



## STATE OF WISCONSIN

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## Electrical Program

Web: [Electrical Program](#)

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### 2017 Winter Electrical Code Update Commercial Electrical Program

1) I have a question in regards to an air handler unit (AHU) listed by Electrical Testing Labs (ETL). It is installed at a local hospital where flexible cord is installed within the unit from the factory for wiring lights within the AHU. In my mind, the AHU is part of the plenum, the same air is moving thru this area and the duct which is connected to the AHU five feet away from the flexible cord location. I have attached a letter from ETL which indicates the AHU is not subject to the NEC. Does this installation violate SPS 316.110?

Code reference: SPS 316.110

Answer: No. The installation is acceptable. The interior of listed equipment is not subject to the NEC.

2) At a state seminar a while ago, there was a discussion regarding the use of the concrete encased electrode (UFER Ground) when available. The discussion revolved around whether the requirement for a "supplemental" ground, two ground rods in Wisconsin, would be required if the UFER Ground was available on site. At that time, it was determined the only ground connection required was to the UFER Ground. Has this changed since then? I am hearing that various municipalities are requiring the additional two ground rods to the UFER Ground.

Code reference: NEC 250.52(A)(3), 250.53(D)(2)

Answer: No. A concrete encased electrode does not need to be supplemented with any additional electrodes. You are correct. If a concrete encased electrode is present it is required to be used by 250.52(A)(3). The requirement for installing a supplemental electrode is found in 250.53(D)(2) and indicates only a metal underground water pipe is required to be supplemented by another electrode.

3) I am in disagreement with a manager on electrical clearance, which I hope you can clear up. In NEC Article 110.26 it states that that equipment needs "access", and in Article 100, it defines access as you can't have barriers in order to access the equipment. I am using this as my argument on why you cannot put "removable" barriers in the electrical clearance. The manager is interpreting 110.26(A) as just working space not access. His reasoning is as long as you can make the clearance by removing the barriers it is ok. Access means you have to have that space only to inspect it as in the definition. So he thinks that 110.26 and 110.26(A) are different meanings. The panel has a barricade in front of it for

protection and the clearance is 28". This is deemed ok since the barricade is removable. I have tried explaining that 110.26 is one article, and that 110.26 and 110.26(A) go together. I know that he is only going to abide by what an inspector says.

Code reference: NEC article 100, 110.26

Answer: NEC article 100 defines Accessible as applied to equipment as: *Admitting close approach; not guarded by locked doors, elevation, or other effective means.*

NEC 110.26 Requires access and working space be provided about all electrical equipment to permit ready and safe operation and maintenance of such equipment. Our current staff consensus and State historical position is that a removable barrier meets the intent of the requirement in NEC 110.26. We would not approve or accept a removable barrier that requires the use of tools to remove. The barrier would need to be constructed to be removed by hand to permit ready and safe operation. The distance shall be measured from the exposed live parts or from the enclosure or opening if the live parts are enclosed.

4) If you have a door in the wall or partition that separates the classified area from the non-classified area, where the non-classified area has positive air pressure, does that change any of the requirement code section NEC 511.3(E)(1)? Does having the door trigger any other code sections that may apply? I am not seeing any, and wanted to get your interpretation on this.

Code reference: NEC 511.3(E)(1)

Answer: No. If you have a door or other opening in a wall or partition we do not consider the adjacent area to be "effectively cut off", and one of the methods mentioned in the code section you cited would have to be used to declassify the adjacent area. In your case, you have utilized one of the methods listed and it would be code compliant.

5) A multi-occupancy building has two services with different characteristics being installed. The first service has the service disconnects inside the building in each occupancy. The second service is being installed on the exterior with the main disconnect located outside. Is this allowed?

Code reference: NEC 230.2(D), 230.40 Exception No 1 & 2

Answer: Yes. This is allowed according to NEC 230.2(D) Services of a Different Characteristic. You are correct in that 230.2(D) allows the installation of a second service on the same building as long as it has different characteristics. Examples would be a single-phase service and a three-phase service. Or a three-phase service of one voltage such as 480/277-volts and a three-phase service of a different voltage such as 240-volt, grounded B-phase or 208Y/120-volts. When you meet one of the conditions in 230.2 that allows a second service supplying the same building, each service is treated separately. Each service would have to meet all of the applicable requirements of Article 230 and could utilize any of the applicable exceptions. The owner could use 230.40 Exception No 1 for one service and locate the service equipment in each tenant's space. They could also use 230.40 Exception No 2 for the second service and group all disconnects for the other new service. However, the disconnecting means for one permitted

service are never required to be grouped with the disconnecting means of another service. Remember, 230.2(E) applies where multiple services supply the same building. At each service location, a permanent plaque or directory must denote the presence of multiple services, the location of them, and the area served by each.

6) I have a question regarding credentialing and I thought I would start with "the answer guys". If a person has his or her Residential Journeymen card, can they work on commercial projects?

Code reference: SPS 305.40(2)(b)

Answer: Yes, with condition. They can work on commercial projects as long as they are under the direct supervision of a Master, Registered Master or Journeyman Electrician.

7) One of my men was just told by an inspector that Romex (NM) could not be installed above a suspended ceiling in a commercial building. I looked this up before having my guy install wiring and found nothing on this. Is the inspector correct and if so where in the code is this located?

