

2023 NEC Study Guide For “Services”

(This Study Guide was prepared by Gaylord Poe)

Many questions come to mind when reviewing NEC Article 230. This study guide will address some of the more common code questions that frequently arise concerning service installations for residential and light commercial projects.

1. **What is considered to be “Service”?** In my experience, one of the biggest problems that arise when people (usually “non-technical people” vs. trained electrical professionals) are debating Art. 230 is that often what the parties are arguing as being “Service” is not “Service” at all! So first things first...let’s discuss what “Service” is and what it isn’t.

a. Art. 100 of the NEC defines **Service** as: “The conductors and equipment connecting the serving utility to the wiring system of the premises served.”

b. Art. 100 of the NEC defines **Service Conductors** as: “The conductors from the service point to the service disconnecting means.”

c. Art. 100 of the NEC defines **Service Point** as: “The point of connection between the facilities of the serving utility and the premises wiring.”

You’ll also see in Article 100 that there are definitions for “Cable, Service”, “Cable, Service Entrance” (there are 3 of these now!), “Service Drop”, “Service-Entrance Conductor Assembly”, “Service-Entrance Conductors”, “Service Equipment”, “Service Lateral” and others. Remember that when you are discussing any of these items you are still discussing items that are covered by the term “**Service**”. Only these items are subject to the rules found in Art. 230.

2. **Consider this example** - A small commercial retail strip center is fed underground from the utility and has an 800-amp meter center with an 800-amp main circuit breaker. There are eight individual meters. Seven meters each have a 100-amp circuit breaker supplying a 100-amp feeder run to each tenant space. The eighth meter supplies a 60-amp house panel. In this example, “Service” consists of the underground supply to and including the 800 amp main section in the meter center. That’s it...nothing downstream of this main section is “Service”.
3. **Misinterpretations** - In reviewing the above example, it’s not uncommon to hear comments that the installation failed either in Plan Review or failed during field inspection because: “There are eight services on the building.” Or “The tenant services are not grouped.” Or “There are eight service disconnects.” The reality of

the example is there is only one service supplying the building, there are no tenant “services”, there are only tenant feeders, and there is only one service disconnect - the 800-amp main. I’ve stated many times – “If you’re unsure, turn off the main(s). Whatever stays ‘hot’ is ‘Service’ whatever ‘goes off’ is not!”

4. **Number of Services allowed** - This issue probably receives more discussion than any other part of Art. 230 especially when it comes to underground service conductors. The basic rule is that (unless you meet certain conditions permitting additional services) you can only install one service of any given voltage to a building. When the service drop is “in the air” (overhead) the number of services to a building is quite obvious. However because of certain verbiage in 230.2, you can have (figuratively speaking) multiple underground “services” without having to count them as multiple services. 230.2 provides “For the purposes of 230.40, Exception No. 2 only, underground sets of conductors, 1/0 AWG and larger, running to the same location and connected together at their supply end but not connected together at their load end shall be considered to be supplying one service.” Note some key points in the above quotation: The sentence doesn’t deny that this is actually “multiple services” it simply states that it can be considered to be supplying one service. There are other conditions that must be met before you can use this section too. You must have the conditions of 230.40 Exception No. 2 (*the most important part of this exception is that the service disconnecting means must be grouped at one location*) and the underground conductors must be a minimum size (*1/0 AWG*) and all of the underground service conductors must come from the same transformer (*connected together at their supply end*). In layman’s terms, if everything “fits” this NEC rule, you can, for example run six 1/0 AWG underground service conductor sets to six individual meters to six 100-amp service disconnects and have a “600 Amp Service” at a very economical price. Without the rule, you would need one set of underground service conductors (single or multiple in parallel) rated at 600 amps run to a distribution board or box or wireway, and have to deal with the larger conductor(s), splices, taps, labor, etc. When you were all done you would still only have a 600-amp service, just at a much higher cost. All that being said, there are a number of installations that get “red-tagged” because the contractor installed multiple sets of underground service conductors to multiple locations on a building obviously thinking it was OK to do so. That same contractor wouldn’t even think of having multiple overhead drops hitting the building in the same manner but assumes it’s OK because “it’s underground”. My advice for when you’re considering what is acceptable and what is not regarding this is to mentally change the elevations (from underground to overhead) when you’re figuring this out. If it’s not OK “in the air” it’s probably not OK underground except as provided above in 230.2.

