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THE USE OF

ALUMINUM CONDUCTORS

WITH WIRING DEVICES IN ELECTRICAL WIRING SYSTEMS

A statement prepared under the auspices of an Ad Hoc Committee sponsored by Underwriters' Laboratories, Inc.

THE USE OF ALUMINUM CONDUCTORS WITH WIRING DEVICES IN ELECTRICAL WIRING SYSTEMS

A number of articles in trade magazines and other technical publications have pointed out the sensitivity of binding screw terminations for aluminum conductors to techniques used and the quality of workmanship employed, and to other factors which might cause unsatisfactory termination performance such as dangerous overheating. Such performance is influenced by:

A. Incompatibility between aluminum conductor and device terminals.
B. Workmanship and installation techniques.
C. High incidence of vibration or mechanical disturbance in use.
D. Wide temperature changes and high humidity environments.
E. Variation in the mechanical characteristics of aluminum conductor material.

Recent revisions in Underwriters' Laboratories, Inc. requirements[1] for Listing solid aluminum conductor in sizes No. 12 and 10 AWG and for Listing snap switches and receptacles for use on 15 and 20 ampere branch circuits incorporate stringent tests which take the above factors into account.

Instructions describing proper installation techniques and emphasizing the need for following these techniques and for practicing good workmanship are required to be included with each coil of No. 12 and 10 AWG insulated aluminum wire or cable.

New product and material designs which provide for increased levels of safety of aluminum wire terminations have recently been developed by the electrical industry.

To assist all concerned parties in the proper and safe use of solid aluminum wire in making connections to wiring devices used on 15 and 20 ampere branch circuits, the following information is presented. Understanding and utilizing this information is essential to proper application of materials and devices now available.

FOR NEW INSTALLATIONS

Comply with Section 110-14(a) of the 1971[2] National Electrical Code (NEC) when aluminum wire is used in new installations.

NEW MATERIALS AND DEVICES

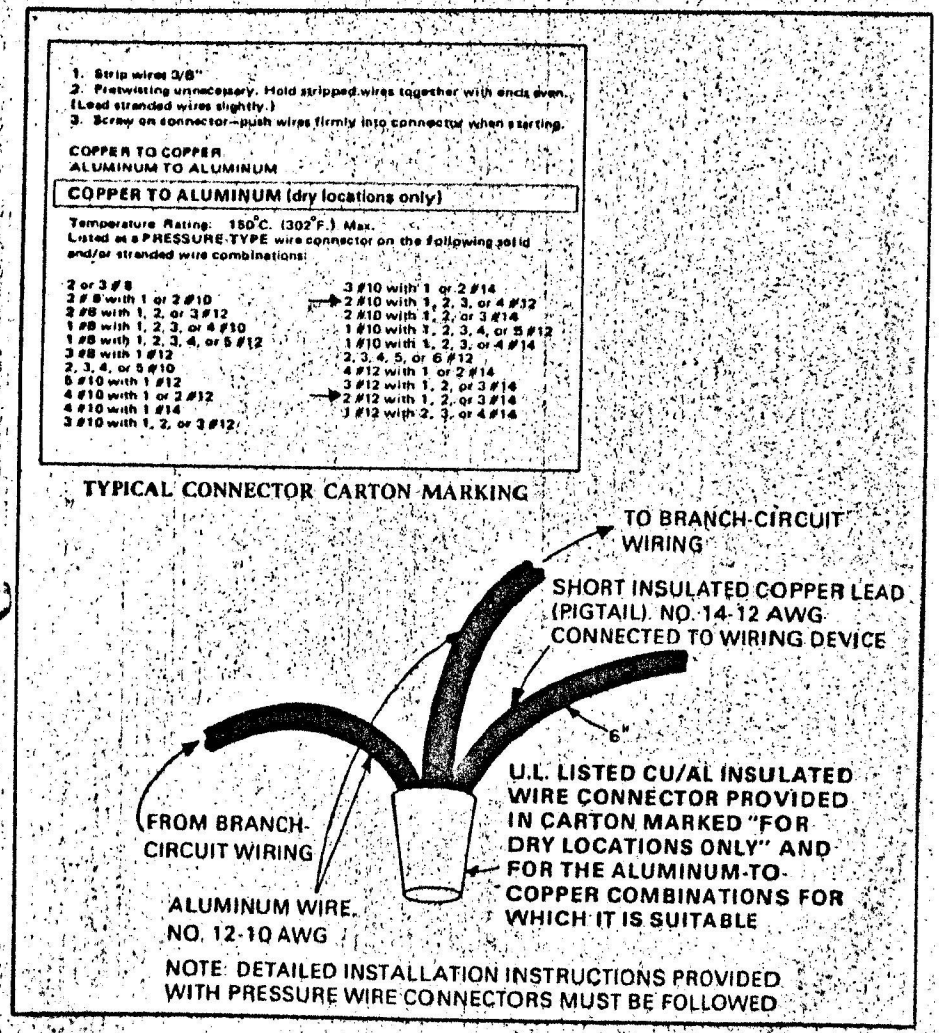
a. For direct connection use only 15-amp and 20-amp receptacles and switches marked "CO/ALR" and connected as described under "Installation Method."

