2024 Electrical License renewal

Based on 2020 NFPA -70

Robert Boender

2024 CT License Renewal

Part III

Question #1

What is the general lighting demand load for a 10,000 sq.ft. office building?

Determine whether the occupancy lighting is continuous or noncontinuous. In the case of an office building the lighting is expected to be on for three hours or more it and would therefore be considered continuous.

******Remember that since this lighting is considered a continuous load the general lighting load VA is calculated as per NOTE in Table 220.12

Refer to Table 220-12 General Lighting Load by Listed Occupancy. This table lists the va/sq.ft. for general lighting loads for a variety of occupancies.

Find Office Buildings = 1.30 VA/sq.ft.

Multiply the VA per square foot times the square footage of the office building:

10,000 sq.ft. X 1.30VA/sq.ft. = 13000 VA

Question 2

Based on a 50,000 square feet warehouse what is the General Lighting Load

Table 200.12 States warehouse is 1.20VA/sq.ft.

50,000 sq ft x 1.20 as per Table 220.12=60,000 Va

Question # 3

If the phase conductors for a 40A circuit (with 75ºC terminals) are increased in size from 8 AWG to 6 AWG due to voltage drop, the circuit equipment grounding conductor must be increased in size from 10 AWG to _____.

(a) 8 AWG (b) 6 AWG (c) 4 AWG (d) 3 AWG

Note: When necessary to comply with 250.4(A((5) or (B)(4), the equipment rounding conductor *might* be required to be sized larger than in Table 250.122

The circular mill area of #6 AWG is 59% more than #8 AWG
(Chapter 9 Table 8). 26,240/16,510 cmil = 1.58933

Or 1.58

TABLE 250.122 STATES THE EQUIPMENT GROUNDING CONDUCTOR FOR A 40 AMP OCPD NEED BE A MIN #10 AWG , HOWEVER THE EGC MUST BE INCREASED IN SIZE BY 159%
ANSWER

CONDUCTOR SIZE = 10,380 X 159% = 16,504 CMIL

CHAPTER 9 TABLE * SHOWS THIS TO BE A #8 AWG

Question #4. Article 310

Which of the following is true of NEC 310

A: Article 310 applies to medium voltage conductors.

B:The requirements in Article 310 do not apply to conductors that form an integral part of equipment.

C:Article 310 applies to conductors rated more than 2000 volts.

D:Article 310 does not have provisions for conductor marking or insulation.

Answer is

B:

The requirements in Article 310 do not apply to conductors that form an integral part of equipment.

Question 5
Article 314.16 (A)

What is the cubic inch volume assigned to a securely installed metal barrier inside a device box?

A:
½ in^3.

B:
1 in^3.

C:
¼ in^3.

D:
2 in^3.

Answer is

A:
½ in^3.

Question 6
314.16 (B)(5) Equipment Grounding Conductor Fill

Based on the 2020 NEC, which of the following is true?

A:
Each equipment grounding conductor is counted individually when calculating box fill.

B:
No volume allowance is used for equipment grounding conductors entering the box.

C:
A double volume allowance is used for every equipment grounding conductor entering the box.

D:
A single volume allowance can be used for up to four equipment grounding conductors entering the box.

Answer is

D:
A single volume allowance can be used for up to four equipment grounding conductors entering the box.

Question 7
Article 320.80 (A) Thermal Insulation

A:
The cables must be separated.

B:
The ampacity of each cable shall be derated by 80%.

C:
The ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

D:
Separate holes are required for each cable.

C:
The ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

LFMC Article 350.10(4)

Interesting factoids- LFMC as per its listing may only be suitable for 60 Degree temperature limitations

Question 8

What is the amperage allowed in LFMC fo 3 #1 AWG THWN Al conductors installed in LFMC?

A. 110 B. 130 C. 85 D. 100

C. 85 Amperes

Article 310.16. Table. 60c Aluminum

Proper Sizing of Conduits and Raceways. NEC Annex C.

What is the maximum number of 14 AWG type THWN copper conductors permitted inside a ¾ inch EMT raceway?

A:
22.

B:
21.

C:
16.

D:
12

Answer is

A:
22.

2021 IRC Smoke and Carbon Monoxide Detectors

R314.2.2Alterations, repairs and additions.

Where *alterations*, *repairs* or *additions* requiring a *permit* occur, the individual *dwelling unit* shall be equipped with smoke alarms located as required for new *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of a porch or deck.

2.Installation, *alteration* or repairs of plumbing or mechanical systems.

