



A NEMA Building Wire and Cable Section Publication

The Evolution of Aluminum Conductors Used for Building Wire and Cable

History

In the past, several wire and cable companies had experimented with technological variations in aluminum and aluminum alloy conductors. Although research had been conducted prior to this time, it was in the 1960's that some significant discoveries were made in aluminum wire and cable technology. In particular, applications for aluminum conductors were discovered for communications wiring. On further exploration of the technology of metallurgical composites, R & D laboratories in several companies uncovered some surprising facts that led to the discovery of a category of electrical grade aluminum alloys. As a result of this research, some excellent characteristics were discovered in aluminum alloys. These particular composites were later assigned the 8000 series category of the Aluminum Association designation system. Superior characteristics of these metals included higher strength, greater ductility, and improved thermal stability.

Application

With the growth in application of aluminum conductors came the manufacture of aluminum building wire in the 1960's, even in the smaller circuit sizes (10 and 12 AWG sizes). Due to their low cost and availability, utility grade AA-1350 aluminum building wire became extremely popular and was installed in many buildings. Field complaints involving termination failures began to appear in the late 1960's. In answer to the problems being experienced in the field, wire and cable producers along with other members of the industry such as testing laboratories and connector manufacturers, began to address the problem with a reevaluation program developed in 1970. Qualification tests for aluminum building wire were developed by testing laboratories and connector manufacturers developed new connectors for use with aluminum wiring. In qualifying wire for aluminum building wire applications, wire and cable manufacturers began to produce and list the 8000 series conductors. By mid-1972, only these re-qualified aluminum conductors (in AWG sizes 8, 10, and 12) and wiring devices (designated CO/ALR) were acceptable by industry standards.

In support the developmental work of the manufacturers and testing laboratories, education programs focusing on the installation of aluminum conductors were implemented by several manufacturers. Additionally, UL Standard 486B for aluminum conductors was revised and reissued in 1978. Today, connectors are rigorously tested using AA-1350 conductors in order to verify that they are suitable for both AA-1350 and AA-8000 series conductors.

The superior properties of 8000 series type of aluminum when compared to the earlier types, provided the industry with a suitable wiring material for all sizes of aluminum building wire. At present, the alloy is available in sizes 8 AWG and larger. In addition to connectivity, which was addressed with the new alloy conductor materials, the electrical contractor was provided with a material which was easier to handle on the job site due to its increased flexibility and decreased springback.

The 1980's

During the 1980's, the electrical industry began to acknowledge the developments which had taken place in the wire and cable segment. Standards, codes, and specifications began to reference the 8000 series electrical grade aluminum alloy conductors which are readily available and in use today.

In 1981, an ASTM Task Group was appointed to write a standard on the AA-8000 series conductors. In 1985, a proposal was made to include the AA-8000 series conductors in the National Electrical Code®. The proposal was adopted and incorporated into Section 310-14 of the 1987 Code®. Also in 1987, Underwriters Laboratories issued an update to the UL 83 standard to require the use of the AA-8000 series conductors in most types of aluminum building wire. In the fall of 1988, ASTM completed the work on the AA-8000 series specification and ASTM standards B-800 and B-801 were published.

Conclusion

The problem of failure in utility grade AA-1350 aluminum conductors when installed with non-compatible connectors occurred 40 years ago, and is no longer relevant to aluminum building wire installed today. With the development of an improved aluminum alloy, AA-8000, and increased NEC® and UL requirements, aluminum building wire has a proven track record of over 30 years.

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