



The I-ENG-A Report

A Publication of the Investigative Engineers Association, Inc. (I-ENG-A®)
 Nationwide (800) 523-3680 www.ienga.net

Possible Concerns with Aluminum Wiring

Aluminum wiring was commonly used from about 1965 until about 1977 as an alternative to copper wiring. Aluminum (Al) was considerably less expensive than copper (Cu). Most homes built during this time frame have aluminum wiring.

According to the US Consumer Product Safety Commission (CPSC), homes installed with aluminum branch circuits (manufactured before 1972) are 55 times more likely to have one or more connections reach "Fire Hazard Conditions" than a home wired with copper.

Many building codes have been rewritten to not allow the use of aluminum wire for branch circuit wiring in houses.

The Problem...

The problem arose because the industry did not understand the fact that the coefficient of expansion of copper is different than that of aluminum. That is, as electrical circuits are turned on and off, the wire heats up and cools down. This thermal "cycling" causes the wire to expand and contract – at a rate different than adjoining copper connections. If these become loose, arcing can occur at these points.

Other concerns with aluminum wire:

- Aluminum does not conduct electricity as well as copper and generates more heat. This overheating can cause fires.
- Aluminum is more brittle than copper and is more likely to break or crimp. Arcing can occur if a wire breaks or crimps, causing very high temperatures inside the wall or ceiling.
- Aluminum is more likely to corrode (i.e., oxidize) than copper. When excessive corrosion occurs it increases the resistance in the circuit and causes overheating. A thinner wire creates more heat when electrical current is running through it.
- Oxidation also causes the wire to expand, putting pressure on the wire's protective plastic coating, causing the plastic to split. If any of these occur, arcing may result which can cause fires.

Therefore, it is very important that electrical connections be made using similar materials so that the connection does not loosen and cause overheating and/or sparking. There are approved mechanical connectors that can be used as well, that take into account this phenomenon.

How do you know if you have aluminum wiring?

Most known problems are associated with solid aluminum wire, sizes #10AWG, #12AWG, and #14AWG. The wiring will be located between the distribution panels, outlets and light switches on single-phase 120V services. When the building was originally constructed, devices and switches with older "CU/AL" marking should have been installed. Unless every device and switch is removed from its box and looked at, there can be no assurance the installing contractor actually used the more expensive aluminum rated devices. Likewise, over the years, residents may have replaced devices with the cheaper, copper-only rated units, not knowing there are special requirements for these devices.

There are several warning signs to look for that would suggest possible connection problems:

- Sparks, smoke, or the smell of burning plastic emanating from outlets
- Outlets and Switches that are warm to the touch
- Lights that flicker, shine unusually bright or burn out quickly
- Blown fuses or breakers that trip for no apparent reason

What can I do if I have aluminum wiring?

Aluminum wiring can be just as safe as copper when properly installed. The National Electric Code is very explicit on the use of devices and aluminum wiring (Refer to section 110-14[b] for connections, 380-14[c] for snap switches, and 410-56[b] for receptacles).

COMPANY NAME
Address Line 1
Address Line 2
City, ST 11111

investigative engineering - property damage - cause and origin - biological growth analysis - fire and arson investigation
accident reconstruction - subrogation - expert witness testimony - construction defects - product failure analysis

THE NEWSLETTER OF INVESTIGATIVE ENGINEERING

VOLUME 8 NO. 2

Possible Concerns with Aluminum Wiring

There are two (2) available options that can be employed that would maintain the integrity of the existing electrical system with regards to receptacles and snap switches:

Option 1: Purchase and install new "CU/ALR" dual rated receptacles and snap switches in all units where devices are found without a "CO/ALR" or "CU/AL" marking. See NEC Article 380-14(c) and 410-56(b). This serves to ensure that every device will be the proper one for aluminum wiring. It also weeds-out any loose connections and any devices that have been replaced with the "copper only" units.

Option 2: Each device should be pulled from its box and checked for loose connections, discoloration, and rating. If a device is found without the CO/ARL dual rating marking, they can be replaced with the proper rated device, or the existing device can be reused if a UL listed AL/CU rated twist-on connector is spliced as a copper pigtail between the device and the aluminum wiring. As an alternate, a crimp-on splice connector with heat shrink overall sleeve could be used to connect the pigtail to the aluminum – but the labor costs are higher.

It is important to be aware that on future replacements, all receptacles and snap switches must be purchased with the "CO/ALR" marking on them. This is the NEC acceptable device designed to be used on aluminum conductors.

Final Note...

If contemplating buying an older building with aluminum wiring or updating a building with aluminum wiring, contact a certified electrician to gain their expertise and opinion regarding the dangers of aluminum wiring.

If at any time you suspect your electrical system as the source of smoke or unusual heat, do not hesitate to call your local Fire Department. There is never a charge for this service. The safety of your family, employees, and property should be your primary concern.

References:

Aluminum Wiring Hazards web site,
<http://www.inspect-ny.com/aluminum.htm>
Aluminum Electrical Wiring, Report promulgated by
City and County of Denver, January 11, 2001,
<http://www.denvergov.org/admin/template3/forms/Aluminum%20Wiring.PDF>

Article originally published by:

*Professional Investigative Engineers,
Investigative Engineers Association, Inc.
(I-ENG-A) Member, Colorado
www.callpie.com*

*I-ENG-A Member Firm Profile located at
<http://www.ienga.net/pie.htm>*