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3 Installation , maintenance or repair of mechanical systems that are not fuel fired

AMENDMENTS TO THE 2020 NFPA 70, NATIONAL ELECTRICAL CODE

ARTICLE 90 – INTRODUCTION

(Amd) **90.2 Scope.**

(A) Covered. This code covers the installation of electrical conductors, equipment and raceways; signaling and communications conductors, equipment and raceways; and optical fiber cables and raceways for the following:

(1) Public and private premises, including:

- *buildings* and structures;
- utility connections, *additions* and alterations to mobile homes;
- utility connections to recreational vehicles; and
- floating *buildings*.

(2) Yards, lots, parking lots, carnivals and industrial substations.

(3) Installations of conductors and equipment that connect to the supply of electricity.

(4) Installations used by the electric utility, such as office *buildings*, warehouses, garages, machine shops and recreational *buildings* that are not an integral part of a generating plant, substation or control center.

(5) Installations supplying shore power to ships and watercraft in marinas and boatyards, including monitoring of leakage current.

(6) Installations used to export electric power from vehicles to premises wiring or for bidirectional current flow.

(B) Not covered. This code does not cover the following:

(1) Installations in ships, watercraft other than floating *buildings*, railway rolling stock, aircraft or automotive vehicles other than mobile homes and recreational vehicles.

(2) Installations underground in mines and self-propelled mobile surface mining machinery and its attendant electrical trailing cable.

(3) Installations of railways for generation, transformation, transmission or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes.

(4) Installations of communications equipment under the exclusive control of communications utilities located outdoors or in *building* spaces used exclusively for such installations.

(5) Installations under the exclusive control of an electric utility where such installations:

- Consist of service drops or service laterals, and associated metering; or

- Are located in legally established easements, rights-of-way or by other agreements either designated by or recognized by public service commissions, utility commissions or other regulatory agencies having *jurisdiction* for such installations; or

c. Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission or distribution of electric energy; or

d. Are located by other written agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having *jurisdiction* for such installations. These written agreements shall be limited to installations for the purpose of communications, metering, generation, control, transformation, transmission, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained. These installations shall be limited to federal lands, Native American reservations through the U.S. Department of the Interior Bureau of Indian Affairs, military bases, lands controlled by port authorities and state agencies and departments, and lands owned by railroads.

(C) Special permission. The State Building Inspector may grant an exception for the installation of conductors and equipment that are not under the exclusive control of the electric utilities and are used to connect the electric utility supply system to the service-entrance conductors of the premises served, provided such installations are outside a *building* or terminate immediately inside a *building* wall.

(Amd) **90.4 Enforcement.** Administration of this code shall be in accordance with the provisions of Chapter 1 of the 2021 *International Building Code* portion of the 2022 Connecticut State Building Code. For the purposes of this code, the authority having *jurisdiction* for interpreting the rules and for granting the special permission contemplated in a number of rules is the State Building Inspector. Interpretations shall be requested verbally or in writing from the Office of the State Building Inspector. Special permission shall be requested in writing using the Request for Modification of the State Building Code form available from local building departments or from the Office of the State Building Inspector, 450 Columbus Boulevard, Suite 1303, Hartford CT 06103. www.portal.ct.gov/DAS.

Where this Code contains requirements for a new product, construction, or material that has an effective date after the adoption date of the 2022 Connecticut State Building Code, those requirements are not part of this Code.

CHAPTER 1 – GENERAL ARTICLE 100 – Definitions.

(Amd) **Authority having jurisdiction.** The organization, office or individual responsible for approving equipment, material, an installation, or a procedure. The local *building official* has the responsibility for approving *construction documents*, issuing *permits*, approving materials and procedures and for making inspections from time to time as the construction process requires. The State Building Inspector has the responsibility for administering the Connecticut State Building Code, interpreting the Connecticut State Building Code and for granting exceptions from specific rules of the Connecticut State Building Code. See the definition of "Special Permission," and Article 90.4.

(Amd) **Special Permission.** For the purposes of this code, the authority having *jurisdiction* for granting the special permission contemplated in a number of rules is the State Building Inspector. Special permission shall be requested in writing using the Request for Modification of the State Building Code form available from local building departments or from the Office of the State Building Inspector, 450 Columbus Boulevard, Suite 1303, Hartford CT 06103. www.portal.ct.gov/DAS.

CHAPTER 2 – WIRING AND PROTECTION

(Amd) **210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. (F) as follows:**

(Amd) **(F) Outdoor Outlets.** All outdoor outlets for dwellings, other than those covered in 210.8 (A)(3), Exception to (3), that are supplied by single-phase branch circuits rated 150 volts to ground or less, 50 amperes or less, shall have ground-fault circuit-interrupter protection for personnel.

Exception No. 1: Ground-fault circuit-interrupter protection shall not be required on lighting outlets other than those covered in 210.8(C).

Exception No. 2: Ground-fault circuit-interrupter protection shall not be required for mini-split-type heating/ventilating/air-conditioning (HVAC) equipment and other HVAC units employing power conversion equipment as a means to control compressor speed.

