NEC 2017 1- and 2- Family Dwelling



ELECTRICAL INSPECTOR CERTIFICATION PROGRAM



1- AND 2- FAMILY STUDY GUIDE

ELECTRICAL INSPECTOR CERTIFICATION PROGRAM



I - AND 2- FAMILY STUDY GUIDE

ELECTRICAL INSPECTOR CERTIFICATION PROGRAM

Updated to the 2017 NEC

International Association of Electrical Inspectors Richardson, Texas



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PART II: Answers 199



Under general conditions conductors installed in raceways shall be stranded if larger than what size?

- A. 12 AWG
- B. 10 AWG
- C. 8 AWG
- D. 6 AWG



ANSWER_

PROCEDURE TO ESTABLISH ANSWER

The question is about stranded conductors installed in raceways.

- 1. In Index, find "Conductors."
- 2. Under "Conductors," find "Stranded, 310.106(C), Chap. 9, Table 10."
- 3. Section 310.106(C) provides that when installed in raceways, conductors of size 8 AWG and larger shall be stranded, except as permitted or required elsewhere in this *Code*.
- 4. When answering a question such as this, one has to really think before selecting the answer. As noted in Step 3, the NEC section is noting that conductors of 8 AWG and larger have to be stranded but the question is essentially asking, what is the largest size solid conductor that can be installed in a raceway?
- 5. The correct answer is B.

2 Raceways for service conductors are considered outside a building or structure if the raceway is installed:

- A. in the hollow spaces of the building or structure
- B. within rigid metal conduit (Type RMC) or intermediate metal conduit (Type IMC) used to accommodate the clearance requirements in 230.24 and routed directly through an eave but not a wall of a building
- C. within insulation between studs in an outside wall
- D. exposed in a crawlspace under a building

ANSWER _____

PROCEDURE TO ESTABLISH ANSWER

The question is about when service conductors are considered to be outside a building.

- 1. In Index, find "Service-entrance conductors" under which find "Considered outside of building, 230.6."
- 2. Section 230.6(5) indicates that statement B is the correct answer.
- 3. The correct answer is B.
- **3** Which one of the following statements applies to a short section of raceway, other than those installed under the provisions of 312.5(C), used to protect exposed wiring from physical damage?
 - A. It may be filled to 53 percent only.
 - B. It may be filled to 31 percent only.
 - C. It may be filled to 40 percent only.
 - D. Fill requirements do not apply.

ANSWER_____

PROCEDURE TO ESTABLISH ANSWER

The question is about conduits used to protect conductors from physical damage.

- 1. In Index, find "Conduits" under which find "Conductors, number in, Chap. 9, Table 1, Annex C, Tables C1 through C12(A)."
- 2. In Chapter 9, Tables, find note 2 under the heading "Notes to Tables," which states short nipples or sections of conduit or tubing used to protect exposed wiring from physical damage are exempt from Table 1.
- 3. The correct answer is D.
- 4 The smallest size of electrical metallic tubing (EMT) that can be used for a residential service with two 2/0 AWG Type THW conductors and one 4 AWG bare conductor is a:
 - A. Metric Designator 27 (trade size 1)
 - B. Metric Designator 35 (trade size 1¼)
 - C. Metric Designator 41 (trade size 1½)
 - D. Metric Designator 103 (trade size 4)

ANSWER _____

PROCEDURE TO ESTABLISH ANSWER

This question is related to various sizes of conductors in the same raceway so we are talking about number of conductors in a raceway or the "conductor fill." The fact that it is a residential service has no bearing on the answer.

1. There are at least two easily identifiable avenues in the Index to find this answer. In the Index find "Conduits" under which find "Conductors, number in, Chap. 9, Table 1, Annex C, Tables C1 through C12(A)." The reference to Table 1 is probably the more direct pathway of the two we are noting but may not be the most effective if the reader does not already know the number of conductors cannot exceed the percentage fill in Table 1.

Alternatively, you can find "Conductor fill" in the Index under which find "Electric Metallic Tubing, 358.22, which notes the number of conductors permitted shall not exceed the percentages allowed in Table 1, Chapter 9. As there are in most *NEC* tables, there are "Notes to Tables" in Table 1, Chapter 9. Notes to Tables should always be considered as they are extremely important and will generally affect the use of the table.

- 2. Annex C was noted in the Index reference in Step 1, but Note 1 to Table 1, Chapter 9 states Annex C only applies to conduit and tubing fill for conductors and fixture wires of all the same size. Since the question states there are different conductor sizes, Annex C cannot be used.
- 3. Scanning the Notes to Tables, you will find that Note 6 applies to combinations of conductors of different sizes. It states that for combinations of conductors of different sizes, Table 5 and Table 5A can be used for conductor dimensions; and Table 4, for the applicable conduit or tubing dimensions.
- 4. Under Table 5 of Chapter 9, find the column for "Approximate Area" and use "in.²" Under the "Type" column find THW, and then under the "Size" column find 2/0 AWG. It shows an approximate area of .2624 in.² x 2 conductors = .5248 in.²
- 5. Note 8 states that where bare conductors are permitted, the dimensions for bare conductors listed in Chapter 9, Table 8 can be used. Look under the "Conductors" column and then find the "Over-all" column, followed by the "Area, in.²"

