Product Selection Guide



PANDUIT®

Heat Shrink Frequently Asked Questions:

1. What are the main considerations when installing heat shrink?

- Pick the right diameter. (See Wire Size Chart on page 5)
- Consider the overlap between the tube and the cable insulation
- · Heat evenly around the tube
- · If using a flame, use a diffuser and keep it moving; start further away from the tube and move closer gradually
- If it's adhesive lined product, the adhesive will be pushed away from the recovery starting point; in general, start recovering
 at the center and work toward each end

2. What's the significance of a material being cross linked?

The majority of heat shrink is made from cross linked materials. Cross linked materials do not melt and flow; they soften and become rubbery but still hold their basic shape. The main benefit is improved thermal, physical and chemical resistance.

3. Why is shrink temperature important?

A tube with a lower shrink temperature will generally shrink faster. Products with higher shrink temperatures generally have higher performance. With any heat shrink tube, you can increase the shrink speed by using hotter temperatures, within reason. Be sure to consider the heat resistance of components under or around the heat shrink.

4. Can the tube be damaged by overheating and what are the signs of overheating?

Excessive temperatures and long exposure times cause damage faster. Most tubes will withstand 200°C to 250°C for a couple of hours without significant damage. Overheating can be difficult to detect since damage may not be obvious. If using a torch, use a flame diffuser, keep the flame at a proper distance, and keep the flame moving to apply heat gradually. Heat guns are easier to work with but can still cause damage. Charring, blistering, or cracking of the surface is a definite sign of overheating and damage.

5. How does operating temperature range relate to shrink temperature?

If the operating temperature is above the shrink temperature of the tube, the tube will be in a soft rubbery state, and it will have lower mechanical properties and abrasion resistance.

6. What is the significance of shelf life?

Per AMS-DTL-23053, all tubes have a defined minimum shelf life, dependent on the base material. The main consideration is expanded and recovered dimensions. If the product meets requirements, the shelf life can be extended up to 50% of the original value and this can be done multiple times.

7. What's the maximum voltage at which I can use Panduit heat shrink?

Unless noted otherwise, all the products have a 600V AC rating. They are "low voltage" products. Per NEMA, Low Voltage is 600V or less; Medium Voltage is 2,400 to 69,000V; and High Voltage is 115k to 230kV.

Dry Locations:

A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

Damp Locations:

Locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. Examples of such locations include partially protected locations under canopies, marquees, roofed pen porches, and like locations, and interior locations subject to moderated degrees of moisture, such as basements, some barns, and some cold storage buildings.

Wet Locations:

Installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

Material Selection Criteria

ee Low Toxicity C	Standard Packaging Available	Operating Temp Range	Shrink Temp	Shrink Ratio				Dielectric
E			-		Life	Flammability	Chemical Resistance	Strength
No C	Clear Brown Red 4' lengths, Orange 25' to 1000' Yellow reels Green depending Blue white ellow/Green	-67°F to 275°F (-55°C to 135°C)	194°F (90°C)	2:1	5 Years	Class 1 Self Extinguishing ASTM D2671 Procedure B Class 2 N/A	Fluid Resistance per AMS-DTL-23053 1000 psi min tensile ASTM D638 400 V/mil min. ASTM D2671	500 V/MIL. (19.7 Kv/mm) min. ASTM D2671
No 3	Black 6" pieces Red 4' lengths Yellow 25' to 1000' Green reels Blue depending on White diameter	-67°F to 275°F (-55°C to 135°C)	194°F (90°C)	2:1	5 Years	Self Extinguishing ASTM D2671 Procedure C VW-1 per UL224	Fluid Resistance per AMS-DTL-23053 1000 psi min tensile ASTM D638 400 V/mil min. ASTM D2671	500 V/MIL. (19.7 Kv/mm) min. ASTM D2671
No I	Black 25' to 1000' reels depending on diameter	-4°F to 221°F (-20°C to 105°C)	212°F (100°C)	2:1	1 Year	Self Extinguishing ASTM D876 VW-1 per UL224	Fluid Resistance per AMS-DTL-23053 1800 psi min tensile ASTM D638 280 V/mil min. ASTM D2671	400 V/MIL. (15.8 Kv/mm) min. ASTM D2671
No	Clear 4.38" to 100' lengths	-4°F to 221°F (-20°C to 105°C)	212°F (100°C)	2:1	1 Year	Self Extinguishing 15 sec, 3 in VW-1 per UL 224	Fluid Resistance per AMS-DTL-23053 1800 psi min tensile ASTM D638 280 V/mil min. ASTM D2671	400 V/MIL. (15.8 Kv/mm) min. ASTM D2671
No I	Black 25' and 100' reels	-94°F to 250°F (-70°C to 121°C)	275°F (135°C)	2:1	5 Years	N/A	Fluid Resistance per AMS-DTL-23053 1000 psi tensile 250% Elongation min ASTM D638 250 V/mil min. ASTM D2671	300 V/MIL. (11.8 Kv/mm) min. ASTM D2671
Low Smoke O	Opaque 4' lengths	-88°F to 482°F (-67°C to 250°C)	644°F (340°C)	2:1	4 Years	Non-Flammable (Highest flame retardancy of any plastic)	Fluid Resistance per AMS-DTL-23053, No Change	800 V/MIL. (31.5 Kv/mm) min. ASTM D2671
Low Smoke	Clear 4' lengths	-67°F to 347°F (-55°C to 175°C)	275°F (135°C)	2:1	5 Years	Self Extinguishing ASTM D2671 Procedure C VW-1 per UL 224	Fluid Resistance per AMS-DTL-23053 5000 psi min tensile ASTM D638 500 V/mil min. ASTM D2671	Size to 12.7mm 800 V/MIL. (31.5 Kv/mm) min Over 12.7mm 600 V/MIL. (23.6 Kv/mm) min ASTM D2671
No I	Black 6" pieces 4' lengths	-67°F to 230°F (-55°C to 110°C)	248°F (120°C)	2:1	5 Years	Self Extinguishing ASTM D2671 Procedure B, Outer Wall UL224 VW-1	Fluid Resistance per AMS-DTL-23053 1000 psi min tensile ASTM D638 400 V/mil min. ASTM D2671	500 V/MIL. (19.7 Kv/mm) min. ASTM D2671
No I	Black 6" pieces 4' lengths	-67°F to 230°F (-55°C to 110°C)	248°F (120°C)	3:1	5 Years	Self Extinguishing ASTM D2671 Procedure B, Outer Wall UL224 VW-1	Fluid Resistance per AMS-DTL-23053 900 psi min tensile ASTM D638 200 V/mil min. ASTM D2671	300 V/MIL. (11.8 Kv/mm) min. ASTM D2671
No I	Black 4' lengths	-67°F to 257°F (-55°C to 125°C)	248°F (120°C)	4:1	5 Years	Self Extinguishing ASTM D2671 Procedure B, Outer Wall UL224 VW-1	Fluid Resistance per AMS-DTL-23053 900 psi min tensile ASTM D638 200 V/mil min. ASTM D2671	300 V/MIL. (11.8 Kv/mm) min. ASTM D2671
No I	Black 4' lengths	-67°F to 230°F (-55°C to 110°C)	257°F (125°C)	2.5:1	5 Years	Outer Wall UL224 VW-1	Fluid Resistance per AMS-DTL-23053 1000 psi min tensile ASTM D638 400 V/mil min. ASTM D2671	500 V/MIL. (19.7 Kv/mm) min. ASTM D2671
No	Black 8" pieces 6" pieces 9" pieces 12" pieces 12" pieces 4' lengths	-67°F to 230°F (-55°C to 110°C)	248°F (120°C)	3:1	10 Years	Self Extinguishing ASTM D2671 Procedure C VW-1 per UL 224	Fluid Resistance per AMS-DTL-23053 750 psi min tensile ASTM D638 200 V/mil min. ASTM D2671	200 V/MIL. (7.9 Kv/mm) min. ASTM D2671
No I	Black Size dependent	-40°F - 257°F (-40°C - 125°C)	248°F (120°C)	2.5:1	10 Years	N/A	N/A	N/A
	Black Size dependent	-67°F to 230°F (-55°C to 110°C)	248°F (120°C)	3:1	10 Years	UL94 V-0 Material	N/A	N/A
	No No No No Low Smoke Low Smoke No	Blue White Yellow/Green Slack Red Fled Yellow Green Blue depending on diameter Site to 1000 reels depending on diameter	Blue Yellow/Green Slack 6" pieces 4" lengths 25" to 1000" 65"°C to 135"°C)	No	Black While Vellow/Green No Plack 6° pieces 4' lengths -67°F to 275°F 194°F 2:1	Blue White Yellow/Green Serve to 275°F Serve to 180°C Serve to	Black	Black Pipers Pi

