### 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 will yield the longest service life.

**Example:** A multi-conductor cable needs to be covered with HSTT Type Dry-Shrink® Heat Shrink. The size to be covered has a measured outside diameter of .700" (.178mm). The two possibilities are HSTT75-48-5 and HSTT100-48-5.

The proper choice is HSTT100-48-5 since the wire will recover more than HSTT75-48-5. The HSTT48-48 will fit over the .700" (.178mm) 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 thinner insulation, more abrasion protection, and more strain relief.

**Related Product**

**Abrasiveness Protection:**
- Variety of products ranging from Pan-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 charming
- 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
- 3.1:1 shrink ratio flame retardant material

Visit us at www.panduit.com
Contact Customer Service by email: cs@panduit.com
or by phone: 800 777 3285

**Heat Shrink**
- A product of the Panduit Corporation
- Printed in the U.S.A.

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Heat Shrink Frequently Asked Questions:

1. What are the main considerations when installing heat shrink?
   - Pick the right diameter. See Size Chart on page 10.
   - Consider the overlap between the tube and the cable insulation.
   - Heavily around the tube.
   - If using a flame, use a diffuser and keep it moving; start further away from the tube and move closer gradually.

2. How do I install the heat shrink?
   - Install the shrink sleeve over the cable. Position the sleeve so that the cable is slightly inside the tube. Place the overlapping section of the sleeve over the cable, allowing a 2:1 to 3:1 overlap. Make sure to do this carefully to prevent damage to the cable insulation.

3. What is the advantage of using heat shrink?
   - The advantage of using heat shrink is that it provides a high-quality, durable seal that can withstand harsh environments and extreme temperatures. In addition, it is easy to use and can be customized to fit different cable sizes and lengths.

4. Can the heat shrink 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 a proper distance, and keep the flame moving to apply heat gradually. Be sure to consider the heat resistance of components under or around the heat shrink.

5. What applications can heat shrink be used for?
   - Typical applications include:
     - Weatherproofing and protection of electrical and electronic components.
     - Strain relief, insulate, protect, and bundle cables and wires.
     - Seals and protects cables, components and connectors in plenum applications and equipment enclosures.
     - Splices from moisture and corrosion, including connectors in radiant applications.
     - Connectors in rugged applications, including military, marine, and aerospace components.
     - Installation underground or in harsh environments.

6. Can the tube be damaged by overheating, and what are the signs of overheating?
   - Overheating can be difficult to detect since damage may not be obvious. If using a torch, use a flame diffuser, keep the flame a proper distance, and keep the flame moving to apply heat gradually. Be sure to consider the heat resistance of components under or around the heat shrink.

7. Where can I find more information on the available sizes and specifications?
   - The product specifications and sizes can be found in the accompanying chart on pages 10 and 11. Additionally, the material selection criteria are included in the table below.

---

### Table: Material Selection Criteria

<table>
<thead>
<tr>
<th>Application</th>
<th></th>
<th>Material</th>
<th>Key Characteristics</th>
<th>Typical Applications</th>
<th>Standard Dimensions (End Cap / Outer Wall)</th>
<th>Applicable Standards</th>
<th>RoHS</th>
<th>Voltage</th>
<th>Low Smoke</th>
<th>Low Toxicity</th>
<th>Chemical Resistance</th>
<th>Flammability</th>
<th>Price/Unit</th>
<th>Price/1000</th>
<th>Price/10000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Flexible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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**For more detailed information, visit the Panduit website at [www.panduit.com/heatshrink](http://www.panduit.com/heatshrink)"
**Heat Shrink Frequently Asked Questions:**

1. **What are the main considerations when installing heat shrink?**
   - *Pick the right diameter.* (See Line Wire Chart on page 15)
   - Consider the overlap between the tube and the cable insulation.
   - Heatly 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 an adhesive-lead product, the adhesive will be pushed away from the recovery starting point in general, start recovering from the far end of the splice.

2. **What is 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 until they burn their basic shape. The main benefit is increased thermophysical and chemical resistance.

3. **Why is shrink temperature important?**
   - A tube with a lower shrunk 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. As a rule, 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 a proper distance, and keep the flame moving to apply gradual heat. Greeners are easier to work with but can still cause damage. Changing, fading, blisters, or cracking of the surface is a definite sign of overheating and damage.

5. **What are the operating temperature ranges for heat shrink?**
   - If the operating temperature is above the shrink temperature of the tube, the tube will be in a rubbery state, and it will have lower mechanical properties and abrasion resistance.

6. **What is the significance of shelf life?**
   - Per MIL-DTL-23053/35, all tubes have a defined minimum shelf life. Beyond the shelf life, the tube will have lower mechanical properties and abrasion resistance.

