



Loss Control TIPS

Technical Information Paper Series

Innovative Safety and Health SolutionsSM

Aluminum Wiring

Understanding the Problem and Its Solutions

Introduction

As copper became relatively scarce during 1965 to 1973, and as its price increased considerably, the use of aluminum wiring became more financially attractive. Significant quantities of aluminum wiring were installed in many types of buildings during this period. Its use was extended into homes, apartments and businesses.

There has been considerable controversy and confusion over the use of aluminum wiring since its introduction into buildings in 1965, due to an increased risk of fire in buildings where it was used. The aluminum wiring industry claims it is safe, yet many safety and consumer organizations accept its use only when it has been installed (or repaired) under certain conditions.

Hazards of Aluminum Wiring

Problems associated with aluminum wiring have largely been limited to 15 and 20 amp connections found in homes, apartments, and businesses. Aluminum wiring can be found in wall receptacles, switches and cable connections (e.g., dishwashers, furnaces, light fixtures, etc.) which were installed from 1965 to 1973. Wiring that was installed during this time period is referred to as "old" technology wiring. This "old" technology wiring has several important deficiencies:

- *Cold flow (creep)*. Under stress, aluminum wiring will deform more easily than copper wiring. (Cold flow, or creep, is the slow deformation of material under stress.)
- *Brittleness*. Aluminum wiring is considerably more brittle than copper wiring.
- *High coefficient of expansion*. Under heat stress, aluminum will expand 30% more than copper.
- *Oxidation*. Oxides form more readily on aluminum wire than on copper wire. This corrosion will not conduct electricity as well.

These physical characteristics of "old" technology wiring can cause loose connections on receptacles, switches, and cable connections, which in turn can cause electrical arcing. This arcing may eventually cause sufficient heat or emit enough sparks to ignite surrounding materials, such as dust, shavings, debris, or a portion of the building. Since most receptacles, switches, and cable connections are concealed within the structure, these materials may smolder or a fire may spread undetected for hours.



Repairing Aluminum Conductors for "Old" Technology Wiring (1965 to 1973)

Three methods are available for repair of "old" technology aluminum wiring:

- Pigtailing
- CO/ALR Devices
- COPALUM Crimp Connector Repair

Pigtailing

Pigtailing consists of disconnecting the aluminum conductor from receptacles, switches, and cable connections, joining it to a short length of copper conductor, and completing the assembly by means of a aluminum/copper type wire connector.

It is important that *all* receptacles, switches, and cable connections be repaired. Pigtailing is the least expensive, but most labor intensive, repair method.

CO/ALR Devices

A second method of repairing aluminum wiring is by replacing receptacles and switches with hardware designed to be compatible with aluminum conductors. These devices, called CO/ALR devices (usually pronounced *COLAR*), are available only in 15 and 20 ampere configurations.

Using CO/ALR devices at receptacles and switches is less labor intensive than pigtailing an *entire* wiring system. Overall, this procedure is the most cost effective method.

This repair method is limited to receptacles and switches. Therefore, in order for an aluminum wiring system to be *completely repaired*, cable connections (e.g., ceiling-mounted light fixtures, permanently wired appliances, etc.) would have to be repaired via pigtailing and/or the copalum crimp connector repair method (the third repair method).

COPALUM Crimp Connector Repair

The crimp connector repair consists of attaching a piece of copper wire to the existing aluminum wire branch circuit with a specially designed metal sleeve and powered crimping tool. The metal sleeve, called a *COPALUM parallel splice connector*, is manufactured only by AMP Inc. (<http://www.amp.com> or 1-800-522-6752). This special connector can be properly installed only with the matching AMP tool. This tool makes a permanent connection that is, in effect, a cold weld. An insulating sleeve is placed around the crimp connector to complete the repair. This repair method is good for receptacles, switches and cable connectors.

The crimping tools required for this process must be rented from an AMP distributor and electricians must complete a training program to qualify for rental privileges. The number of AMP distributors is limited at this time; consequently, the process is not extensively used by electricians. By far, this is the most expensive repair method.

Wire connectors, CO/ALR devices and the COPALUM Crimp Connector Repair equipment should be listed by Underwriters Laboratories, Inc. This will ensure that these products have been tested for this application by a nationally recognized agency.

"New" Technology Aluminum Wiring (After 1973)

Due to the fire hazards associated with "old" technology wiring, the aluminum industry responded to correct the physical deficiencies (cold flow, brittleness, high coefficient of expansion, and oxidation) of aluminum wiring. Aluminum wire produced since 1973, referred to as "new" technology wiring, is less brittle and has lower cold flow rates than the earlier type.

When a "new" technology aluminum wiring system is properly installed, CO/ALR devices are installed on receptacles and switches and cable connections are equipped with aluminum/copper type wire connectors. This wiring installation method is considered a "standard" electrical wiring system. "New" technology aluminum wiring systems are typically installed in this fashion.

Guidelines for Receptacles and Switch Devices for Aluminum Wiring

- Devices marked CO/ALR may be installed using copper, copper-clad aluminum, or aluminum wire. CO/ALR devices are limited to 15-20 amp devices.
- Devices rated 15-20 amp that are not marked CO/ALR should be installed only when using copper or copper-clad aluminum wire.
- Devices with screwless or push-in terminals are for use only with copper and copper-clad aluminum wire.
- Devices rated 30 amps and above *not marked* AL-CU should only be used with copper wire.
- Devices rated 30 amps and above *marked* AL-CU may be installed using copper, copper-clad aluminum, or aluminum wire.

Reference

"Electrical Connection," *National Electrical Code Handbook*, Article 110-14.

For more information, contact your local Hartford agent or your Hartford Loss Control Consultant. Visit The Hartford's Loss Control web site at <http://www.thehartford.com/corporate/losscontrol/>

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