

Selective Coordination Part II

November 20, 2008



imagination at work

NEC Article 90.1 – First words in Code

“The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity.”

Selectivity requirements in 2005/08 Code are completely consistent with the NEC Purpose.

However they do not take precedence over other NEC and NFPA requirements.

Selective Playing Field

NEC: “Coordination (Selective) Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the choice of overcurrent protective devices and their ratings or settings.”

Code language still vague and must be interpreted by AHJs.

“coordinated with *all* supply side OCPDs vs. placement in NEC Chapter 7 for Special Conditions

Articles 700, 701 and 708 do not address other critical issues such as arc flash hazard or ground fault / phase

Alternative Standard – 0.1 Second ... considered by some

AHCA (Florida's Agency for Health Care Administration)

- Preceded NEC 2005 by decades
- Requires selective coordination down to 0.1 seconds
- Applies to entire facility, not just Emergency and Legally Required systems
- Experience has been positive

NEC Status

- Many AHJs still considering alternatives to NEC
- Most States / AHJs have adopted NEC 2005 or 2008
- Not all have visible enforcement of Selectivity provisions
- Three typical interpretations:
 - > Selective back to emergency supplies
 - > Selective back to normal and emergency supplies
 - > Selective back to ATS based on normal AIC, then back to emergency supplies based on emergency AIC.

Ground Fault Protection and Selectivity

- GF not specifically mentioned in Articles 700, 701 & 708 under Coordination
- NEC overcurrent definition does define overloads, short circuits and ground faults as sources of overcurrent
- Hospitals and Health Care facilities are required to have two layers of GF protection on normal incoming supplies > 1000A
- “L-shape” GF TCCs make selective coordination with upstream phase OCPDs difficult

MCCB Layer Limitations

- Traditional design practices utilize “waterfall” of sub-distribution panels of declining ampacities
- Typical “fully selective” designs are limited to no more than three or four MCCB “layers”.
- GE’s MCCB group includes ABB S7, Record Plus FG, Record Plus FB or TEY or THQB.
- You may get to “start over” on the secondary of a lighting transformer.

Utilize riser panels or feed thru lugs

Automatic Transfer Switches

- Most ATS are rated under UL 1008 which references UL 489 for MCCBs, I.e. 3 cycle withstand rating
- Cannot use LVPCB without IOC unless withstand protection of ATS is considered

Switchboard Protection

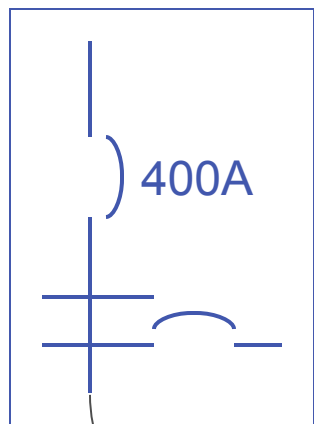
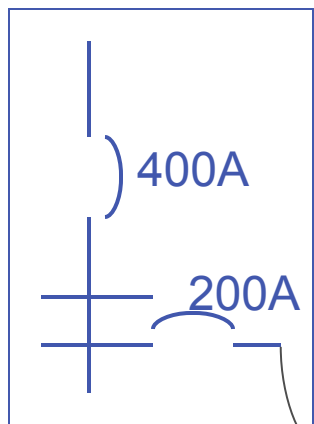
- Lighting panels, distribution panels and most switchboards are only rated to 3 cycles withstand.
- Unless protected with LVPCB with IOC, ICCB or MCCB, withstand rating may not be protected.
- Manufacturers are now looking a 30 cycle ratings
- Some GE Spectra Series switchboards are UL listed, but tested to ANSI 37.20 for 30 cycle withstand as UL 891 has no provisions for 30 cycle withstand ratings or certification.

Transformer Applications

- Primary and secondary CBs around an transformer need not be selective with each other. Both must be selective with the downstream CB.
- Transformer Z can be used to limit AIC on secondary to improve plausibility of a fully selective design.
- One to one transformer ratios or current limiting reactors can be used to limit AIC and bring a design within AIC ratings of fully selective breakers. (GE can supply fully selective designs up to 65kAIC.)