(Amd) **230.46 Spliced and Tapped Conductors.** Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15. Power distribution blocks, pressure connectors, and devices for splices and taps shall be listed.

(Amd) **230.85 Emergency Disconnects.** For new one- and two-family dwelling units, all service conductors shall terminate in disconnecting means having a short-circuit current rating equal to or greater than the available fault current, installed in a readily accessible outdoor location. If more than one disconnect is provided, they shall be grouped. Each disconnect shall be one of the following:

- (1) Service disconnects marked as follows: EMERGENCY DISCONNECT, SERVICE DISCONNEC

- (2) Meter disconnects installed per 230.82(3) and marked as follows: EMERGENCY DISCONNECT
  METER DISCONNECT,
  NOT SERVICE EQUIPMENT

- (3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment and marked as follows:
  EMERGENCY DISCONNECT,
  NOT SERVICE EQUIPMENT

Markings shall comply with 110.21(B).

(Amd) **250.50 Grounding Electrode System**. All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are available at each building or structure served shall be bonded together to form the grounding electrode system. Where none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) through (A)(8) shall be installed and used.

Exception: Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system where the steel reinforcing bars or rods are not accessible for use without disturbing the concrete.

(Amd) **250.68(C) Grounding Electrode Conductor Connections.** Grounding electrode conductors and bonding jumpers shall be permitted to be connected at the following locations and used to extend the connection to an electrode(s):

(1) Interior metal water piping that is electrically continuous with a metal underground water pipe electrode and is located not more than 1.52 m (5 ft) from the point of entrance to the building shall be permitted to extend the connection to an electrode(s). Interior metal water piping located more than 1.52 m (5 ft) from the point of entrance to the building shall not be used as a conductor to interconnect electrodes of the grounding electrode system.

Exception: In industrial, commercial, and institutional buildings or structures, if conditions of maintenance and supervision ensure that only qualified persons service the installation, interior metal water piping located more than 1.52 m (5 ft) from the point of entrance to the building shall be permitted as a bonding conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor, if the entire length, other than short sections passing perpendicularly through walls, floors, or ceilings, of the interior metal water pipe that is being used for the conductor is exposed.

(2) The metal structural frame of a building shall be permitted to be used as a conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor. Hold- down bolts securing the structural steel column that are connected to a concrete-encased electrode complying with 250.52(A)(3) and located in the support footing shall be permitted to connect the metal structural frame of a building or structure to the concrete encased grounding electrode. The hold-down bolts shall be connected to the concrete-encased electrode by welding, exothermic welding, the usual steel tie wires, or other approved means.

(3) A rebar-type concrete-encased electrode installed in accordance with 250.52(A)(3) with an additional rebar section extended from its location within the concrete footing to an accessible location that is not subject to corrosion shall be permitted for connection of grounding electrode conductors and bonding jumpers in accordance with the following:

- Theadditionalrebarsectionshallbecontinuouswiththegroundingelectroderebarorshallbeconnected to the grounding electrode rebar and connected together by the usual steel tie wires, exothermic welding, welding, or other effective means.

- The rebar extension shall not be exposed to contact with the earth without corrosion protection.

- Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.

CHAPTER 3 – WIRING METHODS AND MATERIALS (Add) **300.4.1 Drilling and notching.**
(A) Structural floor, wall, ceiling and roof members.

(1) Solid sawn lumber. Notches in solid lumber joists, rafters and beams shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member and shall not be located in the middle one-third of the span. Notches at the ends of the member shall not exceed one-fourth the depth of the member. The tension side of members 4 inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of holes bored or cut into members shall not exceed one-third the depth of the member. Holes shall not be closer than 2 inches (51 mm) to the top or bottom of the member, or to any other hole located in the member. Where the member is also notched, the hole shall not be closer than 2 inches (51 mm) to the notch.

Exception: Notches on cantilevered portions of rafters are permitted provided the dimension of the remaining portion of the rafter is not less than 4-inch (102 mm) nominal and the length of the cantilever does not exceed 24 inches (610 mm).

(2) Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members or I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a *registered design professional*.

(3) Studs. Any stud in an *exterior wall* or interior bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing interior partitions may be notched to a depth not to exceed 40 percent of a single stud width. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no greater than 40 percent of the stud width, the edge of the hole is no closer than 5/8 inch to the edge of the stud and the hole is not located in the same section as a cut or notch.

Exception No. 1: A stud may be bored or drilled to a diameter not exceeding 60 per cent of its width, provided that such studs located in exterior walls or interior bearing partitions are doubled and not more than two successive studs are bored.
Exception No. 2: Approved stud shoes may be used when installed in accordance with the manufacturer' s recommendations.

