Choices: Magnet Wire & Magnet Wire Connectors

By: Kevin Groth, Branch Manager, Heilind Wisconsin

One of the big stories in manufacturing over the last few years has been the sharp rise in the price of copper, the traditional metal of choice for magnet wire. This steep climb has triggered a growing interest among manufacturers in another, lower-cost, electricity-conducting metal: aluminum.

I've experienced this growing interest first-hand. For example, at the start of the year one of my customers, a manufacturer of generators, switched from copper magnet wire to aluminum for one of its products. The switch was driven strictly by economics. At the time, the price of copper magnet wire was roughly three times that of aluminum, with the consensus being that there would be no sustained pullback in pricing anytime soon. Given these factors, my customer retooled its operations and converted from copper magnet wire to aluminum magnet wire.

Good move. As a result of the substitution, the company was able to cut its manufacturing costs on this generator by about 30%.

The price differential between copper and aluminum remains substantial. And by all accounts this disparity will persist. So I expect that manufacturers will continue to look for opportunities to replace copper wiring with aluminum wiring.

Drawbacks to the use of aluminum magnet wire

While there is currently a huge cost advantage to using aluminum magnet wire, it takes much more aluminum than it does copper to conduct the same amount of electricity. As I understand, about 65% more. So, if it's a tight space you're working with – like, for example, in a radio-controlled car – aluminum is probably not an option for you. Also, aluminum is trickier to work with. For instance, if you're stripping insulation off aluminum wire, or soldering it, you'll need to go about it more delicately to ensure that the more malleable aluminum stays intact.

Of course, once you decide on your magnet wire you'll need to decide on how you'll make your connection.

Making the connection: Strip. Solder. Insulation displacement connector (IDC).

Typically, copper or aluminum magnet wire is coated with a thin layer of insulation that has to be removed to get to the conductor. This is commonly done through stripping or soldering and either process can present "issues."

- **Stripping** – Stripping usually involves a person inserting magnet wire into a device that looks like a pencil sharpener. The device also *works* much like a pencil sharpener in that it strips away the wire's insulation. There are two common problems with this process:

    1. Not only is all insulation removed, if the operator isn't careful, conduit can be stripped away as well, leaving the wire with uneven amounts of circular mill and creating potential connection problems.

2. Because of the repetitive back and forth motion of the wrist by the operator doing the stripping, there can be a high incidence of carpal tunnel.

- **Soldering -** Soldering, generally speaking, is just a messy process. You're using heat of course, and sometimes the high heat can damage the conduit. Plus, solder that contains lead is toxic. And, the use of lead is prohibited under RoHS.

- **IDC: Lowest total applied cost** – When total applied costs are considered, most often it's the insulation displacement magnet wire connector that represents your best connection value. The IDC also shines in two other important areas: safety and quality. With stripping, you have the cost of labor to cut and strip the wire along with the inherent connection quality and worker health (carpal tunnel) issues. With soldering, you have similar issues as well as the RoHS issue.

  With the insulation displacement magnet wire connector, though, you have none of the labor, quality, worker safety or environmental issues that you do with stripping and soldering. You simply put your insulated copper or aluminum wire into the product, press a button to crimp it, and the component's teeth will pierce the insulation to get right to the conduit and make a gas-tight connection.

  Specifically, here's how the process is described in TE Connectivity's product guide for its COPALUM line of magnet wire connectors: "The combination of an insulation displacement crimp configuration and an integral perforated inner sleeve design penetrates the film insulation, creating an electrical interface between the conductor and terminal."

  Molex also has an excellent line of insulation displacement magnet wire connectors that go under the brand name of Magkrimp™.

Copper or aluminum? Splice, solder, or IDC? You know your product, application, and manufacturing operation better than anybody does; and you'll make the right choices. Please know that we at Heilind are here to help you in any way we can.