2020 National Electrical Code® Code Change Analysis

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In the previous issue of this newsletter the topic was a continuation of changes in Article 210. This issue we begin our journey into ***Article 215 – Feeders***. Our goal is to better understand the changes to help apply them more uniformly; and reduce the probability of installer confusion. We Hope.

Article 215 – Feeders

215.2 Minimum Ratings and Sizes

215.2 Feeders Not More Than 1000 Volts.

(A)(1) General. *Feeder conductors shall have an ampacity not less than the larger of 215.2(A)(1)(a) or (A)(1)(b) and shall comply with 110.14(C).*

The savvy code user noticed that the very first change is we are finally completing that migration from 600 volts to 1000 volts that the code making panels started a few cycles ago.

However, the subtle change, that doesn't attempt to change the intent of the *CODE* itself appears to be as follows. In the 2017 NEC, there was a statement in *215.2(A)(1)* that reads; *"feeder conductors shall have an ampacity not less than required to supply the load as calculated in Part III, IV, and V of Article 220,".*

That specific language is no longer in *215.2(A)(1)* which leaves us all assuming that the load calculation has to be performed anyway per *Article 220*. So, it was pointless to remind us of that fact, thus they removed the language. Regardless of if you agree or disagree, the conductors are still required to have an ampacity to handle the calculated loads so this change will only serve to confuse folks who always pointed to *215.2(A)(1)* for reassurance that whatever you do the conductors must be able to handle the loads as calculated in *Part III, IV, and V of Article 220*, which is 100% accurate. Nothing really changed the intent except to add ambiguous assumptions. I guess you can tell I liked the 2017 *NEC* language because it says what it means and means what it says. But, didn't I say I would leave my opinions out of these newsletters? Yes, I failed.

215.3 Overcurrent Protection

While there were no significate changes to *215.3* Overcurrent Protection itself, I did want to bring the code users attention to the removal of Exception 2. That exception stated *"Overcurrent protection for feeders between 600 and 1000 volts shall comply with Parts I through VIII of Article 240. Feeders over 1000 volts, nominal, shall comply with Part X of Article 240."*

So just to clear that exception is deleted for the 2020 *NEC* but I just wanted to let you know. The real reason for the deletion is that finally all 600-volt statements have been increased to 1000 volts, so it made the exception irrelevant in the eyes of the CMP.

CODE FACT - You will start to notice the phrase "provisions of" being removed throughout the 2020 *NEC*, so get used to missing that beloved phrase.

215.9 Ground-Fault Circuit-Interrupter Protection for Personnel.

The change in *215.9* serves to remove the limitations of GFCI protection to feeders that only supply 15- and 20-ampere receptacle branch circuits. So basically, the GFCI on a feeder can be utilized in lieu of those provided in *210.8* and *590.6(A)* and is no longer limited to receptacle branch circuits only.

Why is this change important? Well, in the 2017 *NEC* there were many hard-wired loads that would not have permitted

GFCI protection at the feeder origination point location, such as boat hoists in *555.9*.

215.10 Ground-Fault Circuit-Interrupter Protection of Equipment.

The general rule here is that each feeder disconnect that is rated 1000 amperes or more and installed on solidly grounded wye systems of more than 150 volts to ground and not exceeding 600 volts phase to phase are to be protected by GFPE in accordance with *230.95*. However, in the 2017 *NEC* there were two exceptions to the general rule. Well, in the 2020 *NEC* you now have a third exception.

"Exception No. 3: If temporary feeder conductors are used to connect a generator to a facility for repair, maintenance, or emergencies, ground-fault protection of equipment shall not be required. Temporary feeders without ground-fault protection shall be permitted for a time period necessary but shall not exceed 90 days."

Without this exception this author would find if rather difficult to make such repairs to a system whereas the generator and its temporary nature would make GFPE impractical.

Article 220 – Branch-Circuit, Feeder, and Service Load Calculations

We can all appreciate calculations and the importance of them in designing an electrical system. In fact, the majority of engineering design issues and overall failures come from guestimation. Yes, I made that word up and I am now going to define it in my opinion. "**Guestimation- something someone does or says when they have no real clue."** Well, something like that anyway. Sadly, that doesn't work well when you size a service to 800 amps, and it needed to be 1000 amps or sized it to 1000 amps, and it only needed to be 800 amps. Costly mistake to happen on your dime.

