and carton quantities. Other sizes, lengths and packaging options are available, subject to factory quotation.

Printing

Custom printing to identify resistors, diodes and other components is available, subject to factory quotation.

Ordering Information

Order 3M TES tubing by product name and part number and cut length. *Example: TES tubing, .300,55 mm length, white.*

Standard Sizes and Dimensions

Ordering Size	Minimum Expanded I.D.	Maximum Recovered I.D.	Nominal Recovered Melt Wall	Minimum Recovered Outer Wall	Color Code
.220	.220"	.045"	.030"	.027"	Yellow
.300	.300"	.060"	.033"	.028"	White
.350	.350"	.080"	.038"	.033"	Green
.450	.450"	.105"	.043"	.053"	Red
.700	.700"	.175"	.060"	.053"	Orange

Note: Dimensions in inches are approximate.

Typical Properties*

Physical	
Tensile Strength	2450 PSI
Ultimate Elongation	475%
2% Secant Modulus[2]	16,500 PSI
Longitudinal Change[1]	+0%, –10%
Specific Gravity[3] (outer wall)	0.97
Heat Aging	135°C (Adhesive softens)
Thermal Cycle	5°C to 135°C
Vibration	24 hours
Cold Flex	-30°C
Electrical	
Dielectric Strength[5] (outer wall)	500 V/mil
Dielectric Withstand	1000 Volts AC
Current Leakage	< 0.250 Microamps
Chemical	
Auto Fluid Compatibility	8 fluids

ESB-M99D56-Ford
MS-DB56-Chrysler

*Not recommended for specification purposes. Product specifications will be provided upon request.

3M test methods available upon request.

Test Methods
[1] ASTM-D 2671
[2] ASTM-D 882 Procedure A
[3] ASTM-D 792
[4] ASTM-D 2671 Procedure B
[5] ASTM-D 149

3M™ Heat Shrink Tubing SMS

Adhesive-Lined Semi-Rigid Polyolefin for Automotive Applications; Shrink Ratio 4:1

All-Weather, Heat-Shrinkable, Dual Wall, Polyolefin Tubing for Automotive Wire Harnesses

- Semi-rigid polyolefin
- Provides excellent strain relief
- Functional over wide temperature range
- Puncture resistant
- Resistant to salt water, automotive fluids and corrosive chemicals
- Fire retardant

Product Description

3M Heat Shrink Tubing SMS is a co-extruded, dual wall product. It is a composite of a polyolefin shrinkable outer wall and a thermoplastic adhesive inner wall. 3M SMS tubing resists degradation when exposed to typical automotive and marine environments, such as severe vibration, temperature changes, moisture or automotive fluids.

Typical Application

Semi-rigid 3M SMS tubing is ideal for applications requiring moisture sealing, mechanical protection and strain relief.

The adhesive layer is compatible with typical wire insulation and is intended for moisture sealing and insulation of automotive, RV, truck, trailer, tractor, heavy equipment and marine wire splices, in-line components, fusible links and terminals.

Shrink Ratio

3M SMS tubing has a 4:1 shrink ratio. When fully recovered, the tubing will shrink to 25% of its original diameter. The recovered wall thickness of the tubing is proportional to the degree of recovery.

Standard Color

The tubing is supplied in black and is color-coded by diameter with printed squares to aid in identification.

Standard Packaging

Cut pieces and four-foot lengths. See price pages for standard lengths and carton quantities. Other sizes, lengths and packaging options are available, subject to factory quotation.

Printing

Custom printing to identify resistors, diodes and other components is available, subject to factory quotation.

Ordering Information

Order 3M SMS tubing by product name and part number and cut length. Example: SMS tubing, .300, 55 mm length, white.

Standard Sizes and Dimensions

Ordering Size	Minimum Expanded I.D.	Maximum Recovered I.D.	Nominal Recovered Melt Wall	Minimum Recovered Outer Wall	Color Code
.220	.220"	.045"	.030"	.027"	Yellow
.300	.300"	.060"	.033"	.028"	White
.350	.350"	.080"	.038"	.033"	Green
.450	.450"	.105"	.043"	.053"	Red
.700	.700"	.175"	.060"	.053"	Orange

Note: Dimensions in inches are approximate.

Typical Properties*

Physical

Tensile Strength	1900 PSI
Ultimate Elongation	350%
2% Secant Modulus[2]	35,000 PSI
Longitudinal Change[1]	+0%, –10%
Specific Gravity[3] (outer wall)	1.25
Heat Aging	135°C (Adhesive softens)
Thermal Cycle	5°C to 135°C
Vibration	24 hours
Cold Flex	-30°C

Electrical

Dielectric Strength[5] (outer wall)	500 V/mil
Dielectric Withstand	1000 Volts AC
Current Leakage	< 0.250 Microamps

Chemical

Auto Fluid Compatibility	8 fluids

ESB-M99D56-Ford
MS-DB56-Chrysler

*Not recommended for specification purposes. Product specifications will be provided upon request.

3M test methods available upon request.

Test Methods
[1] ASTM-D 2671
[2] ASTM-D 882 Procedure A
[3] ASTM-D 792
[4] ASTM-D 2671 Procedure B
[5] ASTM-D 149

3M™ Special Purpose Tubing

- High-temperature applications
- Excellent chemical and solvent resistance
- Abrasion and tear resistant
- Flame retardant
- Meets UL/CSA specifications
- Meets military specifications

3M™ MFP Heat Shrink Tubing

Modified Polyvinylidene Fluoride; Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing LMFP is a cross-linked, thin-walled, heat-shrinkable tubing offering a high degree of mechanical strength and high-temperature resistance. Fabricated from polyvinylidene fluoride, the tubing has excellent abrasion resistance and cut-through properties in combination with high dielectric strength. It is inherently flame retardant, semi-rigid and highly resistant to most industrial fuels, chemicals and solvents. When heated in excess of 175°C (347°F), 3M MFP tubing rapidly shrinks to a skintight fit. This tubing is rated for continuous operation from –55°C (–67°F) to 175°C (347°F).

Typical applications

3M MFP tubing is designed for shrink-fit protection and strain relief of wires, solder joints, terminals and connections. Suggested applications include automotive wiring, jackets, fuse coverings and military wire markers. Because the tubing is transparent, it allows see-through inspection and identification and is ideal for use as a jacketing for components such as resistors and capacitors. The tubing is readily marked by hot-stamp and print-wheel equipment.

Shrink ratio

3M MFP tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its as-supplied internal diameter. The recovered wall thickness is proportional to the degree of recovery.

Standard color

Clear. Colors available subject to factory quotation.

Standard packaging

Four-foot lengths.

Ordering information

Order 3M MFP tubing by product name, size equivalent to the expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the item to be covered. *Example: MFP tubing, 3/8", 4 ft., clear.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D.(Minimum)		Recovered I.D. (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
3/64	.046	(1,17)	.023	(0,58)	.010	(0,25)
1/16	.063	(1,60)	.031	(0,79)	.010	(0,25)
3/32	.093	(2,36)	.046	(1,17)	.010	(0,25)
1/8	.125	(3,18)	.062	(1,57)	.010	(0,25)
3/16	.187	(4,75)	.093	(2,36)	.010	(0,25)
1/4	.250	(6,35)	.125	(3,18)	.012	(0,30)
3/8	.375	(9,53)	.187	(4,75)	.012	(0,30)
1/2	.500	(12,70)	.250	(6,35)	.012	(0,30)
5/8	.625	(15,88)	.313	(7,94)	.014	(0,36)
3/4	.750	(19,05)	.375	(9,53)	.017	(0,43)
1	1.000	(25,40)	.500	(12,70)	.019	(0,48)

Note: Dimensions in inches are approximate.

Typical Properties

SAE-AMS-DTL-23053/8*, Meets functional requirements of SAE-AMS-DTL-23053/18, Class 1; UL File E-39100, VW-1; CSA LR 38227, OFT**

Physical	
Tensile Strength	5500 PSI
Ultimate Elongation	350%
Longitudinal Change	+1, –10%
Specific Gravity	1.7
Operating Temperature Range	–55°C to +175°C
Shrink Temperature (Min.)	175°C (347°F)
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish meets UL 224 VW-1 Test
Secant Modulus (2%)	123,000 PSI

Electrical	
Dielectric Strength	900 V/mil
Volume Resistivity	10^{14} ohm-cm

Chemical	
Corrosion Resistance	Non-corrosive
Fuel & Oil Resistance	Excellent
Abrasion Resistance	Excellent
Acids & Alkalis Resistance	Excellent

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Formerly MIL+23053/8 and MIL-DTL-23053/8
** Formerly MIL+23053/18 and MIL-DTL-23053/18

3M™ Heat Shrink Tubing NST

Modified Chlorinated Polyolefin (Neoprene); Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing NST provides excellent cut-through and abrasion resistance. It also is resistant to some solvents and fluids, including oil. The tubing maintains flexibility at low temperatures and can be readily marked by hot-stamp and print-wheel methods. When heated in excess of 135°C (275°F) 3M NST tubing rapidly shrinks to a skintight fit. 3M NST tubing is rated for continuous operation from –70°C (–94°F) to 121°C (250°F).

Typical applications

3M NST tubing is designed for applications requiring a tough, highly flexible covering. It is particularly useful for fabrication and repair of flexible harnesses and wire bundles and for covering hydraulic couplings. Its excellent mechanical properties and broad operating temperature range make it an ideal choice for jacketing cable harnesses and custom-made cables that must operate in severe environmental conditions.

Shrink ratio

3M NST tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its as-supplied internal diameter. The recovered wall thickness is proportional to the degree of recovery.

Standard color

Black.

Standard packaging

Spools.

