



The Societal Benefits of Copper

Copper and Electrical Safety

Introduction

About half of all residential electrical fires are linked to issues with electrical wiring.¹ For example, in the United States, during a typical year, electrical problems in the home account for more than 26,000 fires and \$1 billion in property losses. In any electrical installation, adherence to safety standards is crucial. Safety norms dictate the use of high quality, high conductivity materials. With its unique properties, copper is, by far, the best, non-precious metal conductor of electricity, and it provides electrical safety for people and property in building construction applications.

1. History

Electric wiring and electrical distribution systems had their origins in the 1880's with widespread use beginning in the twentieth century. Electric wiring was pronounced "the greatest engineering success of the twentieth century" by the National Engineering Academy.² Copper has played an integral part in the development of electric wiring systems since 1900.

2. Electrical transmission and distribution

The electrical power distribution network often referred to as the grid, supplies energy from the point of generation to the end user.³ To meet the needs of both businesses and individual citizens, very high levels of supply reliability and quality are required.⁴ The equipment involved includes transformers, conductors (wires and cables) and a variety of safety components.

By building extensive distribution networks, it was possible to interconnect more and more users. As a result, in the first years of the twentieth century, electricity was spread to practically every country in the world.

2.1 Electrical Installations

An electrical installation is composed of one or more circuits, each containing the necessary equipment to ensure correct operation.⁵ Installations are classified according to their voltage (low, medium and high) and use (generation, transformation, transport and reception).

Copper is mainly found in conductors (wires and cables), control devices (circuit-breakers) and power outlets (sockets). Copper's exceptional strength and durability, plus its resistance to creep (deformation) and corrosion, make it the safest conductor for commercial and residential building wiring.

2.2 Design, Construction and Operation of an Electrical Installation

The safe design of electrical installations is of critical importance for end-users as well as for efficient energy use. Incorporating the correct safety components reduces the risk of electrical accidents caused by short-circuits, overcharging, electrocutions and fires.

Copper electrical conductors are energy-efficient which reduces energy losses, leading to lower CO₂ emissions and lower energy bills. They are also highly reliable, which increases facility safety and quality, thus adding value to the property.

¹ Electrical Home Fire Safety. U.S Fire Administration. FEMA

² Electrification. Wikipedia. The Free Encyclopedia

³ Electrical Power Distribution Grid. Wikipedia. The Free Encyclopedia

⁴ Copper Statistics and Information, USGS

⁵ Electrical Installation. Wikipedia. The Free Encyclopedia



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3. Safety Aspects of an Electrical Installation

3.1 Electrical Codes

The design, construction and operation of an electrical installation must be regulated by electrical norms and codes. Electrical codes are a set of mandatory norms established for the electrical wiring system.⁶ First developed in 1880, with the introduction of commercial electric power, they contain specific rules that guarantee the electrical distribution system is safe and unlikely to cause accidents.⁷

3.2 Material selection - The Role of Copper

Choosing copper for an electrical installation improves the safety, reliability and quality of the building or home, because of the following characteristics:

- **Reliability:** *Copper conductors increase system safety and quality, improving the performance of the construction and adding, in turn, value to the property*
- **Efficiency:** *Copper conductors reduce energy losses leading to lower CO₂ emissions and lower utility bills*
- **Quality:** *Copper is easy to install, offers excellent performance and has a value that makes it economically attractive to recycle at its end of life*

3.3 Electrical wiring

Copper wiring has many practical benefits as an electrical conductor: it is efficient, safe, reliable and boosts the service life of installations.

Proper cable terminations and connections are particularly vital. Because of its resistance to oxidation, copper is far superior to aluminum, particularly in the smaller sizes found in homes and buildings.

3.4 Installation Importance

Statistics, from fire departments around the world, indicate that inadequate electrical installations are among the main causes of fires and accidents in homes. An electrical installation can have “leaks”, which means that a conductor in the installation is allowing energy to escape. It is, therefore, important to have certified professionals check new electrical installations, as well as to inspect existing ones, every ten years, and to carry out the required maintenance.

Conclusions

An electrical installation designed with copper is reliable, safe and minimizes the probability of accidents that endanger the lives of users.

While there are other types of electrical conductors in the market, they have lower conductivities. This reduces system safety and durability and increases end-user electricity costs.

Finally, copper is one of the few materials that can be recycled, over and over again, without any loss in performance. From a sustainable development perspective, this delivers a significant added benefit for the environment and for society.

⁶ Electrical Code. Wikipedia. The Free Encyclopedia

⁷ Electrical Wiring. Wikipedia. The Free Encyclopedia