Western Section 101st Annual Meeting
Hot Springs, Arkansas
September 21, 2005
Charlie Trout Code Breakfast

1.Question: An add on unit for a hydromassage bathtub consists of a small 1-gallon water heater with a cord and plug connector. It is mounted under the tub space cover. This unit operates at 240 Volts. Is it required to have GFCI protection?

Answer: Yes, Article 680.71 requires hydromassage bathtubs and their associated electrical components be protected by a GFCI.

2.Question: On a corner grounded delta system is overcurrent protection required on the grounded phase at the service?

Answer: No, Article 230.90(B) prohibits this, unless the overcurrent device opens all conductors of the circuit.

3.Question: Are the receptacles used on small-appliance branch circuits required to be rated 20 amperes?

Answer: No, if the circuit supplies two or more receptacles, 15 amp receptacles may be used according to Article 210.21(B)(3).

4.Question: How close to the wall do I have to install a floor receptacle at fixed glass partitions in exterior walls, in order to count them as the required receptacle outlets?

Answer: These floor outlets must be within 18" of the wall in order to be counted as required wall outlets. NEC 210.52(a)(3)

5.Question: You are installing Tray Cable (TC). The cable is manufactured with a metallic shield. What is the minimum bending radius when installing this cable?

Answer: Article 336.24 specifies that Type TC cable with a metallic shielding shall have a minimum-bending radius of not less than 12 times the cable diameter.

6.Question: What is the maximum length of Flat Conductor Cable that may be installed in a dwelling unit?

Answer: Flat Conductor Cable (FCC) is not approved for use in a residence according to Article 324.12(4).

7.Question: What size generator is required to start and run the following loads at three phase 277/480 volt?

100HP, 3 Phase, 480 volt
75HP, 3 Phase, 480 volt
60HP, 3 Phase, 480 volt
Lighting Load = 62 amperes
Receptacle Load = 25 amperes
Other Loads = 122 amperes

Answer:

Sizing generator using the rule of thumb method

Step 1: Finding FLA of loads – 430.6(A); Table 430.150; 220.14

100 HP	=124 A
75 HP	= 96 A
60 HP	= 77 A
Ltg. Ld.	= 62 A
Plug ld.	= 25 A
Other lds.	=122 A

Step 2: Calculating Running A

Motor loads	=124 A
	= 96 A
	= 77 A
Ltg. Ld.	= 62 A
Plug ld.	= 25 A
Other lds.	= 122 A
Running A	= 506 A

Step 3: Calculating Starting A (Applying 125% multiplier)

Motor load	
124 A x 125%	= 155 A
96 A x 125%	= 120 A
77 A x 125%	= 96.25 A
Lighting load	
62 A x 100%	= 62 A
Plug load	
25 A x 100%	= 25 A
Other loads	
122 A x 100%	= 122 A
Starting A	= 580.25 A

Step 4: Selecting KW of generator

Running KW
KW = 506 A x 480 V x 1.732/1000
KW = 421
Starting KW
KW = 580.25 A x 480 V x 1.732/1000
KW = 482

Solution: The size generator must have a starting capacity of 482 KW and a running capacity of 421 KW.

Note: Largest motors are connected to start in sequence at 125% and all the other loads at 100%.

8.Question: What size THHN conductors are required for a 25KVA capacitor supplying a three Phase 50HP 208-volt motor?

Answer:

Sizing conductors based on 1/3

Step 1: Finding FLA of motor
50 HP = 143 A

Step 2: Calculating conductors 430.22(A)
143 A x 125% = 178.8 A

Step 3: Selecting conductors 310.15; Tbl. 310.16
178.8 A requires 3/0 THWN cu.

Step 4: Calculating conductors at 1/3 of 3/0
460.8(A); Table 310.16
3/0 THWN cu. = 200 A
1/3 200 A = 66.7 A

Step 5: Selecting conductors Table 310.16
66.7 A requires # 4 cu.

Solution: THWN cu. Conductors based on 1/3 of branch circuit is # 4.

Sizing conductors based on 135%

Step 1: Calculating FLA of capacitor
460.8(A)
FLA=KVA x 1000/208 V x 1.732
FLA=25x1000/208Vx1.732
FLA = 69.4 A

Step 2: Calculating conductors 460.8(A)
69.4 A x 135% = 93.7 A

Step 3: Selecting conductors
310.15: Table 310.16
93.7 A requires # 3 cu.

Solution: THWN cu**.** based on 135% of FLA of capacitor are # 3

Note: *460.8 requires the largest conductors calculated which are the # 3 THWN copper.*

9.Question: I recently inspected a job where the contractor put the grounded and the grounding conductor in the same terminal for that circuit, is this a violation?

Answer: Yes, Article 408.41 requires each grounded conductor to terminate within the panelboard to an individual terminal that is not used for another conductor.