Ordering information

Order 3M NST tubing by product name, size equivalent to the expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the component to be covered. When ordering 3M NST tubing, please indicate the applicable specification required. *Example: NST tubing, 3/16", spools, black.*

Standard Sizes and Dimensions

Ordering Size	Expanded I.D.(Minimum)		Recovered I.D. (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
1/8	.125	(3,18)	.062	(1,83)	.030	(0,76)
3/16	.187	(4,75)	.093	(2,69)	.035	(0,89)
1/4	.250	(6,35)	.125	(3,18)	.035	(0,89)
3/8	.375	(9,53)	.187	(4,75)	.040	(1,02)
1/2	.500	(12,70)	.250	(6,35)	.048	(1,22)
5/8	.625	(15,88)	.312	(7,92)	.052	(1,32)
3/4	.750	(19,05)	.375	(6,99)	.057	(1,45)
7/8	.875	(22,23)	.437	(11,10)	.065	(1,65)
1	1.000	(25,40)	.500	(12,70)	.070	(1,78)
1-1/4	1.250	(31,75)	.625	(15,54)	.087	(2,21)
1-1/2	1.500	(38,10)	.750	(19,05)	.095	(2,41)
1-3/4	1.750	(44,45)	.875	(22,23)	.107	(2,72)
2	2.000	(50,80)	1.000	(25,40)	.110	(2,79)
3	3.000	(75,20)	1.500	(38,10)	.125	(3.18)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification
SAE-AMS-DTL-23053/1*, Class 1, 2; UL File E-39100; CSA LR38227; SC-X-15112.

Physical	
Tensile Strength	2100 PSI
Ultimate Elongation	500%
Longitudinal Change	+1, –10%
Specific Gravity	1.3
Operating Temperature Range	–70°C to +121°C
Shrink Temperature (Min.)	135°C (275°F)
Low Temperature Flexibility (4 hrs. @ –70°C)	No cracking
Flammability	Self-extinguish

Electrical	
Dielectric Strength	800 V/mil
Volume Resistivity	10^{12} ohm-cm

Chemical	
Corrosion Resistance	Non-corrosive
Fuel & Oil Resistance	Excellent
Solvent Resistance	Good
Abrasion Resistance	Excellent
Acids & Alkalis Resistance	Excellent

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Formerly MIL+23053/1 and MIL-DTL-23053/1

3M™ Heat Shrink Tubing VTN-200

Modified Fluoroelastomer; Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing VTN-200 is highly abrasive and cut-through resistant and can withstand a wide variety of fuels, lubricants, acids and highly corrosive fluids at high operating temperatures. In addition to its high continuous operating temperature and chemical-resistance properties, this tubing is very flexible and is easily marked by hot-stamp or print-wheel methods. When heated in excess of 175°C (347°F), 3M VTN-200 tubing rapidly shrinks to a skintight fit. 3M VTN-200 tubing is rated for continuous operation from –55°C (–67°F) to 200°C (392°F).

Typical applications

Because of its excellent high-temperature fluid performance, 3M VTN-200 tubing is often used to protect wiring and component covers in aircraft/aerospace applications including electronic control systems and hydraulic fluid transport mechanisms and in chemical plants.

Shrink ratio

3M VTN-200 tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its as-supplied internal diameter. The recovered wall thickness is proportional to the degree of recovery.

Standard color

Black.

Standard packaging

Spools.

Ordering information

Order 3M VTN-200 tubing by product name, size equivalent to the expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the component to be covered. Example: VTN-200 tubing, 3/16", black, spools.

Standard Sizes and Dimensions

Ordering Size	Expanded I.D.(Minimum)		Recovered I.D. (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
1/8	.125	(3,18)	.062	(1,57)	.030	(0,76)
3/16	.187	(4,75)	.093	(2,36)	.035	(0,89)
1/4	.250	(6,35)	.125	(3,18)	.035	(0,89)
3/8	.375	(9,53)	.187	(4,75)	.035	(0,89)
1/2	.500	(12,70)	.250	(6,35)	.035	(0,89)
5/8	.625	(15,88)	.312	(7,92)	.042	(1,07)
3/4	.750	(19,05)	.375	(9,53)	.042	(1,07)
7/8	.875	(22,23)	.438	(11,11)	.049	(1,24)
1	1.000	(25,40)	.500	(12,70)	.049	(1,24)
1-1/4	1.250	(31,75)	.625	(15,88)	.055	(1,40)
1-1/2	1.500	(38,10)	.750	(19,05)	.055	(1,40)
2	2.000	(50,80)	1.000	(25,40)	.065	(1,65)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification SAE-AMS-DTL-23053/13*

Physical

Tensile Strength	2400 PSI
Ultimate Elongation	450%
Longitudinal Change	+1, –10%
Specific Gravity	1.7
Operating Temperature Range	–55°C to +200°C
Shrink Temperature (Min.)	175°C (347°F)
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish

Electrical

Dielectric Strength	500 V/mil
Volume Resistivity	10^{12} ohm-cm

Chemical

Corrosion Resistance	Non-corrosive
Fuel & Oil Resistance	Excellent
Solvent Resistance	Excellent
Abrasion Resistance	Excellent
Acids & Alkalis Resistance	Excellent

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Formerly MIL+23053/8 and MIL-DTL-23053/8
** Formerly MIL+23053/18 and MIL-DTL-23053/18

3M™ Heat Shrink Tubing PSTH

Flexible Elastomeric Polyester; Shrink Ratio 2:1

Product description

3M Heat Shrink Tubing PSTH is a high performance, rugged heat shrinkable tubing designed for harsh operating conditions. The tubing is made from flexible elastomeric polyester and has a continuous operating temperature range of –55°C (–70°F) to 150°C (302°F). 3M PSTH tubing is resistant to a wide range of solvents and chemicals including aviation fuel, diesel fuel, lubricating oils and hydraulic fluid. 3M PSTH tubing is specifically designed to pass the SC-X15111C military specification but also meets the functional requirements of AMS-DTL-23053/16*.

Typical applications

3M PSTH tubing was developed for wire harness applications on military ground vehicles and is well suited for applications where conditions call for a high-performance heat shrink tubing, particularly where the tubing will be exposed to petroleum based fluids. 3M PSTH is also an excellent choice for heavy duty equipment and off-road vehicles.

Shrink ratio

3M PSTH tubing has a 2:1 shrink ratio. When freely recovered, the tubing will shrink to 50% of its as-supplied internal diameter. The recovered wall thickness is proportional to the degree of recovery.

Standard color

Black.

Standard packaging

Spools.

Ordering Information

Order 3M PSTH tubing by product name, size equivalent to the expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the component to be covered. Example: PSTH tubing, 3/8", black, spools.

Standard Sizes and Dimensions

Ordering Size	Expanded I.D.(Minimum)		Recovered I.D. (Maximum)		Recovered Wall Thickness (Nominal)	
in.	in.	(mm)	in.	(mm)	in.	(mm)
3/16	.187	(4,75)	.093	(2,36)	.035	(0,89)
1/4	.250	(6,35)	.125	(3,18)	.035	(0,89)
3/8	.375	(9,53)	.187	(4,75)	.035	(0,89)
1/2	.500	(12,70)	.250	(6,35)	.035	(0,89)
5/8	.625	(15,88)	.312	(7,92)	.042	(1,07)
3/4	.750	(19,05)	.250	(6,35)	.042	(1,07)
7/8	.875	(22,23)	.437	(11,10)	.045	(1,14)
1	1.000	(25,40)	.500	(12,70)	.049	(1,24)
1-1/4	1.250	(31,75)	.625	(15,88)	.055	(1,40)
1-1/2	1.500	(38,10)	.750	(19,05)	.055	(1,40)
2	2.000	(50,80)	1.000	(25,40)	.065	(1,65)

Note: Dimensions in inches are approximate.

Typical Properties

Applicable Specification SC-X15111C (Military Spec)

Meets the functional requirements of SAE-AMS-DTL-23053/16*

Physical	
Tensile Strength	2200 PSI
Ultimate Elongation	350%
Longitudinal Change	+2, –8%
Specific Gravity	1.6
Operating Temperature Range	–55°C to +150°C
Shrink Temperature (Min.)	170°C (338°F)
Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish

Electrical	
Dielectric Strength	500 V/mil
Volume Resistivity	7×10^{14} ohm-cm

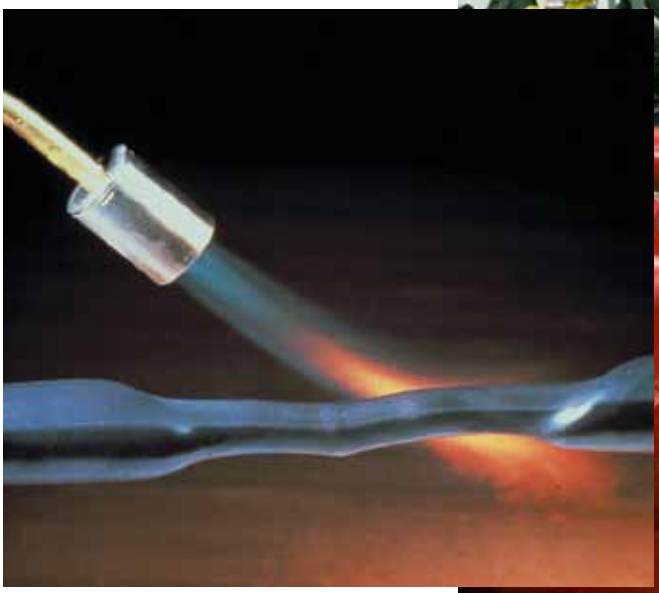
Chemical	
Corrosion Resistance	Non-corrosive
Fuel & Oil Resistance	Excellent
Solvent Resistance	Excellent
Abrasion Resistance	Excellent
Acids & Alkalis Resistance	Excellent

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Formerly MIL+23053/16 and MIL-DTL-23053/16

3M™ Heavy-Duty Tubing

- Abrasion and tear resistant
- Adhesive lined for environmental sealing
- Chemical and solvent resistant
- Flame retardant
- UV resistant



3M™ Heat Shrink Tubing MDT

Medium-Duty, Polyolefin

Product description

3M Heat Shrink Tubing MDT can offer increased flexibility in combination with excellent abrasion, corrosion and environmental resistance properties and data meets AMS-DTL-23053/15*, Class 2.

