

# 3M™ Heat Shrink Tubing Selector Guide

Product	Material/Typical Applications	Application Specifications
<b>THIN-WALL TUBINGS</b>		
FP-301	Flexible Polyolefin (2:1 Shrink) tubing for general purpose insulation; identification; UL, CSA and MIL-I-23053/5 applications; cable and component covering. Rated to 135°C. (black, white, red, blue, clear, green and yellow)	MIL-I-23053/5, Class 1 and 2; AMS-3636; AMS-3637; File E39100; CSA LR38227
MFP	Semi-rigid, thin-wall (2:1 Shrink) heat-resistant transparent insulation and marking for electronic and appliance applications. Rated to 175°C.	MIL-DTL-23053/18, Class 1; MIL-DTL-23053/8; AMS-3632; UL File E-39100, VW-1, E69751; CSA LR38227 OFT
<b>THIN-WALL ADHESIVE-LINED</b>		
EPS-300	Flexible, polyolefin tubing (3:1 Shrink) with adhesive; insulation, strain relief and environmental protection for automotive and marine wire bundles and splices. Rated to 110°C. (black)	MIL-I-23053/4, Class 3; File 15227
MW	Semi-rigid, polyolefin tubing (2.5:1 Shrink) with adhesive; insulation strain relief and sealing electrical connections and electrical components. Rated to 110°C. (black)	MIL-I-23053/4, Class 1; AMS-3534 File 15227
<b>MEDIUM-WALL</b>		
IMCSN	Adhesive lined, medium wall polyolefin (3:1 Shrink). Split resistant tubing for electrical splices, connections; moisture seals and mechanical protection. Rated to 1000V. (black)	
MDT	Adhesive lined, thick wall polyolefin (3:1 Shrink). Flame-retardant, split resistant tubing for electrical splices, connections; mechanical and abrasion resistance. Rated to 1000V. (black, not printed)	MIL-I-23053/15, Class 2
<b>HEAVY-WALL</b>		
ITCSN	Adhesive lined, thick wall polyolefin (3:1 Shrink), split resistant tubing for electrical splices, connections; mechanical and abrasion resistance. Rated to 1000V. (black)	UL 486D, File E102356
HDT	Adhesive lined, medium wall polyolefin (3:1 Shrink). Flame-retardant, split resistant, tubing for electrical splices, connections; moisture seals and mechanical protection. Rated to 1000V. (black, not printed)	MIL-I-23053/15, Class 1
<b>BUS BAR INSULATION</b>		
BBI-A	See page 439	Conforms to requirements of ANSI/IEEE #C37.20

## 3M™ Heat Shrink Tubing Selector Guide

Typical Properties	FP-301	MW	EPS-300	IMCSN
Operating Temperature Range	-67°F to +275°F (-55°C to +135°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)
Shrink Temperature (Min.)	212°F (100°C)	275°F (135°C)	250°F (121°C)	250°F (121°C)
Shrink Ratio	2:1	2.5:1	3:1	3:1
Standard Sizes Expanded Diameter	3/64" to 4" (1,19 to 101,6 mm)	1/8" to 1" (3,18 to 25,4 mm)	1/8" to 1 1/2" (3,18 to 38,1 mm)	0.400" to 6" (10,16 to 152,4 mm)
Dielectric Strength (V/Mil)	900	900	700	500
Volume Resistivity (ohm-cm)	10 <sup>15</sup>	10 <sup>15</sup>	10 <sup>14</sup>	10 <sup>14</sup>
Tensile Strength (psi)	2400	2200	2100	2400
Elongation (%)	400	400	450	450
Longitudinal Change (± %)	±5%	+1, -10%	+1, -15%	+1, -10%
Specific Gravity	1.3	1.0	1.3	1.28
Flammability	Self-extinguish meets UL 224 flame test except clear	n/a	Outer jacket self-extinguish meets UL 224 flame test	N/A
Corrosive Effect	Non-corrosive	Non-corrosive	Non-corrosive	Non-corrosive
Abrasion Resistance	Good	Good	Good	Good
Fuel and Oil Resistance	Good	Good	Good	Good
Solvent Resistance	Excellent	Excellent	Good	Excellent
Resistance to Acids and Alkalis	Excellent	Excellent	Excellent	Excellent