4 AWG overall = 0.042. Adding the 0.042 to the .5248 for the 2/0 conductors, there is a total sq. in. area of .5668 in.²

- 6. To find tubing size for this fill, go to Chapter 9, Table 4, "Article 358—Electrical Metallic Tubing," "Over 2 Wires 40% column," and then "in.²" A metric designator 27 (1 in.) tubing is permitted to have a conductor fill of only 0.346 square inches, which is not large enough. A metric designator 35 (1¼ in.) tubing is permitted to have conductor fill of 0.598 square inches at 40% fill.
- 7. To meet the minimum overall conductor fill of 0.5668 in.², a metric designator 35 (1¼ in.) EMT conduit would be required.
- 8. The correct answer is B.
- 5 Generally, electrical nonmetallic tubing shall be secured within a minimum of how many inches from each outlet box?
 - A.300 mm(12 in.)B.450 mm(18 in.)C.600 mm(24 in.)D.900 mm(36 in.)

ANSWER _

PROCEDURE TO ESTABLISH ANSWER

The question is about securing electrical nonmetallic tubing.

- 1. In Index, find "Electrical nonmetallic tubing" under which find "Securing and supporting, 362.30."
- 2. Section 362.30(A) requires ENT to be securely fastened within 900 mm (3 ft) of each outlet box.
- 3. The correct answer is D.

What is the minimum size Schedule 40 rigid polyvinyl chloride conduit (PVC) permitted for three 4 AWG Type THW copper conductors used for a 100-ampere dwelling service?

- A. Metric Designator 21 (trade size ³/₄)
- B. Metric Designator 27 (trade size 1)
- C. Metric Designator 35 (trade size 1¼)
- D. Metric Designator 41 (trade size 1½)

ANSWER _____

PROCEDURE TO ESTABLISH ANSWER

The question is about conductor fill. The fact that it is a dwelling unit service had no bearing on the question.

- 1. In Index, find "Conductor fill" under which find "Rigid polyvinyl chloride conduit, 352.22."
- 2. Section 352.22 refers to Table 1, Chapter 9, which permits 40 percent fill for over two conductors.
- 3. Note 1 to Table 1 permits the use of Annex C for conductors of same size.
- 4. Table C10 applies to the maximum number of conductors permitted in polyvinyl chloride conduit (PVC), Schedule 40.
- 5. For Type THW conductors, size 4 AWG, a metric designator 27 (1 in.) conduit may contain three conductors. A metric designator 21 (¾ in.) conduit will accept only one conductor, so the 1 in. conduit is required.
- 6. The correct answer is B.

The maximum permitted spacing between supports for flexible metal conduit run exposed along the outside of a wall between two outlet boxes is:

- A. 450 mm (1½ ft) B. 1.4 m (4½ ft)
- C. 1.8 m (6 ft)
- D. 3.0 m (10 ft)



ANSWER_

PROCEDURE TO ESTABLISH ANSWER

The question is about supports for flexible metal conduit.

- 1. In Index, find "Flexible metal conduit" under which find "Securing and supporting, 348.30."
- Section 348.30(A) requires flexible metal conduit to be supported at intervals not exceeding 1.4 m (4½ ft).
- 3. Since none of the four exceptions applies in this question, assume that the general conditions apply.
- 4. The correct answer is B.



Generally, flexible metal conduit shall be securely fastened within how many inches from an outlet box?



PROCEDURE TO ESTABLISH ANSWER

The question is about securing flexible metal conduit.

- 1. In Index, find "Flexible metal conduit" under which find "Securing and supporting, 348.30."
- 2. Section 348.30(A) requires flexible metal conduit to be securely fastened within 300 mm (12 in.) on each side of every outlet box or fitting.
- 3. Since none of the four exceptions is stated in the question, assume that the general conditions apply.
- 4. The correct answer is C.
- **9** Rigid polyvinyl chloride conduit (PVC) is installed underground as a raceway between a dwelling and an outdoor post light. Two 12 AWG Type THW insulated conductors and a bare 12 AWG equipment grounding conductor are pulled into the raceway. The circuit is protected by a 20 ampere GFCI circuit breaker. What is the minimum burial depth permitted for the raceway?
 - A. 150 mm (6 in.)
 - B. 300 mm (12 in.)
 - C. 450 mm (18 in.)
 - D. 600 mm (24 in.)



ANSWER ____

PROCEDURE TO ESTABLISH ANSWER

The question is about burial depth of rigid nonmetallic conduit for a branch circuit.

- 1. In Index, find "Direct burial" under which find "Rigid polyvinyl chloride conduit, 300.50, 352.10(G)."
- 2. Section 352.10(G) refers to 300.5, and 300.5(A) refers to Table 300.5 for minimum cover requirements.
- 3. Table 300.5, Column 4, allows 300 mm (12 in.) of cover for a residential branch circuit rated 120 volts or less with GFCI protection and a maximum overcurrent protection of 20 amperes.
- 4. The correct answer is B.

