Aluminum wire issues for Generator supply conductors

Alum has approx. 60% more resistance per cross sectional area than Copper. Therefore to achieve the same amount of conductivity, Aluminum wire must be 60% larger cross sectional area that copper to keep the voltage drop across the length of the alum. wire equal to that of copper wire.

Aluminum tends to oxidize/corrode in humid or wet environments. This can lead to poor connections at the ends & can present overheating there.

Aluminum has a coefficient of linear thermal expansion approx. 34% higher than copper.

See below (taken from Wikipedia)

Problems with aluminum wires

Aluminum wires have been implicated in house fires.[5][6] There are several possible reasons why these connections failed. The two main reasons were improper installation and the differences in the coefficient of expansion between aluminum wire used in the 1960s and the terminations.

Aluminum oxidation[edit]

Most metals (with a few exceptions, such as gold) oxidize freely when exposed to air. Aluminum oxide is not an electrical conductor, but rather an electrical insulator. Consequently, the flow of electrons through the oxide layer can be greatly impeded. However, since the oxide layer is only a few nanometers thick, the added resistance is not noticeable under most conditions. When aluminum wire is terminated properly, the mechanical connection breaks the thin, brittle layer of oxide to form an excellent electrical connection. Unless this connection is loosened, there is no way for oxygen to penetrate the connection point to form further oxide.

Coefficient of expansion and creep[edit]

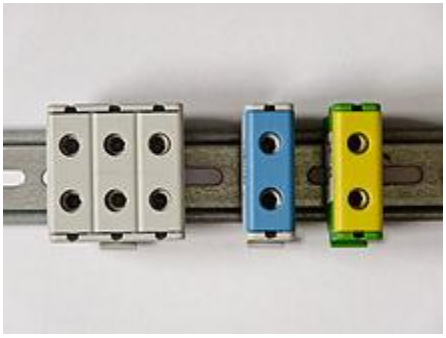
Aluminum wire used before the mid-1970s has a coefficient of expansion that varies significantly from the metals common in devices, outlets, switches, and screws. Many terminations of aluminum wire installed in the 1960s and 1970s continue to operate with no problems. However, problems can develop in the future and some connections were not made properly when installed, including not wrapping wires around terminal screws and inadequate torque on the connection screws. There can also be problems with connections made with too much torque as it causes damage to the wire.

Aluminum and steel both expand and contract at different rates under thermal load, so a connection can become loose, and loose connections get progressively worse over time. This cycle results in the connection loosening slightly, overheating, and allowing intermetallic steel/aluminum alloying to occur between the conductor and the screw terminal. This results in a

high-resistance junction, leading to additional overheating. Although many believe that oxidation was the issue, studies have shown[citation needed] that oxidation was not significant in these cases. The problems related to aluminum wire are typically associated with older pre-1970s solid wire smaller than No. 8 AWG, as the properties of that wire result in significantly more expansion and contraction than modern day AA-8000 series aluminum wire. Older solid aluminum wire also had problems with a property called *creep*, which made the wire permanently deform or relax over time under load.

Aluminum wire smaller than No. 8 AWG is typically not used in new house wiring, but larger stranded aluminum wires are fairly common in much of North America. The larger size stranded aluminum wires don't have the same historical problems as solid aluminum wires, and most common terminations for larger sizes are dual-rated lugs made of an aluminum alloy. Proper termination of larger stranded aluminum wiring is considered safe, since long-term installations have proven its reliability. Larger aluminum wire is often used in residential applications for services and large branch circuit loads such as ranges and air-conditioning units.

Joining aluminum and copper wires



Terminals joining aluminum wires to copper wires

Result improperly joined aluminum and copper wires in old USSR apartments, done by qualified electrician

Another issue is the joining of aluminum wire to copper wire. As aluminum and copper are dissimilar metals, galvanic corrosion can occur in the presence of an electrolyte and these connections can become unstable over time.

Hazard insurance

In some states of the United States, home hazard insurance do not cover homes with any aluminum wiring, and some insurance companies that claim to cover it charge a higher premium than for homes with copper wiring.

Upgrading or repairing aluminum-wired homes

Flat 81 is waiting to be upgraded from Soviet-era aluminum cable to modern copper cable.

Several upgrades or repairs are available for homes with pre-1974 aluminum branch circuit wiring:

- Completely rewiring the house with copper wires
- "Pigtailing" involves splicing a short length of copper wire (pigtail) to the original aluminum wire, and then attaching the copper wire to the existing electrical device. The splice of the copper pigtail to the existing aluminum wire uses special wire nuts, special crimp connectors, or special miniature lug-type connectors.