## 3M™ Heat Shrink Tubing Selector Guide

Typical Properties	ITCSN	HDT	MDT	MFP
Operating Temperature Range	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +347°F (-55°C to +175°C)
Shrink Temperature (Min.)	250°F (121°C)	250°F (121°C)	250°F (121°C)	347°F (175°C)
Shrink Ratio	3:1	3:1	3:1	2:1
Standard Sizes Expanded Diameter	0.400" to 4.30" (10,16 to 152,4 mm)	0.300" to 7.00" (7,62 to 177,8 mm)	0.400" to 4.30" (10,16 to 152,4 mm)	3/64" to 2" (1,19 to 50,8 mm)
Dielectric Strength (V/Mil)	500	500	500	900
Volume Resistivity (ohm-cm)	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>
Tensile Strength (psi)	2400	2400	2400	5500
Elongation (%)	475	475	475	350
Longitudinal Change (± %)	+1, -10%	+1, -10%	+1, -10%	+1, -10%
Specific Gravity	1.28	1.28	1.28	1.7
Flammability	N/A	Flame retardant	Flame retardant	Self-extinguish meets UL 224 VW-1 Test
Corrosive Effect	Non-corrosive	Non-corrosive	Non-corrosive	Non-corrosive
Abrasion Resistance	Good	Good	Good	Excellent
Fuel and Oil Resistance	Good	Good	Good	Excellent
Solvent Resistance	Good	Good	Good	Excellent
Resistance to Acids and Alkalis	Excellent	Excellent	Excellent	Excellent

# Thin-Wall Tubing

## 3M™ Thin-Wall Tubing FP-301

Shrink Ratio 2:1

3M Thin-Wall Tubing FP-301 is a heat shrinkable flexible polyolefin tubing that offers an outstanding balance of electrical, physical and chemical properties for a wide variety of industrial and military applications. Rated for 275°F (135°C) continuous operation. 3M tubing FP-301 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.

3M Clear Tubing FP-301 provides excellent visibility for component packing. All 3M Tubing FP-301 is split resistant, mechanically tough, easily marked and resists cold flow.

FP-301 is available in black, white, red, blue, yellow and clear in the standard lengths of 6-inch (15,2 cm) cut pieces, 48-inch (1,21 m) and small (8.5-inch core diameter) spools of 50 (15,24 m) and 100 (30,48 m) feet. Four-foot lengths of green tubing are available in sizes 1/16 inch to 1/2 inch. The Assorted Color Kit has a total of 133 pieces and contains seven colors: black, red, white, yellow, blue,



green and clear (see chart below). The Black Kit contains 102 pieces, all 6" (512,4 mm) lengths (see chart below). Additional sizes, colors and put-ups are available—please contact your 3M Electrical Products Sales Representative.

Application Specifications: UL Recognized and CSA Certified at 600 volts at 257°F(125°C); UL File No. E-39100 and CSA No. 38227. MIL-I-23053/5, Class 1,2. AMS 3636 (Type I) and AMS 3637 (Type II).

To Order: Reference specific product size, color and description on the following pages. Example: FP-301-1/4, white 6" (15,2 cm) pieces.

## Specifications and Ordering Information for 3M Thin-Wall Tubing FP-301 Assortment Kits

Description	UPC (051135-)	Case Qty.
<b>ASSORTED COLORS KIT</b>	<b>37677</b>	<b>5 kits</b>
Kit Contents:	Kit Quantity:	
3/32" (2,35 mm)	35	—
1/8" (3,18 mm)	28	—
3/16" (4,75 mm)	21	—
1/4" (6,35 mm)	21	—
3/8" (9,53 mm)	14	—
1/2" (12,70 mm)	14	—
<b>ASSORTED BLACK KIT</b>	<b>38139</b>	<b>5 kits</b>
Kit Contents:	Kit Quantity:	
3/16" (4,8 mm)	30	—
1/4" (6,5 mm)	28	—
3/8" (9,6 mm)	20	—
1/2" (12,7 mm)	14	—
3/4" (19,1 mm)	6	—
1" (25,4 mm)	4	—

