

**402.7 Number of Conductors in Conduit or Tubing.** The number of fixture wires permitted in a single conduit or tubing shall not exceed the percentage fill specified in Table 1, Chapter 9.

#### See also

**Chapter 9, Table 4**, which provides the usable area within the selected conduit or tubing

**Chapter 9, Table 5**, which provides the required area for each of the conductors

The following examples show how to determine the minimum size conduit where the conductors are different sizes and, where the conductors are all the same size, how to select the minimum size conduit directly from the tables in Informative Annex C.

#### Calculation Example 1

A remote ballast installation requires a single flexible metal conduit (FMC) to contain fourteen 16 AWG TFFN fixture wires and three 12 AWG THHN conductors. What size FMC is required?

#### Solution

**Step 1.** Using Table 1 in Chapter 9, look up the maximum percent of cross section of conduit permitted for conductors. Table 1 limits the raceway fill for more than two conductors at 40 percent of the total cross-sectional area of the raceway. Note 6 in the Notes to Tables refers to Tables 5 and 5A for conductor dimensions and Table 4 for the raceway dimensions.

**Step 2.** Find the individual conductor cross-sectional areas in Chapter 9, Table 5:

$$16 \text{ AWG TFFN} = 0.0072 \text{ in.}^2$$

$$12 \text{ AWG THHN} = 0.0133 \text{ in.}^2$$

**Step 3.** Calculate the total area occupied by the wires as follows:

$$\text{Fourteen } 16 \text{ AWG TFFN} \times 0.0072 = 0.1008 \text{ in.}^2$$

$$\text{Three } 12 \text{ AWG THHN} \times 0.0133 = 0.0399 \text{ in.}^2$$

$$\text{Total area} = 0.1407 \text{ in.}^2$$

**Step 4.** Using the 40-percent column of Table 4, Chapter 9, in the section entitled "Article 348, Flexible Metal Conduit (FMC)," find the appropriate FMC size based on 40-percent fill and a total conductor area fill of 0.1407 in.<sup>2</sup> Because 0.1407 in.<sup>2</sup> is greater than 0.127 and less than 0.213, select trade size ¾.

#### Calculation Example 2

If the conductors in the FMC are all of the same wire size (16 AWG), Informative Annex C tables can be used instead of doing the calculations. This example uses Informative Annex C tables to determine FMC size.

What size FMC is required for seventeen 16 AWG TFFN conductors?

#### Solution

**Step 1.** In Informative Annex C, Table C.3, find TFFN insulation in the first column.

**Step 2.** Find 16 AWG in the second column. Proceed across the table until the desired number of conductors is equal to or less than the number shown in the table for the respective conduit sizes. Trade size ½ is required.

**402.8 Grounded Conductor Identification.** Fixture wires that are intended to be used as grounded conductors shall be identified by one or more continuous white stripes on other than green insulation or by the means described in 400.22(A) through (E).

This requirement is similar to that required for flexible cords and cable to ensure that the grounded conductor is easily recognized. Because connection of the grounded conductor to the screw shell of lampholders is necessary to reduce exposure to an electric shock hazard when lamps are being replaced or changed, the grounded conductor must be easily recognized.

#### 402.9 Marking.

**(A) Method of Marking.** Thermoplastic insulated fixture wire shall be durably marked on the surface at intervals not exceeding 610 mm (24 in.). All other fixture wire shall be marked by means of a printed tag attached to the coil, reel, or carton.

**(B) Optional Marking.** Fixture wire types listed in Table 402.3 shall be permitted to be surface marked to indicate special characteristics of the cable materials. These markings include, but are not limited to, markings for limited smoke, sunlight resistance, and so forth.

**402.10 Uses Permitted.** Fixture wires shall be permitted (1) for installation in luminaires and in similar equipment where enclosed or protected and not subject to bending or twisting in use, or (2) for connecting luminaires to the branch-circuit conductors supplying the luminaires.

Fixture wire is permitted to be used as a tap conductor to connect a luminaire(s) to the branch-circuit conductors. The transition from the branch-circuit wiring method to the fixture wire tap conductors can be accomplished via a junction box or other fitting that is allowed to contain splices.

#### See also

**240.5(B)(2)** for overcurrent protection of fixture wire tapped to branch-circuit conductors

**402.12 Uses Not Permitted.** Fixture wires shall not be used as branch-circuit conductors except as permitted elsewhere in this Code.

**402.14 Overcurrent Protection.** Overcurrent protection for fixture wires shall be as specified in 240.5.