

From: David MacLeod, C.E.I., P.Eng.
Chief Electrical Inspector

Date: January 19, 2004

Subject: Aluminum Wiring Information Guide

Application:

The following information is to be used where older aluminum wire is found in older type buildings and homes. This generally applies to those installations between mid 1960's and the late 1970's.

The following information is to be used as a general guide and may not address all situations.

Problem:

When aluminum wire was being used in the mid 1960's connectors were not approved to accept aluminum wire.

When aluminum wire is connected to a lug, screw or termination point that is not approved to accept aluminum wire, the connection when under electrical load, may eventually come loose.

A loose connection, when under an electrical load, can possibly heat up to the point of becoming a possible fire hazard.

Workmanship:

The investigation and repair of any electrical connections shall only be performed by a qualified construction electrician who is familiar with older aluminum wire installations. Not all electricians are experienced with aluminum wire and the necessary corrective measures.

Reducing possible fire hazards as a result of aluminum wire installations depends very much on the quality of the workmanship by the electrician. Even the best type of splicing device, if not installed properly, can cause potential problems.

Only a qualified and experienced construction electrician shall inspect and make any corrective alterations with regard to any requirements within this guideline.

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Course of action:

1. The electrician shall inspect the building to determine if aluminum wire is present.
2. Where aluminum wire has been found, the electrician shall inspect the existing connections per the inspections procedures listed below.

Inspection procedures:

1. With the power off, the electrician shall remove all of the cover plates of the receptacles and light switches and inspect the area of each wire terminal for signs of overheating, loose connections or improper wiring.

Indicators of overheating could be charring or discoloration of the plastic wiring device body near the screw terminals, tarnishing or corrosion of the wire or screw terminal and melting, bubbling, burnback or discoloration of the wires insulation.

One improper wiring method is the termination of aluminum wires into the "push in" wiring holes in the back of the receptacle.

The electrician shall also be inspecting each device to ensure it is approved to accept aluminum wire. Typically items are marked CO/ALR, CU-AL or AL-CU indicating they can be used for both copper and/or aluminum wire and the device shall also have an approved agencies certification mark on it (see general note 5).

2. The electrician shall inspect the connections or terminations of all other devices such as in the panel board, disconnect switches and other electrical boxes in addition to those for the receptacles or light switches.

The electrician shall inspect for loose connections or signs of overheating as specified above.

Warning signs such as flickering lights, inoperative circuits, strange odours, smoke, arcs, may only occur at the hazardous stage of failure. Immediate action may be required to correct any such installation where such warning signs occur.

Signs of overheating may not always be present if no significant current was ever drawn from that device. It may not overheat until used in conjunction with something like a portable heater, which draws a fairly heavy current.

If, during the inspection, the electrician finds any of the problems indicated above (i.e. overheating, equipment not approved to accept aluminum wire , etc.), that device shall, as a minimum, be replaced with an approved device.

Corrective measures for building wiring:

The following options are recommended corrective measures where problems have been identified by the electrician or where no problems have been identified but corrective measures are going to be taken to possibly reduce future problems.

Options vary in cost and in some instances a mix of the following options can be applied in varying degrees depending on the situation. The following options are listed in preferred recommended order of corrective action to be taken place.

Options:

1. Replace all aluminum wire with copper wire.
2. Use an AMP COPALUM type connector to pigtail a piece of copper wire to the aluminum wire and connect the copper wire to the device.
3. Use an approved marrette type connector and pigtail a piece of copper wire to the aluminum wire and connect the copper wire to the device.

Some studies recommend that even with the use of approved marrettes this option may cause future problems with the marrette itself failing. Reliability of the correction is based on the workmanship of the installation

4. Add an oxidizing agent (Penetrox) to all terminations and re-tighten all connections. Review manufacturer's instructions as to acceptability to add the oxidant. (see note 3 below)

Notes:

1. AMP COPALUM type splices are considered the next best solution after replacing the wire, however, this type of connector is a specialized system and not readily available and not all electricians are aware of it.
2. Use only solid copper wire as a pigtail extension.
3. Option 4, depending on the electrical load, will require a scheduled maintenance check at least every 5 years. Ensure all devices are approved to accept aluminum wire.
4. Approved marrette connectors are those specifically approved for aluminum and copper connections, not just plain marrettes.

Corrective measures for main incoming services and main distribution panels with aluminum wire:

1. Have electrician check and oxidize all connections and re-torque.
2. Ensure all connection points are approved to accept aluminum wire.
3. Where connectors (lugs) are not approved, have the electrician consult with the manufacturer on replacement connections.
4. Use only approved parts acceptable to the manufacturer.

Corrective measures for larger buildings with aluminum wire :

Facilities with a 600V or 400 AMP and above incoming service and several distribution systems may warrant the system to be reviewed on a scheduled basis at least every 2 years by an engineering consultant using an infrared heat scanner.

This would occur only after the previous mentioned corrective measures have been implemented.

GENERAL NOTES:

1. Rule 12-118 of the Canadian Electrical Code (2002) shall be followed and implemented for splicing and terminations of all aluminum wire.
2. The manufacturer's instructions shall also be reviewed and implemented as required.
3. Any new wiring shall be done under a wiring permit and shall be inspected by the electrical inspector. No permit is required for the straight replacement of any device such as receptacles, light switches etc. with another approved and equal device.
4. Where splicing occurs, the box or panel fill shall always be maintained within the acceptable limits of the code. Do not over fill outlet boxes or panels. (Refer to Code Rules 12-3034 & 12-3036).
5. Always replace any device with an approved device . An approved device means that it has been certified by one of the following approval agencies CSA, cUL, cETL and cENTELA ,etc. , and the device has the agencies certification mark on the device.

Note that the small " c " identifier as shown is mandatory and without the small "c " the product is not acceptable.

6. Replace and/or test wiring where possible damage may have occurred.
7. The electrician shall inspect fuse sizes to ensure they are properly sized for the circuit they are supplying.
8. Maintenance checks on connections shall be performed if the use of the building has changed or where electrical loads are known to have increased.
9. Aluminum wire is and always has been allowed for installation in Nova Scotia construction. Its use became unpopular in the late 1970's because of its problems and its use became very limited for many years . It was not until the late 1980's or early 1990's that its use began to increase.
10. Since the early 1980's manufacturers have been making improvements in aluminum wire and the connectors. These improvements help to reduce most of the problems in the older aluminum wire and combined with properly approved connectors and a good installation by an experienced electrician newer installations are much safer than the early aluminum wire installations.

Some of the newer aluminum wire names are :

NUAL - STABILOY - ACM.

Installations using these types or newer types of aluminum wire should still have scheduled inspection programs to check installations at least every 5 years . Where a building has changed its use or where the electrical loads are known to have increased then inspections shall occur at that time and then at least every 2 years till the electrical loads stabilize.

11. It should be noted that even installations with copper wiring should have maintenance plans in place to do periodic inspections of the wiring and its connections, this would be for buildings at least 10 years old and where major additions or renovations have occurred the electrical service should be inspected by a qualified electrician to ensure that no overloading exist and that all connections are tight.

Questions concerning this information guide can be forwarded to the Provincial Chief Electrical Inspector -David MacLeod,P.Eng. at 902-424-8018 or by email at macleodd@gov.ns.ca .