10.Question: Does communication wiring installed in a residence have to meet the same requirements as Type NM cable regarding notched or drilled holes plate protection and installations for protection from nails or screws?

Answer: Yes, Section 800.24 states the communication circuits shall conform with Section 300.4(D) for cables ran parallel to framing members in notched and bored holes.

11.Question: If equipment for a commercial kitchen comes with a cord that has a 15-amp, 120 volt three wire twist lock connector; does it need to be GFCI protected?

Answer: Yes, all 125-volt, single-phase, 15- and 20 ampere receptacles installed in commercial kitchens shall have ground-fault circuit-interrupter protection for personnel. NEC 210.8(B)

12.Question: Is it necessary to re-identify both ends of the white conductor in a NM cable used as a switch loop or just the end at the switch?

Answer: Yes, Article 200.7 (C)(2) requires the conductor to be identified at its termination and at each location where the conductor is visible and accessible.

13.Question: Am I required to ground a satellite dish antenna? And if so, what size wire should I use and to what should I connect my ground?

Answer: Yes, Article 810.15 requires masts and metal structures supporting antennas be grounded. Article 810.21(H) specifies that the conductor be copper, minimum #10 or Aluminum, minimum #8. Article 810.21(F) specifies the connection to the grounding electrode. It may be:

The building or structure grounding electrode system as covered in 250.50.
The grounded interior metal water piping system within 5' from its point of entrance to the building.
The power service accessible means external to the building, as covered in 250.94.
The metallic power service raceway.
The service equipment enclosure
The grounding electrode conductor or the grounding electrode conductor metal enclosures

14.Question: A service to a building has two paralleled runs of 500 kcmil copper conductors. What size grounded conductor (copper) is required in each conduit run?

Answer: A 1/0 copper conductor would be required in each raceway, based on Table 250.66. Article 250.24(C)(2) states that the grounded conductor in each raceway is based on the size of the ungrounded conductor in each raceway of a parallel installation.

15.Question: I have 4 #12 THWN, 4 #10 THWN, and 8 #6 THWN conductors. I plan to install them in EMT. What size EMT am I required to install?

Answer: Use Table 5 for area of conductors:

4	12THWN	.0133	.0532
4	10THWN	.0211	.0844
8	6THWN	.0507	.4056

.5432 Total area of conductors

Table 4 indicates area of EMT
1"= .346
11/4=. 598 11/4" EMT would be required

16.Question: A Jacuzzi is bonded from the pump motor to the piping system with a #8 solid copper wire. Can stranded wire of the same size be used?

Answer: Article 680.74 requires the bonding jumper be solid copper.

17.Question: What is the maximum gap between gypsum wallboard and the edge of a flush switch box?

Panel Response: Article 314.21 requires the gap be no more than 1/8".

18.Question: A private aircraft hanger has receptacles installed on the wall. Do these require GFCI protection?

Answer: Yes, Article 513.12 requires GFCI protection for all 125 volt, 15 or 20 amp receptacles.

19. Question: What size OCPD and THWN copper conductors are required to supply a single phase, phase converter, on the input side at 240 volt. The output side supplies a 3 phase 25 HP 460 volt motor?

Answer:

Sizing conductors for input side		**Sizing OCPD for input side**
Step 1:	Finding FLA of motor 430.6(A); Table 430.150 25 HP = 68 A @ 240v	**Step 1:** Calculating OCPD-455.7(B) 68 A x 250% = 170 A
Step 2:	Calculating conductors 455.6(A)(2) 68 A x 250% = 170 A	**Step 2:** Selecting OCPD 455.7(B); 240.4(G); 240.6(A)
Step 3:	Selecting conductors 310.16 & table 170 A requires 2/0	
Solution:	2/0 THWN copper conductors	**Solution:** Requires 175 A OCPD

20. Question: What size THWN conductors and OCPD are required for the following two resistance type welders with the following nameplate ratings?

91 amperes @ 50% duty cycle
80 amperes @ 40% duty cycle

Answer:

Sizing Conductors		**Sizing OCPD**
Step 1:	Finding FLC - 630.31(A) Largest welder =91 A Other welders =80 A	**Step 1:** Finding multiplier-630.32(B) Multiplier = 300%
Step 2:	Finding multiplier - 630.31(B) Largest welder = 71% x 100% Other welders = 63% x 60%	**Step 2:** Calculating Amp.-630.32(B) 100 A x 300% = 300 A
Step 3:	Calculating Amperes - 630.31(B) 91 A x 71% x 100% = 64.61 A 80 A x 63% x 60% = 30.24 A	**Step 3:** Selecting OCPD - 240.4(G); 240.6; 630.32(B)
Step 4:	Selecting conductors – Table 310.16 94.85 A requires #3	
Solution:	Size #3 THWN copper conductors.	**Solution:** 300 A OCPD is required.