To The Point
Aluminum Wiring

CHUBB®

In North American residential construction, electrical cables installed between 1965 and the mid-1970s in new construction, in additions and as part of rewired circuits may contain aluminum wiring. Aluminum was widely used to wire entire buildings during this period due to high copper prices, and that wiring is now often implicated in fires and other hazardous incidents.

Aluminum wires have been implicated in residential fires. The U.S. Consumer Product Safety Commission (CPSC) and other government bodies have investigated many incidents and fires across the nation involving failed connections in aluminum branch circuit wiring. The two main reasons why the connections failed were improper installation and differences in the coefficient of expansion between aluminum wire used in the 1960s/1970s and the terminations.

Improper Installation

Most metals oxidize freely when exposed to air. Aluminum oxide is not an electrical conductor, but an electrical insulator. Consequently, the flow of electrons through the oxide layer is greatly impeded. When aluminum wire is not terminated properly, oxygen penetrates the connection point to form additional oxide, increasing resistance. Over time, many of these aluminum wire terminations fail due to improper connection techniques. These failed connections generate heat under electrical load and, in some cases, cause fires.

Different Expansion Rates

Copper, aluminum, and steel expand and contract at different rates under thermal load, so a connection can become loose and progressively worsen over time. This cycle results in a high-resistance junction, leading to additional overheating–and the increased potential for fire. Failing aluminum-wired connections seldom provide easily detected warning signs, often failing or overheating without any indications beforehand.

Identifying Aluminum Cabling

If electrical cables, service drops, laterals or feeder circuits for sub-panels were installed between 1965 and the mid-1970s, check to see if the site has aluminum wiring and buss connections. Most aluminum wiring was installed as plastic-sheathed cable (type NM, often called Romex). Cable with aluminum conductors have "Al" or "Aluminum" and other information marked on one side of the cable jacket every few feet along its length.

Correcting the Problem

The CPSC approves of only three methods for a permanent repair:

- **Complete replacement with copper cable** - Replacing aluminum branch circuit conductors with copper wire eliminates the primary cause of the potential hazards: the aluminum wire itself. This is the best method, but rewiring with copper is often impractical and/or prohibitively expensive.
- The **COPALUM Method** involves attaching a short section of copper wire to the ends of the aluminum wire at connection points (a technique commonly referred to as pig-tailing), using a special connector called COPALUM to join the wires. The repair should include every connection or splice with aluminum wire in the building - including outlets, dimmers, switches, fixtures, appliances, and junction boxes. The repaired system—with short copper wire extensions at every termination throughout the building—enables the use of standard wiring devices, including receptacles and switches.
- The **COPALUM connector** is a specially designed system that includes a metal sleeve installed with a dedicated power tool and crimping die to make a permanent connection. In effect, it is a cold weld; the precision dies in the COPALUM tool compress the connector and wires using up to 10,000 pounds of force to make the permanent aluminum wire connection. Only electricians who are trained by the manufacturer to use the tool properly are authorized to install COPALUM connectors.
- The **AlumiConn Connector** is considered the next best alternative to COPALUM for a permanent repair. This method involves pig-tailing using a set screw connector instead of the COPALUM crimp connector in the repaired connections. The repair should be conducted by a qualified electrician to ensure it is safe and permanent.

Cautions about Repairs

The CPSC does not consider every repair method as acceptable to control aluminum wire exposures. In some cases, the repairs can actually increase the risk of fire. The following common repairs are not accepted by the CPSC:

- Special twist-on connectors, commonly referred to as wire nuts designed for joining aluminum to copper wire, they require a special antioxidant paste to prevent corrosion of the connection. The CPSC considers the use of pig-tails with wire nuts a temporary repair because using wire nuts can increase the risk of fire.
- Use of antioxidant paste.
- Changing the plug outlet or light switch to a new AL-compatible device.

Steps toward a Permanent Solution

Owners of facilities, buildings, or homes equipped with aluminum wiring should meet with a licensed electrician to discuss:

- Replacement with copper wire or repair using COPALUM connectors or AlumiConn connectors.
- Having repairs made by a licensed electrical contractor.
- An ongoing inspection and maintenance program to check connections for tightness and corrosion preferably performed every three years by a licensed electrical contractor.

Resource

U.S. Consumer Product Safety Commission, Publication 516, 2011, www.cpsc.gov/pagefiles/118856/516.pdf

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