

# Cable Conductor Materials

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In order to transmit electrical current with as few losses as possible, a cable conductor needs to be of low resistivity (or high conductivity). There are two main cable conductor materials used in practice, copper and aluminium, because of their low resistivity characteristics, coupled with their relatively low cost. Silver has better resistivity characteristics than either copper and aluminium, but being a precious metal, is far too costly.

## Copper

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The resistivity of [copper](#) is in the order of  $1.7 - 1.8 \times 10^{-6} \Omega mm^2 / m$ . Copper is a denser material than aluminium and has a higher melting point, hence has better performance under short circuit conditions and is mechanically stronger. However the high density of copper makes it less flexible than aluminium. Copper conductors also need to be very pure, and small traces of impurities (e.g. phosphorous) can significantly affect conductivity.

Copper is typically used more commonly in industrial plants, generating stations and portable equipment because of its mechanical properties. Furthermore, it is used in applications where space restrictions abound, e.g. offshore platforms and aircraft

## Aluminium

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The resistivity of [aluminium](#) is around  $2.8 \times 10^{-6} \Omega mm^2 / m$ , which makes it roughly 60% less conductive than copper. Therefore, aluminium conductors need to be oversized by a factor of 1.6 in order to have the equivalent resistance of

copper conductors. However aluminium is also 50% lighter in mass than copper so it has a weight advantage. Additionally, it is more malleable and flexible than copper.

Aluminium is inherently corrosion resistant due to the thin oxide layer that is formed when aluminium is exposed to the air. Aluminium also performs better than copper in sulfur laden environments (in terms of corrosion resistance).

Aluminium is typically used for overhead aerial lines because of its light weight and high conductivity. It is also used in applications where space restrictions are not a large factor, e.g. underground cables

### Summary

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The table below summarises the pros and cons of copper and aluminium as conductor materials:

	<b>Copper</b>	<b>Aluminium</b>
Advantages	<ul style="list-style-type: none"><li>▪ High conductivity</li><li>▪ High mechanical strength</li><li>▪ Good short circuit performance</li></ul>	<ul style="list-style-type: none"><li>▪ Lower weight</li><li>▪ Flexible and malleable</li><li>▪ Corrosion resistant</li></ul>
Disadvantages	<ul style="list-style-type: none"><li>▪ Heavier and less flexible</li><li>▪ Impurities have large effects on conductivity</li></ul>	<ul style="list-style-type: none"><li>▪ Lower conductivity than copper</li><li>▪ Low mechanical strength</li></ul>

Source:

[http://www.openelectrical.org/wiki/index.php?title=Cable\\_Conductor\\_Materials](http://www.openelectrical.org/wiki/index.php?title=Cable_Conductor_Materials)