(4) Top plates. When wiring, conduit, piping or ductwork is placed in or partly in an *exterior wall* or interior bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 per cent of its width, a galvanized metal tie of not less than 0.054 inch thick (1.37 mm) (16 ga) and 1 1⁄2 inches (38 mm) wide shall be fastened across and to the plate at each side of the opening with not less than eight 10d (0.148 inch diameter) nails at each side or equivalent. The metal tie must extend a minimum of 6 inches (152 mm) past the opening.

Exception: When the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.

CHAPTER 4 – EQUIPMENT FOR GENERAL USE

(Amd) **440.14 Location –** Add exception No. 3.

(Add) Exception No. 3: Where the interior section of a factory packaged split system is fed solely from the exterior section of the system and the disconnecting means for the exterior section is capable of being locked in the open position, a separate disconnecting means for the interior section shall not be required within sight from that section. The provisions for locking or adding a lock to the disconnecting means shall remain in place with or without the lock installed.

How to seek State Building code Interpretations

Please go to

How to find 2020 NEC TIA’s and Errata’s

2020 National Electrical Code (NEC) Errata and Tentative Interim Amendments (TIA) Users of the National Electrical Code (NEC) should be aware that the NEC may be amended from time to time through the issuance of Tentative Interim Amendments (TIA) or corrected by Errata. The NEC, as adopted by the state of Connecticut, at any point in time, consists of the current edition together with any Tentative Interim Amendments and any Errata then in effect. For convenience, the following list contains a list of Errata and TIAs.
For official, detailed information visit the National Fire Protection Association's website: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70

Errata Reference Topic Issued Date Errata NEC Handbook NEC 210.12(A) Page 80 AFCI protection for dwelling units February 6, 2020 Errata 70-20-1 NEC 700.16(B) Emergency system reliability October 10, 2019 Errata 70-20-2 NEC Table C.16 Corrected headings for ventilated cable tray December 23,2019 Errata 70-20-3 NEC 225.30 Updated references for number of supplies March 10, 2020 TIA Reference Topic Issued Date TIA 20-1 NEC 725.121(C) Marking of power sources August 6, 2019 TIA 20-2 NEC 210.52(C)(2) Island and peninsular countertops August 6, 2019 TIA 20-3 NEC 725.121(C) Marking of power sources (Informational Note No. 2) August 6, 2019 TIA 20-4 NEC 240.67(C) Arc Energy Reduction (Performance Testing) (Fuses) August 6, 2019 TIA 20-5 NEC 240.87(C) and Informational Note Arc Energy Reduction (Performance Testing) (Circuit Breakers) August 6, 2019 TIA 20-6 NEC Annex D3 Revisions to Example D3 for Store Building August 6, 2019 TIA 20-7 NEC Table 430.252 Deletion of Table 430.252 August 6, 2019 TIA 20-8 NEC 551.71(F) GFCI protection at RV site equipment December 6, 2019 TIA 20-9 NEC 800.100(B)(2) Revised Figure 800.100(B)(2) April 1, 2020 TIA 20-10 NEC 356.10(8) Liquidtight Flexible Nonmetallic Tubing August 11, 2020

Questions for review Put Answer and code article Please

1. Examples of ground-fault current paths include any combination of conductive materials including

_____

a.Equipment grounding conductors

b.Metallic railways

c.Metal water and gas piping

d.All of these

2. At the time of installation, grounded conductors _____ or larger can be identified by distinctive white or gray markings at their terminators

a.10 AWG

b.8 AWG

c.6 AWG

d.4 AWG

3. In other than dwelling units, GFCI protection shall be provided for all 125V through 250V receptacles supplied by a single-phase branch circuits rated 150V or less to ground, 50A or less, where receptacles are installed within _____ ft from the top inside edge of the bowl of a sink

a.3

b.4

c.5

d.6

4. A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a ____ intended for expansion, contraction or deflection used in buildings, bridges, parking garages, or other structures

a.Junction box

b.Structural joint

c.Cable tray

d.Unistrut hanger

5.. Where direct-buried conductors and cables emerges from grade, they shall be protected by enclosures or raceways to a point at least ____ above finished grade

a.3ft

b.6ft

c.8ft

d. 35

6. The ampacities of flexible cords and flexible cables are found in _____

a.Table 310.16

b.Tables 400.5(A) and (B)

c.Chapter 9, Table 1

d.Table 430.52

e.10ft

Answer sheet

1. D. All of these 100 Ground-Fault Current Path, Note
2. D. 4 AWG 200.6(B)(4)
3. A. 210.8(B)(5)
4. B. Structural joint 300.4(H)
5. C. 8ft 300.5(D)(1)
6. B. Tables 400.5(A) and (B) 400.5(A)