Uncoated product (without sealant) is available on special order. 3M MDT medium-duty tubing is designed to provide reliable performance as well as excellent mechanical and environmental protection. These flame-retardant products combine the important advantages of easy handling and installation with maximum operating reliability and system protection. 3M MDT tubing comes with a factory-applied sealant. This sealant is a heat-activated thermoplastic material that remains soft and flexible over long periods under adverse environmental conditions. During heating the sealant softens, bonds to underlying surfaces and fills small voids that might be present. When cool, the sealant forms a barrier against water, moisture, dirt and other environmental contaminants.

Typical applications

3M MDT tubing installs easily and has shrink ratios to accommodate effective insulating and sealing over large transitions, splices and battery cables.

Standard color

All sizes available in black. 3M MDT-0400, -0800 and -1100 tubing are also available in red.

Standard packaging

Four-foot lengths. Other lengths are available subject to special quotation.

Ordering information

Order 3M MDT tubing by product name, size equivalent to the expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the component to be covered. *Example: MDT-1100-48A tubing, 4 ft., black.*

Typical Properties

Applicable Specification – SAE-AMS-DTL-23053/15,** Class 2

Physical

Tensile Strength	2400 PSI
Ultimate Elongation	475%
Longitudinal Change	+1, –10%
Secant Modulus (2%)	14,000 PSI
Specific Gravity	1.28
*Heat Aging	7 days @ 175°C Elongation 225%
*Heat Shock (4 hrs. @ 225°C)	No dripping, cracking, flowing
*Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking

Electrical

Dielectric Strength	500 V/mil (60 mils)
Volume Resistivity	10^{14} ohm-cm

Chemical

Corrosive Effect	Non-corrosive
Solvent Resistance	
Tensile Strength	1500 PSI
Dielectric Strength	400 V/mil
Water Absorption	0.2%
Fungus Resistance	Non-nutrient

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Outer wall only.
* Formerly MIL+23053/15 and MIL-DTL-23053/15

Standard Sizes and Dimensions (without adhesive)

Part Number	Cable Range	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Recovered Outer Wall Thickness (Nominal)		Length	Std. Pkg. Pieces/ Carton	Color
		in.	(mm)	in.	(mm)	in.	(mm)	in.		
MDT-0400-48A	#12 - #6 AWG	.40	(10,2)	.15	(3,8)	.09	(2,3)	48	20	Red and Black
MDT-0800-48A	#8 - #3 AWG	.80	(20,3)	.22	(5,6)	.10	(2,5)	48	20	Red and Black
MDT-1100-48A	#2 - 2/0 AWG	1.10	(27,9)	.37	(9,4)	.10	(2,5)	48	20	Red and Black
MDT-1300-48A	#1 - 4/0 AWG	1.30	(33,0)	.43	(10,9)	.10	(2,5)	48	15	Black Only
MDT-1500-48A	1/0 - 250 MCM	1.50	(38,1)	.50	(12,7)	.10	(2,5)	48	20	Black Only
MDT-1700-48A	4/0 - 400 MCM	1.70	(43,2)	.60	(15,2)	.10	(2,5)	48	20	Black Only
MDT-2000-48A	300 - 500 MCM	2.00	(50,8)	.75	(19,1)	.10	(2,5)	48	15	Black Only
MDT-3000-48A	600 - 1250 MCM	3.00	(76,2)	1.00	(25,4)	.12	(3,0)	48	15	Black Only
MDT-4300-48A	1000 - 2500 MCM	4.30	(109,2)	1.50	(38,1)	.15	(3,8)	48	10	Black Only

Note: Dimensions in inches are approximate.

3M™ Heat Shrink Tubing HDT

Heavy-Duty, Polyolefin

Product description

3M Heat Shrink Tubing HDT is designed to provide reliable performance as well as excellent mechanical and environmental protection. This flame-retardant product combines the important advantage of easy handling and installation with maximum operating reliability and system protection. 3M HDT tubing comes with a factory-applied sealant. This sealant is a heat-activated thermoplastic material that remains soft and flexible over long periods under adverse environmental conditions. During heating the sealant softens, bonds to underlying surfaces and fills small voids that might be present. When cool, the sealant forms a barrier against water, moisture, dirt and other environmental contaminants.

Heavy-duty tubing is fabricated from specially formulated cross-linked polyolefin, providing long-term environmental protection. The tubing is also highly chemical, abrasion and split resistant. Meets AMS-DTL-23053/15**, Class 1.

Uncoated product (without sealant) is available on special order.

Standard color

All sizes available in black. 3M HDT-0300, -0400, -0800 and -1100 tubing are also available in red.

Standard packaging

Four-foot lengths. Other lengths are available subject to special quotation.

Ordering information

Order 3M HDT tubing by product name, size equivalent to the expanded inside diameter, package type and color. Always order the largest size that will shrink snugly over the component to be covered. *Example: HDT-1100-48A tubing, 4 ft., black.*

Typical Properties

Applicable Specification – SAE-AMS-DTL-23053/15**, Class 1

Physical

Tensile Strength	2400 PSI
Ultimate Elongation	475%
Longitudinal Change	+1, –10%
Secant Modulus (2%)	14,000 PSI
Specific Gravity	1.28
*Heat Aging	7 days @ 175°C Elongation 225%
*Heat Shock (4 hrs. @ 225°C)	No dripping, cracking, flowing
*Low Temperature Flexibility (4 hrs. @ –55°C)	No cracking
Flammability	Self-extinguish

Electrical

Dielectric Strength	500 V/mil (60 mils)
Volume Resistivity	10^{14} ohm-cm

Chemical

Corrosive Effect	Non-corrosive
Solvent Resistance	
Tensile Strength	1500 PSI
Dielectric Strength	200 V/mil
Water Absorption	0.02%
Fungus Resistance	Non-nutrient

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

* Outer wall only.
* Formerly MIL+23053/15 and MIL-DTL-23053/15

Standard Sizes and Dimensions (without adhesive)

Part Number	Cable Range	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Recovered Outer Wall Thickness (Nominal)		Length	Std. Pkg. Pieces/ Carton	Color
		in.	(mm)	in.	(mm)	in.	(mm)	in.		
HDT-0300-48A	#14-#8 AWG	.30	(7,62)	.10	(2,5)	.08	(2,0)	48	20	Red and Black
HDT-0400-48A	#12 - #6 AWG	.40	(10,2)	.15	(3,8)	.09	(2,3)	48	20	Red and Black
HDT-0800-48A	#8 - 1/0 AWG	.80	(20,3)	.20	(5,1)	.11	(2,8)	48	20	Red and Black
HDT-1100-48A	#2 - 4/0 AWG	1.10	(27,9)	.37	(9,4)	.12	(3,0)	48	20	Red and Black
HDT-1500-48A	3/0 - 400 MCM	1.50	(38,1)	.50	(12,7)	.17	(4,3)	48	20	Black Only
HDT-2000-48A	250 - 750 MCM	2.00	(50,8)	.65	(16,5)	.17	(4,3)	48	10	Black Only
HDT-3000-48A	600 - 1250 MCM	3.00	(76,2)	1.00	(25,4)	.17	(4,3)	48	10	Black Only
HDT-4500-48A	1500 - 2500 MCM	4.50	(114,3)	1.50	(38,1)	.17	(4,3)	48	5	Black Only
HDT-6000-48A	2.1" - 4.8" O. D.	6.00	(152,4)	1.80	(45,7)	.17	(4,3)	48	5	Black Only
HDT-7000-48A	2.5" - 5.6" O. D.	7.00	(177,8)	2.00	(50,8)	.17	(4,3)	48	5	Black Only

Note: Dimensions in inches are approximate.

3M™ Heat-Shrinkable Tubing for Bus Bar BBI-A Series

Tubing for Bus Bar Series 5–35 kV

Product Description

3M™ Heat Shrink Tubing for Bus Bar BBI-A Series is designed for insulating rectangular, square, and round bus bar rated from 5 kV through 35 kV. It will also cover and insulate inline bolted connections of rectangular bus bars. The tubing meets the requirements of ANSI/IEEE Standard C37.20. The standard tubing lengths are 20 ft. (6,1 m) and 50 ft. (15,2 m).

3M BBI-A tubing is made of a specially formulated cross-linked polyolefin. The tubing is colored orange-red. The material has high resistance to splitting, good solvent resistance and excellent tracking resistance properties. The tubing shrinks easily with industry-standard methods, forming an aesthetically appealing insulation cover.

Durable

3M BBI-A tubing is made of specially formulated, cross-linked, flame retardant, track resistant polyolefin. This material has a high resistance to splitting, while providing the flexibility to conform to bends in certain applications. Excellent split resistance may prevent insulation failures and resulting downtimes.

Reliable

Heat shrinkable bus bar tubing is unaffected by normal cleaning fluids and is resistant to physical damage and high temperatures.

Excellent dielectric strength allows the required space between bus bars and metal enclosures to be substantially reduced. Closer spacing reduces both the overall size of the assembly, and the overall cost.

Cost effective

3M BBI-A tubing will shrink to fit rectangular, square or round bus bars and will handle voltage ranges from 600 volts to 35 kV. This can help reduce your inventory requirements.

Ordering Information

All sizes are available in 20 ft. (6,1 m) and 50 ft. (15,2 m) rolls, one per box. Order by product number and length. See chart for correct sizing.