""Halogen Free as defined by IEC 61249-2-21 900 ppm max chlorine 900 ppm max bromine 1500 ppm max combined halogens (Fluorine is excluded)

THHW – Indicates a fine strand flexible wire with thermoplastic insulation. Moisture, oil and acid resistant. Rated 105°C wet or dry.

THW – Indicates a single conductor having flame-retardant, moisture and heat-resistant thermoplastic insulation. The wire is rated 75°C wet or dry.

TW – Indicates a single conductor having flame-retardant, moisture-resistant thermoplastic insulation. The wire is rated 60°C wet or dry.

TFN – Indicates a thermoplastic-insulated wire. The wire is rated at a 90°C maximum operating temperature.

THHN – Indicates a single conductor having flame-retardant and heat-resistant thermoplastic insulation with a jacket of extruded nylon or equivalent material. The wire is rated 90°C dry only.

	Approximate Wire Outside Diameter In. (mm)						
	With THW/	With TFN/	,				
Size	THHW/TW Insulation	THHN/THWN Insulation	Min.	Max.			
24 AWG	0.059 (1.5)	0.088 (2.2)	0.020 (0.5)	0.024 (0.6)			
22 AWG	0.066 (1.7)	0.094 (2.4)	0.025 (0.6)	0.031 (0.8)			
20 AWG	0.071 (1.8)	0.101 (2.6)	0.032 (0.8)	0.038 (1.0)			
18 AWG	0.084 (2.1)	0.111 (2.8)	0.040 (1.0)	0.049 (1.2)			
16 AWG	0.096 (2.4)	0.124 (3.1)	0.051 (1.3)	0.060 (1.5)			
14 AWG	0.111 (2.8)	0.133 (3.4)	0.064 (1.6)	0.073 (1.9)			
12 AWG	0.130 (3.3)	0.152 (3.9)	0.081 (2.1)	0.095 (2.4)			
10 AWG	0.164 (4.2)	0.176 (4.5)	0.102 (2.6)	0.116 (2.9)			
8 AWG	0.216 (5.5)	0.236 (6.0)	0.128 (3.3)	0.146 (3.7)			
6 AWG	0.254 (6.5)	0.304 (7.7)	0.162 (4.1)	0.184 (4.7)			
4 AWG	0.324 (8.2)	0.352 (8.9)	0.204 (5.2)	0.232 (5.9)			
3 AWG	0.352 (8.9)	0.380 (9.7)	0.229 (5.8)	0.260 (6.6)			
2 AWG	0.384 (9.8)	0.420 (10.7)	0.258 (6.6)	0.292 (7.4)			
1 AWG	0.446 (11.3)	0.492 (12.5)	0.289 (7.3)	0.332 (8.4)			
1/0	0.486 (12.3)	0.532 (13.5)	0.325 (8.3)	0.373 (9.5)			
2/0	0.532 (13.5)	0.578 (14.7)	0.365 (9.3)	0.418 (10.6)			
3/0	0.584 (14.8)	0.630 (16.0)	0.410 (10.4)	0.470 (11.9)			
4/0	0.642 (16.3)	0.688 (17.5)	0.460 (11.7)	0.528 (13.4)			
250 MCM	0.711 (18.1)	0.765 (19.4)	0.500 (12.7)	0.575 (14.6)			
300 MCM	0.766 (19.5)	0.820 (20.8)	0.548 (13.9)	0.630 (16.0)			
350 MCM	0.817 (20.8)	0.871 (22.1)	0.592 (15.0)	0.681 (17.3)			
400 MCM	0.864 (21.9)	0.918 (23.3)	0.633 (16.1)	0.728 (18.5)			
500 MCM	0.949 (24.1)	1.003 (25.5)	0.707 (18.0)	0.813 (20.7)			
600 MCM	1.051 (26.7)	1.113 (28.3)	0.775 (19.7)	0.893 (22.7)			
700 MCM	1.122 (28.5)	1.184 (30.1)	0.837 (21.3)	0.964 (24.5)			
750 MCM	1.156 (29.4)	1.218 (30.9)	0.866 (22.0)	0.998 (25.3)			
800 MCM	1.188 (30.2)	1.250 (31.8)	0.894 (22.7)	1.031 (26.2)			
900 MCM	1.252 (31.8)	1.314 (33.4)	0.949 (24.1)	1.093 (27.8)			
1000 MCM	1.310 (33.3)	1.372 (34.8)	1.000 (25.4)	1.152 (29.3)			
1250 MCM	_	1.539 (39.1)	1.121 (28.5)	1.289 (32.7)			
1500 MCM	_	1.662 (42.2)	1.228 (31.2)	1.412 (35.9)			
1750 MCM	_	1.776 (45.1)	1.327 (33.7)	1.526 (38.8)			
2000 MCM	_	1.882 (47.8)	1.419 (36.0)	1.632 (41.5)			

