SECTION 26 0573

OVERCURRENT PROTECTIVE DEVICE STUDIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical system fault-current and protective device study:

1. Fault-current analysis.

B. Description: Provide study for overcurrent protective devices connected to existing switchboard and new generator serving new panelboards, and for new panelboards.

1.2 RELATED SECTIONS

A. Sections in Division 26, including Section 26 2416 Panelboards.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
2. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.
3. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
4. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
4. ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code, latest edition.
2. NFPA 70E – Standard for Electrical Safety in the Workplace.

D. Occupational Safety and Health Administration (OSHA):

1. OSHA 29 Code of Federal Regulations (CFR) Part 1910, Subpart S.

1.4 SUBMITTALS

A. Product data: For computer software to be used to perform studies.

B. Product certificates: For coordination-study and fault-current analysis computer software programs, certifying compliance with IEEE 399.

C. Qualifications: Submit evidence indicating individual and organization compliance with requirements indicated in “Quality Assurance” below.

D. Preliminary electrical system study: Submit for review before distribution equipment shop drawings have been submitted, and before equipment order has been released to the manufacturer.

1. If formal completion of the study may delay the project schedule, Engineer may approve use of the preliminary draft for ordering equipment.
2. If approved for use in ordering equipment, preliminary draft shall include sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

E. Final electrical system study:

1. Submit final report for review and record.
2. Incorporate changes resulting from deficiencies and corrections of preliminary draft report.

F. Reports:

1. Electrical system study report: Submit reports required above including the following items:

a. General report information: Scope, definitions, descriptions, assumptions, and other information necessary to properly interpret results of the report.
b. Tabulated summary comparing protective device ratings and calculated available fault-current levels.
c. Fault-current analysis calculations.
d. System one-line diagram.
e. Input and output data used for each component and for study calculations.

2. Submit final reports as electronic files in portable document format (.pdf) to Owner. Submit program base files in file format of computer software utilized to perform study.

1.5 QUALITY ASSURANCE

A. Electrical system study shall be performed by one or more independent qualified organizations, and under the supervision and approval of a Registered Professional Engineer skilled in performing and interpreting the power system studies.

B. Qualifications of organization performing electrical system study: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices:

1. Registered Professional Engineer shall be a full-time employee of the equipment manufacturer or of an approved engineering firm.
2. Registered Professional Engineer shall have a minimum of five (5) years of experience in performing power system studies and registered in the state where the project is located.

C. Qualifications of computer-based software: Widely available, complying with standards, guides, and codes as referenced above.

D. Comply with IEEE 399 for general study procedures.

E. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Computer software: Subject to compliance with requirements, utilize product by one of the following:

1. EDSA Micro Corporation
2. Operation Technology, Inc.
3. SKM Systems Analysis, Inc. (Basis of Design)

2.2 COMPUTER SOFTWARE REQUIREMENTS

A. Comply with IEEE 399.

B. Computer software program shall be capable of performing fault-current analysis of project electrical distribution system.

C. Computer software program shall be capable of plotting and diagramming time-current characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

D. Computer software program shall be capable of performing arc fault hazard analysis using equations as established by IEEE 1584 and requirements presented in NFPA 70E, Annex D.

E. Software shall include a comprehensive equipment library of manufacturer-based and IEEE / ANSI based equipment to accurately model the electrical distribution system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine project submittals for compliance with electrical distribution system requirements outlined on the drawings and in electrical specification sections.

3.2 SYSTEM DATA COLLECTION

A. The Contractor shall furnish data required to perform the power system studies. The Engineer performing the fault analysis study shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to ensure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. If applicable, include fault contribution of existing motors and equipment in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

C. The Engineer performing the studies shall gather and tabulate input data necessary to support each study including the following:

1. Product data for each component of the electrical distribution system.
2. Utility available fault contribution and impedance values.
3. Drawings, one-line, and riser diagrams showing system configuration, equipment designations, feeder lengths, and other applicable system characteristics.

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3.3 SYSTEM FAULT CURRENT ANALYSIS

A. Calculate the maximum available short-circuit momentary current and interrupting duties in amperes rms symmetrical for electrical power distribution system components. The calculation shall be performed for current immediately after initiation and for a three-phase bolted fault at each of the following locations:

1. Electric utility's supply termination.
2. Existing switchboard.
3. New branch circuit panelboards.
4. Generator output terminals.

B. Study the project's electrical distribution system from normal and alternate power sources throughout electrical distribution system.

C. For grounded systems, provide line-to-ground fault current values for areas as defined above for the three-phase, bolted fault, short-circuit study.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141, IEEE 241 and IEEE 242.

E. Study report:

1. Input data: Gather and provide the following input data, in tabular or graphic form, used to perform fault calculations and other studies in this section.

   a. Utility three-phase and line-to-ground available contribution with associated X/R ratios.
   b. Short-circuit reactance of rotating machines with associated X/R ratios.
   c. Cable type, construction, size, quantity per phase, length, impedance and conduit type.
   d. Transformer primary & secondary voltages, winding configurations, kVA rating, impedance, and X/R ratio.
   e. Circuit breaker types and sizes.

2. Methods and assumptions: Indicate calculation methods and assumptions that may have been used to perform analysis.
3. Results: Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram. Provide the following in a table format:

   a. Source fault impedance and generator contributions
   b. X/R ratios
   c. Asymmetry factors
   d. Motor contributions
   e. Short circuit KVA
   f. Symmetrical and asymmetrical fault currents

4. Equipment evaluation and conclusions:

   a. Verify interrupting ratings and withstand ratings are equal to or higher than calculated fault current levels.
   b. Verify adequacy of phase conductors at maximum three-phase, bolted fault currents.

5. Recommendations: List recommendations for equipment with inadequate ratings. Notify Engineer, in writing of existing equipment improperly rated for the calculated available fault current of the system.

3.4 AVAILABLE FAULT CURRENT LABELS

A. Provide a machine printed adhesive label on the enclosure for each switchboard and new panelboard. The label shall include the following information, at a minimum:

   1. Available fault current
   2. Calculation date

B. Labels will be based on calculated maximum available short-circuit momentary current and will be provided after the results of the analysis have been presented to the Owner and after any system changes, upgrades or modifications have been incorporated in the system.

C. Labels shall be in compliance with NFPA 70E and OSHA standards.

3.5 FIELD QUALITY CONTROL

A. Field adjustment: Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Engineer in writing of any required equipment modifications.

END OF SECTION

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