Typical Properties

Applicable Specification

ASTM-D-257, 149, 150, 2303; IEC 216; ANSI/IEEE Standard C37.20

Physical

Tensile Strength	2200 PSI
Ultimate Elongation	575%
Water Absorption 7 days @ 23°C (73°F)	0.3%
Corrosion (Copper) 16 hrs. @ 120°C (248°F)	Pass

Electrical

Dielectric Strength	550 V/mil
Volume Resistivity	10^{13} ohm-cm
Track Resistance	2.5 kV

Thermal

Thermal Endurance	110°C (230°F)
Accelerated Aging	
Tensile	1430 PSI
Elongation	400%
Heat Shock 4 hrs. @ 225°C (437°F)	Pass
Low Temp. Flexibility 4 hrs. @ -55°C (-67°F)	Pass

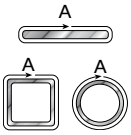
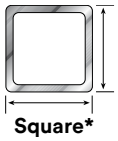
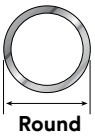
Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

Standard Sizes and Dimensions (without adhesive)

Product Number	Lengths ft. (m)	Expanded I.D. (Minimum)		Recovered I.D. (Maximum)		Expanded Wall Thickness		Recovered Outer Wall Thickness	
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
BBI-3A	20 (6,1) 50 (15,2)	2.38	(60,0)	1.01	(26,0)	.049	(1,24)	.113	(2,87)
BBI-4A	20 (6,1) 50 (15,2)	4.35	(110,0)	1.67	(42,0)	.043	(1,09)	.113	(2,87)
BBI-5A	20 (6,1) 50 (15,2)	5.30	(135,0)	2.04	(52,0)	.043	(1,09)	.114	(2,90)
BBI-6A	20 (6,1) 50 (15,2)	5.90	(150,0)	2.33	(59,0)	.046	(1,17)	.117	(2,97)
BBI-7A	20 (6,1) 50 (15,2)	6.78	(172,0)	2.55	(65,0)	.048	(1,22)	.130	(3,30)
BBI-8A	20 (6,1) 50 (15,2)	8.25	(210,0)	3.18	(81,0)	.049	(1,24)	.128	(3,25)
BBI-9A	20 (6,1) 50 (15,2)	8.83	(224,0)	3.78	(96,0)	.054	(1,37)	.127	(3,23)
BBI-10A	20 (6,1) 50 (15,2)	10.28	(261,0)	4.53	(115,0)	.059	(1,50)	.138	(3,51)

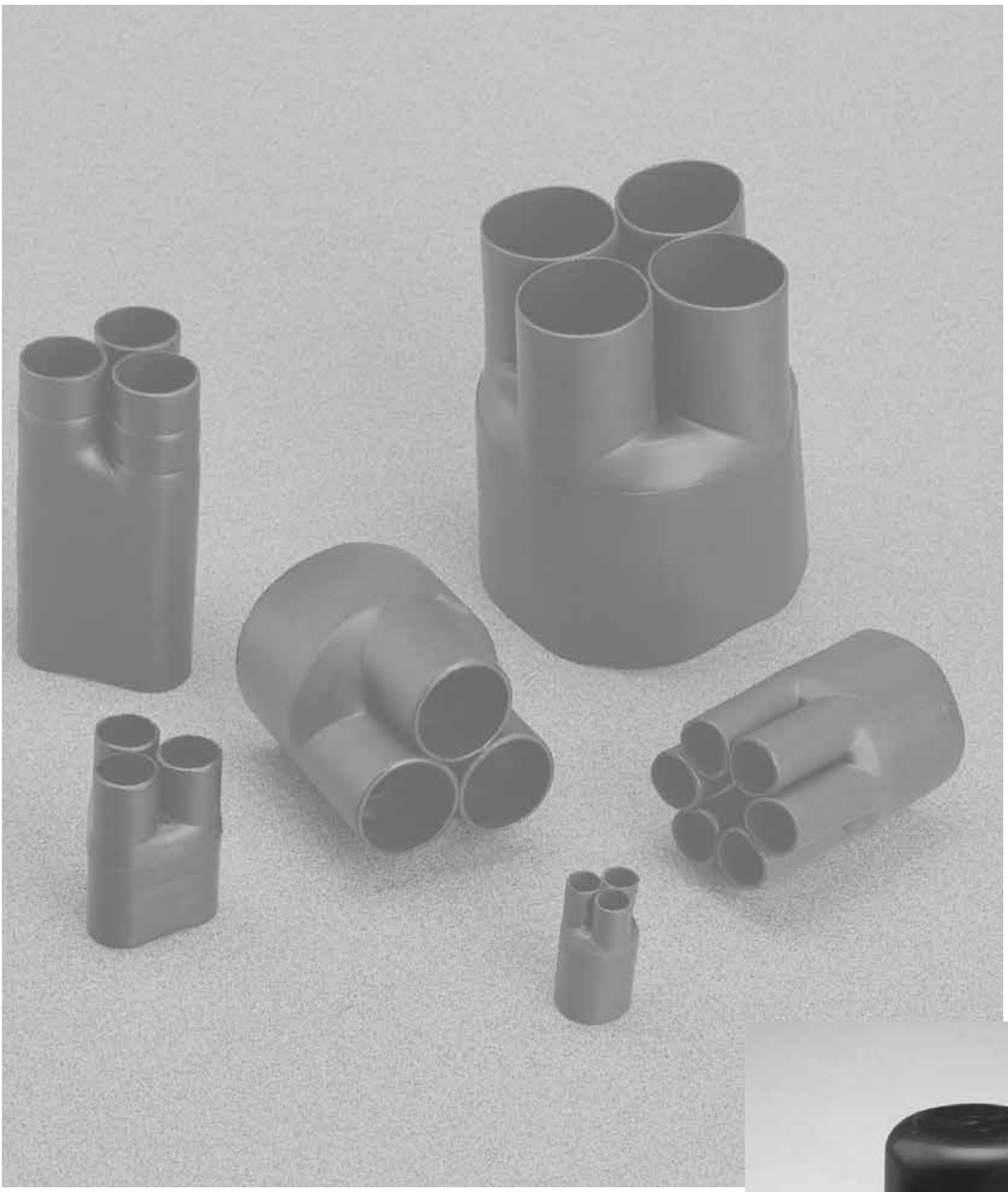
Note: Dimensions in inches are approximate.

Bus Bar Size Ranges

Product Number	Outside Dimension (Bar Circumference A) 	 Rectangular*	 Square*	 Round
5.8 & 15 kV Bus Bar Size Ranges				
BBI-3A	3.28 – 5.57 in. (83 – 141 mm)	1-1/2 × 1/4 – 2-1/2 × 1/2 in. (38×6 – 64×13 mm)	1 × 1 – 1-1/2 × 1-1/2 in. (25×25 – 38×38 mm)	1-1/8 – 1-3/4 in. (29 – 44 mm)
BBI-4A	5.43 – 8.86 in. (138 – 225 mm)	2-1/2 × 3/8 – 4 × 3/4 in. (64×10 – 102×19 mm)	2 × 2 in. (51 × 51 mm)	1-3/4 – 2-3/4 in. (44 – 70 mm)
BBI-5A	6.67 – 10.86 in. (169 – 276 mm)	3 × 5/8 – 5 × 3/4 in. (76×16 – 127×19 mm)	2 × 2 – 2-1/2 × 2-1/2 in. (51×51 – 64×64 mm)	2-1/8 – 3-3/8 in. (54 – 86 mm)
BBI-6A	7.57 – 12.86 in. (192 – 327 mm)	3-1/2 × 1/2 – 6 × 3/4 in. (89×13 – 152×19 mm)	2-1/2 × 2-1/2 – 3 × 3 in. (64×64 – 76×76 mm)	2-1/2 – 4 in. (64 – 102 mm)
BBI-7A	8.28 – 13.00 in. (210 – 330 mm)	4 × 1/4 – 6 × 3/4 in. (102×6 – 152×19 mm)	2-1/2 × 2-1/2 – 3 × 3 in. (64×64 – 76×76 mm)	2-3/4 – 4-1/8 in. (70 – 105 mm)
BBI-8A	10.29 – 16.43 in. (261 – 417 mm)	5 × 1/4 – 8 × 3/8 in. (127×6 – 203×10 mm)	3 × 3 – 4 × 4 in. (76×76 – 102×102 mm)	3-3/8 – 5-1/8 in. (86 – 130 mm)
BBI-9A	12.29 – 19.23 in. (312 – 488 mm)	6 × 1/4 – 9 × 3/4 in. (152×6 – 229×19 mm)	3-1/2 × 3-1/2 – 5 × 5 in. (89×89 – 127×127 mm)	4 – 6-1/8 in. (102 – 156 mm)
BBI-10A	15.43 – 24.14 in. (392 – 613 mm)	8 × 1/4 – 10 × 3/4in. (203×6 – 254×19 mm)	5 × 5 – 6 × 6 in. (127×127 – 152×152 mm)	5 – 7-5/8 in. (127 – 194 mm)
25 kV Bus Bar Size Ranges				
BBI-3A	3.28 – 3.56 in. (83 – 90 mm)	1 1/2 × 1/4 – 1 1/2 × 3/8 in. (38×6 – 38×10 mm)	Measure Circumference	1-1/8 in. (29 mm)
BBI-4A	5.43 – 5.80 in. (138 – 147 mm)	2 1/2 × 3/8 – 2 1/2 × 5/8 in. (64×10 – 64×16 mm)	Measure Circumference	1-3/4 in. (44 mm)
BBI-5A	6.67 – 7.18 in. (169 – 182 mm)	3 × 5/8 – 3 × 3/4 in. (76×16 – 76×19 mm)	Measure Circumference	2-1/8 – 2-1/4 in. (54 – 57 mm)
BBI-6A	7.57 – 8.43 in. (192 – 214 mm)	3 1/2 × 1/2 – 4 × 1/4 in. (89×13 – 102×6 mm)	Measure Circumference	2-1/2 – 2-5/8 in. (64 – 67 mm)
BBI-7A	8.28 – 10.44 in. (210 – 265 mm)	4 × 1/4 – 5 × 3/8 in. (102×6 – 127×10 mm)	2-1/2 × 2-1/2 in. (64×64 mm)	2-3/4 – 3-1/4 in. (70 – 83 mm)
BBI-8A	10.29 – 12.88 in. (261 – 327 mm)	5 × 1/4 – 6 × 3/4 in. (127×6 – 152×19 mm)	3 × 3 in. (76×76 mm)	3-1/8 – 4 in. (86 – 102 mm)
BBI-9A	12.29 – 15.31 in. (312 – 389 mm)	6 × 1/4 – 7 × 3/4 in. (152×6 – 178×19 mm)	3-1/2 × 3-1/2 – 4 × 4 in. (89×89 – 102×102 mm)	4 – 4-7/8 in. (102 – 124 mm)
BBI-10A	15.43 – 19.79 in. (392 – 503 mm)	8 × 1/4 – 9 × 3/4 in. (203×6 – 229×19 mm)	5 × 5 in. (127×127 mm)	5 – 6-1/4 in. (127 – 159 mm)
35 kV Bus Bar Size Ranges				
BBI-7A	8.28 – 8.86 in. (210 – 225 mm)	4 × 1/4 – 4 × 3/4 in. (102×6 – 102×19 mm)	Measure Circumference	2-3/4 in. (70 mm)
BBI-8A	10.29 – 10.94 in. (261 – 278 mm)	(5 × 1/4 – 5 × 3/4 in. (127×6 – 127×19 mm)	Measure Circumference	3-3/8 in. (86 mm)
BBI-9A	12.29 – 13.00 in. (312 – 330 mm)	6 × 1/4 – 6 × 3/4 in. (152×6 – 152×19 mm)	Measure Circumference	4 – 4-1/8 in. (102 – 105 mm)
BBI-10A	15.43 – 16.86 in. (392 – 428 mm)	8 × 1/4 – 8 × 3/4 in. (203×6 – 203×19 mm)	Measure Circumference	5 – 5-1/4 in. (127 – 133 mm)

* Note: Rectangular and square bar sizes are based on bars having radiused edges and corners.