7. **What's the maximum voltage at which I can use Panduit heat shrink?**
   - Unlike 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 6 to 15kV; High Voltage is 11kV to 33kV.

---

### Material Selection Criteria

**Applications**

<table>
<thead>
<tr>
<th>Material</th>
<th>Key Characteristics</th>
<th>Typical Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRY</td>
<td><strong>Polyethylene</strong></td>
<td>Flexible, stronger than polyolefin, highly abrasion and tear resistant, flame retardant, crystal clear, resistant to most fuels and oils, UV resistant, resistant to most abrasives and most chemicals, non-toxic, non-flammable, and non-irritating.</td>
</tr>
<tr>
<td>DAMP</td>
<td><strong>Polyolefin</strong></td>
<td>Semi-rigid, adhesive lined, highly flame retardant, low outgassing, transparent, and low coefficient of friction.</td>
</tr>
<tr>
<td>WET</td>
<td><strong>Teflon</strong></td>
<td>Non-flammable, ETO and autoclave sterilizable, highly flame retardant, highly abrasion and tear resistant, resistant to most fuels and oils, UV resistant, resistant to most abrasives and most chemicals, non-toxic, non-flammable, and non-irritating.</td>
</tr>
</tbody>
</table>

**Dimensions**

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>3/64&quot; to 2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>3/64&quot; to 3/8&quot;</td>
</tr>
<tr>
<td>Length</td>
<td>30 to 0 AWG and 3/64&quot; to 2&quot;</td>
</tr>
</tbody>
</table>

**Temperature**

<table>
<thead>
<tr>
<th>Operating Temp</th>
<th>(-55°C to 110°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelf Temp</td>
<td>(-20°C to 105°C)</td>
</tr>
</tbody>
</table>

**Extinguishing**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>UL224 VW-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 &amp; 2</td>
<td>Mil. Spec: AMS-DTL-23053/12</td>
</tr>
<tr>
<td>Class 1</td>
<td>UL Recognized (VW-1)</td>
</tr>
<tr>
<td>Class 2</td>
<td>CSA Certified</td>
</tr>
</tbody>
</table>

**Fluid Resistance**

| ASTM D2671 | 500 V/MIL. |
| ASTM D638  | 1000 psi min. |
Wire Size Chart

<table>
<thead>
<tr>
<th>Size</th>
<th>24 AWG</th>
<th>22 AWG</th>
<th>20 AWG</th>
<th>18 AWG</th>
<th>16 AWG</th>
<th>14 AWG</th>
<th>12 AWG</th>
<th>10 AWG</th>
<th>8 AWG</th>
<th>6 AWG</th>
<th>4 AWG</th>
<th>2 AWG</th>
<th>1 AWG</th>
<th>3/0 AWG</th>
<th>2/0 AWG</th>
<th>1/0 AWG</th>
<th>1 AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.099 (2.5)</td>
<td>0.106 (2.7)</td>
<td>0.113 (2.9)</td>
<td>0.120 (3.0)</td>
<td>0.125 (3.2)</td>
<td>0.132 (3.3)</td>
<td>0.140 (3.5)</td>
<td>0.150 (3.8)</td>
<td>0.166 (4.2)</td>
<td>0.191 (4.8)</td>
<td>0.225 (5.7)</td>
<td>0.261 (6.6)</td>
<td>0.305 (7.7)</td>
<td>0.371 (9.4)</td>
<td>0.447 (11.3)</td>
<td>0.510 (13.0)</td>
<td></td>
</tr>
<tr>
<td>Approximate Wire Outside Diameter in. (mm)</td>
<td>0.089 (2.3)</td>
<td>0.096 (2.4)</td>
<td>0.104 (2.6)</td>
<td>0.111 (2.8)</td>
<td>0.117 (2.9)</td>
<td>0.125 (3.2)</td>
<td>0.135 (3.4)</td>
<td>0.145 (3.7)</td>
<td>0.162 (4.1)</td>
<td>0.188 (4.8)</td>
<td>0.225 (5.7)</td>
<td>0.260 (6.6)</td>
<td>0.305 (7.7)</td>
<td>0.370 (9.4)</td>
<td>0.445 (11.3)</td>
<td>0.500 (12.7)</td>
<td></td>
</tr>
</tbody>
</table>

THHN—Indicates a fine stranded flexible wire with thermoplastic insulation. Moisture, oil and temperature resistant. Rated 105°C wet or dry.

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

THW–W—Includes a jacket of extruded nylon or equivalent material.

TFN—Indicates a single conductor having flame-resistant, moisture and heat-resistant thermoplastic insulation. The wire is rated 90°C wet or dry.

TFNW—Indicates a single conductor having flame-resistant, moisture and heat-resistant thermoplastic insulation. The wire is rated 60°C wet or dry.