10 A 40-ampere, 240-volt feeder between a dwelling and garage in Schedule 80 rigid polyvinyl chloride conduit (PVC), buried in earth, shall be installed at a minimum depth of:

A.	150 mm	(6 in.)
B.	300 mm	(12 in.)
C.	450 mm	(18 in.)
D.	600 mm	(24 in.)

ANSWER ____

PROCEDURE TO ESTABLISH ANSWER

The question is about burial depth of rigid nonmetallic conduit.

- 1. In Index, find "Direct burial" under which find "Rigid polyvinyl chloride conduit, 300.50, 352.10(G)."
- 2. Section 352.10(G) refers to 300.5, and 300.5(A) refers to Table 300.5 for minimum cover requirements.
- 3. Column 3 of Table 300.5 requires 450 mm (18 inches) of cover for all locations not specified below listed conditions.
- 4. Scan all conditions under "Location of Wiring Method or Circuit" as well as the notes below the table. The basic requirement of 450 mm (18 in.) applies.
- 5. The correct answer is C.

Raceways may be used as a means of support for which one of the following?

- A. A raceway containing power supply conductors for electrical equipment is permitted to provide support for the Class 2 control circuit conductors for the same equipment
- B. Other raceways
- C. Telephone cables
- D. Nonelectric equipment

ANSWER _____

PROCEDURE TO ESTABLISH ANSWER

The question is about raceways used as a means of support.

- 1. In Index, find "Raceways" under which find "Support for nonelectrical equipment, 300.11(C)."
- 2. Section 300.11(C) prohibits raceways from being used as a means of support for other raceways, cables, or nonelectrical equipment.
- 3. Section 300.11(C)(2), however, permits raceways containing power supply conductors for equipment to support Class 2 circuit conductors for the control of that equipment.
- 4. The correct answer is A.

Note: An example would be 24-volt, Class 2 thermostat circuit conductors for a furnace supported by the raceway containing the power supply conductors to the furnace.

12 All of the following wiring methods are acceptable for use as service-entrance conductors within a dwelling occupancy EXCEPT:

- A. surface metal raceway
- B. liquidtight flexible nonmetallic conduit
- C. flexible metal conduit
- D. electrical nonmetallic tubing

ANSWER _____

PROCEDURE TO ESTABLISH ANSWER

The question is about permitted wiring methods for service-entrance conductors to a dwelling.

- 1. In Index, find "Service-entrance conductors" under which find "Wiring methods, 230.43."
- 2. Section 230.43 lists nineteen types of wiring methods approved for service-entrance conductors.
- 3. Surface metal raceway is not listed as one of the approved wiring methods.
- 4. The correct answer is A.

13 All of the following statements regarding metal enclosures and raceways enclosing grounding electrode conductors are true EXCEPT:

- A. They shall be a minimum of a metric designator 21 (¾ in.) raceway.
- B. They shall be electrically continuous from the service equipment to the electrode, and shall be securely fastened to the ground clamp or fitting.
- C. Bonding shall apply at each end of a ferrous metal raceway and enclosure between the service equipment and the grounding electrode to form an electrically parallel path.
- D. Electrical metallic tubing may be used to protect 6 AWG grounding electrode conductors subject to physical damage.

ANSWER _____

PROCEDURE TO ESTABLISH ANSWER

The question is about enclosures for grounding electrode conductors.

- 1. In Index, find "Grounding electrode conductors" under which find "Installation, 250.64." Section 250.64(B) permits electrical metallic tubing to protect conductors.
- 2. Scan through 250.64, and find that 250.64(E) requires metal raceways and enclosures to be electrically continuous, securely fastened to the ground clamp or fitting, and bonded on each end to form an electrically continuous path.
- 3. No minimum size of conduit is given.
- 4. The correct answer is A.
- **14** Generally, electrical metallic tubing shall be securely fastened in place within how many feet of each outlet or junction box?
 - A. 300 mm (1 ft) B. 900 mm (3 ft) C. 1.4 m (4¹/₂ ft) D. 1.8 m (6 ft)



ANSWER

PROCEDURE TO ESTABLISH ANSWER

The question is about securing electrical metallic tubing.

- 1. In Index, find "Electrical metallic tubing" under which find "Securing and supporting, 358.30."
- 2. Section 358.30(A) requires that EMT be supported within 900 mm (3 ft) of each outlet box, etc.
- 3. The correct answer is B.

ONE- AND TWO-FAMILY STUDY GUIDE

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Most people study because they are required to show competence in a given subject.

Competence, however, is measured by test scores.

Test scores are not set in concrete; you can improve your score by doing four things:

- Become familiar with the use of the NEC
- Know exactly what the Code covers and where it can be found
- Underline key words and consider carefully what is being asked
- Practice answering the question first, before checking the choices

The easiest way to improve your test performance is to learn how to locate information quickly and accurately.

That's the design of this book: locate information quickly and accurately. If you carefully walk through these questions, you will be considerably more knowledgeable about the Code when you reach the last page.



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