Code reference: SPS 316.334(2), NEC 300.22(C)(1)

Answer: It may be allowed. SPS 316.334(2) deletes the language in NEC 334.12(2) that prohibits the use of NM cable above suspended ceilings in other than one and two family dwellings. NM cable is allowed above suspended ceilings in commercial buildings that are of Type III, IV, or V construction. If the ceiling space is a considered a plenum, NM cable is prohibited in the space per NEC 300.22(C)(1).

8) I have a question regarding feeding panels. I currently have two panels. The first panel is connected to a 300A feeder and by using feed through lugs feeds a secondary panel. I would like to separate these two panels. I would like to use the same conduit, but replace the feeders. The issue is that the feeders for the second panel would still go through the first panel.

Code reference: NEC 312.8

Answer: Yes, your installation would be code compliant with conditions. Section 312.8 in the 2011 NEC permits what you propose when the conditions in (1) through (3) are met.

9) I am working on a medical office building and the landlord wants us to design mount the VFDs for the roof mounted exhaust fans eight to ten feet up on the wall so that they can have storage space below. While I don't think this is a good idea, and if I can't come up with a code based reason, then we'll be pushed to design a room with a wall of VFDs mounted as high as possible on the wall. The landlord is arguing that the circuit breaker for the VFD can have a breaker padlock provision and the drives can be ordered without an integral disconnect switch so there is no concern over the disconnect handle being mounted over 6'-7" to the highest point.

Code reference: NEC 430.102(A), 110.26(B)

Answer: 430.102(A) requires a controller disconnect within sight of the controllers (VFD's) with several exceptions. None of these exceptions apply to your installation. We also consider VFD's likely to require

examination or servicing while energized and 110.26(B) would prohibit the area in front of them from being used for storage.

10) We are doing an assisted living/memory care unit. The sprinkler contractor needs a fire pump to meet the required pressure at the stand pipes. I would like the state's interpretation regarding the need for a generator. If there is a required fire pump, is a diesel generator backup required for this pump?

Code reference: NEC 695.3

Answer: No. A backup generator is not required for a fire pump where the individual source is "reliable" as described in 695.3(A). We would require statistics from the utility company showing the reliability history of the transmission/distribution lines that would serve the property. If any doubt exists about the reliability of the utility service we would require multiple sources in accordance with 695.3(B), and a generator could be installed in accordance with 695.3(B)(2) and 695.3(D). It would not necessarily have to be a diesel powered generator.

11) I have a contractor that is telling me that he always drops SO cord to hardwire machinery in manufacturing facilities. This machinery is fasted to the floor and not utilization equipment. Apparently, and according to him, this has been allowed in numerous jurisdictions and inspected as being code compliant. I have never allowed this in the past, and reading through NEC 400.7 & 400.8, I don't see anything allowing it in either one of those code references.

Code reference: NEC 400.7 & 8

Answer: You are correct in the code sections pertaining to the permitted & non-permitted use of cords. Flexible cord is not allowed as a substitute for the permanent wiring of the building. NEC 400.7(A)(6) permits flexible cords used to connect utilization equipment to facilitate frequent interchange. The utilization equipment supplied by a flexible cord must have an attachment plug (400.7(B)). In this installation I do not see a cord & plug connection. This is a violation of NEC 400.7(B). In determining frequent interchange, a letter from the owner of the building explaining the process of the equipment may assist with compliance.

12) Am I correct in requiring that contractors adding receptacles and switches in rated fire walls not utilize steel sectional boxes with box fasteners, and rather secure the boxes to framing members?

Code reference: NEC 300.21

Answer: The info note below NEC 300.21 discusses listing installation restrictions necessary to maintain the fire resistive rating of assemblies where penetrations or openings are made. You are correct in your assessment, the installation restrictions must be followed, and a box is required to be secured to the framing member. This can be more expensive and time consuming but must be followed to comply with code and the qualified testing laboratories' specifications. Also, NEC 300.21 requires electrical penetrations to be firestopped using approved methods to maintain the fire resistance rating.

13) I have a question in regards to overcurrent devices being coordinated. I have an emergency system which is not properly coordinated. Does the circuit breaker in the main service panel which supplies the transfer switch on the emergency system have to be coordinated with the downstream overcurrent devices? From my recollection this breaker is required to be coordinated as this is part of the emergency system. Could you please let me know your thoughts on this?

Code reference: NEC 700.27

Answer: Your recollection is correct. NEC 700.27 and 701.27 require emergency and legally required OCPDs to selectively coordinate with all supply side OCPDs, including those of the normal system that are upstream of the emergency/legally required OCPDs.

14) We chatted about the proper field wiring of dimming control conductors (gray / purple) from an LED driver within or outside of the raceway with power wiring. Our discussion ended where I needed to do some research into whether the dimming control conductors were rated Class 1 or Class 2 by the driver manufacturer. I have found that the dimming conductors are rated as Class 2. I understand that Class 2 conductors cannot be installed along with power wiring within the same raceway. Would the use of AFC MC Lite Luminary cable be acceptable for use as a "fixture" whip? From then, would it be acceptable to run the gray and purple #14 control wire in with power conductors in EMT conduit from ceiling fixture j-box down to wall box dimmer location? This does not make sense. Would it not be best that all conductors that originate with power at the light fixture and end at the wall box dimmer with the power conductor be installed within the same raceway, rather than the separate Class 2 low voltage conductors be run without a raceway? These are on the load side of the circuit. We are using Class 1 methods, THHN in conduit/flex. The driver in the LED fixture is actually the power source, so the 0-10V is the load side wiring.