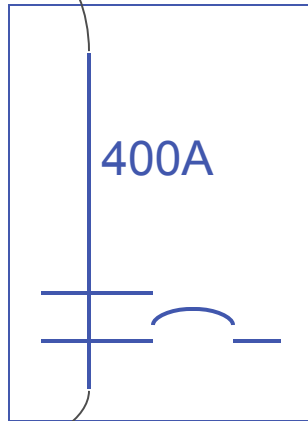
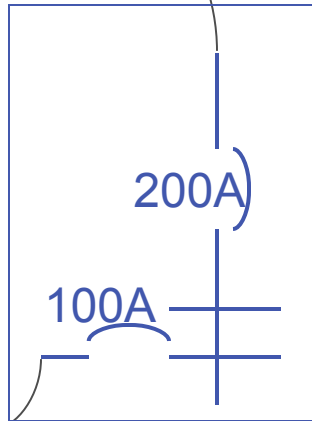
Design Tips

- Have consultant place AIC values on drawings
- Have consultant define circuit to be “fully selective”
- Limit AIC to 65k whenever possible
- Limit MCCB feeder size in “supply” panels to no more than 1200A
- Recognize ATS and switchboard that may need 30 cy withstand
- Utilize FTL panels to limit number of MCCB selective layers
- Increasing frame or sensor size may increase max IOC and facilitate full selectivity
- CBs on lighting transformers less than 75kVA can be made selective using traditional coordination techniques
- Utilize FTL or riser panels to minimize number of selective layers

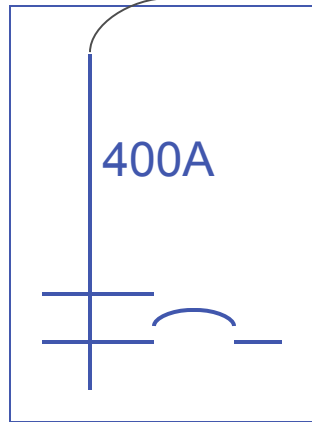
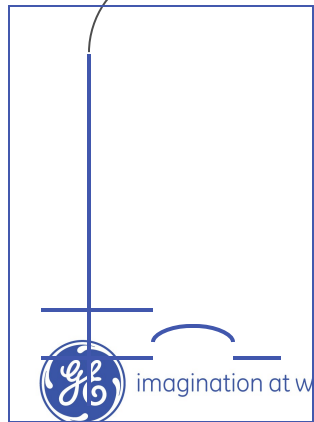


200A

400A



100A



Local mains are often used for a local way to turn a panel off . . . but

- Extra mains, sub-mains, subfeeds make it more difficult.
- Riser panels may make it easier.
- Non-automatic CBs are not necessarily completely without a trip

Best practices for AHCA or non-instantaneous selective coordination.

Series Ratings should be avoided in circuits that require selective coordination. Series ratings depend on the upstream OCPD to be “current limiting”. Upstream devices open before fault currents to the downstream device reaches catastrophic failure levels for the downstream device. Diametrically opposite of the principles of selective coordination.

Design Tips

- For systems with 35 kAIC or less:
 - > Service Entrance Main – LVPCB without IOC – Layer 5
 - > Service Entrance Feeders – PBII – Layer 4
 - > Downstream – S7 – Layer 3
 - > Sub panel branches – FG – Layer 2
 - > Sub-sub panel branches – FB, TEY, or THQB – Layer 1

Design Tips

- For systems with 65 kAIC or less:
 - > Service Entrance Main – LVPCB without IOC – Layer 5
 - > Service Entrance Feeders – LVPCB without IOC – Layer 4
 - > Downstream – S7 – Layer 3
 - > Sub panel branches – FG – Layer 2
 - > Sub-sub panel branches – FB, TEY, or THQB – Layer 1

Existing System Selectivity

- Probably not...
- Pre-existing systems probably not designed to be fully selective
- Upgrades to new “selective” breakers would likely require increased equipment sizes and large scale replacement of existing system
- Making only the “new” breakers selective is of limited real value if they are not selective with upstream pre-existing breakers

Arc Flash Considerations

- Fully selective system designs may significantly increase arc flash incident energy
- High incident energy levels may force de-energization of entire system to perform maintenance or post-fault repairs

More
questions?