

GENERAL:

The scope of this document is to provide requirements for low voltage (600 volts and below) studies and documentation. This includes short circuit analysis with equipment evaluation, overcurrent protective device coordination, and arc flash hazard analysis for all projects installing electrical overcurrent protective devices.

DESIGN GUIDELINES:

1. The following equipment and devices shall be included (but not be limited to) in all studies;
 - 1.1. Service Entrance Equipment.
 - 1.1.1. All overcurrent protective devices installed in service entrance panels.
 - 1.2. Feeder Circuits.
 - 1.2.1. All three (3) phase Feeder circuit overcurrent protective devices installed with a rating equal to or greater than 30 amps.
 - 1.3. Branch Circuits.
 - 1.3.1. All three (3) phase Branch circuit overcurrent protective devices installed with a rating equal to or greater than 30 amps.
 - 1.3.2. All motor circuit overcurrent protective devices for motors with a rating equal to or greater than 10 horse power.
 - 1.4. Motor Control Centers
 - 1.4.1 All motor circuit overcurrent protective devices for motors with a rating equal to or greater than 10 horse power.
2. A short circuit study and analysis shall be performed during design to provide needed current ratings for equipment specified and to identify any existing equipment with ratings that are insufficient for the design.
3. A coordination study shall be provided. The study shall include maximum short circuit calculations, coordination analysis, and settings for all protective devices with adjustable set points. The protective device settings must address the need to minimize arc flash hazards while maintaining full coordination. Where full coordination can't be attained, propose coordination based on calculated Arc Flash Analysis and have it reviewed/approved by the Owner. The analysis shall be based on the specific equipment installed, and shall be updated to include project "as built" documentation.
4. An Arc Flash Hazard Analysis shall be provided detailing the incident energy available at each equipment location. (Include batteries per 2015 NFPA 70E Sec 320, such as emergency lighting battery banks.)
 - 4.1. A preliminary review shall be performed by the consultant during design incorporating methods to reduce the arc incident energy available at equipment locations.
 - 4.2. The final analysis shall be based on the specific equipment installed, and shall be updated to include project "as built" documentation. With the exception of the service entrance main breaker, the incident energy available shall be reduced as low as practical, but no higher than 8.0 cal/cm² while maintaining coordination.

- 4.3. The project shall include color, printed waterproof labels for equipment. Labels shall be owner approved, furnished and installed by the contractor.
 - 4.3.1. For incident energy values less than or equal to 40 cal/cm^2 , label shall indicate “WARNING” using black lettering on orange background.
 - 4.3.2. For incident energy values greater than 40 cal/cm^2 , label shall indicate “DANGER” using white lettering with red background.
 - 4.3.3. Labels installed outdoors shall be resistant to ultraviolet light.
 - 4.3.4. At a minimum, each label shall list the following:
 - Location
 - Source protective device name providing the protection (fed from)
 - Nominal system voltage
 - Arc flash boundary
 - Specific arc incident energy available
 - Bolted fault current available
 - Label date
5. Format
 - 5.1. All studies shall be reviewed and updated to reflect any changes within one week of the final electrical walk through for punch list. The studies shall include the stamp or seal and signature of the preparing engineer, and shall be reviewed and approved by the Engineer of Record.
 - 5.2. A complete set of manufacturers’ descriptive literature and detailed instructions for adjusting overcurrent protective devices shall be provided to the Owner’s Representative within six (6) weeks after overcurrent protective device shop drawings have been approved.
 - 5.3. All mains shall have the required protective device settings installed and arc flash labels in place prior to being energized. All other equipment labels must be installed prior to operation by owner (e.g. substantial completion).
 - 5.4. All studies shall be provided using the most current version of SKM Systems Analysis, Inc SKM Power Tools Electrical Engineering Software (PTW 32). Do not use the “Use Equipment Specific Arc Flash Equation in Protective Device Library” method for arc flash calculations in the SKM software.
 - 5.5. Prior to project completion, all studies shall be provided in both hard copy and digital format. The hard copy shall include time current curves (for phase and ground fault settings) for each panel and the corresponding TCC report clearly showing each device set point (see attached example TCC and TCC report). The digital format shall include the complete coordination file including all device curves (use the SKM “Project - Backup” command). Digital format shall include the complete SKM data files for the project.
 - 5.6. Where MU provides the consultant with an existing SKM study on renovation projects, the consultant should create a scenario titled with the project number for design and construction, and final submittal to Owner.