

Aluminum and Copper wire basics

1. (a) Is aluminum wire allowed ? - Yes , the Canadian Electrical Code (CEC) which is adopted by the Province allows the use of aluminum wire in all types of construction at present and in the past when aluminum wire was first introduced.

(b) Is aluminum wire safe ? - Yes , when installed and used in its proper application per the CEC it will operate as safely as copper wiring.

2. Background of aluminum wiring use- Aluminum wiring was used quite extensively in residential homes any time from 1965 to 1976 and possibly in other applications such as commercial, industrial and institutional buildings. After the late 1970's aluminum wire became unpopular and not until the early 1990's was it starting to be used again but not as much as copper.

3. The problem with aluminum wiring installations and the consequences - As mentioned above aluminum wire is safe , **it is the connections that cause the problem.** When aluminum wiring was first used the connection points on electrical equipment such as panel board breakers, receptacles and light switches etc had copper terminations. Aluminum has different properties than copper and the two react differently and expand and contract differently when under electrical load (terms you may hear used are creep or cold flow) which may cause the connections to become loose. When the connections become loose this can result in sparking, arcing, oxidation and heat build up and finally the possibility of a fire through the ignition of surrounding combustibles such as the insulation on the wire, wall insulation or wallpaper in the area of the electrical box etc..

Oxidation is the build up of a thin layer of aluminum oxide which creates a thin insulating layer increasing the electrical resistance of the connection and thus increasing heat build up - copper does oxidize but does not act as an insulator and copper does not expand or contract as much when under load as does aluminum .

4. Innovations to address the problems with aluminum wire connections- In order to address this problem of aluminum wire connections during this time the industry came out with dual rated connectors that would accept either copper or aluminum wire. Items with the dual rating were indicated by a marking such as CU-AL, CO/ALR , AL/CU or something similar. This solution offered some relief to the problem but not totally and with the many fires that had occurred its use in the industry basically stopped in the late 1970's. During this time such things as antioxidants were developed that would be applied to connections to reduce the oxidation of the connectors but this involved continual maintenance and was too time consuming and therefore not a very favourable solution.

During the late 80's manufacturers made improvements on the aluminum wire itself by adding a small percentage of another type of metal. This additional metal helped in the reduction of creep and cold flow and combined with the dual rated connectors almost eliminated all past problems .

At present aluminum wire may be referred by some of the following manufactures names:

- NUAL
- STABILOY
- ACM

5. Recommendations to address existing problems with aluminum wiring installations - Where an existing building has the older aluminum wire installed this does not mean that it has to be removed or disconnected there are corrective actions that can take place to make sure that the installation is safe.

An inspection by a construction electrician with experience in older aluminum wire installations should inspect the entire electrical system and do any of the corrective work using one of the following methods.

If the aluminum wire is terminated on devices (including breakers or fuse terminations in the panel) that are approved to accommodate aluminum wire (such as dual rated items marked as listed above and marked by CSA or equivalent as shown below) then all that needs to be done is for the electrician to possibly apply some antioxidant and tighten all the connections. The connections may require to be tightened again so continual maintenance may be required and therefore this is considered a temporary solution.

If the aluminum wire is not terminated on properly approved connectors then one of two procedures can occur:

- First all of the devices can be replaced with properly approved devices to accommodate aluminum wire, this could be costly and therefore is to be considered a last alternative.

-Second is to have the electrician pigtail a small piece of copper wire to the aluminum wire and terminate the copper wire portion of the cable to the device. In order to pigtail the two different wires together you have to use an appropriate connector(dual rated) and it must be approved for use in Canada (ie marked with a CSA, cUL, cETL, cENTELA, cMET, Warnock Hersey, cTUV or cQAI- NOTE the small 'c ' is required in front of some of those listed for them to be allowed in Nova Scotia). Typically this connection is done using twist on connectors called marrettes.

The use of marrettes, even those properly approved, is considered by many not to eliminate the possibility of future problems occurring.

It is therefore considered by many that for proper pigtail to occur between copper and aluminum wire a high pressure bonding crimp type connector be used and one that is recognized and used extensively is a connector by AMP called COPULUM..

6. General rules of thumb with regard to copper or aluminum wiring and its age- The following would be used only as a rough guideline, when ever specific problems occur or when additional electrical loads are added then an electrician should review and /or install the system.

-If the wiring is more than 40 years old without a recent inspection , it is long overdue , have an electrician inspect the entire system

-If the wiring is 10- 40 years old it is advisable to have an inspection done especially where additional loads or extensions to the building were carried out or any electrical problems exist or the wiring is aluminum

-If the wiring is less than 10 years an inspection is typically not required unless additions or renovations that have added additional electrical loads or changed the loading from the original design or any problems exist.

7. Specific things to watch for -Items that indicate electrical problems exist and that an electrician should inspect the situation are:

-signs of arcing or sparking at an electrical device-unusual sounds such as sizzles or buzzes

-an item is hotter than it typically should be to the touch

- breakers or fuses continually trip or blow

-equipment or wire is damaged

- discolouration of receptacle or light switch cover plates

General items to watch for:

The following items if not reviewed and maintained or upgraded may cause problems down the road that may lead to an increase in the possibility of fires or shock.

-One item if you may come across in older homes even today is "knob & tube wiring" - this type of wiring can be identified possibly in the attic or basement if the ceiling is open and appears as open type wire supported by porcelain type insulators. It is recommended that due to the age of this type of wiring (over 50 years) and its limitations(not having a ground wire) that it be replaced.

-Also older homes may have the older two slot type receptacles, it is recommended that these be replaced by electrician with the newer type receptacles(3 prong), ones that have two different sized slots ,the neutral being the larger slot,(this ensures proper polarity for equipment) and a ground pin(this will protect against typical shock hazards) .The installation of a newer type receptacle (3 prong-1 hot-1- neutral and 1 -ground) will not work properly unless properly installed, that is the neutral and hot wire must be properly connected to the proper points on the receptacle and a ground (bond) wire must be installed and properly connected to the receptacle and junction box in which the receptacle is installed in. Therefore this work should be done by a qualified person.

-Also some older homes still have 60 amp services. To ensure that the service does not get overloaded it is recommended that this be increased to a minimum 100 amp service. Many insurance companies will require this upon sale of the home to someone else. Also there requirements to upgrade other aspects of the electrical system per NSPI bulletins when the service is upgraded.

Note: Where major electrical work is performed, such as the wiring of a new home, the rewiring of an existing house or the upgrading of a main service the electrician must ,by law, obtain a wiring permit to do this type of work. When the electrician obtains this permit they are then responsible to contact the local electrical inspection utility and have the work inspected. While the cost of the permit may add an additional dollar amount to the consumer , having the work inspected ensures that the work was done per the electrical code and should provide a safe installation. The risk of fire or shock should always outway the small additional cost to ensure safety by obtaining a permit. Your safety should always be number one.