3M™ Heat Shrinkable Molded Shapes



Heavy-Duty Breakout Boots:

- Strain relief and environmental and mechanical protection
- For breakouts in multiconductor armored or sheathed cables

Heavy-Duty End Caps:

- Seal cable ends
- Provide environmental and mechanical protection
- Most can be fitted with air valves suitable for pressurized cable applications

3M™ Heat Shrinkable Shapes Selection Guide

3M Part Series	Description	Style	Page
Heavy-Duty Breakout Boots			
HDBB-205 to 230	Heavy-Duty Breakout Boot, 2-Way Outlet		72
HDBB-310 to 345	Heavy-Duty Breakout Boot, 3-Way Outlet		73
HDBB-405 to 430	Heavy-Duty Breakout Boot, 4-Way Outlet		74
HDBB-505	Heavy-Duty Breakout Boot, 5-Way Outlet		75
HDBB-605	Heavy-Duty Breakout Boot, 6-Way Outlet		76
Cable End Caps			
SKE 4/10 to SKE 45/100	Heavy-Duty End Caps		78

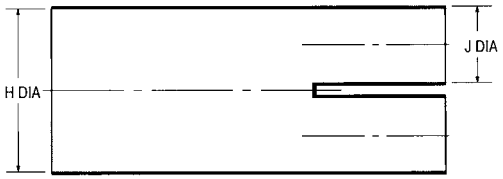
3M™ Heat Shrink Heavy-Duty Breakout Boot HDBB-205 to 230

2-Way Outlet

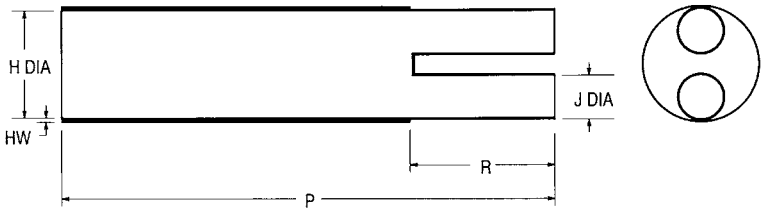
Typical applications

These breakout boots provide strain relief and environmental/mechanical protection for breakouts in multiconductor armored or sheathed cables. This style is designed for two breakouts.

Expanded part (as supplied)



Fully recovered part (after heating)



Standard Sizes and Dimensions

Part Number	NAVSEA or DOD-STD-2003-1 Part Number	Cable End H DIA		Conductor Legs J DIA		P +10% R	R +10% R	HW +20% R
		Min X	Max R	Min X	Max R			
HDBB-205-1-250	1A62-1	0.80 (20.32)	0.37 (9.40)	0.33 (8.38)	0.11 (2.79)	2.70 (68.58)	0.70 (17.78)	0.06 (1.52)
HDBB-210-1-250	1A62-2	1.20 (30.48)	0.60 (15.24)	0.50 (12.70)	0.17 (4.32)	3.50 (88.90)	1.00 (25.40)	0.08 (2.03)
HDBB-220-1-250	1A62-3	1.90 (48.26)	0.90 (22.86)	0.75 (19.05)	0.30 (7.62)	4.20 (106.68)	1.20 (30.48)	0.12 (3.05)
HDBB-230-1-250	1A62-4	3.00 (76.20)	1.50 (38.10)	1.45 (36.83)	0.50 (12.70)	5.00 (127.00)	1.50 (38.10)	0.12 (3.05)

Notes:

- All dimensions in both inches and metric, all angles in degrees
- Dimension in table: X = Expanded (Minimum) R = Recovered (Maximum)
- Color: Black
- 3M CAGE Code: 75037

Materials Available	Standard Part Supplied with -250 Adhesive		
-1 Semi-rigid Flame Retardant Polyolefin†	**Adhesive (Part #)**	**Factory Applied**	**Description**
-3 Flexible Polyolefin, Halogen Free*	TTS-250	-250	Thermoplastic 80°C
-6 Flexible Flame Retardant Polyolefin*			

† Standard Product

* Price, minimum order quantity and lead will vary for these.

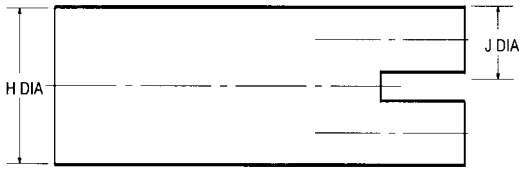
3M™ Heat Shrink Heavy-Duty breakout Boot HDBB-310 to 345

3-Way Outlet

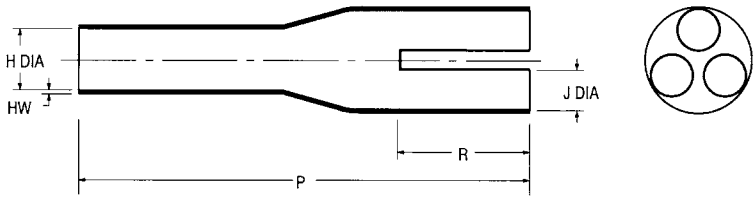
Typical applications

These breakout boots provide strain relief and environmental/mechanical protection for breakouts in multiconductor armored or sheathed cables. This style is designed for three breakouts.

Expanded part (as supplied)



Fully recovered part (after heating)



Standard Sizes and Dimensions

Part Number	NAVSEA or DOD-STD-2003-1 Part Number	Cable End H DIA		Conductor Legs J DIA		P +10% R	R +10% R	HW +20% R
		Min X	Max R	Min X	Max R			
HDBB-310-1-250	1A62-5	0.90 (22.86)	0.36 (9.14)	0.33 (8.38)	0.12 (3.05)	2.70 (68.58)	0.70 (17.78)	0.10 (2.54)
HDBB-320-1-250	1A62-6	1.20 (30.48)	0.50 (12.70)	0.50 (12.70)	0.16 (4.06)	3.30 (83.82)	1.00 (25.40)	0.10 (2.54)
HDBB-321-1-250	1A62-7	1.50 (38.10)	0.69 (17.53)	0.65 (16.51)	0.18 (4.57)	4.00 (101.60)	2.20 (55.88)	0.90 (22.86)
HDBB-325-1-250	1A62-8	1.70 (43.18)	0.90 (22.86)	0.82 (20.83)	0.30 (7.62)	4.50 (114.30)	1.20 (30.48)	0.14 (3.56)
HDBB-335-1-250	1A62-9	2.40 (60.96)	1.40 (35.56)	1.25 (31.75)	0.50 (12.70)	5.10 (129.54)	1.60 (40.64)	0.15 (3.81)
HDBB-340-1-250	1A62-10	3.20 (81.28)	2.00 (50.80)	1.40 (35.56)	0.75 (19.05)	5.10 (129.54)	1.60 (40.64)	0.15 (3.81)
HDBB-345-1-250	1A62-11	4.90 (124.46)	2.32 (58.93)	2.00 (50.80)	1.00 (25.40)	10.00 (254.00)	2.50 (63.50)	0.13 (3.30)

Notes:

- All dimensions in both inches and metric, all angles in degrees
- Dimension in table: X = Expanded (Minimum) R = Recovered (Maximum)
- Color: Black
- 3M CAGE Code: 75037

Materials Available	Standard Part Supplied with -250 Adhesive		
-1 Semi-rigid Flame Retardant Polyolefin†	**Adhesive (Part #)**	**Factory Applied**	**Description**
-3 Flexible Polyolefin, Halogen Free*	TTS-250	-250	Thermoplastic 80°C
-6 Flexible Flame Retardant Polyolefin*			

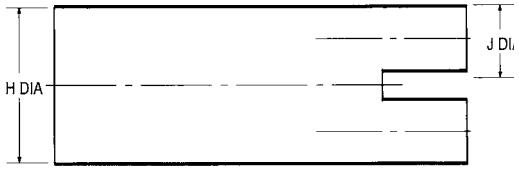
3M™ Heat Shrink Heavy-Duty Breakout Boot HDBB-405 to 430

4-Way Outlet

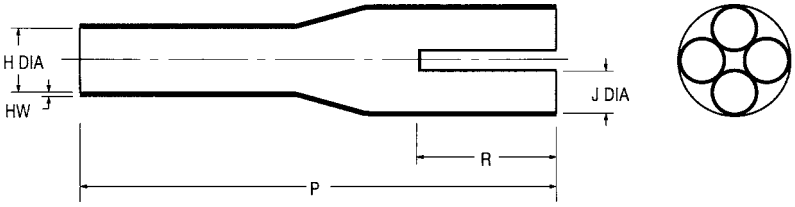
Typical applications

These breakout boots provide strain relief and environmental/mechanical protection for breakouts in multiconductor armored or sheathed cables. This style is designed for four breakouts.