THWN—Indicates a single conductor having flame-resistant, 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–W—Includes a jacket of extruded nylon or equivalent material.

THWN–W—Includes a jacket of extruded nylon or equivalent material.

THWN–W—Includes a jacket of extruded nylon or equivalent material.

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

TFNW—Indicates a single conductor having flame-resistant, moisture and heat-resistant thermoplastic insulation. The wire is rated 60°C wet or dry.

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

Related Product

Abstraction Protection:
- Variety of products ranging from Pan-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
- 2:1 Shrink ratio

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

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 prolong the lifetime of service.

Example:
A multi-conductor cable needs to be covered with HSTT Type Dry-Shrink™ Heat Shrink. The size to be covered has a measured outside diameter of .705 (17.4mm). The two possibilities are HSTT110-48-5 and HSTT110-46-5.

The proper choice is HSTT110-46-5 since the wire tube will receive more than HSTT110-48-5. The HSTT110-46-5 will fit over the .705inch (17.4mm) outside diameter. However, this is not the proper choice since it is smaller than the HSTT110-46-5. In general, heat shrink should have at least 10% – 20% to reduce stress and yield the longest service life and thicker walls, resulting in fewer failures, more abrasion protection, and more strain relief.

Heat Shrink Product Selection Guide

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HSTT110-46-5: 1.08 (27.4) / .80 (20.3)
HSTT110-48-5: 1.29 (32.8) / .99 (25.1)
### Wire Size Chart

<table>
<thead>
<tr>
<th>Size</th>
<th>Approximate Wire Outside Diameter (in.)</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsulated Conductors, Range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 AWG</td>
<td>.089 (2.3)</td>
<td>0.100 (2.5)</td>
<td></td>
</tr>
<tr>
<td>2 AWG</td>
<td>.112 (2.9)</td>
<td>0.125 (3.2)</td>
<td></td>
</tr>
<tr>
<td>4 AWG</td>
<td>.157 (4.0)</td>
<td>0.175 (4.5)</td>
<td></td>
</tr>
<tr>
<td>6 AWG</td>
<td>.200 (5.1)</td>
<td>0.230 (5.8)</td>
<td></td>
</tr>
<tr>
<td>8 AWG</td>
<td>.250 (6.4)</td>
<td>0.280 (7.1)</td>
<td></td>
</tr>
<tr>
<td>10 AWG</td>
<td>.300 (7.6)</td>
<td>0.330 (8.4)</td>
<td></td>
</tr>
<tr>
<td>12 AWG</td>
<td>.360 (9.2)</td>
<td>0.390 (9.9)</td>
<td></td>
</tr>
<tr>
<td>14 AWG</td>
<td>.420 (10.7)</td>
<td>0.450 (11.4)</td>
<td></td>
</tr>
<tr>
<td>16 AWG</td>
<td>.480 (12.2)</td>
<td>0.510 (13.0)</td>
<td></td>
</tr>
<tr>
<td>18 AWG</td>
<td>.540 (13.7)</td>
<td>0.570 (14.5)</td>
<td></td>
</tr>
<tr>
<td>20 AWG</td>
<td>.600 (15.2)</td>
<td>0.630 (16.0)</td>
<td></td>
</tr>
<tr>
<td>22 AWG</td>
<td>.660 (16.8)</td>
<td>0.690 (17.5)</td>
<td></td>
</tr>
<tr>
<td>24 AWG</td>
<td>.720 (18.3)</td>
<td>0.750 (19.1)</td>
<td></td>
</tr>
<tr>
<td>25 AWG</td>
<td>.780 (19.8)</td>
<td>0.810 (20.6)</td>
<td></td>
</tr>
<tr>
<td>26 AWG</td>
<td>.840 (21.3)</td>
<td>0.870 (22.1)</td>
<td></td>
</tr>
<tr>
<td>28 AWG</td>
<td>.900 (22.9)</td>
<td>0.930 (23.7)</td>
<td></td>
</tr>
</tbody>
</table>

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

- Indicates a heat-resistant, single conductor insulated with a jacket of extruded nylon or equivalent material.
- Indicates a heat-resistant, single conductor insulated with a jacket of extruded nylon or equivalent material.

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

### Related Products

**Heat Shrink Sizing Example**

The proper choice is HSTT110-48-6 since the tube will recover more than HSTT75-48-5. The HSTT-48 size will fit over the .750-inch (19.1mm) wire outside diameter. However, this is not the proper choice since it is smaller than the HSTT110-48-6. In general, heat shrink should recover at least 10% – 20% to reduce stress and yield the longest service life and thinner walls, resulting in thicker insulation, more abrasion protection, and lower strain rating.

**Related Products**

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