

Electrical fires

Though not found very often, aluminum wiring requires special attention. A national survey conducted for the CPSC (Consumer Product Safety Commission) showed that about 1.5 million homes in the United States built before 1972 wired with the original aluminum alloy wiring are 55 times more likely than homes wired with copper to have one or more wire connections at outlets that can reach fire hazard conditions. During an inspection we pay particular attention frequently used outlets in kitchens and bathrooms that may be warm or scorched.

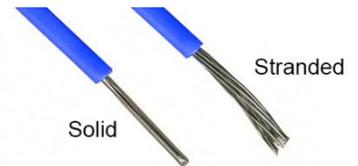


There are several challenges with using aluminum for wiring. Aluminum expands and contracts with current more than copper, which can lead to loose connections at wire terminals that can create arcing and electrical fires.

Aluminum can be prone to oxidation forming on the wires that can cause a poor connection and increased resistance, resulting in overheating. Wiring two dissimilar metals together like aluminum and copper can also lead to galvanic corrosion and increased resistance, again leading to overheating. It is more ductile than copper and will break easier with repeated bending or movement. As a side note, some insurance companies may decline to offer coverage if the wiring is present or may come at a higher cost.

History of Aluminum wiring

Aluminum alloy wiring was used to install electrical branch circuits from 1965 to the mid 1970's when there was a shortage of copper. The use of aluminum wiring is not by itself a concern. We still use larger stranded aluminum wiring for main service conductors and other large wires, but 15 to 30-amp rated **single-strand** branch circuit wires can be a significant fire hazard (a typical outlet or light fixture).



This aluminum wiring is not to be confused with earlier cloth or rubber insulated tin coated copper wires in the 1930's and 40's, or copper coated aluminum found later on.

The wiring that gained notoriety as a cause of fires was the aluminum "Romex®" (non-metallic thermoplastic insulation) found in homes built between 1964 and 1972. An improved aluminum alloy that appeared in 1973 didn't become absolutely required until the 1981 edition of the NEC. While the older aluminum alloy is a significant safety issue, the newer single-strand alloy is still a concern. As a home inspector, while we can see if it is a copper or aluminum wire, we cannot determine whether it is the older or newer alloy.



Electrical outlets and switches

Electrical panels and devices such as outlets, switches and light fixtures were initially intended for copper wires and were not designed to handle the special qualities of aluminum. Eventually a specification known as CU/AL was introduced for devices to be used with aluminum wiring. As it turned out, it is generally ok for electrical panels, but proved insufficient for wiring devices like receptacles and switches.

An improved "CO/ALR" standard that appeared in the 1973 timeframe included terminal screws better designed to prevent aluminum wires from becoming loose. Prior to this time, it was optional for the manufacturers to label device compatibility with aluminum wiring, therefore we don't always know if the appropriate device is being used.



CO/ALR electrical receptacle

Newer aluminum wiring is still a concern

Even if everything is installed properly (I've learned you cannot assume anything) with the newer aluminum alloy, properly rated CU/AL breakers with properly rated CO/ALR outlets and switches, occasional maintenance should be conducted to check and re-tighten connections at terminals.

Aluminum wiring also has to be properly sized. It has higher electrical resistance to electrical current flow, which means that relative to copper, aluminum conductors must be of a larger diameter (different gauge), which may not be understood by non-professionals that are adding or repairing circuits.

Aside from the aluminum alloy and electrical devices used before the 1973 improvements, the **biggest concern** in my experience is changes that have been made to a home's electrical system after it was originally installed. There *will* have been some changes and replacements in 40-year old plus homes. Not all devices, receptacles and switches you may see at the hardware store are rated for aluminum. Homeowners (or electricians) may have replaced a failed switch or receptacle with a standard copper-only device. Or, light fixtures have been changed, or ceiling fans added that are rated for copper wires only. Improper repairs and additions create fire hazards.

Solutions and Repairs

I will not attempt to go through the history and range of what should be done to correct any concerns about aluminum wiring. It will vary somewhat on whether it is the newer or older alloy version, and whether the breakers in the panel are properly rated. There is a history of repair methods and materials, some of which have proven to be unsafe. In some older homes, complete re-wiring should be considered.



(C) 2009 InspectAPedia.com

*Wrong. Can't use just any wire nut.
Common nuts loosen and allow corrosion*

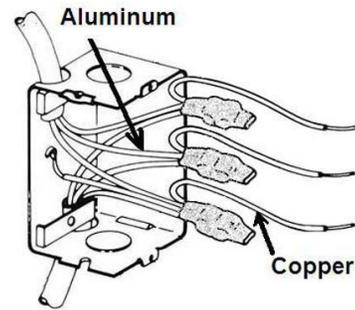


Aluminum Wire Repair, Inc © 2004

*Ideal "65" twist connector, originally
recommended for aluminum pigtails, often fail*

Verifying that connections are all rated as CO/ALR rated receptacles and switches is part of the solution, however these may not be available for the entire wiring system, such as ceiling-mounted light fixtures or permanently wired appliances. Therefore, the CPSC says that CO/ALR connections must be considered, at best, to be an *incomplete repair*.

In many cases, copper 'pigtails' using Copulam crimps may need to be added so the end of the circuit that connects to devices is copper. This work should only be done by licensed electricians certified with the Copulam repair method. Other connectors are now also available, but have not been subjected to exhaustive testing.



For more information

- ["Repairing Aluminum Wiring"](http://www.cpsc.gov/PageFiles/118856/516.pdf) by the CPSC (<http://www.cpsc.gov/PageFiles/118856/516.pdf>)
- https://en.wikipedia.org/wiki/Aluminum_wire and
- http://inspectapedia.com/aluminum/Aluminum_Wiring_Hazards

Terry Beck
NorthStar Inspections