## Specifications and Ordering Information for 3M™ Thin-Wall Tubing FP-301 Four-Foot Sticks (Small Box)

Product Number	Size	Color	UPC (051135-)	Description	Expanded/Recovered I.D.	Box Qty.
FP-301	3/4" (19,05 mm)	Black	36716	48" Sticks (1,22 m)	0.750/0.375" (19,01/9,53 mm)	12
		Clear	36720			
		White	36721			
		Red	36722			
		Blue	36724			
		Yellow	36723			
		Green	37764			
FP-301	1" (25,4 mm)	Black	36725	48" Sticks (1,22 m)	1.000/0.500" (25,4/12,7 mm)	5
		Clear	36726			
		White	36727			
		Red	36728			
		Blue	36730			
		Yellow	36729			
		Green	37767			
FP-301	1-1/2" (38,1 mm)	Black	36731	48" Sticks (1,22 m)	1.500/0.750" (38,1/19,05 mm)	5
		Clear	36732			
		White	36733			
		Red	36734			
		Blue	36736			
		Yellow	36735			
FP-301	2" (50,8 mm)	Black	36737	48" Sticks (1,22 m)	2.000/1.000" (50,8/25,4 mm)	5
		Clear	36738			
		White	36739			
		Red	36740			
		Blue	36742			
		Yellow	36741			
FP-301	3" (76,2 mm)	Black	36743	48" Sticks (1,22 m)	3.000/1.500" (76,2/38,1 mm)	2
FP-301	3" (76,2 mm)	Clear	36744	48" Sticks (1,22 m)	3.000/1.500" (76,2/38,1 mm)	2
FP-301	4" (101,6 mm)	Black	36745	48" Sticks (1,22 m)	4.000/2.000" (101,6/50,8 mm)	2
		Clear	36746			

## Specifications and Ordering Information for 3M™ FP-301 Four-Foot Sticks (Bulk)

Product Number	Size	Expanded/Recovered I.D.	Color	UPC (054007-)	Case Qty. Feet (sticks)
FP-301	3/64" (1,17 mm)	0.046/0.023" (1,17/0,58 mm)	Black	08432	1,000
			Clear	08438	
			White	08433	
			Red	08738	
			Blue	08734	
			Yellow	58680	
FP-301	1/16" (1,60 mm)	0.063/0.031" (1,6/0,79 mm)	Black	08434	1,000
			Clear	08439	
			White	08435	
			Red	08764	
			Blue	08761	
			Yellow	08770	
FP-301	3/32" (2,36 mm)	0.093/0.046" (2,36/1,17 mm)	Black	08436	1,000
			Clear	08440	
			White	08437	
			Red	08788	
			Blue	08787	
			Yellow	08791	
			Green	37654*	

\* UPC prefix 051135-

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Product	Material/Typical Applications	Application Specifications
<b>THIN-WALL TUBINGS</b>		
FP-301	Flexible Polyolefin (2:1 Shrink) tubing for general purpose insulation; identification; UL, CSA and MIL-I-23053/5 applications; cable and component covering. Rated to 135°C. (black, white, red, blue, clear, green and yellow)	MIL-I-23053/5, Class 1 and 2; AMS-3636; AMS-3637; File E39100; CSA LR38227
MFP	Semi-rigid, thin-wall (2:1 Shrink) heat-resistant transparent insulation and marking for electronic and appliance applications. Rated to 175°C.	MIL-DTL-23053/18, Class 1; MIL-DTL-23053/8; AMS-3632; UL File E-39100, VW-1, E69751; CSA LR38227 OFT
<b>THIN-WALL ADHESIVE-LINED</b>		
EPS-300	Flexible, polyolefin tubing (3:1 Shrink) with adhesive; insulation, strain relief and environmental protection for automotive and marine wire bundles and splices. Rated to 110°C. (black)	MIL-I-23053/4, Class 3; File 15227
MW	Semi-rigid, polyolefin tubing (2.5:1 Shrink) with adhesive; insulation strain relief and sealing electrical connections and electrical components. Rated to 110°C. (black)	MIL-I-23053/4, Class 1; AMS-3534 File 15227
<b>MEDIUM-WALL</b>		
IMCSN	Adhesive lined, medium wall polyolefin (3:1 Shrink). Split resistant tubing for electrical splices, connections; moisture seals and mechanical protection. Rated to 1000V. (black)	
MDT	Adhesive lined, thick wall polyolefin (3:1 Shrink). Flame-retardant, split resistant tubing for electrical splices, connections; mechanical and abrasion resistance. Rated to 1000V. (black, not printed)	MIL-I-23053/15, Class 2
<b>HEAVY-WALL</b>		
ITCSN	Adhesive lined, thick wall polyolefin (3:1 Shrink), split resistant tubing for electrical splices, connections; mechanical and abrasion resistance. Rated to 1000V. (black)	UL 486D, File E102356
HDT	Adhesive lined, medium wall polyolefin (3:1 Shrink). Flame-retardant, split resistant, tubing for electrical splices, connections; moisture seals and mechanical protection. Rated to 1000V. (black, not printed)	MIL-I-23053/15, Class 1
<b>BUS BAR INSULATION</b>		
BBI-A	See page 439	Conforms to requirements of ANSI/IEEE #C37.20