5. **Definition of Building** – One point that needs to be considered first and foremost is this – when the NEC uses the word “building”, it is used as the NEC defines “building” in Art. 100. Art. 100 of the NEC contains definitions “essential to the proper application of this Code.” That being said, when we use the NEC, we can’t take definitions of words (such as “building”) from other codes or standards and use NEC rules with the “foreign” definitions. If a definition of a word is in the NEC, we must use that definition. If a definition of a word is not in the NEC, the definition is often subject to debate. In NEC Art. 100, the definition of building is “A structure that stands alone or that is separated from adjoining structures by fire walls.” Note that there are no references to “1-hour rated wall” or “2-hour rated wall” or “3-hour rated wall”. There are also no references to masonry walls etc. The key words are: “A structure that stands alone” and “fire walls”. A “structure that stands alone” is pretty easy to determine but when we talk about “separated...by fire walls” the water often gets just a little muddy. To complicate the matter, Art. 100 contains no definition of “fire wall”. Often someone will want to install a second service to a building and when the inspector says “No” they will come back and say, “We have a 2-hour rated wall.” That statement by itself does not mean they have a fire wall. My advice is this: when seeking to define a word not found in Art. 100, the next best place to look is the applicable building code. According to the Ohio Building Code (OBC) the definition of Fire Wall is: “A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.” The point is it’s going to take more than just additional layers of drywall (for example) to make a wall a fire wall. Structural considerations are also required. My advice is this: If you can’t easily make the determination on this matter for the purposes of interpreting 230.2, ask the building department. And, don’t ask them for the rating (in hours) of the wall in question. Instead ask them if the project in question is actually two separate buildings...period. If you have two buildings, you have no problem.
6. **Number of Disconnects** - The basic rule that we are taught is the maximum number of service disconnects is six. It’s not quite that simple. Art. 230.71 (B) provides a little more detail. The “six disconnect rule” is per service or per each set of service-entrance conductors permitted by 230.40 Exceptions. But it goes on to state that there can’t be more than six sets of disconnects per service grouped in any one location. Conflicting? Not at all. Confusing? It can be. The exceptions to 230.40 not only permit multiple subsets of service-entrance grouped together and fed from one service point but they also permit service-entrance conductors to be run to more than one “place” on a building. What 230.71 (B) says is the “six disconnect rule” can be used for each set of service-entrance conductors permitted by 230.40 as long as you don’t have more than six disconnects grouped in any one

location. Also note that if you have another service as permitted by 230.2 (A) through (D), these rules apply separately to that service. For example, you could have 12 disconnects grouped in one electric room if you had a 120/240V service and a 480V service supplying the building and be NEC compliant.

7. **Surge Protection** – Art. 230.67 (A) through (E) provides the surge protection requirements for specific occupancies, location, type, replacement information, and ratings.
8. **Emergency Disconnects** – Art. 230.85 provides for emergency disconnects for 1, 2, and 3-family (in Ohio) dwelling units. The emergency disconnect shall be installed at a readily accessible outdoor location. Pay close attention to rules 230.85 (B) AND the *Exception* to 230.85 (C)
9. **Length of Service Conductors permitted in a building** – You’ll often hear that there is a “10 foot rule”. There is not. 10 foot is often used as a “rule of thumb” by electrical inspectors but it has no basis in code text but plenty of basis in the practical application of the code! When I was much younger, old-timers of the day told me they were told by the old-timers who taught them that the “10 foot rule” came about in the days when all service entrance work was installed in threaded rigid conduit and the inspector would only let you run “one stick of pipe” into a building without a disconnect. I believe that this is a pretty accurate “story” as I have a copy of a memo dated June 11th, 1926, containing minutes of a meeting held in Cincinnati on March 9th 1926 where the phrase “nearest readily accessible” from the (then current) 1925 NEC was defined locally as being 10 feet with “service conduits” being duly noted. The 2020 NEC provides three basic rules in 230.70 (A)(1) for locating the service disconnecting means: it shall be readily accessible, it can outside, or inside nearest the point of entrance (meaning if it is inside it must be installed where the conductors enter the building). It should be noted that in addition to the three basic rules, Art. 230.70 provides additional rules.