

Ampacity Determination of Electrical Conductors

Overview

NIH typically requires electrical conductors to be selected for ampacity using a strict interpretation of the most recent edition of the National Electrical Code (NEC).

Ampacity Factors

NIH requires all conductors to be copper, with the exception of some lightning protection system conductors that may be copper or aluminum. This allows for not having to individually inspect/verify electrical terminations based on conductor material used. National Institutes of Health (NIH) requires strict compliance with electrical connection temperature limitations due to problems with submittal verification of terminations and lack of available close inspections of all conductor terminations. NIH requires termination provisions of equipment for circuits rated 100 amperes or less having conductors rated 60°C (140°F) and termination provisions of equipment for circuits rated over 100 amperes having conductors rated 75°C (167°F). Conductors with higher temperature ratings shall be used where required by individual terminations, but may also be used elsewhere with ampacities determined based on NEC tables with temperature ratings as previously stated.

Ampacity adjustments from the NEC Ampacity tables are then considered for environmental temperature, in compliance with NEC Ambient Temperature Correction Factor tables or engineering calculations. Ambient temperature corrections may also be required for underground ductbanks based on number of ducts, relative proximity of ducts, ductbank configuration and fill.

Another temperature adjustment factor that needs be considered is for raceways and cables exposed to sunlight on roofs as these installations are subject to a significant increase in temperature when the roof is exposed to direct sunlight. Mounting distance above the roof to the bottom of the raceway or cable is required to be identified to determine the temperature to be added to the design temperature for the specific geographic area to define a compensated ambient temperature required to determine the temperature correction factor to be applied. NIH requires all electrical distribution system conductors to be

installed in a conduit or raceway, unless the use of multi-conductor cables are allowed for select applications. NEC requires ampacity adjustment factors to be applied when there are more than three current carrying conductors in a raceway or cable. NIH typically restricts circuiting to no more than six current-carrying conductors in a single conduit. This most often occurs for branch circuiting running to common source panelboards for 20 ampere circuits with NIH minimum #12 AWG (American Wire Gauge) conductor sizes, with the required 80% adjustment factor not being a concern for less than seven #12 AWG current-carrying conductors in the single raceway.

For paralleled sets of feeder conductors, each conductor carrying current shall be considered and counted as a current-carrying conductor. These are typically installed as sets in separate conduits, where raceway fill adjustments would not apply, but may also be run in parallel in larger raceways or wiring troughs. Individual conductors as well as multi-conductor cables not installed in separate conduits and run in parallel for a continuous length longer than 610 mm (24") without maintaining required spacing would require ampacity adjustment factor corrections related to raceway fill be applied.

Finally, ampacity adjustments are then considered for all feeders and branch circuiting due to circuiting distances and voltage drop. A maximum total combined voltage drop on both feeder and branch circuit to the farthest connection point that does not exceed 5% will provide reasonable efficiency of operation. With the resistance of conductors higher for smaller sized branch circuit conductors, NIH typically allows for maximum 3% voltage drop for branch circuits, with feeders limited to maximum 2% voltage drop to meet the allowable 5% combined voltage drop.

References

1. National Fire Protection Association (NFPA 70) – 2014 National Electric Code
<http://www.nfpa.org/codes-and-standards>