Expanded part (as supplied)



Fully recovered part (after heating)



Standard Sizes and Dimensions

Part Number	NAVSEA or DOD-STD-2003-1 Part Number	Cable End H DIA		Conductor Legs J DIA		P +10% R	R +10% R	HW +20% R
		Min X	Max R	Min X	Max R			
HDBB-405-1-250	1A62-12	0.90 (22.86)	0.43 (10.92)	0.28 (7.11)	0.11 (2.79)	2.75 (69.85)	0.75 (19.05)	0.05 (1.27)
HDBB-410-1-250	1A62-13	1.25 (31.75)	0.80 (20.32)	0.50 (12.70)	0.19 (4.83)	3.30 (83.82)	1.00 (25.40)	0.09 (2.29)
HDBB-415-1-250	1A62-14	1.75 (44.45)	0.98 (24.89)	0.79 (20.07)	0.28 (7.11)	3.50 (88.90)	1.20 (30.48)	0.15 (3.81)
HDBB-420-1-250	1A62-15	2.35 (59.69)	1.00 (25.40)	1.00 (25.40)	0.35 (8.89)	8.50 (215.90)	1.70 (43.18)	0.15 (3.81)
HDBB-425-1-250	1A62-16	2.65 (67.31)	1.40 (35.56)	1.20 (30.48)	0.53 (13.46)	5.00 (127.00)	1.50 (38.10)	0.15 (3.81)
HDBB-430-1-250	1A62-17	5.25 (133.35)	3.00 (76.20)	1.35 (34.29)	0.55 (13.97)	9.00 (228.60)	3.00 (76.20)	0.14 (3.56)

Notes:

- All dimensions in both inches and metric, all angles in degrees
- Dimension in table: X = Expanded (Minimum) R = Recovered (Maximum)
- Color: Black
- 3M CAGE Code: 75037

Materials Available	Standard Part Supplied with -250 Adhesive		
-1 Semi-rigid Flame Retardant Polyolefin†	**Adhesive (Part #)**	**Factory Applied**	**Description**
-3 Flexible Polyolefin, Halogen Free*	TTS-250	-250	Thermoplastic 80°C
-6 Flexible Flame Retardant Polyolefin*			

3M™ Heat Shrink Heavy-Duty Breakout Boot HDBB-505

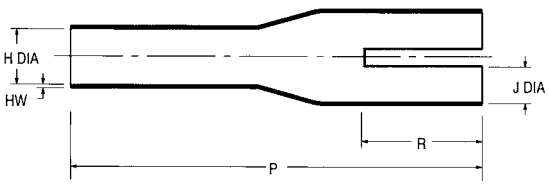
5-Way Outlet

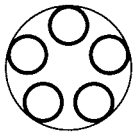
Typical applications

These breakout boots provide strain relief and environmental/mechanical protection for breakouts in multiconductor armored or sheathed cables. This style is designed for five breakouts.

Expanded part (as supplied)

Fully recovered part (after heating)





Standard Sizes and Dimensions

Part Number	Cable End H DIA		Conductor Legs J DIA		P +10% R	R +10% R	HW +20% R
	Min X	Max R	Min X	Max R			
HDBB-505-1-250	2.36 (59.94)	0.96 (24.38)	1.18 (29.97)	0.29 (7.37)	7.08 (179.83)	1.18 (29.97)	0.14 (3.56)

Notes:

- All dimensions in both inches and metric, all angles in degrees
- Dimension in table: X = Expanded (Minimum) R = Recovered (Maximum)
- Color: Black
- 3M CAGE Code: 75037

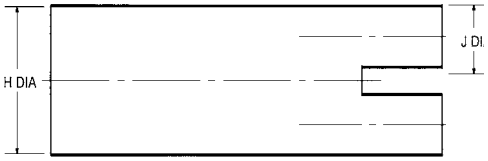
Materials Available	Standard Part Supplied with -250 Adhesive		
-1 Semi-rigid Flame Retardant Polyolefin†	**Adhesive (Part #)**	**Factory Applied**	**Description**
-3 Flexible Polyolefin, Halogen Free*	TTS-250	-250	Thermoplastic 80°C
-6 Flexible Flame Retardant Polyolefin*			

3M™ Heat Shrink Heavy-Duty Breakout Boot HDBB-605
6-Way Outlet

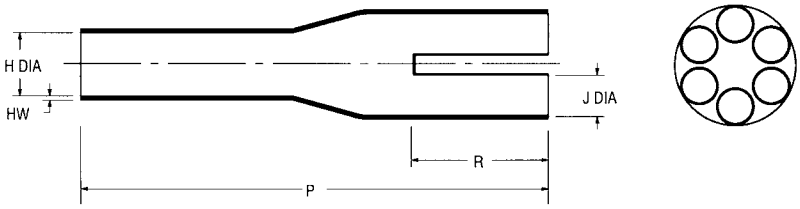
Typical applications

These breakout boots provide strain relief and environmental/mechanical protection for breakouts in multiconductor armored or sheathed cables. This style is designed for six breakouts.

Expanded part (as supplied)



Fully recovered part (after heating)



Standard Sizes and Dimensions

Part Number	NAVSEA or DOD-STD-2003-1 Part Number	Cable End H DIA		Conductor Legs J DIA		P +10% R	R +10% R	HW +20% R
		Min X	Max R	Min X	Max R			
HDBB-605-1-250	1A62-18	2.39 (60.71)	1.45 (36.83)	0.80 (20.32)	0.35 (8.89)	5.40 (137.16)	2.00 (50.80)	0.10 (2.54)

Notes:
- All dimensions in both inches and metric, all angles in degrees
- Dimension in table: X = Expanded (Minimum) R = Recovered (Maximum)
- Color: Black
- 3M CAGE Code: 75037

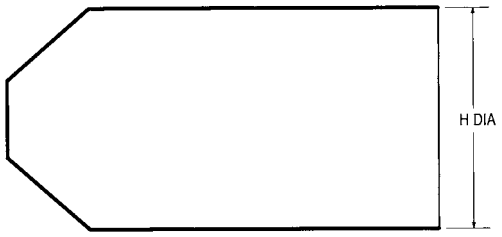
Materials Available	Standard Part Supplied with -250 Adhesive		
-1 Semi-rigid Flame Retardant Polyolefin†	**Adhesive (Part #)**	**Factory Applied**	**Description**
-3 Flexible Polyolefin, Halogen Free*	TTS-250	-250	Thermoplastic 80°C
-6 Flexible Flame Retardant Polyolefin*			

3M™ Heat Shrink Heavy-Duty End Caps SKE 4/10 to SKE 45/100

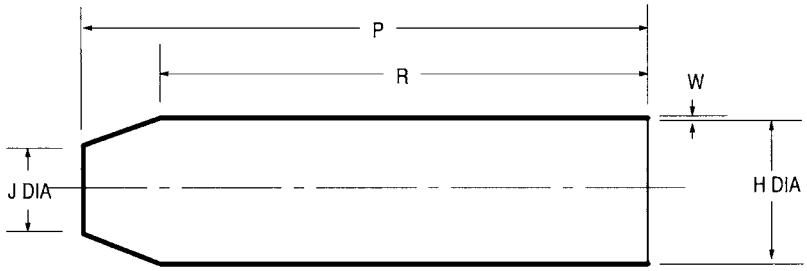
Typical applications

Heat shrinkable end caps are typically used to seal cable ends and provide mechanical and environmental protection. With the exception of SKE 4/10, these end caps can be fitted with air valves suitable for pressurized cable applications. Consult factory.

Expanded part (as supplied)



Fully recovered part (after heating)



Standard Sizes and Dimensions

Part Number	Cable End H DIA		Conductor Legs J DIA	P +10% R	R +10% R	HW +20% R	For Cable Diameters
	Min X	Max R	Max R				
SKE 4/10	0.39 (9.91)	0.16 (4.06)	0.12 (3.05)	1.32 (33.53)	1.18 (29.97)	0.08 (2.03)	0.16 - 0.31 (4-8)
SKE 8/20	0.79 (20.07)	0.30 (7.62)	0.26 (6.60)	2.18 (55.37)	1.97 (50.04)	0.09 (2.29)	0.31 - 0.43 (8-16)
SKE 15/40	1.57 (39.88)	0.59 (14.99)	0.41 (10.41)	3.54 (89.92)	3.15 (80.01)	0.12 (3.05)	0.59-1.26 (15-32)
SKE 25/63	2.48 (62.99)	0.98 (24.89)	0.63 (16.00)	5.63 (143.00)	5.12 (130.05)	0.13 (3.30)	1 - 1.97 (25-50)
SKE 30/76	2.99 (75.95)	1.18 (29.97)	0.67 (17.02)	6.22 (157.99)	5.91 (150.11)	0.16 (4.06)	1.18 - 2.36 (30-60)
SKE 45/100	3.94 (100.08)	1.77 (44.96)	1.02 (25.91)	6.40 (162.56)	5.50 (139.70)	0.16 (4.06)	1.77 - 3.15 (45-80)

Notes:

- All dimensions in both inches and metric, all angles in degrees
- Dimension in table: X = Expanded (Minimum) R = Recovered (Maximum)
- Color: Black
- 3M CAGE Code: 75037

Materials Available	Standard Part Supplied with -250 Adhesive		
-1 Semi-rigid Flame Retardant Polyolefin*	**Adhesive (Part #)**	**Factory Applied**	**Description**
-3 Flexible Polyolefin, Halogen Free*	TTS-250	-250	Thermoplastic 80°C
-6 Flexible Flame Retardant Polyolefin*			

3M™ Moisture Sealing Products

EMB/EMS:

- Self-fusing rubber based mastic
- Flame retardant
- Solvent resistant

3M™ Electrical Moisture Block EMB

3M™ Electrical Moisture Block (EMB) is a specially formulated rubber adhesive/sealant for moisture proofing wire bundles.

- Resistant to salt water, corrosive chemicals and automotive fluids
- Flexible over a wide temperature range
- Easily installed
- Flame retardant

3M EMB moisture block is a self-fusing, rubber based insulating adhesive/sealant designed to prevent the migration of water along harness wiring. 3M EMB moisture block is supplied on a release liner and offered in standard sizes to accommodate different size wire bundles. 3M EMB moisture block is compatible with typical wire insulation such as PVC, synthetic rubber, and crosslinked polyethylene.