Code reference: NEC 725.130

Answer: Yes. You are correct. If the entire circuit is installed as a Class 1 circuit in accordance with 725.130(A) Exception No. 2 and Part II of 725, then the installation is acceptable. The MC-PCS cable could be used as a fixture whip as the low voltage conductors meet the requirements for Class 1 circuits, and the conductors in the conduit to the switch box are installed as Class 1 conductors. You have already determined that the manufacturer of the light fixture allowed it to be connected using Class 1 wiring methods. In addition, check to see if the dimmer manufacturer allows the dimmer to be connected to a Class 1 circuit.

15) I have a restaurant with an unfinished area above where the owners want to turn it into an apartment. It is wood frame construction. Can I wire the apartment with NM wiring? Where in the code do you find the answer?

Code reference: SPS 316.334(1)

Answer: Yes, if the apartment is of III, IV, or V construction, NM would be permitted in the apartment as a Chapter 3 wiring method. SPS 316.334(1) is helpful with compliance. SPS 316.334(1) permits NM

Cable in structures permitted to be of Type III, IV, & V construction except as prohibited in NEC 334.12. Type III, IV, & V construction is typically wood construction. We would encourage you to verify what the building construction type is with the municipality, or building contractor.

16) We put in a 20 ft. long trench in contact with the earth and filled the trench with 2 inches of concrete. Is this acceptable? Our electrical inspector did not accept this.

Code reference: NEC 250.52(A)(3)

Answer: No. Our group has reviewed your pictures and we are in agreement that your proposed solution does not comply with NEC requirements. NEC 250.52(A)(3) reads:

Metallic components shall be encased by at least 50 mm (2 in.) of concrete and shall be located horizontally within that portion of a concrete foundation or footing that is in direct contact with the earth or within vertical foundations or structural components or members that are in direct contact with the earth. If multiple concrete-encased electrodes are present at a building or structure, it shall be permissible to bond only one into the grounding electrode system.

The grounding system installed shall be located within the portion of the building foundation or footing per code. The ground electrode installed in the pictures is not part of the building or structure but separated (not part of the building foundation or footing). The State of Wisconsin electrical staff at DSPS has an acceptable method that satisfies the intent of the NEC when a contractor neglects to install the required concrete encased electrode within the building foundation. The solution permitted is to install 20' of #4 bare copper conductor or 20' of ½ rebar along the edge of the building foundation. The conductor or rebar shall then be encased in 2" of concrete that is poured in contact with the existing building structure. When dried, the electrode system becomes attached to the building structure or foundation satisfying the NEC requirement above.

17) When does a sub panel need a main if it is fed from a breaker in the main distribution panel? Assuming the panel is rated for at least what the breaker in the main panel is rated, of course. Could you point out some specific code areas that I could read over to cover this area? I am in an old hotel doing some remodeling. It has an 800A 3 phase panel. It has a spare 110A breaker in it. The remodel makes more sense to have a sub panel in that area instead of making the many homeruns with the feeds. If I come off the 110A breaker in the main distribution panel, would I need a main in the sub panel? Or, would a main lug sub panel be perfectly legal? If the lug panel is not legal, would you point out the code sections so I can better educate myself?

Code reference: NEC 408.36, 408.4(B)

Answer: No. A main breaker is not needed if the sub-panel is in the same building or facility. Refer to NEC article 408.36. Also, 408.4(B) requires all switchboards and panelboard supplied by a feeder, in other than one and two family dwellings, to be marked to indicate where the power supply originates. If the sub-panel is in a different building then, NEC 225.30 applies and a disconnecting means is required by NEC 225.31.

18) An argument came up in our shop a few weeks ago and I could not find an answer to it. We were discussing outdoor remote emergency heads. They were arguing that the LED remote heads have several LEDs in the head so they felt we shouldn't need a second head. I can't find anything to go one way or the other here. What are your thoughts?

Code reference: NEC 700.16

Answer: Permitted. As long as the failure of an individual LED disk does not leave the space in darkness, one fixture would be permitted. NEC 700.16, paragraph two states "Emergency lighting systems shall be designed and installed such that the failure of any individual lighting element, such as the burning out of a lamp, cannot leave in total darkness any space that requires emergency lighting". Our response follows the concept expressed in the Code.

19) Is it correct in regards to 695.3(C) Approved by the AHJ, when the NEC references AHJ, it refers back to the department, meaning the State, and not the local AHJ?

Code reference: Article 100 definition of AHJ, SPS 316.004(1), SPS 316.005

Answer: No. SPS 316.004(1) stipulates that the State (Department) reserves the right to interpret the requirements of the NEC, while SPS 316.920(2) allows municipalities to exercise jurisdiction over inspection. The State exercises jurisdiction when "special permission" is required by a code section, or when a petition for variance is requested. We define special permission as a petition for variance in accordance with SPS 316.005. Special permission is not required in 695.3(C). The city's inspection department is the AHJ in determining the allowances specified in NEC 695.3(C). We would respect the decision made by the city based on "on-site" conditions on a case by case basis. The State is also willing to assist with any questions you may have. The key to the allowance in NEC 695.3(C) is to determine the reliability of the utility power based on a historical record of power outages. This record will influence the decision made by the AHJ.

20) A recessed lighting fixture is above the shower in a nursing home with an 8 foot ceiling. What should the listing be with a standard shower head? Wet or damp? And, if the shower head is on a wand, does this change?

Code reference: NEC 410.10(A) & (D)

Answer: The NEC requirement is found in NEC 410.10(A) & (D). The recessed trim is typically used to make the recessed luminaire listed for the location. I am unaware of a recessed fixture being listed for a wet/damp location (use the trim to comply with the listing). The trim at a minimum shall be listed for damp locations. If subjected to shower spray (shower head on a wand) the trim shall be listed for a wet location.

