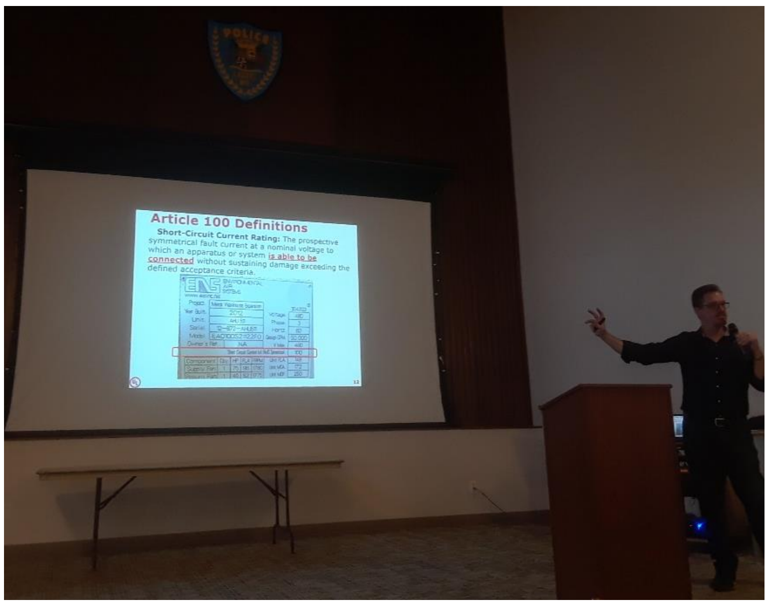
George Washington Chapter, IAEI Meeting 5/23/2018

The George Washington Chapter, IAEI met on May 23, 2018 in Laurel, Maryland. Aside from the speaker, we were 17: 12 chapter members, 1 visiting member, and 4 who have not yet joined. We were a pretty even mix of inspectors, engineers, and electricians. The City of Laurel's electrical inspector, member Michael Thomas, made a fine facility available, and even provided tasty snacks.

We started shortly after 5:30, and finished a bit before 8:30, with a 10-minute break toward the end. Why so long? Our presenter was UL's Jeff Simpson, talking about available fault current, a subject that he often spends four hours explaining. His largest focus was on NEC Sections 110.9 and 110.10, though his insights extended beyond those two core sections. He brought up any number of issues that designers and contractors overlook, and, based on their questions and note-taking, not every inspector present was used to considering them, either.



Early on, Jeff responded to a question about suitability of molded-case circuit breakers for legacy panels by offering to email any member who needed it a list of compatible breakers classified for use in them. What's more, he mentioned that he has some letters he got from UL when he was still an inspector that identify further matches.

A bit later, he mentioned that the default rating for circuit breakers, if not marked with AIC, is 5 kAIC. He also said that Classified breakers are never rated for more than 10 kAIC. This also applies to the issue of using series-rated panelboards, (discussed a little later).

He talked a good bit about his experiences finding Available Fault Current violations when he was an inspector in Durham, North Carolina.
On one commercial job, he noticed that the equipment was quite close to the utility transformer. This automatically raised a question about whether there was much impedance between the transformer and equipment that might be subjected to the current it could supply. He asked whether he could see the old panelboard, and he checked the AIC ratings of the circuit breakers in it. They were rated 22 kAIC , while the new ones were rated 10 kAIC: another warning signal.

In an aside, he mentioned that kAIC could also be written kAIR, “Rating” rather than “Current.”

Home Inspector Bob Sisson mentioned cases where the ground has sunk under a meterbase, pulling the lateral down and causing a fault in damaged service conductors. He made the point that residential services can have a LOT of fault current at the meter. If a meter is near the transformer, he said, and the transformer is feeding 5-8 houses at 200A each, the fault current at the nearest house is much higher than most realize. This is especially true if the drop is wired with 350 kCMIL, Bob commented, simply because that’s what the line guys had on the truck. The panelboard may be only three ft from that, so the fault current at those lugs is essentially the same.

He saw a meter arc-welding itself for quite a while because it was the nearest to the transformer, and all of the other houses were off peak.
The transformer was perfectly happy to send 8x200A continuously until the utility got there. Bob said the sight was spectacular, and the protective device at the transformer never acted.