Performance Criteria

3M EMB moisture block is supplied on a release liner in three thicknesses. They are compatible with typical extruded wire insulations found in automotive and marine wiring. The product is not functionally affected by moisture, or automotive fluids, and withstands severe vibration and extreme temperature changes. Sealed wire harnesses have demonstrated effective moisture proofing in vehicles through-firewall applications. In addition, sealed harnesses withstand direct spray in 3M laboratory tests.

Installation Techniques

Remove cut piece from liner. Place among wires ensuring there is space between wires to allow room for sealant flow. Wires are best aligned vertically to accomplish this. Wrap around to other side of wire and press together (figure 1).

A second assembly can then be pressed into the original. Further wires are sealed in the same manner (figure 2).

After assembly, the sealant is pressed together and shaped by hand and then compressed with a mechanical tool. To complete the harness moisture block, tightly insulate with 3M Heat Shrink or Cold Shrink Tubing or 3M Vinyl Tape (figure 3).

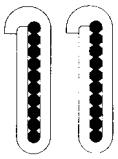


Figure 1

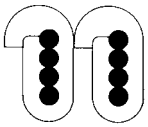


Figure 2

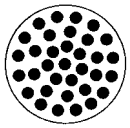


Figure 3

Storage

Under normal storage conditions (23°C, @ 50% RH), 3M EMB moisture block will have a minimum two year shelf life when the material is stored in the original container.

Product Description

Part Number	Color	Pad Thickness	Pad Dimensions
EMB-45R	Black	.045"	0.75" x 100'
EMB60	Black	.060"	0.75" x 100'
EMB60R	Black	.060"	0.75" x 100'
EMB-75	Black	.075"	0.875" x 4"

100 foot rolls and other sizes available by special order.

Typical Properties

Property	Value*
Thickness of Sealant[1]	
EMB-45R	45 mils
EMB-60/EMB-60R	60 mils
EMB-75	75 mils
Adhesion to Steel1	12.5 lbs/in. width (22 N/10 mm)
Adhesion to Polyethylene[2]	12.5 lbs/in width (22 N/10 mm)
Water Absorption[3]	0.75%
Heat Resistance[4]	130°C

Test Methods

[1]ASTM-D1000-82a

[2]ASTM-D1000-82a modified

[3]ASTM-D570-63

[4]Ford Performance Test ES-FOEB-1A263-AA

*Not recommended for specification purposes. Product specifications will be provided upon request.

3M™ Electrical Moisture Sealant Pads EMS II

Flame-Retardant All-Weather Polyvinyl Chloride Backing with Thick Rubber Adhesive for Wiring Harnesses

- Encapsulates and seals under 600 volt connections
- Resistant to salt water, corrosive chemicals
- Easily installed
- Flexible over wide temperature range
- Resists vapors/splashes from automotive fluids
- Improved three-sided construction, mastic exposure eliminated

3M™ Electrical Moisture Sealant Pads EMS II-60 and EMS II-90, are self-fusing, rubber based insulating compounds laminated to a flexible, all-weather grade vinyl (PVC) backing. The pre-cut pads are designed to electrically insulate and moisture seal electrical junctions for automotive, trailer, truck, heavy equipment, marine or other outdoor wiring connections. These pads have excellent resistance to abrasion, moisture, ozone, alkalies, acids, copper corrosion and varying weathering conditions.

The seal materials are compatible with typical wire insulations, such as PVC, synthetic rubber, and cross-linked polyethylene.

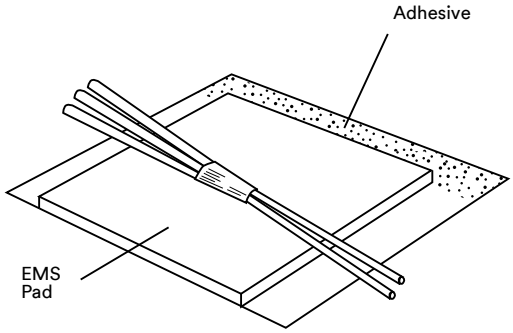
These pads incorporate a vinyl backing overlap on three sides. This improvement eliminates exposed sealant when the pad is applied.

Performance criteria

The insulation is a composite of all-weather polyvinyl chloride (PVC) backing and a thick rubber-based pressure sensitive adhesive. 3M EMS II electrical moisture sealant pads do not degrade when exposed to automotive and marine environments. They are compatible with typical extruded wire insulations found in automotive and marine wiring, and are not affected by severe vibration or extreme temperature changes. These products are not functionally affected by moisture, auto fluid splashes or vapors.

Installation techniques

Remove pad from liner. Place splice in center of pad with adhesive tape side parallel to wires and fold pad around splice such that adhesive surfaces come in contact. Press together. Place the newly insulated splice in the center of a compression tool with the pad seam up. Compress the pad with tool for four seconds. Finger pressure may be adequate for simpler splices. Remove splice.



NOTE: *Do not hold wires while compressing pad. Hydraulic pressure from compressed adhesive will flair the wires automatically causing the adhesive to flow between and seal the wires. Pressed pads may be reshaped to make the covered junction more compact.*

Typical Properties

Property	Conditions*
Current Leakage	<0.250 microamps
Heat Aging	130°C
Thermal Cycle	–40°C to 130°C
Vibration	24 hrs.
Auto Fluid Compatibility	10 fluids
Cold Flex	–18°C
Dielectric Withstand	1000 volts A.C.

*Not recommended for specification purposes. Product specifications will be provided upon request.

3M Test Methods available upon request. EMS II-60 and EMS II-90 moisture sealant pads meet UL flammability requirements.

Product Description

Part Number	Color	Pad Dimensions (sealant only)	Overall Thickness with vinyl backing
EMS II-60	Gray	.060" x 1.5" x 1.5"	.067
EMS II-90	Brown	.090" x 1.5" x 1.5"	.097
EMS II-125	Black	.125" x 1.5" x 1.5"	.132

Sizing Guidelines for 3M™ Electrical Moisture Sealant Pads EMS II given AWG and Number of Wires*

Number of wires						
Wire AWG	1	2	3	4	5	6
22 AWG	EMS II-60	EMS II-60	EMS II-60	EMS II-60	EMS II-60	EMS II-90
20 AWG	EMS II-60	EMS II-60	EMS II-60	EMS II-60	EMS II-90	EMS II-90
18 AWG	EMS II-60	EMS II-60	EMS II-60	EMS II-90	EMS II-90	EMS II-125
16 AWG	EMS II-60	EMS II-60	EMS II-90	EMS II-90	EMS II-125	EMS II-125
14 AWG	EMS II-60	EMS II-90	EMS II-90	EMS II-125		
12 AWG	EMS II-60	EMS II-90	EMS II-125			
10 AWG	EMS II-60	EMS II-125				

Example: Splicing 3 × 16 AWG wires to 1 × 12 AWG wires
Step 1: 3 × 16 AWG wires requires an EMS II-90 pad.
Step 2: 1 × 12 AWG wires requires an EMS II-60 pad.
Therefore use the larger pad, the EMS II-90.

*Guidelines only - Customer must determine suitability for its own application.

Non-Flame Retardant Mastic Pads Available in Smaller Put-ups

3M Mastic Pad 2210 rolls (90 mil thickness) and 2200 pads (125 mil thickness) are made of a self-fusing, rubber-based insulating compound, laminated to an all-weather grade vinyl (PVC) backing. They mold easily around difficult shapes and will insulate, moisture-seal and pad all connections up to 600 volts.

Product Description for 3M™ Mastic Pad

Part Number	Dimensions (Sealant only)	Quantity
2200	0.125" x 3.25" x 4.5" pads	10 pads/box; 5 bxs/ctn
2200	0.125" x 6.5" x 4.5" pads	10 pads/box; 5 bxs/ctn
2210	0.090" x 4.0" x 10' roll	1 roll/box; 10 rolls/ctn

3M™ Adhesives to Suit the Application

3M adhesives are an important part of wire harness assemblies where they provide environmental sealing between heat shrinkable components. 3M offers two adhesive options to suit a range of application and temperature requirements, while retaining compatibility with the various types of 3M molded shapes and tubings used in wire harnesses.

Thermoplastic Hot Melt Adhesives

A hot melt, thermoplastic adhesive, 3M™ Adhesive TTS-450 is supplied in strip or tape form for easy installation at the time of harness fabrication. It will melt and flow when heated, and upon cooling will set up to provide a firm, flexible environmental seal. The tape form permits placing the adhesive where it is required to seal between the shape and tubing prior to shrinking the shape. The heat applied to shrink the shape will also melt and flow the adhesive in place at the same time. Thermoplastic adhesives, such as 3M TTS-450 adhesive, can be remelted if reheated above their melt temperature to facilitate component repair or repositioning.

Two-Part Epoxy Adhesive

3M TPA-150 adhesive is a two-part, epoxy adhesive system adhesive with cure conditions ranging from 24 hours at room temperature to only 30 minutes at 150°C. 3M TPA-150 adhesive is a high temperature adhesive which maintains bond integrity from -55°C to 150°C. It is normally used in high temperature systems, such as with the special purpose elastomeric tubing and shapes.

3M TPA-150 adhesive is packaged in cartridges for use with a 3M Scotch-Weld™ Applicator EPX. This application system simultaneously meters and mixes the adhesives as it is applied, eliminating waste and the need for separate mixing equipment.

The following tables show typical properties and compatibility with shapes and tubing for these adhesives.

Adhesives

3M™ Adhesives for Heat-Shrinkable Molded Shapes Compatibility with Shapes and Tubings

3M Adhesive Part Number	Description	Available Form	Factory Preapplied Designation	Operating Temperature	Compatible With
TPA-150, or TPA 150M	2-Part Thermoset cross linkable Epoxy	1.67 oz. Cartridge with Applicator	_	-55°C to 150°C	Polyolefin, NST VTN-200, PST-H, Kynar
TTS-450	Thermoplastic hot melt, re-enterable	Tape 100' x 1" x .010"	-450	-55°C to 120°C	Polyolefin, NST

Cold Shrink Connector Insulators

These open-ended, tubular rubber sleeves are designed for protecting and insulating solid dielectric insulated wire and cable but also provide excellent strain relief and physical protection for wire harnesses.