21) I am installing a 600A 120/208V service on a new building. The building is sprinkled so the water main is metal. The service is on the opposite end as the water main and is not a steel structure. I am looking for clarification if I could CAD weld on the rebar in the foundation wall and go to the water, and then CAD onto the rebar by the service and use that as the bond between the two systems?

Code reference: NEC 250.68(C)

Answer: No. Rebar is not listed in the NEC as a conductor to extend the grounding electrode on opposite sides of a building. NEC 250.68(C) outlines the only approved method of interconnection which is using the structural metal frame as a conductor.

22) The 2011 NEC under 250.110 exception 2 states that: "Distribution apparatus such as transformers and capacitor cases, mounted on wooden poles at a height of 8' above ground or grade level shall not be required to be grounded." How do we argue that? If this is allowed it would mitigate the problem of the two services on the farm being tied together inadvertently.

Code reference: NEC 250.30(C), 250.30(A)(2), and 250.110

Answer: No. Isolation transformers are not allowed. If there was a fault on the primary, there would be no way for the fault to clear and it would energize the GEC, neutral, supply side bonding jumper, and equipment grounds downstream. According to the figure below, if the fault occurs on H2 as indicated by orange flash on the drawing, all lines and equipment highlighted in red would become energized with no way to clear the fault. We could use 250.110 to require the equipment ground to be ran with the primary.

23) I have been wiring memory care facilities going on my 10<sup>th</sup> year. There are two switches and a GFCI receptacle in each bathroom. An inspector today questioned the install because there is no curtain on the shower and said the switch circuit needed to be GFCI protected. Does it need to be GFCI protected?

Code reference: NEC 404.4

Answer: No. Take a look at NEC 404.4. Switches cannot be installed in the wet location of a tub or shower stall. They can be located anywhere outside the stall and no GFCI protection is required. If inside they would be required to be part of a listed tub shower assembly. Is the switch located where it will be subject to the spray from the shower head? Will there be glass doors or similar that will protect the switch from shower spray? If not, the switch must be moved to a dry location or equipped with a weatherproof enclosure in accord with NEC 404.4. There is no requirement in Article 404 to provide GFCI protection for the switches in question.

24) I have a contractor that is going to be adding a new generator to a skilled nursing home facility. The generator will be providing two separate feeders to two separate transfer switches. One is for the Optional Standby Power. The other feeder and transfer switch is for the Life Safety Branch. The raceways for the two feeders from the generator will be run underground. They would like to run both feeders into the same underground vault. The feeders would run into the vault in separate conduits and then leave the vault in separate conduits. Would this installation be permissible if the feeder for the life safety branch was enclosed in some sort of trough while in the vault? Or would a barrier need to be installed in the vault to keep the life safety feeder separated from the optional load feeder?

Code reference: NEC 517

Answer: Yes. It is permitted. Your proposed solution meets the intent of the code. We have approved installations as described in your email throughout the state. The barrier and or trough would be the way to go to ensure separation.

25) We are performing electrical work at an existing maintenance garage, which has a 600A panelboard service entrance panelboard located in a Class I Division 2 location. The existing 600A main circuit breaker is mounted at 84" off the finished floor. We are replacing this 600A panelboard. The bottom of the panelboard already has to start out at 18" above the floor due to existing seal-offs and wiring passing through the seal-offs, which is to remain. We were told by an engineer that the main circuit breaker only qualifies for the 6'7" height per 404.8 and not the branch circuit breakers within the 600A panel. Therefore, we should specify the main 600A circuit breaker as bottom mounted. This would put the top most branch circuit breakers within the panel at about 85" above floor finish. I understand his point, as many times circuit breakers installed in MCCs are above 6'7" but would like to confirm the validity of the engineer's comments.

Code reference: NEC 240.24

Answer: Violation. NEC 240.24(A) is helpful for compliance. It requires the center grip of the device when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform. The NEC requirement in NEC 240.24 applies to all overcurrent devices not just the main breaker. The installation described in your email would not meet minimum code.

26) Can ENT be used in a plenum rated ceiling if the ceiling is sprinkled? The contractor told me that they sprinkled above the suspended ceiling and not below. Does this get them out of following NEC 300.22(C)(1)? I just have never seen them sprinkle above the ceiling and not below, and I am wondering if this gets them out of the plenum issue, perhaps?

Code reference: NEC 300.22(C)(1)

Answer: No. NEC 300.22 (C)(1) addresses your question. No exception exists for ENT wiring in a plenum if the ceiling is sprinkled. The transport of environmental air still exists and poses a safety concern even with a sprinkler system above the drop ceiling. Only the wiring methods listed in code section are permitted.

27) I recently encountered these LED fixtures on a commercial job. The fixture is attached directly to the ceiling tile with factory provided clips, but has no provisions for securing to ceiling framing or grid. Then, the LED driver is fed with a 6 foot fixture whip from a j-box directly above, and is connected to the fixture via factory provided modular cord. This LED driver has no provisions for mounting to the structure, and as such, just lies directly on top of removable ceiling tile. The manufacturer's instructions actually indicate a preference for this.

Code reference: NEC 410.36(B)

Answer: NEC 410.36(B) prohibits the installation you described in your email. The requirements found in 410.36(B) apply to all luminaires supported by a suspended ceiling assembly, including lay-in and

surface mounted type. While the install instructions may be more restrictive than minimum NEC requirements, they cannot be less restrictive. See SPS 316.110.