Returning to Jeff, our speaker said that although NEC Section 110.9 means overcurrent protection equipment must have a rating equal to or greater than the available fault current, some contractors whose work he inspected didn’t recognize what this implies. When he’d ask a commercial contractor the available current at some point in the system, he might hear “No, I’m only required to mark it at service equipment. His response is that the amount of available fault current doesn’t need to be marked on the downstream equipment, but it does need to be calculated.

He asked how you would calculate that. Engineer Danish Verma offered an appropriate response: “Up, over and down.”

Section 110.10 applies to other equipment intended to make and break current besides overcurrent devices. Jeff mentioned that not only can't you exceed the line a lighting contactor is intended to feed, you much limit the fault current that is available to it–or a time clock. One contractor had to re-feed a time clock that was nippled to a panel, because it was equipped to withstand no more than 5kA of fault. There are tables in UL standard 508, Supplement SB, giving the default withstand ratings of common equipment.

He had a few other disconcerting things to say about contactors. A Definite Purpose Contactor is much less expensive than the other type, because a Definite Purpose Contactor is a recognized component, not a listed product. It cannot be legally installed except as an authorized replacement within a listed piece of equipment.

Article 100 defines an Industrial Control Panel as an enclosure containing, for example, two contactors, or two pilot lights, or two of any number of other items. Now an Industrial Control Panel does not need to be listed, but all the pieces in it do need to be listed, and the normal spacings in Article 312 need to be maintained, and the ampacity is specified.

A number of challenges were raised, for example the idea that a 2-gang switch box qualifies under this definition, as does a single-gang switch box with a combination switch and pilot light. We didn't chase too, too far down this rabbit hole. We also didn't fuss too much about whether Section 110.10 applies to an ordinary snap switch.

Jeff mentioned something tricky about utility communications. He has seen utility letters that gave the available fault current calculated at the point of service, and other letters from the same utility that gave the available fault current at the transformer itself. He did require that letter. He could get some clues to likely fault current by walking around a building and seeing how far away the transformer is. However, he couldn't look at a utility transformer and determine its rating, either in terms of power of or internal impedance.

There is an ap, even a mobile ap, produced by Eaton's Bussman division, for calculating available fault current downstream of the service. We probably will have a chance to be drilled on it at our November meeting.

Cooper Bussman, incidentally, publishes Ugly's electrical guide, containing the formulas and tables electricians are most likely to need.
One is "C" values. Fault current depends on the characteristics of a circuit, including conductor material and size, wiring method, and length of run. When a designer specifies a "C" value, this indicates wire and raceway or cable type. Because ferrous raceways' inductance has a choke effect on a fault, circuits run in them carry lower levels of fault current. The electrician may not recognize the meaning of the "C" rating, and therefore not look it up to ensure that the fault current remains within the bounds calculated by the designer.

The higher the available fault current, the quicker the overcurrent device operation, and thus the lower the calorie rating of PPE required to work on energized equipment. However, the higher the available fault current, the more expensive the equipment rated to withstand it.

A one-line diagram needs to show fault points and be accompanied by a chart showing circuit characteristics used to calculate fault current at each point. An inspector can look at the characteristics and get an idea of whether the installer played loose with the specs, so that the equipment's AIC rating may no longer be adequate.

Series-rated panels can be tricky. These can incorporate a main with a higher AIR, branch circuit breakers with lower AIR, and still be permissible for installation where calculation shows the higher AIR level is needed. This is because they have been tested as a whole to withstand faults at that higher level.

They can be misused in two ways that may not be obvious. One is installation of Classified circuit breakers of the lower rating, rather than those that were tested to work with the particular main. Another is to presume that the main and branch circuit breakers are necessarily coordinated. All that the standard requires is for either the main or the branch circuit breaker to trip without suffering specific kinds of damage, in response to a fault of specified magnitude.

Fortunately, the NEC only requires coordinated protection in a few places, including elevator operation and critical healthcare circuits.
Fortunately, also, with nonadjustable molded-case breakers, branch circuit breakers generally will trip before the main.
As noted at the beginning, we kept Jeff way beyond the expected end of the session. He has plenty more to say about fault current, and we may have him back for this. Meanwhile, if you need help with questions about NEC-compliant product application and inspection, contact him at UL:
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