## 3M™ Heat Shrink Tubing Selector Guide

Typical Properties	FP-301	MW	EPS-300	IMCSN
Operating Temperature Range	-67°F to +275°F (-55°C to +135°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)
Shrink Temperature (Min.)	212°F (100°C)	275°F (135°C)	250°F (121°C)	250°F (121°C)
Shrink Ratio	2:1	2.5:1	3:1	3:1
Standard Sizes Expanded Diameter	3/64" to 4" (1,19 to 101,6 mm)	1/8" to 1" (3,18 to 25,4 mm)	1/8" to 1 1/2" (3,18 to 38,1 mm)	0.400" to 6" (10,16 to 152,4 mm)
Dielectric Strength (V/Mil)	900	900	700	500
Volume Resistivity (ohm-cm)	10 <sup>15</sup>	10 <sup>15</sup>	10 <sup>14</sup>	10 <sup>14</sup>
Tensile Strength (psi)	2400	2200	2100	2400
Elongation (%)	400	400	450	450
Longitudinal Change (± %)	±5%	+1, -10%	+1, -15%	+1, -10%
Specific Gravity	1.3	1.0	1.3	1.28
Flammability	Self-extinguish meets UL 224 flame test except clear	n/a	Outer jacket self-extinguish meets UL 224 flame test	N/A
Corrosive Effect	Non-corrosive	Non-corrosive	Non-corrosive	Non-corrosive
Abrasion Resistance	Good	Good	Good	Good
Fuel and Oil Resistance	Good	Good	Good	Good
Solvent Resistance	Excellent	Excellent	Good	Excellent
Resistance to Acids and Alkalis	Excellent	Excellent	Excellent	Excellent

## 3M™ Heat Shrink Tubing Selector Guide

Typical Properties	ITCSN	HDT	MDT	MFP
Operating Temperature Range	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +230°F (-55°C to +110°C)	-67°F to +347°F (-55°C to +175°C)
Shrink Temperature (Min.)	250°F (121°C)	250°F (121°C)	250°F (121°C)	347°F (175°C)
Shrink Ratio	3:1	3:1	3:1	2:1
Standard Sizes Expanded Diameter	0.400" to 4.30" (10,16 to 152,4 mm)	0.300" to 7.00" (7,62 to 177,8 mm)	0.400" to 4.30" (10,16 to 152,4 mm)	3/64" to 2" (1,19 to 50,8 mm)
Dielectric Strength (V/Mil)	500	500	500	900
Volume Resistivity (ohm-cm)	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>	10 <sup>14</sup>
Tensile Strength (psi)	2400	2400	2400	5500
Elongation (%)	475	475	475	350
Longitudinal Change (± %)	+1, -10%	+1, -10%	+1, -10%	+1, -10%
Specific Gravity	1.28	1.28	1.28	1.7
Flammability	N/A	Flame retardant	Flame retardant	Self-extinguish meets UL 224 VW-1 Test
Corrosive Effect	Non-corrosive	Non-corrosive	Non-corrosive	Non-corrosive
Abrasion Resistance	Good	Good	Good	Excellent
Fuel and Oil Resistance	Good	Good	Good	Excellent
Solvent Resistance	Good	Good	Good	Excellent
Resistance to Acids and Alkalis	Excellent	Excellent	Excellent	Excellent

# Thin-Wall Tubing

## 3M™ Thin-Wall Tubing FP-301

Shrink Ratio 2:1

3M Thin-Wall Tubing FP-301 is a heat shrinkable flexible polyolefin tubing that offers an outstanding balance of electrical, physical and chemical properties for a wide variety of industrial and military applications. Rated for 275°F (135°C) continuous operation. 3M tubing FP-301 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.

3M Clear Tubing FP-301 provides excellent visibility for component packing. All 3M Tubing FP-301 is split resistant, mechanically tough, easily marked and resists cold flow.

