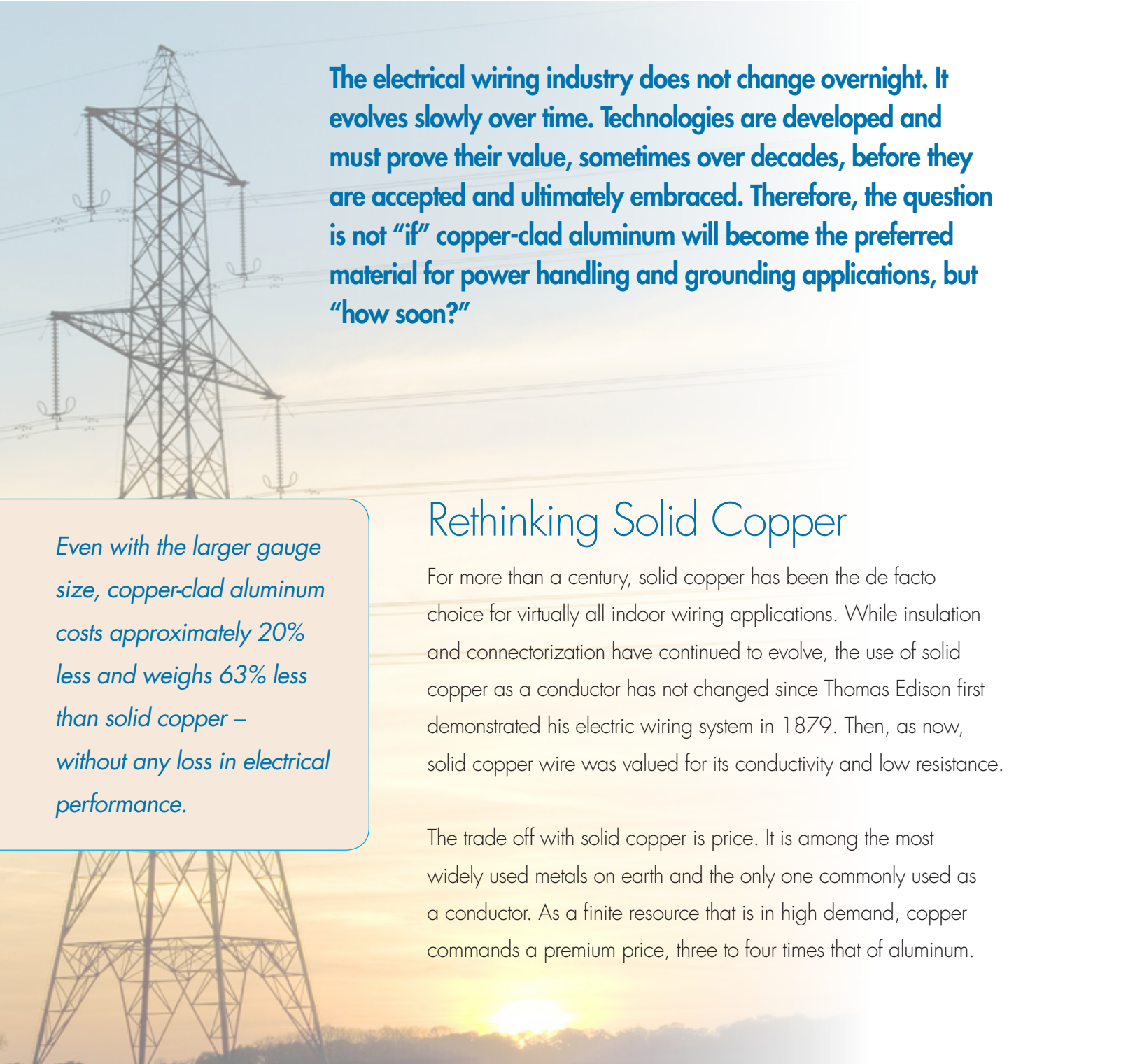


## Copper-Clad Aluminum (CCA) Indoor Wiring Solutions Guide



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The electrical wiring industry does not change overnight. It evolves slowly over time. Technologies are developed and must prove their value, sometimes over decades, before they are accepted and ultimately embraced. Therefore, the question is not “if” copper-clad aluminum will become the preferred material for power handling and grounding applications, but “how soon?”