28) Would you explain what type of equipment is required to be listed and labeled and how these requirements can be met. For example, a machine shop has been in business for many years and has out grown its present location. The owner of the machine shop builds a new building and moves his existing equipment into the new building. The electrical inspector will not final the building because the machine shop equipment does not have a third party label or listing. The owner states he has been using this equipment for many years and feels the electrical contractor is responsible for this problem.

Code reference: SPS 316.012

Answer: Now is the time to bring it up to current standards. All equipment shall be listed and labeled per SPS 316.012.

29) We are involved in a remodel on a condo unit. We will be extending an existing non-AFCI protected circuit for a few additional receptacles. Do we need to provide AFCI protection for these new receptacles?

Code reference: NEC 210.12, SPS 316.210(4)

Answer: No. AFCI protection is required for branch circuits in dwelling unit rooms indicated in NEC 210.12. These rooms include family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms. If you are installing a new circuit to one of these rooms AFCI protection would be required. However, if you are only extending an existing circuit you would not be required to protect it according to SPS 316.210(4).

30) Can you please let me know where to look for fire and water damage repairs?

Code reference: SPS 316.010

Answer: The attached document is extremely helpful in dealing with fire, heat issues and water issues.

31) I have a contractor who will be replacing master-satellite style fluorescent lay-in type fixtures with LED lay-in fixtures. The new fixtures will be part of a listed lighting assembly. Are the cables associated with manufactured wiring systems required to comply with Chapter 3 of the NEC? What about the cables that connect the master to the satellites?

Code Reference: NEC 406.7, 410.36

Answer: No. Not necessarily. Branch circuit wiring associated with the manufactured wiring system shall be secured and supported in accordance with the applicable cable article for the cable type used with the system. If the satellite (slave) cables were included as part of the overall manufactured assembly, then they are covered by the listing of the luminaire and not the NEC. We would not consider it to be branch circuit wiring. NEC 410.36 requires the slave cable(s) to be supported. We permit the framing members of the ceiling to be used to provide that support. In short, the slave cables must be

adequately supported but without referring to the prescriptive requirements for Chapter 3 wiring methods.

32) We are wiring a supper club with a large room that will be used as a dining or meeting room. I will be installing a number of battery packs around the outside of the room for emergency lighting. Will this be sufficient?

Code reference: IBC 1003.2.11, 1003.2.11.1 & 1003.2.11.2

Answer: It depends on how much light they will provide. You will need an average of 1 foot-candle along the means of egress. The minimum illumination level is 0.1 foot-candle. The maximum illumination level is 40:1. The latter is difficult to achieve with unit equipment. Since there is no permanent seating, you would not be able to determine the means of egress aisles. In this type of facility, you need to meet the lighting level throughout the room.

33) Is there a requirement in the Code that addresses a maximum distance from the building to have a disconnect? I would like to install a pole-mounted service, and then feed the building which is 200' away. There will be a main breaker in the panel closest to the point of entrance inside the building. The service is on the pole and a feeder to the building. The service at the building is treated as a sub-panel with isolated neutral, 4 wires and also a grounding electrode system. Or in other words, how far can the service disconnecting means be from the building?

Code reference: Article 550

Answer: No. Articles other than 550 do not provide a specific distance. NEC 550.32(A) indicates the disconnecting means must be located "not more than 30-feet from the exterior wall of the mobile home it serves" for the service rated disconnect as found in NEC 550.32(A). The only code Sections that come close are NEC 700.12(B)(6), NEC 701.11(B)(5), and NEC 702.11 (Outside Generator Sets). Where the generator has a readily accessible disconnecting means and is "located within sight" (see Def. Article 100) from the building, an additional disconnect at the building is not required for the feeder. NEC 225.32 (Outside Branch Circuits and Feeders) is most common and requires a service rated disconnect to be located inside nearest the point of entrance or outside. CMP 4 did initially accept a proposal to require the building disconnecting means to be "within sight" of the building it serves. The panel did return to the current text during the comment stage of the Code revision process. Their discussion clearly supports the concept that the building disconnect does not need to be physically attached to the building it serves. The panel statement indicates that it is up to the AHJ, owner and installer to determine the appropriate location on a case-by-case basis.

34) My question is in regard to an eye clinic that will provide Lasik surgery in addition to regular eye checkup appointments. This project is in the early design and bidding stages. Here is the information as of today:

- 1) Slab on Grade
- 2) Wood Frame (Type III, IV or V)
- 3) IBC Occupancy is Business (B)

## 4) Eye Clinic with Lasik

Is this type of facility just an office building, or is it a health care facility subject to 2011 NEC Article 517? Specifically, would the exam rooms be considered patient care areas (general care) and require redundant ground and HCF MC or AC Cable (health care approved flexible metal conduit or armored conduit)? For future reference, would a dentist office be a healthcare facility subject to Article 517? Or only the procedure room where teeth are being removed? Or the dentist chairs where general teeth cleaning is occurring? What about a doctor's office in a small rural community where there is one doctor that has perhaps 4 to 5 examination rooms and an x-ray room?

Code reference: NEC 517.1, 517.2

Answer: Yes. The exam rooms need to meet the requirements found in Parts II and III of Article 517. See the Scoping statement in NEC 517.1 and the definitions for Health Care Facilities, Patient Care Area, and General Care Areas. The answer regarding the dentist office is any area where patients "are intended to be examined or treated" would fall under the scope and definitions above. Finally, in regards to a doctor's office in a small rural community is subject to the same requirements as those for the dental office. The x-ray room would also need to meet the requirements of Part V of Article 517.

