

SECTION 160XX

SHORT CIRCUIT, COMPONENT PROTECTION, FLASH HAZARD ANALYSIS,
AND SELECTIVE COORDINATION STUDY

PART 1 GENERAL

1.1 SUMMARY

- A. Provide a short-circuit, component protection, flash hazard analysis, and selective coordination study for the electrical distribution system from all power sources (normal and emergency) down to the branch circuit overcurrent protective device and equipment.

1.2 PURPOSE

- A. The study shall calculate the available short-circuit current at each point in the electrical distribution system. The overcurrent protective devices shall have an interrupting rating equal to or greater than the available short-circuit current at the point of application.
- B. The study shall examine proper protection of electrical system components and utilization equipment such that the equipment has a sufficient short-circuit current rating. If a specific type of overcurrent protective device is required for proper protection of equipment, it shall be noted in the report and reflected in the design of the system.
- C. The study shall include a flash hazard analysis for electrical distribution equipment where required per codes and standards. The analysis shall determine the flash protection boundary, incident energy, and required level of personal protective equipment (PPE) for workers at the electrical distribution equipment. The flash protection boundary and incident energy shall be determined based upon a working distance of 18 inches. The electrical distribution equipment shall be field marked with this information in accordance with codes and standards.
- D. The overcurrent protective devices shall be analyzed for selective coordination. This analysis shall identify any potential selective coordination problems up the available short-circuit current. Any areas where the overcurrent protective devices are not selectively coordinated shall be explicitly noted and recommendations shall be made to achieve selective coordination if desired.

1.3 REFERENCES

- A. The study shall be completed in accordance with the latest edition of IEEE Standard 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
- B. The flash hazard analysis shall be completed in accordance with latest editions of NFPA 70E – Standard for Electrical Safety Requirements for Employee Workplaces and IEEE Standard 1584 – Guide for Performing Arc-Flash Hazard Calculations.

1.4 QUALIFICATIONS

- A. The company and individual(s) performing the study shall have a minimum 5 years documented experience in power system analysis and completed projects of similar size and scope. The individual(s) performing the study shall be a registered Professional Engineer in the state of the project location.
- B. The company performing study shall have the capability and experience to provide assistance during system start up.

1.5 SCHEDULING

- A. The selection of the company and individual performing the study shall be submitted and approved by the design engineer prior to the start of the study.
- B. The study shall be completed and submitted prior to the equipment submittals. The study will be reviewed during the equipment submittal and review process. Any changes to the study or equipment will be noted in the returned submittals.
- C. Final approval of both the study and equipment submittals shall be given prior to the release of equipment for manufacturing.

1.6 SUBMITTALS

- A. The results of the study shall be summarized in report form. Submit 10 copies for review and approval by the design engineer.
- B. The results of the study shall include the following:
 - 1. Descriptions, purpose, basis, and scope of study.
 - 2. Fault current calculations including definition of terms and guide for interpretation of computer printout.
 - 3. Tabulations of protective device and equipment ratings versus calculated short-circuit duties, and commentary regarding same.
 - 4. Flash hazard analysis report for electrical distribution equipment
 - 5. Time versus current curves or fuse selectivity ratio analysis, with tabulations of overcurrent protective device settings, and selective coordination analysis and commentary regarding same.
- C. If power company review and approval is required, the results of the study shall be submitted to the power company for review and approval. Approved copies from the power company shall be forwarded to the design engineer.

1.7 SUBMITTALS – CLOSEOUT

- A. Submit ten copies of the final approved study to the electrical design engineer.

PART 2 PRODUCTS

2.1 REQUIREMENTS

- A. The short circuit and flash hazard analysis study shall be completed with the aid of a computer software program where possible.

- B. The available short-circuit current, corresponding required interrupting or short-circuit current ratings of components, and flash hazard analysis data, shall be calculated based upon the 3-phase bolted short-circuit current and phase to ground/neutral short-circuit current at each of the following (if applicable):
1. Utility Service Point
 2. Medium voltage switchgear
 3. Medium voltage motor controllers
 4. Medium/Low-Voltage Unit Substations
 5. Low-voltage switchgear or switchboards.
 6. Distribution panelboards.
 7. Branch circuit panelboards.
 8. Motor control centers.
 9. Busway and Busplugs.
 10. Other significant equipment or utilization equipment.
- C. The study shall include the following:
1. Calculation methods and assumptions
 2. One-line diagram (with available short-circuit current and flash hazard data identified)
 3. Calculations shall identify:
 - a. Available short-circuit currents from all power sources (kVA)
 - b. Motor fault contribution
 - c. Component impedance data
 - d. X to R ratio
 - e. Symmetrical and asymmetrical fault current characteristics
 - f. Flash hazard analysis data
 4. Tabulation of all calculation quantities and results
 5. Detailed description of each protective device identifying its type, function, manufacturer, interrupting rating, ampere rating, selected settings, and time-current characteristics.
 6. System component characteristic curves or short-circuit current ratings identified and/or plotted up to the maximum symmetrical fault current to which the component is exposed. Include the following where applicable:
 - a. Medium voltage equipment characteristics
 - b. Low voltage equipment characteristics
 - c. ICEA conductor damage characteristics
 - d. Transformer characteristics
 - e. Motor and motor circuit equipment characteristics
 - f. Generator and transfer switch (manual or automatic) characteristics
 - g. Other system equipment characteristics.
 7. Time-current curves prepared graphically on full size, log-log forms with title, one-line diagram, and specific system components analyzed.
 8. Conclusions regarding interrupting rating for overcurrent protective devices, flash hazard analysis, protection of components, selective coordination, and recommendations and requirements on the same.

PART 3 EXECUTION

3.1 INSTALLATION/START-UP

- A. The contractor shall install equipment and protective devices in accordance with the approved short-circuit and selective coordination study.
- B. The contractor shall field mark equipment with flash hazard analysis data as required in accordance with codes and standards.
- C. The company performing the study shall provide assistance to the installing contractor during start up of electrical system and equipment as needed.

END OF SECTION