*Even with the larger gauge size, copper-clad aluminum costs approximately 20% less and weighs 63% less than solid copper – without any loss in electrical performance.*

## Rethinking Solid Copper

For more than a century, solid copper has been the de facto choice for virtually all indoor wiring applications. While insulation and connectorization have continued to evolve, the use of solid copper as a conductor has not changed since Thomas Edison first demonstrated his electric wiring system in 1879. Then, as now, solid copper wire was valued for its conductivity and low resistance.

The trade off with solid copper is price. It is among the most widely used metals on earth and the only one commonly used as a conductor. As a finite resource that is in high demand, copper commands a premium price, three to four times that of aluminum.

# Copper-Clad Aluminum Maximizing Performance - Minimizing Cost

Copper-clad aluminum (CCA) takes advantage of the environmental properties of copper while enabling the industry to realize greater cost savings and make better use of the world's finite amount of copper. CCA is produced by metalurgically bonding a thin layer of pure copper onto an aluminum core. While drawn CCA contains only ten to fifteen percent copper by volume, it delivers virtually the same AC conductivity and only slightly higher electrical resistance than solid copper. In addition, CCA is 63% lighter and, making it easier to handle and minimizing the investment required in cable support systems. Increasing the size of CCA two AWG delivers the same electrical resistance and mechanical properties as copper at a lower weight and lower cost per linear foot.

Based on its excellent electrical performance and ease of handling, copper-clad aluminum is allowed under NEC article 310, if listed and tested in accordance with UL 83, as a suitable replacement for solid copper in indoor power conduction and grounding applications. Because of the slightly higher resistance, the NEC requires using CCA wire that is two gauge sizes larger than what would normally be used with solid copper. Even with the larger gauge size, copper-clad aluminum costs approximately 20 percent less and weighs 63% less than solid copper – without any real loss in electrical performance.

## **CCA has all of the advantages but none of the issues of solid aluminum.**

Today's copper-clad aluminum should not be confused with the solid aluminum wiring that was briefly tried in the 1970s as a low-cost, lightweight substitute for solid copper conductors. The solid aluminum had two inherent problems that led to its use being discontinued for most wiring applications.

Firstly, because the vast majority of connectors and termination points in indoor wiring are copper-based, aluminum wiring is susceptible to Galvanic corrosion at the connection points. Secondly, solid aluminum exhibits a relatively high rate of "cold flow" or "creep". When connected under compression, the connections tend to loosen over time. Both Galvanic corrosion and cold flow can lead difficult to find intermittent connections. Copper-clad aluminum conductors, however, has neither of these problems.

The copper cladding ensures all connections and termination points are copper-to-copper, thereby eliminating any possibility of Galvanic corrosion. The copper skin on CCA wire also prevents any cold flow issues, as copper does not creep. When used for indoor power handling and grounding, copper-clad aluminum provides all the cost and handling advantages of pure aluminum while delivering all the safety and electrical performance of solid copper.

**“...in recent times the price of copper has jumped. While global construction has certainly increased as well, it has not risen as fast as copper prices.”<sup>2</sup>**

## Proven Value Since 1971

The first uses of copper-clad aluminum date to the 1970s when it helped fuel the growth of the cable television (CATV) industry. Prized for its conductivity, light weight and low cost, CCA quickly became the material of choice for coaxial cable. Today, CCA continues to be a primary component of CATV distribution cables.

