in exposed or concealed installations. Openings in such devices shall form a close fit around the outer covering of the cable, and the device shall fully enclose the part of the cable from which any part of the covering has been removed. Where connections to conductors are by binding-screw terminals, there shall be available as many terminals as conductors.

(C) Devices with Integral Enclosures. Wiring devices with integral enclosures identified for such use shall be permitted as provided by 300.15(E).

Δ **334.80 Ampacity.** The ampacity of Types NM and NMC cable shall be determined in accordance with 310.14. The ampacity shall not exceed that of a 60°C (140°F) rated conductor. The 90°C (194°F) rating shall be permitted to be used for ampacity adjustment and correction calculations, provided the final calculated ampacity does not exceed that of a 60°C (140°F) rated conductor. The ampacity of Types NM and NMC cable installed in cable trays shall be determined in accordance with 392.80(A).

Where more than two NM cables containing two or more current-carrying conductors are installed, without maintaining spacing between the cables, through the same opening in wood framing that is to be sealed with thermal insulation, caulk, or sealing foam, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1) and 310.14(A)(2), Exception, shall not apply.

Where more than two NM cables containing two or more current-carrying conductors are installed in contact with thermal insulation without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1) and 310.14(A)(2), Exception shall not apply.

As stated in 310.15(C)(1), "The ampacity of each conductor shall be reduced as shown in Table 310.15(C)(1), where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables not installed in raceways are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.)."

Failure to apply the appropriate ampacity adjustment factor called for by Table 310.15(C)(1), where Type NM cables are stacked or bundled without maintaining spacing, can lead to overheating of conductors. The ampacity adjustment requirements prevent overheating of the conductors where they pass though wood-framed draft- and fire-stopping material or are in direct contact with thermal insulation. Not only is thermal insulation provided within structures to reduce heat loss or heat gain, the same thermal insulation material can be used to control sound within structures as well.

Calculation Example

Four 2-conductor, size 12 AWG, copper with ground, Type NM cables are installed in direct contact with thermal insulation without maintaining spacing. Calculate the ampacity of the conductors according to the requirements of 334.80 and determine the maximum overcurrent protection permitted for the four circuits.

Solution

Step 1. Determine the number of current-carrying conductors:

4 cables × 2 conductors per cable = 8 current-carrying conductors

Step 2. Determine the initial conductor ampacity. Using the 90°C copper ampacity from Table 310.16 for derating purposes, the initial ampacity of 12 AWG is 30 A.

Step 3. Determine the adjusted conductor ampacity. Due to the direct contact with thermal insulation, use Table 310.15(C)(1). Eight current-carrying conductors require an adjustment factor of 70 percent.

30 A × 0.7 = 21 A (adjusted)

Section 334.80 does not allow an ampacity greater than that given in the 60°C column of Table 310.16; therefore, the conductor ampacity is limited to 20 A.

Step 4. Determine the maximum permitted overcurrent device for each circuit. According to the footnote in Table 310.16, conductor sizes 14 AWG through 10 AWG must also comply with 240.4(D), which limits protection of a 12 AWG copper conductor to a maximum of 20 A.

Conclusion. The final ampacity for each current-carrying conductor is 20 A, and the maximum overcurrent device permitted for each of the four circuits is 20 A.

This example points out that the 14 AWG to 10 AWG Type NM cable typically used for branch circuits can be installed without spacing and placed within thermal insulation with little impact on most installations. For similar installations, as long as the bundle is limited to not more than nine current-carrying conductors, the adjusted ampacity will not be below the overcurrent protection set in 240.4(D).

Part III. Construction Specifications

334.100 Construction. The outer cable sheath of nonmetallic-sheathed cable shall be a nonmetallic material.

334.104 Conductors. The 600-volt insulated power conductors shall be sizes 14 AWG through 2 AWG copper conductors or sizes 12 AWG through 2 AWG aluminum or copper-clad aluminum conductors. Control and signaling conductors shall be no smaller than 18 AWG copper.

334.108 Equipment Grounding Conductor. In addition to the insulated conductors, the cable shall have an insulated, covered, or bare equipment grounding conductor.

334.112 Insulation. The insulated power conductors shall be one of the types listed in Table 310.4(1) that are suitable for branch-circuit wiring or one that is identified for use in these cables. Conductor insulation shall be rated at 90°C (194°F).