Calculation Example

Determine the ampacity of 2 AWG THHN copper conductors to be installed in a raceway in an ambient temperature of 50°C (122°F).

Solution

Table 310.16 shows that the allowable ampacity of the conductor at 30°C is 130 A, which is multiplied by 0.82 [the ambient temperature correction factor in Table 310.15(B)(1)(1)].

$$130 \text{ A} \times 0.82 = 106.6 \text{ A}$$

Thus, the allowable ampacity of the 2 AWG conductor at 50°C is reduced to 106.6 A. For six of the conductors run in the raceway, 310.15(C)(1) requires the allowable ampacity to be further reduced to 80 percent:

$$106.6 \text{ A} \times 0.8 = 85.28 \text{ A}$$

Under these conditions, the 2 AWG conductors would be suitable for an 80-A circuit, based on the standard ampere ratings of circuit breaker and fuses in 240.6(A).

The basis for determining the ampacities of conductors for Tables 310.16 and 310.17 was the NEMA *Report of Determination of Maximum Permissible Current-Carrying Capacity of Code Insulated Wires and Cables for Building Purposes*, dated June 27, 1938. The basis for determining the ampacities of conductors for Tables 310.18 and 310.19 and the ampacity tables in Informative Annex B was the Neher–McGrath method.

Informational Note No. 1: See Table 310.4(1) and Table 315.10(A) for the temperature rating of a conductor that is the maximum temperature, at any location along its length, that the conductor can withstand over a prolonged time period without serious degradation. The ampacity tables of Article 310 and the ampacity tables of Informative Annex B, the ambient temperature correction factors in 310.15(B), and the notes to the tables provide guidance for coordinating conductor sizes, types, ampacities, ambient temperatures, and number of associated conductors. The principal determinants of operating temperature are as follows:

(1) Ambient temperature — ambient temperature may vary along the conductor length as well as from time to time.
(2) Heat generated internally in the conductor as the result of load current flow, including fundamental and harmonic currents.
(3) The rate at which generated heat dissipates into the ambient medium. Thermal insulation that covers or surrounds conductors affects the rate of heat dissipation.
(4) Adjacent load-carrying conductors — adjacent conductors have the dual effect of raising the ambient temperature and impeding heat dissipation.

Informational Note No. 2: Refer to 110.14(C) for the temperature limitation of terminations.

(B) Engineering Supervision. Under engineering supervision, conductor ampacities shall be permitted to be calculated by means of Equation 310.14(B).

$$I = \sqrt{\frac{T_c - T_a}{R_{dc}(1 + Y_c)R_{ca}}} \times 10^3 \text{ amperes} \qquad \textbf{[310.14(B)]}$$

where:

T_c = conductor temperature in degrees Celsius (°C)
T_a = ambient temperature in degrees Celsius (°C)
R_{dc} = dc resistance of 305 mm (1 ft) of conductor in microohms at temperature, T_c
Y_c = component ac resistance resulting from skin effect and proximity effect
R_{ca} = effective thermal resistance between conductor and surrounding ambient

310.15 Ampacity Tables.

Δ **(A) General.** Ampacities for conductors rated 0 volts to 2000 volts shall be as specified in the Ampacity Table 310.16 through Table 310.21, as modified by 310.15(A) through (F) and 310.12. Under engineering supervision, ampacities of sizes not shown in ampacity tables for conductors meeting the general wiring requirements shall be permitted to be determined by interpolation of the adjacent conductors based on the conductor's circular-mil area.

The temperature correction and adjustment factors shall be permitted to be applied to the ampacity for the temperature rating of the conductor, if the corrected and adjusted ampacity does not exceed the ampacity for the temperature rating of the termination in accordance with 110.14(C).

Informational Note No. 1: Table 310.16 through Table 310.19 are application tables for use in determining conductor sizes on loads calculated in accordance with Part II, Part III, Part IV, or Part V of Article 220. Ampacities result from consideration of one or more of the following:

(1) Temperature compatibility with connected equipment, especially the connection points
(2) Coordination with circuit and system overcurrent protection
(3) Compliance with the requirements of product listings or certifications
(4) Preservation of the safety benefits of established industry practices and standardized procedures

Informational Note No. 2: See Chapter 9, Table 8, Conductor Properties, for conductor area. Interpolation is based on the conductor circular-mil area and not the conductor overall area.

Informational Note No. 3: See 400.5 for the ampacities of flexible cords and cables. See 402.5 for the ampacities of fixture wires.

Informational Note No. 4: See Table 310.4(1) and Table 310.4(2) for explanation of type letters used in tables and for recognized sizes of conductors for the various conductor insulations. See 310.1 through 310.14 and the various articles of this *Code* for installation requirements. See Table 400.4, Table 400.5(A)(1), and Table 400.5(A)(2) for flexible cords.

Ampacity tables, particularly Table 310.16, do not consider all factors affecting ampacity. However, experience has proven the table values to be adequate for loads calculated in accordance with Article 220 because not all the load diversity occurring in