35) The scenario is a commercial facility with an RTU with labeled 23MCA and 40MOCP. We have two different views.

- (1) Utilize #10THHN to meet the MCA and protect per the MOCP 40A for inrush.
- (2) Utilize #8THHN because of the 40A MOCP being utilized.

Code reference: NEC 240.4(G), 440.6, 310.15(B)(16)

Answer: Assuming this is an A/C unit, the small conductor overcurrent protection rules in 240.4(D) do not apply and we can use 240.4(G) for specific conductor applications. A/C equipment is one of the applications listed in table 240.4(G) and the conductor sizes and overcurrent protection can be sized in accordance with Article 440. NEC 440.6(A) lets us use the manufacturer's nameplate data to size the conductors and overcurrent devices, and 440.6 directs us to use table 310.15(B)(16) to size the conductors. Table 310.15(B)(16) indicates the ampacity of #12 THHN is 30 amperes. However, we must use the weakest link in the circuit, which is normally the terminals of the equipment, and most terminals are rated at 75°C. This limits us to the use the 75°C column in 310.15(B)(16), and the ampacity of #12 at 75°C is 25 amperes, which is above your MCA of 23 amperes. In your case a 40 ampere overcurrent device with #12 THHN would meet the minimum requirements

36) I know that the main service panel cannot be located in a UDC bathroom. Can a sub panel be located in the bathroom if it meets the workings space under 110.26? 408.37, 312.2 refer to damp locations. Is there something more specific that I can use?

Code reference: NEC 230.70(A)(2), 240.24(E)

Answer: Generally any service panel, regardless of occupancy, is prohibited from being placed in a bathroom by 230.70(A)(2). Overcurrent devices in dwelling units are not allowed to be placed in

bathrooms by 240.24(E). Subpanels are allowed in non-dwelling unit bathrooms if the working clearances can be met. We do not consider the typical bathroom as a damp location.

37) This system will be installed per NFPA 13, fully sprinkled. The State agency doing the review and inspection will be DHS. The generator will just power the fire pump, correct?

Code reference: NEC 700.4(B)

Answer: The generator can have additional loads in addition to the fire pump. A priority load shedding system has to be installed. It is normally done through the transfer switch and a control circuit. A PLC is used to set the priorities based on generator capacity and connected loads. The NEC requirements are found in 700.4(B). Test the load shedding sequence under a variety of possible loading arrangements to verify the EM loads are always maintained.

38) I have a customer (school administrator) for a daycare/primary school with age ranges from infant to 5 years old that claims for preschool children the newer style tamperproof receptacles are not correct for her child age range. I believe I am correct in installing the current style here. Do you know of any reason she may be saying this?

Code reference: NEC 406.4(D)(5)

Answer: The receptacle would have to be a listed tamper resistant type. I am not sure if the type she is referring to is a listed tamper resistant type.

39) I have recently roughed a small "spa" in an assisted living home. The construction used steel studs in a basement location. I used type MC cable to wire the room. The electrical inspector said that the code requires me to use steel stud grommets to protect the MC cable when passing it thru the studs or the top plate. I have searched the code book and the internet and I didn't find a requirement that fits this situation. It would seem that the grommet is not required by NEC 320.17 or 330.17 (2011 code). Is this an electrical code requirement or is it possibly a building code requirement? I didn't find anything required by the state code. I have asked the manufacturer if grommets are required for any reason even because of dissimilar metals, possibly by 300.4? He stated that this is not a requirement that he has ever heard of. I may be missing something.

Code reference: NEC 330.17

Answer: You are correct. NEC 320.17 and 330.17 refer us back to 300.4(A),(C), and (D) but excludes (B) which covers only NM cable through metal framing members. Metal studs do not need grommets when MC or AC cable is used.

40) I was recently at the commercial code update class. During the review of questions and answers I missed one concerning being licensed to work in an industrial setting. Now, if I understood correctly, you do not need an electrical license to do repairs on existing equipment, but you must be licensed to perform new work. If my company buys a new piece of equipment and they need a new feeder from an existing I-line panel going to a new disconnect where they need to size system, run pipe, pull wire etc.,

or add new lights to a room, or add a new convenience outlet somewhere, or add new machine safety systems to safeguard equipment and personal, then, they would need a licensed electrician. However, if my company is just maintaining or repairing what's there, then, they wouldn't need a licensed electrician. Do I have it correct? If so, could you give me a ruling on this with all state references? I'm trying to educate my employer in plain easy to understand English, so I can get them on the right path.

Code reference: SS 101.862

Answer: No electrical license is required for a person who installs electrical wiring in an existing industrial or manufacturing facility if the person is employed by the facility. The same applies to maintaining and repairing electrical equipment.

101.862(4)(am) (am) A person engaged in installing electrical wiring within an existing industrial facility or existing manufacturing facility owned or leased by the person or by an entity for which the person is an agent or employee.

101.862(4)(b) (b) A person engaged in maintaining or repairing electrical wiring within an existing facility or on premises owned or leased by the person or by an entity for which the person is an agent or employee.

41) I'm having a problem with an inspector wanting previously installed conduit and boxes removed even when all the wires are removed and covers in place. I can't find the article that requires this in the NEC, please advise.

