

How to Convert From Copper to Aluminum Conductors

by Dave Mercier

Ampacities based upon Table 310-16 of the National Electrical Code.

A commonly used rule-of-thumb for converting the two conductor metals is to have aluminum two AWG sizes larger than copper for equivalency. This works in most cases when one is working inside the American Wire Gage system. One example where the two AWG size rule may not be appropriate is for a 90 ampere circuit which could be served with 75°C rated conductors (provided equipment is so marked). From NEC Table 310-16, the selection could be a No. 3 AWG copper or No. 2 aluminum conductor provided voltage drop is not a factor. Also, with conductor sizes 250 kcmil and larger we are no longer in the American Wire Gage system; therefore, the two AWG size rule can no longer apply.

The technically correct way to make these conversions is to select an equivalent or higher ampacity rating while maintaining the same conductor temperature rating. For example, replace a No. 6 AWG, copper, type TW conductor with an aluminum conductor. Table 310-16 lists the ampacity of No. 6 copper TW (60°C column) at 55 amperes. Now select an aluminum conductor from the 60°C column that has an ampacity of 55 amperes or higher. A No. 4 aluminum would be used to replace the No. 6 copper TW conductor. This aluminum conductor does not have to be type TW, it could have a higher temperature designation such as THW or THHN; however, the ampacity must be based upon a 60°C rated conductor.

Notice that a No. 6 aluminum type THHN conductor has an ampacity rating of 60 amperes which is higher than the 55 ampere rating for No. 6 copper TW. It may seem logical that No. 6 aluminum THHN could replace No. 6 copper TW based upon the ampacity rating alone; however, it is not correct. Difference in voltage drop is one consideration opposing a size-for-size replacement but the main reason lies with equipment ratings. A conductor must terminate at the equipment it serves and this equipment is tested and listed with definite conductor types. Equipment rated 100 amperes or less is tested and listed for use with 60°C rated conductors unless marked otherwise and to connect a conductor to be used at 90°C ampacity effectively voids the listing. It would also violate section 110-3 (b) of the NEC because this section states that equipment shall be installed according to any instructions in the listing or labeling. To repeat, always make conversions from aluminum to copper or copper to aluminum by selecting equivalent or large ampacity while maintaining the same conductor temperature rating.