[1]Available from UL upon request.
[2]Covered in Section 110-14(a) of 1975 National Electrical Code.

The "CO/ALR" marking is on the device mounting strap. The "CO/ALR" marking means the devices have been tested to stringent heat cycling requirements to determine their suitability for use with UL labeled aluminum, copper, or copper-clad aluminum wire.

Note:

Pigtailing, either field or factory-wired, as illustrated in Figure 1 is recognized by the NEC.



PIGTAILING COPPER TO ALUMINUM CONDUCTOR
FIGURE 1

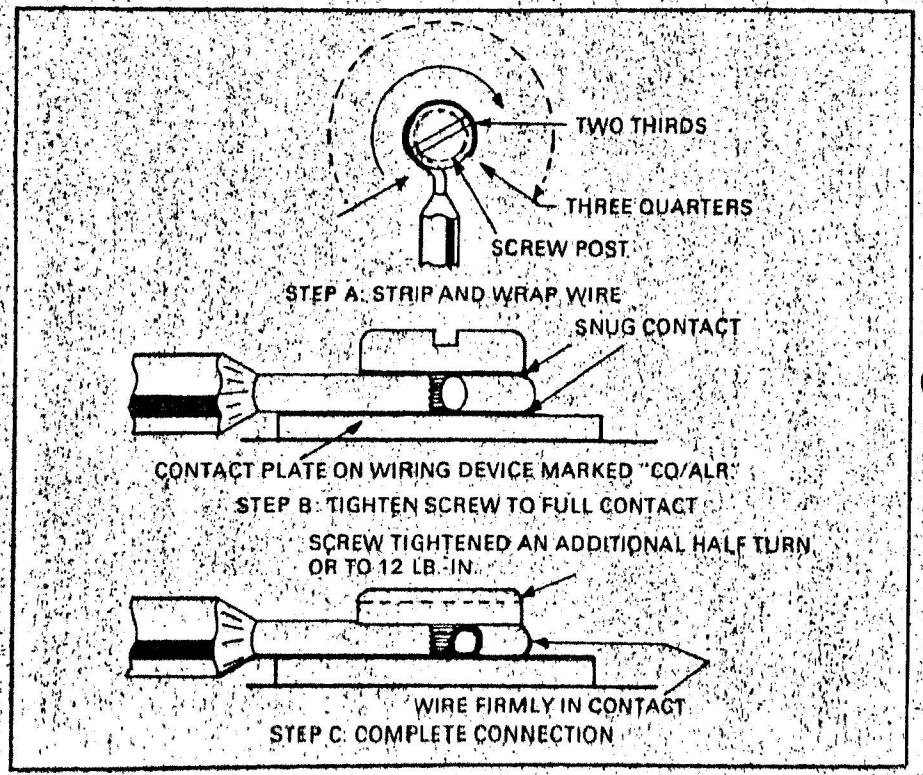
b. Use solid aluminum wire, No. 12 or 10 AWG marked with the Underwriters' Laboratories' new aluminum insulated wire label, as shown below. Follow the installation instructions packaged with the wire.

Conductor bearing this UL label is judged under the requirements for the chemistry, physical properties and processing of the conductor which became effective September 20, 1972.

INSTALLATION METHOD

Figure 2 illustrates the correct method of termination at wire-binding screw terminals of receptacles and snap switches.

1. Wrap the freshly stripped end of the wire 2/3 to 3/4 of the distance around the wire-binding screw post as shown in Step A.



CORRECT METHOD OF TERMINATING ALUMINUM WIRE AT WIRE-BINDING SCREW TERMINALS OF RECEPTACLES AND SNAP SWITCHES

FIGURE 2

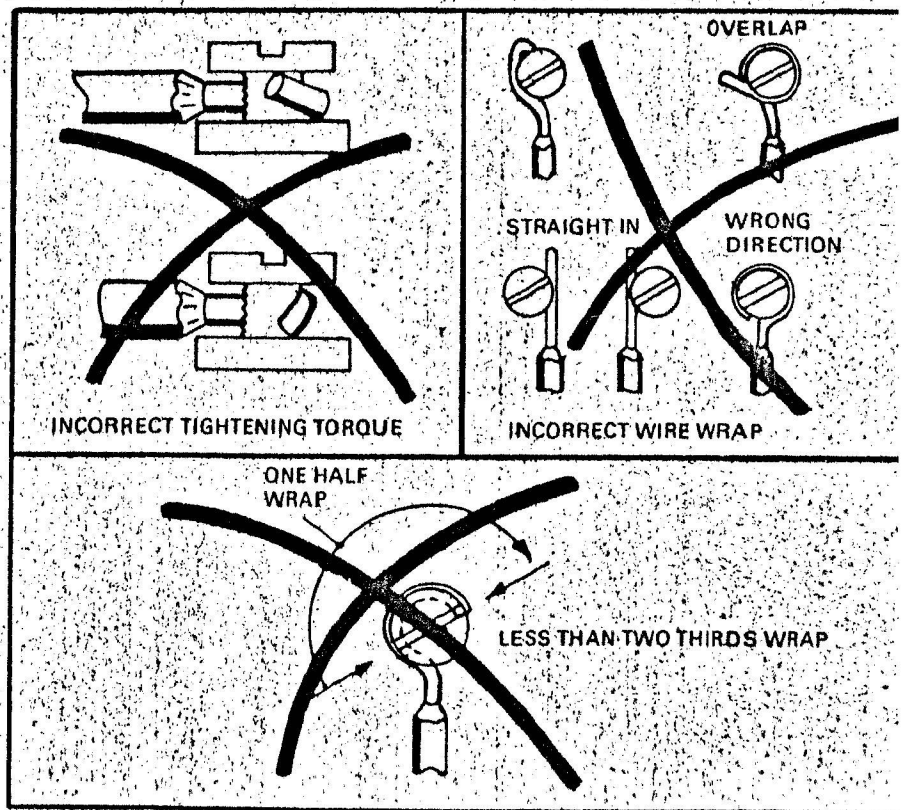
The loop is made so that rotation of the screw in tightening will tend t wrap the wire around the post rather than unwrap it.