FP-301 is available in black, white, red, blue, yellow and clear in the standard lengths of 6-inch (15,2 cm) cut pieces, 48-inch (1,21 m) and small (8.5-inch core diameter) spools of 50 (15,24 m) and 100 (30,48 m) feet. Four-foot lengths of green tubing are available in sizes 1/16 inch to 1/2 inch. The Assorted Color Kit has a total of 133 pieces and contains seven colors: black, red, white, yellow, blue,



green and clear (see chart below). The Black Kit contains 102 pieces, all 6" (512,4 mm) lengths (see chart below). Additional sizes, colors and put-ups are available—please contact your 3M Electrical Products Sales Representative.

Application Specifications: UL Recognized and CSA Certified at 600 volts at 257°F(125°C); UL File No. E-39100 and CSA No. 38227. MIL-I-23053/5, Class 1,2. AMS 3636 (Type I) and AMS 3637 (Type II).

To Order: Reference specific product size, color and description on the following pages. Example: FP-301-1/4, white 6" (15,2 cm) pieces.

## Specifications and Ordering Information for 3M Thin-Wall Tubing FP-301 Assortment Kits

Description	UPC (051135-)	Case Qty.
<b>ASSORTED COLORS KIT</b>	<b>37677</b>	<b>5 kits</b>
Kit Contents:	Kit Quantity:	
3/32" (2,35 mm)	35	—
1/8" (3,18 mm)	28	—
3/16" (4,75 mm)	21	—
1/4" (6,35 mm)	21	—
3/8" (9,53 mm)	14	—
1/2" (12,70 mm)	14	—
<b>ASSORTED BLACK KIT</b>	<b>38139</b>	<b>5 kits</b>
Kit Contents:	Kit Quantity:	
3/16" (4,8 mm)	30	—
1/4" (6,5 mm)	28	—
3/8" (9,6 mm)	20	—
1/2" (12,7 mm)	14	—
3/4" (19,1 mm)	6	—
1" (25,4 mm)	4	—

## Specifications and Ordering Information for 3M™ Thin-Wall Tubing FP-301 Four-Foot Sticks (Small Box)

Product Number	Size	Color	UPC (051135-)	Description	Expanded/Recovered I.D.	Box Qty.
FP-301	3/4" (19,05 mm)	Black	36716	48" Sticks (1,22 m)	0.750/0.375" (19,01/9,53 mm)	12
		Clear	36720			
		White	36721			
		Red	36722			
		Blue	36724			
		Yellow	36723			
		Green	37764			
FP-301	1" (25,4 mm)	Black	36725	48" Sticks (1,22 m)	1.000/0.500" (25,4/12,7 mm)	5
		Clear	36726			
		White	36727			
		Red	36728			
		Blue	36730			
		Yellow	36729			
		Green	37767			
FP-301	1-1/2" (38,1 mm)	Black	36731	48" Sticks (1,22 m)	1.500/0.750" (38,1/19,05 mm)	5
		Clear	36732			
		White	36733			
		Red	36734			
		Blue	36736			
		Yellow	36735			
FP-301	2" (50,8 mm)	Black	36737	48" Sticks (1,22 m)	2.000/1.000" (50,8/25,4 mm)	5
		Clear	36738			
		White	36739			
		Red	36740			
		Blue	36742			
		Yellow	36741			
FP-301	3" (76,2 mm)	Black	36743	48" Sticks (1,22 m)	3.000/1.500" (76,2/38,1 mm)	2
		Clear	36744			
FP-301	4" (101,6 mm)	Black	36745	48" Sticks (1,22 m)	4.000/2.000" (101,6/50,8 mm)	2
		Clear	36746			

## Specifications and Ordering Information for 3M™ FP-301 Four-Foot Sticks (Bulk)

Product Number	Size	Expanded/Recovered I.D.	Color	UPC (054007-)	Case Qty. Feet (sticks)
FP-301	3/64" (1,17 mm)	0.046/0.023" (1,17/0,58 mm)	Black	08432	1,000
			Clear	08438	
			White	08433	
			Red	08738	
			Blue	08734	
			Yellow	58680	
FP-301	1/16" (1,60 mm)	0.063/0.031" (1,6/0,79 mm)	Black	08434	1,000
			Clear	08439	
			White	08435	
			Red	08764	
			Blue	08761	
			Yellow	08770	
FP-301	3/32" (2,36 mm)	0.093/0.046" (2,36/1,17 mm)	Black	08436	1,000
			Clear	08440	
			White	08437	
			Red	08788	
			Blue	08787	
			Yellow	08791	
			Green	37654*	

\* UPC prefix 051135-