Code reference: NEC 372.13, 650.7, 725.25, 760.25, 770.25, 800.25, 820.25, 830.25 & 840.25

Answer: The NEC does not require the removal of abandoned raceways or the installation of covers on enclosures/boxes that do not contain conductors. The inspector cannot order you to remove previously installed conduit and boxes when all the wiring is removed. There are requirements for other types of abandoned cable which are listed below:

- NEC 372.13 Discontinued outlets requires that the conductors supplied to that outlet to be removed, and this article only deals with cellular concrete flooring.
- NEC 800.25 deals with abandoned communications circuit cable that requires unused cables to be removed, unless tagged for future use.
- NEC 725.25 also requires the removal of accessible portion of class 2, class 3, and PLTC cables, unless tagged for future use.
- NEC 760.25 requires the removal of the accessible portion of abandoned fire alarm cables, unless tagged for future use.
- NEC 770.25 requires the removal of the accessible portion of optical fiber cable, unless tagged for future use.
- NEC 650.7 requires abandoned cables to be identified with a tag.
- NEC 820.25 requires the accessible portion of abandoned coaxial cable to be removed unless tagged for future use.

- NEC 830.25 requires the accessible portion of abandoned network-powered broadband cables to be removed unless tagged for future use.
- Lastly, NEC 840.25 deals with premises-powered broadband communications systems where 770.25, 800.25, and 820.25 apply.

42) We are interested in bidding a low voltage building automation system installation at a local superstore. We had spoken with an electrical inspector back in 2003. At that time there were no licenses or permits required for this type of low voltage work. Several years have passed, are there any changes or revisions to the state's requirements?

Code reference: SS 101.862, SPS 316.002(1)(a)

Answer: Low voltage contactors are not required to be licensed per Wisconsin State Statute 101.862. In addition, local municipalities may no longer require you to be licensed by the municipality.

Municipalities may require an electric permit be secured for work performed, but are prohibited from requiring you to pay for and obtain a municipal license. Check with the municipality you are working in to see if a permit is required.

The following may be helpful to you:

SUBJECT: Prohibition on Municipal Low Voltage Wiring Licenses

The definition of electrical wiring contained in the Wisconsin Statutes is broad and includes all electrical equipment "used for the production, modification, regulation, control, distribution, utilization, or safeguarding of electrical energy for mechanical, chemical, cosmetic, heating, lighting, or similar purposes, as specified under the state electrical wiring code." Wis. Stat. § 101.80(1m). The Department has further clarified this definition by stating it includes all installations of electrical and communication conductors. Wis. Admin. Code § SPS 316.002(1)(a). "No person may install, repair, or maintain electrical wiring unless the person is licensed as an electrician by the Department." Wis. Stat. § 101.862(2).

Municipalities, as of March 31, 2014, are no longer able to license electricians. Wis. Stat. § 101.861(1). Low voltage wiring is included in the electrical code both by statute and administrative rule, as a result, municipalities cannot license for low voltage or communication wiring installing, repairing, or maintenance.

43) I am on a jobsite where the owner has purchased some tubing at a sale and wants us to use it for electrical installation. It is 3/4". It has rust and when I looked inside, it was dirty. It has no detectable markings to know what it is. I do know that the 3/4" EMT couplings had to be machined out for this tubing to fit. I am guessing that this is a code violation, but cannot find it in the code.

Code reference: NEC 358.6

Answer: You are correct. EMT is required to be listed per NEC 358.6.

44) Can a 120/240 volt panel, less than 200amps, be located in or on a wall where a building door can swing open in front of the panel? When the building door is closed, the area in front of the panel is clear and meets 110.26 requirements.

Code Reference: NEC 110.26(A)

Answer: You are correct. This question has come up before. The NEC does not prohibit a door swing into the working space, however, maintaining a safe working environment must be considered. Will the electrician need to block the door from opening to work safely on the equipment? How about when the door is open, is the working clearance maintained and does that permit at least a 90 degree opening of equipment door? Permanent door stops may need to be installed. I would encourage you to discuss this with your local inspector in case other issues need consideration.

45) Per SPS 316.701 (1) a legally required standby system is required to be located 10 feet horizontally from any combustible portion of a Type III, Type IV, or Type V building. We are installing a legally required standby system next to a Type II building. Are there any clearance requirements next to this type of building? I understand that the clearances listed in 110.26 (A) (1) would still need to be maintained.

Code reference: SPS 316.701

Answer: Look at the installation instructions of the generator itself, there may be additional specifications regarding the location of the generator.

*SPS 316.701 Legally required standby systems.*

*(1) ADDITION. This is a department rule in addition to the requirements in NEC 701.12 (intro.): The enclosure of the alternate source of power located outdoors for legally required standby systems shall be located at least 10 feet horizontally from any combustible portion of a Type III, Type IV, or Type V building and at least 20 feet from an outdoor electrical transformer, electrical metering, service equipment or normal power distribution equipment. These dimensions may be reduced where a noncombustible barrier is installed that extends at least 3 feet beyond each side of the alternate power source and transformer. The height of the barrier shall be at least one foot above the top of the transformer, electrical metering, service equipment, or alternate power source, whichever is higher.*

46) I could not find the information on how long the time could be from normal lighting to emergency lighting switch over. A generator installer said it could be 10 seconds, but that sounds like it would be a long time with no lighting. I looked in section 700 in the code but did not see a time listed.