THWN - Indicates a single conductor having flame-retardant, moisture and heat-resistant thermoplastic insulation with a jacket of extruded nylon or equivalent material. The wire is rated 75°C wet or dry. THWN wire suitable for exposure to mineral oil and to liquid gasoline and gasoline vapors at ordinary ambient temperature is marked "Gasoline and Oil Resistant I" if suitable for exposure to mineral oil at 60°C, or "Gasoline and Oil Resistant II" if the compound is suitable for exposure to mineral oil at 75°C. Gasolineresistant wire has been tested at 23°C when immersed in gasoline. It is considered inherently resistant to gasoline vapors within the limits of the temperature rating.

Heat Shrink Sizing Example

Generally, the largest tube that shrinks down tightly onto an object should be chosen. This allows the heat shrink tubing maximum stress relief and this will yield the longest service life.

Example:

A multi-conductor cable needs to be covered with HSTT Type Dry-Shrink™ Heat Shrink. The area to be covered has a measured outside diameter of 0.700" (17.8mm). The two possibilities are HSTT75-48-5 and HSTT100-48-5.

Part Number	Expanded I.D In. (mm)	Recovered I.D. In. (mm)
HSTT75-48-5	0.750 (19.1)	0.375 (9.5)
HSTT100-48-5	1.00 (25.4)	0.500 (12.7)

The proper choice is HSTT100-48-5 since the tube will recover more than HSTT75-48-5. The HSTT75-48-5 will fit over the 0.700 inch (17.8mm) outside diameter; however, this is not the proper choice since it is smaller than the HSTT100-48-5. In general, heat shrink should recover at least 10% - 20% to reduce stress and yield the longest service life and thicker walls, resulting in thicker insulation, more abrasion protection, and more strain relief.

Related Products



Abrasion Protection:

- Variety of products ranging from Pan-Wrap[™] Split Harness Wrap to Non-Shrink Tubing
- Provides protection in various applications to protect wires/cables



Heat Gun and Accessories:

- · Gun allows heating of the tubing without burning or charring
- · Attachments reflect the heat around tubing to reduce shrink time



HSEC:

- · Protects ends of wires/cables temporarily
- · Adhesive lined to keep out moisture
- 2.5:1 shrink ratio



HSECFR:

- Protects ends of wires/cables temporarily
- · Adhesive lined to keep out moisture
- 3:1 shrink ratio flame retardant material



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