Additionally, CCA is widely used for voice coils in headphones and portable loudspeakers, mobile coils and high frequency RF antennas. Most recently, copper-clad aluminum is, in some cases, replacing solid copper as the new, lower cost standard for indoor power handling and grounding applications.

## THHN for Indoor Applications

For indoor power handling and grounding applications, CCA is an ideal and cost-efficient substitute for solid copper. Excellent conductivity and low weight-to-volume ratio make it especially suited for power handling installations involving long runs. Other benefits of using CCA wire for power handling and grounding include:

- Direct connectivity with solid copper wire
- Thermal expansion equal to solid copper
- Solder connection equal to solid Copper
- Compatible with all twist-on connectors and wire nuts

CommScope’s Copper-clad aluminum products are now available in UL-approved THHN (Thermoplastic High Heat-resistant PVC/Nylon-coated) 600 volt applications, meeting NEC code. These provide lower cost alternatives to solid copper for dry and damp applications and those requiring flame retardant and high heat (up to 90 degrees Celsius) protection.

## Electrical and Physical Properties

	CCA	Solid Copper
Conductivity		
Resistance	$2.82 \times 10^{-8}$	$1.68 \times 10^{-8}$
Weight per linear ft.	54	100
Tensile Strength	50000	50000

*Conductivity just inverse of resistance, not necessary*

*Resistance in ohm-meter*

*Weight is in lbs for same conductivity (aluminum 2 gauges larger than copper)*

*Tensile strength in lbs for same conductivity (aluminum 2 gauges larger than copper)*

## Comparable AWG Sizes

CCA	Solid Copper
#0	#2
#2	#4
#4	#6
#6	#8

# CCA Drawn Wire and Rods from CommScope®

As one of the world's largest manufacturers of coaxial and HFC (Hybrid Fiber Coax) cable, CommScope is a leading producer of copper-clad aluminum for the CATV, telecom and OEM markets.

**Finished CCA Solutions:** Available in stranded or solid configurations and a wide range of UL-approved jacket types, our drawn CCA wire is certified for use in most indoor power handling or grounding applications. Our newest copper-clad aluminum THHN wire is a 600 volt, flame retardant product, certified up to 90 degrees C and dry or damp locations. Advanced cladding and drawing capabilities enable CommScope to maintain strict quality tolerances for all drawn sizes, including extra fine wire as thin as 44 AWG (0.00198 inches).

**CCA Rods:** CommScope is also a major provider of raw copper-clad aluminum rods to clients who draw their own wire. Rods are available in a variety of thicknesses and either ten or fifteen percent copper content by volume.



## Evolve to Copper-Clad Aluminum

Like any industry, electrical systems evolve as more variables are introduced. Good solutions inevitably give way to better ones. The best solutions optimize as many variables as possible.

In today's competitive environment, having power handling and grounding solutions that maximize electrical performance alone is not good enough, installation and CAPEX costs also drive decision making. With copper-clad aluminum able to deliver the same electrical performance and reliability as solid copper, 20 percent less CAPEX costs and reduced installation costs, it is time to re-consider. Is solid copper still the only acceptable solution?

To learn more about the benefits of using copper-clad aluminum for your indoor power handling and grounding needs, contact your local CommScope representative or visit us at [www.commscope.com](http://www.commscope.com).



# We're proud to be part of your network's story.

Here at CommScope, we embrace our role as a trusted resource, partner, and facilitator. We create the infrastructure that connects the world and evolves with every advance in technology. By investing all of our capabilities, resources, relationships, and products into your toughest challenges, we continue our long history of solving problems together—paving the way for new ideas and fresh ways of thinking. We're a trusted resource and partner around the world because we're invested in you: your people, your networks, your success. It inspires us to build relationships and infrastructure... connect people and technologies across protocols, oceans, and time zones...and share what we learn along the way. We'll never stop connecting and evolving networks for the business of life at home, at work, and on the go.

**This is our promise to you.**

**This is CommScope.**



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