They are factory expanded and assembled onto a core which is removed after the tube has been positioned for installation over an inline connection or harness section. The tube shrinks, forming a dynamic, environmental seal which resists prolonged aging and exposure. It installs quickly with little training and no tools or heat source.

The 3M Cold Shrink Connector Insulators 8420 series are made of EPDM rubber. Six diameter sizes may cover a range of 1000-volt cable to 10 AWG through 1000 kcmil.

The 3M insulators 8440 series are made of silicone rubber and come in three sizes which may cover an application range of 6 AWG to 3/0 AWG.

Product Series	UPC	Typical Conductor Size	Min. Cable Diameter for Seal	Max.** Diam. Insulator Covers	Max. Connector Length	Relaxed Tube Length	Inner Unit Pack	Case Qty.
Single Conductor Cable								
See above for cable type illustration.								
8423-6	054007-42146	6–4 AWG (14–16 mm²)	0.31" (7,8 mm)	0.56" (4,3 mm)	2.0" (50,8 mm)	6.0" (152,4 mm)	10 each	10 each per case
8423-6P	054007-42864	6–4 AWG	0.31" (7,8 mm)	0.56" (4,3 mm)	2.0" (50,8 mm)	6.0" (152,4 mm)	10 each	10 each per case
8424-8	054007-42390	10–1/0 AWG (6–16 mm²)	0.10" (2,5 mm)	0.82" (20,9 mm)	3.0" (76,2 mm)	8.0" (203,2 mm)	10 each	10 each per case
8424-8P	054007-42865	1–1/0 AWG	0.10" (2,5 mm)	0.82" (20,9 mm)	3.0" (76,2 mm)	8.0" (203,2 mm)	10 each	10 each per case
8425-8	054007-42391	2–1/0 AWG (35–50 mm²)	0.40" (10,1 mm)	0.82" (20,9 mm)	3.0" (76,2 mm)	8.0" (203,2 mm)	10 each	10 each per case
8425-8P	054007-42866	2–1/0 AWG	0.40" (10,1 mm)	0.82" (20,9 mm)	3.0" (76,2 mm)	8.0" (203,2 mm)	10 each	10 each per case
8426-9	054007-34457	2/0 AWG–250 kcmil (70–125 mm²)	0.55" (13,9 mm)	1.18" (30,1 mm)	5.0" (127,0 mm)	9.0" (228,6 mm)	10 each	10 each per case
8426-9M	054007-43436	2–4/0 AWG (30–90 mm²)	0.40" (10,1 mm)	1.18" (30,1 mm)	5.0" (127,0 mm)	9.0" (228,6 mm)	10 each	10 each per case
8426-9P	054007-42867	2/0 AWG–250 kcmil	0.55" (13,9 mm)	1.18" (30,1 mm)	5.0" (127,0 mm)	9.0" (228,6 mm)	10 each	10 each per case
8426-11	054007-34458	2/0 AWG–250 kcmil (70–125 mm²)	0.55" (13,9 mm)	1.18" (30,1 mm)	7.0" (177,8 mm)	11.0" (279,4 mm)	10 each	10 each per case
8427-6	054007-09915	-	0.69" (17,5 mm)	1.38" (35,1 mm)	2.0" (50,8 mm)	6.0" (152,4 mm)	10 each	10 each per case
8427-12	054007-34459	250–400 kcmil (125–200 mm²)	0.69" (17,5 mm)	1.38" (35,1 mm)	8.0" (203,2 mm)	12.0" (304,8 mm)	10 each	10 each per case
8427-12P	054007-42868	250–400 kcmil	0.69" (17,5 mm)	1.38" (35,1 mm)	8.0" (203,2 mm)	12.0" (304,8 mm)	10 each	10 each per case
8427-16	054007-34460	250–400 kcmil (125–200 mm²)	0.69" (17,5 mm)	1.38" (35,1 mm)	12.0" (304,8 mm)	16.0" (406,4 mm)	10 each	10 each per case
8428-6	054007-09916	-	0.95" (24,1 mm)	1.94" (49,2 mm)	2.0" (50,8 mm)	6.0" (152,4 mm)	10 each	10 each per case
8428-6M	051128-53828	450–800 kcmil	0.95" (24,1 mm)	1.94" (49,2 mm)	2.0" (50,8 mm)	6.0" (152,4 mm)	50 each	50 each per case
8428-8	051128-53711	500–800 kcmil	0.95" (24,1 mm)	1.94" (49,2 mm)	3.0" (76,2 mm)	8.0" (203,2 mm)	25 each	25 each per case
8428-12	054007-09056	500–800 kcmil (300–400 mm²)	0.95" (24,1 mm)	1.94" (49,2 mm)	8.0" (203,2 mm)	12.0" (304,8 mm)	10 each	10 each per case
8428-12M	054007-43746	500–800 kcmil	-	-	-	-	10 each	10 each per case
8428-12P	054007-42869	500–800 kcmil	0.95" (24,1 mm)	1.94" (49,2 mm)	8.0" (203,2 mm)	12.0" (304,8 mm)	10 each	10 each per case
8428-18	054007-34461	500–800 kcmil (300–400 mm²)	0.95" (24,1 mm)	1.94" (49,2 mm)	14.0" (355,6 mm)	18.0" (457,2 mm)	10 each	10 each per case

Product Series	UPC	Typical Conductor Size	Min. Cable Diameter for Seal	Max.** Diam. Insulator Covers	Max. Connector Length	Relaxed Tube Length	Inner Unit Pack	Case Qty.
Single Conductor Cable								
8429-6	054007-09917	-	1.27" (32,2 mm)	2.67" (67,8 mm)	2.0" (50,8 mm)	6.0" (152,4 mm)	10 each	10 each per case
8429-9	054007-09931	900–1000 kcmil (500 mm²)	1.27" (32,2 mm)	2.67" (67,8 mm)	5.0" (127,0 mm)	9.0" (228,6 mm)	10 each	10 each per case
8429-9M	054007-42018	900–1000 kcmil	1.27" (32,2 mm)	2.67" (67,8 mm)	5.0" (127,0 mm)	9.0" (228,6 mm)	10 each	10 each per case
8429-12	054007-42389	900–1000 kcmil (500 mm²)	1.27" (32,2 mm)	2.67" (67,8 mm)	8.0" (203,2 mm)	12.0" (304,8 mm)	10 each	10 each per case
8429-15	054007-44198	900–1000 kcmil (500 mm²)	1.27" (32,2 mm)	2.67" (67,8 mm)	11.0" (279,4 mm)	15.0" (381,0 mm)	10 each	10 each per case
8429-18	054007-34462	900–1000 kcmil (500 mm²)	1.27" (32,2 mm)	2.67" (67,8 mm)	14.0" (355,6 mm)	18.0" (457,2 mm)	10 each	10 each per case
8430-9	054007-42147	1250-2000 kcmil	1.68" (42,6 mm)	3.69" (93,7 mm)	5.0" (127,0 mm)	9.0" (228,6 mm)	10 each	10 each per case
8430-18	054007-42388	1250-2000 kcmil	1.68" (42,6 mm)	3.69" (93,7 mm)	14.0" (355,6 mm)	18.0" (457,2 mm)	10 each	10 each per case

Product Series	UPC	Typical Conductor Size	Min. Cable Diameter for Seal	Max. Diam. Insulator Cable or Connector Covers	Relaxed Tube Length	Min. Order Quantity	Case Qty.
Single Conductor Cable							
8443-2	054007-09485	6–2 AWG (14–30 mm²)	0.27" (6,9 mm)	0.56" (14,2 mm)	2.00" (50,8 mm)	12 each	12 each per case
8443-6.5	054007-09482	6–2 AWG (14–30 mm²)	0.27" (6,9 mm)	0.56" (14,2 mm)	6.50" (165,1 mm)	12 each	12 each per case
8445-2.5	054007-09486	2–1/0 AWG (35–50 mm²)	0.35" (8,9 mm)	0.72" (18,3 mm)	2.50" (63,5 mm)	12 each	12 each per case
8445-7.5	054007-09483	2-1/0 AWG (35-50 mm²)	0.35" (8,9 mm)	0.72" (18,3 mm)	7.50" (190,5 mm)	12 each	12 each per case
8447-3.2	054007-09487	1/0–3/0 AWG (60–80 mm²)	0.48" (12,2 mm)	0.95" (24,1 mm)	3.20" (81,3 mm)	12 each	12 each per case
8447-8	054007-09484	1/0–3/0 AWG (60–80 mm²)	0.48" (12,2 mm)	0.95" (24,1 mm)	8.00" (203,2 mm)	12 each	12 each per case

Other 3M™ Electrical Insulation Products

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Tape and Related Products

3M offers a wide variety of electrical and electronic insulating tapes for insulating, holding, protecting, bonding, resin impregnation, harnessing and electromagnetic compatibility. These products have key industry component recognition, such as UL, and excellent mechanical, electrical and physical properties. 3M™ Insulating and Conductive Tapes are designed to provide a high level of protection for electrical and electronic components. All 3M tapes and related products feature exceptionally high quality backed by experienced technical support.

Liquid Resins

3M™ Scotchcast™ Electrical Liquid Resins are 100-percent solid, thermosetting, electrical-grade insulating resins. These two-part liquids are classified chemically as either epoxies or polyurethanes. These resins have electrical and physical properties that make them excellent for insulating and protecting electrical and electronic parts and assemblies.

Powder Resins

3M™ Scotchcast™ Powder Resins are a series of one-part, 100-percent-solid electrical-grade systems offering fast curing, excellent thermal and mechanical shock resistance, significant cut-through resistance, high adhesion, excellent chemical and moisture resitance, high-to-low flow characteristics, and excllent electrostatic coating capability. Insulation systems established per UL 1446 and IEC 85 requirements are available in this family of resins up to Class H (180° C).

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