Code reference: NEC 700.12

Answer: Refer to 700.12 General Requirements. This reads:

*Current supply shall be such that, in the event of failure of the normal supply to, or within, the building or group of buildings concerned, emergency lighting, emergency power, or both shall be available within the time required for the application but not to exceed 10 seconds.*

The supply system for emergency purposes, in addition to the normal services to the building and meeting the general requirements of this section, shall be one or more of the types of systems described in 700.12(A) through (E). Unit equipment in accordance with 700.12(F) shall satisfy the applicable requirements of this article. In selecting an emergency source of power, consideration shall be given to the occupancy and the type of service to be rendered, whether of minimum duration, as for evacuation of a theater, or longer duration, as for supplying emergency power and lighting due to an indefinite period of current failure from trouble either inside or outside the building. Equipment shall be designed and located so as to minimize the hazards that might cause complete failure due to flooding, fires, icing, and vandalism.

47) I have an electrical panel in a showroom. The owner wants to put a cupboard door over the existing panel to conceal it from view. The door of the electrical panel would still be able to open 90deg. Are there any codes that restrict us from covering it?

Code reference: NEC 110.26

Answer: Permitted. As long as you follow these two code articles that are given your installation will be OK.

*110.26 Spaces About Electrical Equipment. Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment. (2) Width of Working Space. The width of the working space in front of the electrical equipment shall be the width of the equipment or 762 mm (30 in.), whichever is greater. In all cases, the work space shall permit at least a 90 degree opening of equipment doors or hinged panels.*

48) Concerning parking lot luminaire poles, what is your view on grounding to the earth using the rebar cage, or a ground rod? Do I need two if rods are used? Do I connect the electrode to the equipment ground conductor or only to the pole?

Code reference: NEC 410.42

Answer: Refer to part V. Grounding of NEC 410.

*410.42 Luminaire(s) with Exposed Conductive Parts. Exposed metal parts shall be connected to an equipment grounding conductor or insulated from the equipment grounding conductor and other conducting surfaces or be inaccessible to unqualified personnel. Lamp tie wires, mounting screws, clips, and decorative bands on glass spaced at least 38 mm (1 ½ in.) from lamp terminals shall not be required to be grounded.*

49) We installed a standard two position breaker enclosure rated for service equipment at a power supply as we usually do. The inspector is telling us that we are not installing it correctly and it needs to

have a main disconnect installed before the enclosure that we are using. I provided the code articles that I feel allow us to use it, and yet the inspector disagrees. He wants me to have a disconnect before the power goes to the buss of the disconnect. If this were the case, nobody could use the (6) disconnect rule on any panelboard. Can you let me know if we are installing it to meet the intent of 230.79?

Code Reference: NEC 230.71(A)

Answer: NEC 230.71(A) is helpful understanding the requirement. Based on the information provided in your email, the installation complies with NEC 230.71(A). One set of service-entrance conductors, either overhead or underground, is permitted to supply two-six service disconnecting means in lieu of a single main disconnect.

50) I'm sizing the riser conductors for a 400-ampere service. The service supplies 4 units and a public panel. All panels are rated at 100-amperes. It seems to me I would have to do a load calculation if the riser conductors are 500 kcmil or smaller. Do I size the meter packs the same way?

Code Reference: NEC 230.42(A), Table 310.16, Table 310.15(6)

Answer: Yes. You are correct. The service conductors that supply all of the dwelling units and the public panel must be calculated and sized per the load. Same for the meter socket. For example, say the result of the load calculation was 250-amperes after all applicable demand factors were applied. The service conductors would have to have an allowable ampacity of 250-amperes. So, 250 kcm THWN or 350-kcm XHHW conductors would be the minimum size in the riser or mast. The common power buss of the socket would also have to have a minimum 250-ampere rating. Each meter position could be rated 100-amperes. Since the voltage is 240/120-volt, single phase, you could use Table 310.15(B)(6) for the supply conductors to each individual dwelling unit. You could not use this Table for sizing the conductors in the riser or mast or for the public panel.

51) I had an inspector stop by a job site today and tell one of my guys on site that the breakers in a sub panel needed to be rated at 20K. I currently have 10K breakers in the panel. The power company provided me with the arc fault rating at the transformer that is 35,600 and I did my calculations to my MDP so my arc fault rating at the service is 17,124. My MDP has a rating of 35,000. I have never been asked to calculate beyond the MDP and honestly don't know how. I was told today it's more than wire size and distance. There is a factor of the breaker curve, and I'm not sure what that is. I have not talked to the inspector myself so I'm not sure why he is stating that breakers need to be 20K. Can you lend some insight on this?

Code reference: NEC 110.9

Answer: 110.9 requires all of the overcurrent devices to have an interrupting rating not less than the available fault current at that point in the system. There are fault current calculators out there that you could use to find the available fault current at any point in the system. I am not sure what "breaker curve" is either. The fault current calculators that I have used do not mention breaker curve. I believe the inspector is requiring 20k rated breakers because the only fault current value that he knows is

17,124. Your available fault current could very well be below 10k at the subpanel, but you would have to do a calculation to be sure. A very good Excel spreadsheet calculator can be found at <http://electrical-engineering-portal.com/download-center/electrical-software/fault-current-calculation> It is a free download. Bussman also has a free calculator at: <http://www.cooperindustries.com/content/public/en/bussmann/electrical/resources/fc2.html> Bussman's calculator can be downloaded to you smartphone as well.

52) I have a two building (51 unit and 39 unit) apartment complex with a below grade parking garage and 3000 amp 120/208 v electrical service common to both. The facility has 2 water mains. Would I be required to connect to both water mains with the main grounding electrode conductor?

Code reference NEC 250.50

Answer: Both water mains/electrodes are required to be connected as part of the common grounding electrode system.