

Heat Shrink Tubing: It Gets The Job Done In More Ways Than One

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Of all the components and tools a design engineer has at her disposal, one of the most versatile and economical is heat shrink tubing. My first experience with this product was in 1999 when I worked as a product engineer at Tyco and it acquired Raychem, the company that invented heat shrink tubing. Raychem's founder, chemical engineer Paul Cook, discovered a way to use *radiation chemistry* (hence the company's name) to manipulate polymers using a process known as cross-linking. This process gives the polymers *plastic memory* and when exposed to heat the *memory* is activated and the chemical reaction causes the plastic tubing to shrink back to its original diameter. Call it regression memory therapy. (Sorry, I couldn't resist that.)

My customers use a lot of heat shrink tubing, both in their original product designs and as a maintenance and repair tool. One customer of mine, a manufacturer of power monitoring devices, is even considering using heat shrink tubing in its expanded state, as a protectant for its devices' wires and cables. Using heat shrink tubing for insulating and protecting wires and cables is, of course, one of the product's main applications. Usually though, it involves heating and shrinking. But if it does the job for the customer without those steps – hey, I'm all for it.

As noted, heat shrink tubing is a versatile product with many uses. In addition to providing insulation and protection, here are other common ways this nifty product can be used to serve your design purposes:

- **Use heat shrink tubing as strain relief or for added strain relief** – If your application is such that you can use heat shrink tubing as your strain relief – as I've had customers do – you'll typically save yourself money. Also, while many terminals and connector backshells come with built-in strain relief, the use of heat shrink tubing will give your product added durability.
- **Use heat shrink tubing for environmental protection** – The most common materials used for heat shrink tubing are polyolefin and PVC. The polyolefin material also comes in an adhesive-lined version (known as "dual wall" tubing) in which the inner diameter is coated with an adhesive. When heated, the adhesive causes the tubing to mold around an object, forming a water-tight seal. Adhesive-lined heat shrink tubing is a cost-effective choice for sealing connections, backshells and gaps from moisture and other contaminants.
- **Use heat shrink tubing for identification** – Heat shrink tubing is available in a rainbow of colors, making it a great choice for identifying various wires and components. And again, it can save you money. For example, using color-coded heat shrink tubing is a lot cheaper than using color-coded connectors. If need be, you can even heat-stamp information on your tubing. This way, the ID stays permanent to your wire; and offers more durability than a label marker.

- **Use heat shrink tubing for wire bundling and harnessing** - Say your product has a number of wires coming into an area. If it's a stationary industrial device that's going to be sitting on the factory floor, or in some dark room for most of its useful life a wire tie will work fine. On the other hand, if yours is a high-end medical device that's going to be rolling in and out of hospital rooms 18 – 20 hours a day, you'll most likely want to specify heat shrink tubing. After all, your equipment is going to be in the public eye day in and day out. And the tubing will give you a clean, smooth finish and a tight, compact wire wrap that's more aesthetically suitable for a high-tech medical device.
- **Use heat shrink tubing for maintenance and repair** – Heat shrink tubing, in its versatility and usefulness is often compared to duct tape. Indeed, in an industrial setting, like on the factory floor, the product can be every bit as useful as a roll of duct tape around the house. Use heat shrink tubing to repair harness and cable jackets. It'll pass over connectors and then tighten down snugly on harnesses and cables. Use heat shrink tubing to seal and protect in-line splices and repair damaged wire insulation. Without losing flexibility. Walking the factory floor and notice that that cable jacket is starting show the wear and tear of its age? Get some heat shrink tubing and a heat gun and give it a new lease on life.

As I come to the end of this post I feel like I ought to say a few words about shrink ratios. You can buy heat shrink tubing in various ratios, of course – 2 to 1, 3 to 1, all the way up to 6 to 1. Tubing with a shrink ratio of 2 to 1 will shrink to half its original size, 3 to 1 down to a third, and so on. Keep in mind that in its expanded state the wall of the 6 to 1 tubing will be much thinner than the wall of the 2 to 1 tubing. But by the time your 6 to 1 tubing shrinks back to its original state, you'll have a much thicker wall and, correspondingly, less flexibility. If you're covering an uneven surface like a cable and a connector...a good rule of thumb for figuring out the tubing size and shrink ratio you need is to determine the biggest and smallest sizes you have to cover.

There's a lot more I could say about this versatile, cost-effective product, but for now I'll close this out by saying that heat shrink tubing really does, indeed, get the job done in more ways than one.