When designing electrical systems, it is critical to take a bottom-up approach to calculations, starting with the branch circuits, then progressing to the feeders then ultimately the service calculations. At least that is what is supposed to happen.

Article 220 is laid out the way it is for a logical reason but I digress, and you are not here to read my philosophy on calculations so I will move on.

220.11 Floor Area

Here is the new language as written. However, you will notice that is simply extracts components from the 2017 *NEC* section *220.12* that dealt with floor area and just created its own section.

"220.11 Floor Area. The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use."

So, nothing fancy in *220.11* but at least it clears up *220.12* to address the lighting load calculations rather than how to obtain the floor space dimensions.

220.12 Lighting Load for Non-Dwelling Occupancies

220.12(A) General

As you can probably guess by the new header of *220.12* that dwelling units and their infamous 3 VA per square foot no longer perched in *Table 220.12*. In fact, nothing in *220.12* now has anything to do with dwellings period. The *Table 220.12* has been redone, the volt amps per square foot have all been revised based on historical data from the *American Society of Heating, Refrigerating and Air-Conditioning Engineers*. But we usually just call them ASHRAE for short. The basis for the change was due to research data on lighting density power studies to establish new values.

But if you are like me you want to know the biggest benefit of this change and the ASHRAE data. The designer no longer has to worry about figuring in lighting as a continuous load using 125%. The new note added to the bottom of *Table 220.12* reads: *"The 125 percent multiplier for a continuous load as specified in 210.20(A) is included when using the unit loads in this table for calculating the minimum lighting loads for a specific occupancy."*

We now have some footnotes that help to clear up various occupancy's questions from the past. For example, while an Office is in *Table 220.12* you will not see banks any longer. However, the footnote "d" reminds us that banks are really just office-type occupancies. There are few more, check them out.

So, what else is important? Well, it now states that motors rated less than 1/8 HP and connected to a lighting circuit shall be considered general lighting loads. This is great news for those non-dwelling ceiling fan applications where the motors are less

than 1/8 HP. Now, it is simply part of the general lighting load you calculate using *220.11* for floor area and *Table 220.12* for the VA per square foot based on the occupancy.

220.12(B) Energy Code

In the 2017 *NEC*, the ability to utilize the energy code to obtain your lighting load was part of an exception to the general rule. However, in the 2020 *NEC* it is now a viable option without being considered an exception. If your building is designed and constructed in accordance with an energy code that has been adopted by the local authority, you are permitted to calculate the lighting loads via the unit loads specified in that energy code. Just remember if you choose this route you have to meet all of the caveats expressed in *220.12(B)*, and there are four of them to be aware of. Oh, and one of them happens to be that you are back to counting the continuous lighting loads at 125%.

Warning- My Opinion Alert – I don't think we will see many engineers using *220.12(B)* but I could be wrong. Well maybe in the state of California or Washington perhaps.

220.14 Other Loads- All Occupancies

220.14(J) Dwelling Units

With the removal of dwellings and dwelling units from *220.12* and *Table 220.12* there had to be changes made to *220.14(J)* to accommodate all the rules necessary to dwellings. So, here is the entire change to *220.14(J).*

(J) Dwelling Units. In one-family, two-family, and multifamily dwellings, the minimum unit load shall be not less than 3 volt-amperes per square foot. The lighting and receptacle outlets specified in 220.14(J)(1), (J)(2), and (J)(3) are included in the minimum unit load. No additional load calculations shall be required for such outlets. The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 220.11 for dwelling occupancies. Motors rated less than 1/8 HP and connected to a lighting circuit shall be considered part of the minimum lighting loads.

(1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits in 210.11(C)(3) and 210.11(C)(4)

(2) The receptacle outlets specified in 210.52 (E) and (G)

(3) The lighting outlets specified in 210.70

So this change simply brings in the 3 VA per square foot component from *Table 220.12* and of course add the motors that are rated less than 1/8 HP to be already considered into the load if connected to a lighting circuit. No additional calculation needed for those smaller motors is awesome when folks always ask those questions about every motor in existence, even the small ones and how they are to be addressed in the calculation. Now you know.

You will also notice that the reference to guest rooms or guest suites of hotels and motels was removed as well. That has been incorporated into a new *220.14(M)*

Now, we will not discuss *220.14(M)* in detail because to be honest it is simply a cut and paste from *220.14(J)* without the added 1/8 HP motors on lighting circuits language as that was not added to *220.14(M)*.