2. Tighten the screw until the wire is snugly in contact with the unde side of the screw head, and with the contact plate on the wiring device shown in Step B.

3. Tighten the screw an additional 1/2 turn thereby providing a fir connection. Where torque screwdrivers are used, tighten to 12 pounc inches. See Step C.

4. Position the wires behind the wiring device so as to decrease th likelihood of the terminal screws loosening when the device is positione into the outlet box.

Figure 3 illustrates incorrect methods for connection and should not b used.



INCORRECT METHODS OF TERMINATING ALUMINUM WIRE A WIRE-BINDING SCREW TERMINALS OF RECEPTACLES AND SI SWITCHES

FIGURE 3

EXISTING INVENTORY

When UL labeled solid aluminum wire No. 12 and 10 AWG not bearing the new aluminum wire label (see page 4) is used, it should be used with wiring devices marked "CO/ALR" and connected as described in "Installation Method." This is the preferred and recommended method for using such wire.

Note:

Pigtailing, either field or factory-wired, as illustrated in Figure 1 is recognized by the NEC.

In the following types of devices the terminals shall *not* be directly connected to aluminum conductors but may be used with UL labeled copper or copper-clad conductors:

Receptacles and snap switches marked "AL-CU"

Receptacles and snap switches having no conductor marking

Receptacles and snap switches having back-wired terminals or screwless terminals of the push-in type

FOR EXISTING INSTALLATIONS

If examination discloses overheating or loose connections the recommendations described under *For New Installations - Existing Inventory* should be followed.

To help the property owner or occupant in identifying potential problems with materials that were available prior to the use of improved materials, the information in the accompanying "Safety Message" is being distributed through various print media or other forms of communication.

SAFETY MESSAGE

From various parts of the United States over the past few years hav come reports of excessive overheating and even fires originating in th connections of wire to conventional wall receptacle outlets and sna switches. Such incidents can occur irrespective of the type of wire used- aluminum or copper—but field reports indicate that the possibility o such incidents is greater when certain combinations of aluminum wir devices, and workmanship have been used. The electrical industry ha recently developed improved products and re-emphasized the need fo following good installation practices.

If your residence (house, apartment or mobile home), business or othe property was built prior to 1965 and has had no additional or replacemen wiring for receptacle outlets and snap switches since that date, there i little chance that aluminum wire was used.

If your property was built subsequent to 1965, or has had additiona wiring since then, you should consult the builder or electrical contracto to determine if aluminum wire was used. DO NOT ATTEMPT TO MAKI THIS DETERMINATION ON YOUR OWN.

If aluminum wire was used, you should have a qualified contractor o electrician check connections on the most heavily-loaded or most con- stantly-loaded circuits to determine if they have been properly made o show evidence of possible problems.

Readily detectable signs of possible trouble are unusually warm face plates on switches and receptacles, or a distinctive or strange odor in the vicinity of the receptacle or switch. Persistent but intermittent flicker- ing of lights not traceable to appliances or other external causes are also indications of possible wiring problems.

IF SUCH SIGNS ARE PRESENT, OR IF THEY SUBSEQUENTLY DEVELOP, YOU SHOULD CONSULT A QUALIFIED CONTRACTOR OR ELECTRI- CIAN WITHOUT DELAY.

REPRESENTATIVES OF THE FOLLOWING ORGANIZATIONS SERVED ON THE AD HOC COMMITTEE ON THE USE OF ALUMINUM CONDUCTORS WITH WIRING DEVICES IN ELECTRICAL WIRING SYSTEMS

- The Aluminum Association
- Battelle-Columbus Laboratories
- Edison Electric Institute
- Fire Marshals Association of North America
- International Association of Electrical Inspectors
- National Bureau of Standards
- National Electrical Contractors Association
- National Electrical Manufacturers Association
- National Fire Protection Association
- National Joint Apprenticeship and Training Committee (IBEW-NECA)
- Underwriters' Laboratories, Inc.

Additional copies are available at ten cents each from:

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