Ask Jon Eakes

Aluminum to Copper electrical connectors

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Aluminum wire does a good job of conducting electricity (although you do have to use one size larger wire than copper for the same electrical load) and can do the same job for less money. So for a short while it was used in houses for regular wiring. Then the "aluminum wiring crisis" came along, which actually had less to do with the wire itself than with its connection to fixtures or to other wires. Aluminum wiring can be perfectly safe if you use the proper switches and outlets and take special precautions when connecting to copper wire.

The two problems are that the aluminum wire expands and contracts with change in temperature, as does copper wire, but aluminum tends to lose its round shape and become oval, whereas copper maintains its original shape and size. So with many cycles of expansion and contraction, the aluminum wire can become loose under ordinary screw heads, causing sparking. The second problem is that the skin of the wire can oxidize, reducing its electrical conductivity, particularly at a connection from an aluminum wire to a copper wire.

For the first problem, any time that an aluminum wire is connected to any fixture at all, it should be a fixture that is designed for aluminum wire -- it will have the indication "Al" or "Alu" printed right on the switch or outlet. These fixtures use aluminum screws rather than brass screws. To avoid having to always buy special fixtures, many people add a short copper wire to the end of the aluminum wire (we call this a pigtail) that then allows you to attach the copper wire to any fixture. But the joint between the copper and the aluminum wire has become the great point of debate.

Officially, according to CSA in Canada and UL in the States, if you use an approved aluminum-to-copper twist connector that includes anti-oxidant creams, everything will be just fine. But one home inspection group (www.inspect-ny.com) has convinced the US Consumer Product Safety Commission (a US Federal government consumer watchdog agency) to state publicly that these connectors are at best a temporary solution. Yet they are still officially approved in both the US and Canada. The companies that sell the connectors try to make it all look easy, so they have even gone as far as saying that you do not have to twist the wires together before putting on the connector. To me, that is cutting corners that should not be cut.

If the aluminum and copper pair of wires do not have excellent electrical contact between them by being closely twisted together and being coated with an anti-oxidant cream to ensure that the surface of the aluminum does not lose its conductivity, then the electricity takes the path of least resistance, which is the spiral thread inside the connector. But this spiral thread is not large enough to carry much current and the above web site shows real examples of this spiral heating red hot and the whole connector bursting into flame.

According to these safety advocates, there is only one way of having a fail safe aluminum-to-copper connection for a pigtail, and that is with a special crimp connector that has a heavy ring that is squeezed onto the two wires with tons of force in a special heavy duty crimper -- the whole system is called CopAlum crimps. Only one company makes them and only a few electricians have bothered to purchase the necessary crimping tool, but it is possible to find, even in Canada. In Canada, call (905) 470-5266 to find the AMP tool or a certified AMP electrician.

If you are using twist connectors, the best procedure is to use the anti-oxidant cream as a lubricant together with some wet/dry emery cloth to scrape any invisible oxidation off of the aluminum wire,

leaving it covered in the cream during and after the whole process to keep it from oxidizing again. This ensures maximum electrical flow out of the aluminum wire. Then tightly twist the copper and aluminum wires together with a pair of pliers. Then apply the connector, either using one that is already filled with cream, or filling one with cream yourself. The cream will keep the cleaning job you did from oxidizing and the twist connector will simply hold the wires together without carrying the electrical load. For interesting details on connectors and even different anti-oxidant creams, brand names and more, check out the "inspect-ny.com" web site.

One other thing that can be done for aluminum wiring, or for that matter, any wiring is to install the new "Arc Fault Interrupters" in the mains panel. These gadgets are both circuit breakers and special "spark" detectors that will shut down any line that is sparking. This will catch some of the aluminum problems, particularly those caused by loose screws. It will not stop an improperly sized or installed twist connector from heating up, but once the wires start to spark, it will break the power to the problem.

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