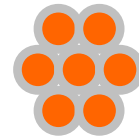


Conductor Coatings

Metal coatings are often applied to electrical conductors to provide easier termination, reduce oxidation, increase a wire's temperature rating or to improve a conductor's electrical properties at high frequencies. The most common coatings for copper conductors are tin, silver and nickel—although gold can also be used. Coated conductors are also often referred to as “plated” conductors.



Coating Materials

Tin is typically used for improved corrosion resistance and solderability. Its relatively low cost and ease of processing makes tin the most commonly used coating material. Tin is used in wires with temperature ratings up to 150°C.

Silver is commonly used in high temperature environments and can withstand temperatures up to 200°C. Silver is often used in combination with Teflon insulation. Silver-plated conductors are also used for high frequency applications, where silver's high conductivity and the *skin effect* work together to reduce attenuation at high frequencies.

Nickel coatings are used on conductors that operate at higher temperatures than can be withstood by silver coatings. At temperatures above 200°C, copper oxidizes rapidly if not plated. Nickel is typically used in cables rated up to 450°C. One drawback of nickel plating is its poor solderability.

Conductor Coating Comparison

	Tin	Silver	Nickel
Maximum Service Temperature	150 C	200 C	450C
Conductivity	15% that of copper	106% that of copper	25% that of copper
Crimp Contact Resistance	Good but can deteriorate over time	Excellent	Good but can deteriorate over time
Solderability	Good but can deteriorate over time	Excellent	Requires active flux

Gold is rarely used because of its high cost. Its electrical conductivity is 72% that of copper and it is highly corrosion resistant.

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Coating Methods

Hot Dip is a process by which bare copper wire is passed through a bath of molten metal to apply the coating.

Electroplating bonds the coating to the base conductor by an electrolytic process.

Cladding is a method in which a base metal is covered with a relatively heavy coating of a different metal. Examples include Copperweld[®], (copper covered steel) and Alum-o-weld^{®*} (aluminum covered steel). Cladding is done under heat and pressure.

Coating Types

Tinned or Heavy Tinned coatings can be applied by either a hot dip or electroplating process. To qualify as “tinned” 40 microinches (1 micrometer) of tin must remain on each strand. Tinned conductors are low in cost but sometimes require the additional step of twisting and solder dipping after stripping of the insulation and prior to termination. To be considered “heavy tinned” 100 microinches (2.5 microns) of tin must remain on each strand. Heavy tinned conductors can be used with automatic stripping equipment.

Prefused or Prebonded is a method in which the heavy tinned twisted strands of a copper conductor are fused together by heating. As a result, no special equipment is required by the wire user to bond the strands of the conductor after stripping the insulation. It is less flexible than other types, is restricted to 16 through 26 AWG and is not available in bunched constructions.

Overcoated conductor is composed of *tinned* copper strands twisted together followed by an overall tin coating. The individual copper strands are bonded along their entire length. Overcoated conductors have many of the same advantages (and disadvantages) of prefused and are available in all conductor strandings, including bunched.

Topcoated conductors are composed of *bare* copper strands twisted together and which are then given an over-all coating of metal, typically tin. Topcoated conductors are similar in characteristics to overcoated but are less expensive.

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