220.16 Loads for Additions to Existing Installations

220.16(A) Dwelling Units.

Loads added to an existing dwelling unit(s) shall comply with the following as applicable:

(1) Loads for structural additions to an existing dwelling unit or for a previously unwired portion of an existing dwelling unit shall be calculated in accordance with 220.14.

(2) Loads for new circuits or extended circuits in previously wired dwelling units shall be calculated in accordance with 220.14.

When looking at the above change you will notice that in the 2017 *NEC* there was a trigger for structural additions or previously unwired portions of existing buildings within item 1 for new additions exceeded 500 square feet.

Notice that in the 2020 *NEC* language, item 1, the trigger is gone. As a result, all additions to existing dwelling units will require a calculation in accordance with *220.14.*

Table 220.42 – Lighting Load Demand Factors

As you look at the sample table on the next page you will notice that hospitals have been removed from the demand table. That means in the 2020 *NEC* hospitals lighting load (VA) is to be taken at 100% of the total calculated lighting load.

You will also notice that the percentages changed for motels and hotels as well. The values were 50%, 40% and 30% and they are now 60%, 50% and 35%. As a result, the changes coincide with changes made to *Table 220.12* by the ASHRAE data which dropped the VA per square foot from 2 in the 2017 *NEC* to 1.7 in the 2020 *NEC*.

Table 220.42 Lighting Load Demand Factors

Type of Occupancy	Portion of Lighting Load to Which Demand Factor Applies (Volt-Amperes)	Demand Factor (%)
Dwelling units	First 3000 at	100
	From 3001 to 120,000 at	35
	Remainder over 120,000 at	25
Hotels and motels, including apartment houses without provision for cooking by tenants*	First 20,000 or less at	60
	From 20,001 to 100,000 at	50
	Remainder over 100,000 at	35
Warehouses (storage)	First 12,500 or less at	100
	Remainder over 12,500 at	50
All others	Total volt-amperes	100

*The demand factors of this table shall not apply to the calculated load of feeders or services supplying areas in hotels and motels where the entire lighting is likely to be used at one time, as in ballrooms or dining rooms.

220.53 Appliance Load- Dwelling Unit(s)

It shall be permissible to apply a demand factor of 75 percent to the nameplate rating load of four or more appliances rated 1⁄4 hp or greater, or 500 watts or greater, that are fastened in place, and that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling. This demand factor shall not apply to:

(1) Household electric cooking equipment that is fastened in place

(2) Clothes dryers

(3) Space heating equipment

(4) Air-conditioning equipment

This change has been long awaited. Easier usability of the *NEC* is something we all strive for, and this change was attempting to clarify the intent of *220.53*. The additional language *"rated ¼ hp or greater, or 500 watts or greater, that are fastened in place"* really defines the appliances that this rule applies to and more importantly it clarifies which appliances to which rule doesn't apply. Why, because items 1 through 4 already have *NEC* rules that provide potential demand factors associated with them. We can't have any double dipping now can we.

220.60 Noncoincident Loads

Where it is unlikely that two or more noncoincident loads will be in use simultaneously, it shall be permissible to use only the largest load(s) that will be used at one time for calculating the total load of a feeder or service. Where a motor is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of the motor load shall be used in the calculation if it is the largest motor.

Now, explaining this change is a bit tricky. Why, because there are folks that say it reads one way but applied another way. So, I promise you this one will be changed quickly either in the 2023 *NEC development process* or sooner via a Temporary Interim Amendment (TIA).

The whole concept is where you have potential loads that are not likely to be operated at the same time, referred to as simultaneously. As a result, you get to discard the lessor of the compared values when calculating the total load of a feeder or service. However, what the change appears to say is if that lessor load you just discarded has a motor, 125 percent of that motor load shall be used in the calculation if it is the largest motor.

So let me get this right, If I have an AC unit vs Heat Calculation and the heating load is the larger load but the AC unit has a condenser motor that is the actual largest motor in the building. We would take the heating load at its VA and then take the AC unit condenser motor VA at 125% and add the other AC associated loads and then compare them again to the heat loads to see which is now larger, now we understand. We can only assume this is to cover the largest motor at 125%, which is what we always have done in the past per section *220.50*.