

Electrical Overcurrent Studies

Deliverables associated with electrical overcurrent studies are as follow :

a. Draft Reports

- i. Construction Related Projects have the following draft reports as detailed in the RFP:
 1. Preliminary Study Reports: Consist of Design Development and Intermediate Construction Document and Final Review Construction Document reports as detailed in the RFP. These reports are partial reports as described in the RFP submitted via email. The purpose of these reports is to convey the pertinent information and document any preliminary recommendations.
 2. “As-Drawn” Study: This report is a partial report as described in the RFP submitted via email. This is a report conducted at completion of design phase.
 3. “Construction” Study: This report is a partial report as described in the RFP submitted via email. This is a report conducted after submittal phase of the project to ensure equipment and devices being supplied are acceptable to the AFC and result in the lowest incident energy. AFC shall furnish construction arc flash hazard label printed on paper with “Preliminary” stamp to University for use during construction.
- ii. Non-Construction Related Projects have the following draft report as detailed in the RFP:
 1. Final Report Draft: Draft version of final report to convey the pertinent information for review and discussion and document any preliminary recommendations.

b. Infrared Scan Report – **When required by the RFP.**

- i. Report shall be submitted in hardcopy and softcopy format.
 1. Softcopy shall be in the form of a PDF file.
 2. Hardcopy shall be in the form of a bound report with color photographs.
- ii. Report shall be separately bound from all other study reports.
- iii. Report shall contain the following sections:
 1. Cover sheet that identifies the building name, building abbreviation, date of review, AFC Company contact information.
 2. Summary that identifies extent of work performed, equipment utilized and significant findings.

3. Findings and Recommendations: Identify any equipment that requires further review and preventive maintenance by University staff. Include representative digital images to aid in the review and correction of issues.
- c. Final Report - Softcopy
 - i. Compact Disk #1: PDF files only. (Label shall read "Report Copy".)
 - ii. Compact Disk #2: PDF, Excel, DWF, SKM Backup Files (Label shall read "Archive Copy".)
 - d. Final Report Format- Hardcopy
 - i. Report Binders shall be black vinyl covered cardboard nominally 11.75" Tall by 10.5" Wide with clear plastic sleeves on the outside front, back and spine for insertion of printed coversheets. The integral binder shall be three (3) ring, D shape with minimum size of 1" and maximum size of 4". The size of binder used shall be consistent with report being bound.
 - ii. Report covers shall be consistent with the sample reports and shall include the following information:
 1. Back Cover: AFC Company contact information centered at bottom of cover.
 2. Spine: Information with bottom of text toward back of binder from left to right:
 - a. Left end: University Logo.
 - b. Centered: Building Name with Building Abbreviation (All Caps, large type, bold font) below
 - c. Right end: "Arc Flash Study", Report Date below in format "09/30/2010"
 3. Front Cover: University Logo, Building Name, Building Abbreviation, "Arc Flash Study", Date, AFC Company Logo.
 - iii. Tabbed Dividers: Report shall be tabbed with labeled dividers for each section.
 - iv. Pages: Pages shall be printed double sided and numbered by section, when appropriate, in the lower right hand corner. (Make note of the requirement for overcurrent protective device tabular information to be located on left side with associated Time Current curve on the facing page located on the right side printed in color.)
 - v. Drawing sleeves shall be clear plastic, three-hole punched sized for 8.5" x 11" paper. A separate sleeve shall be provided for each drawing. Drawings shall be folded and inserted into the sleeve so that the title block is visible.
 - vi. Compact Disk Sleeves shall be clear plastic three-hole punched and sized to hold two compact disks.

- vii. Compact Disks shall have label with University Logo, Building Name, Building Abbreviation (all caps, large type, bold), Arc Flash Study, Report Date (style 09/30/2010) and “Report Copy” or “Archive Copy” as appropriate.
 - viii. Drawings shall be produced per CADD standards and shall be D-Size drawings with a University standard border that contains the applicable information about the project. Drawing text shall be 13 point and Bus names shall be 12 point bold.
- e. Final Report Contents –**Construction Related projects**
- i. Table of Contents: Report shall contain a table of contents with numerical chapters and page numbers indicated.
 - ii. Introduction: Report shall contain brief summary of the study, including the project name, building name and name and contact information for the AFC. The introduction should describe the format of the report and what is contained within each chapter.
 - iii. Findings and Recommendations: This section of the report shall be separated into three areas:
 - 1. AFC shall identify on a line by line basis all locations with a greater than Category 2 hazard level and include an accompanying recommendation to lower the incident energy to achieve a PPE Category of 2 or lower.
 - 2. AFC shall identify on a line by line basis any Overcurrent Protective Device coordination issues and include an accompanying recommendation to improve coordination.
 - 3. AFC shall identify any protective devices that appear to have inadequate interrupting capacity.
 - iv. Table of Calculated Arc Flash Data (As Found) – **Construction Related projects when project has existing structures when applicable.**
 - 1. Narrative summary.
 - 2. Table Arc Flash Evaluation IEEE 1584 Bus + Line Side Report. (Table shall be based on running multiple scenarios to report the worst case condition.)
 - v. Table of Calculated Arc Flash Data
 - 1. Narrative summary.
 - 2. Table Arc Flash Evaluation IEEE 1584 Bus + Line Side Report. (Table shall be based on running multiple scenarios to report the worst case condition.)
 - vi. Single Line Diagrams:
 - 1. Narrative description and schedule of drawings included.

2. An accurate detailed One-Line electrical diagram of the system shall be created as part of this project. Information on the One-Line Diagram shall include, but not be limited to:
 - a. Electrical Structure
 - b. Voltage at each point (e.g. 480/277, 120/240, 120/208, etc.)
 - c. Bolted short circuit current available at each point in the system.
 - d. Horsepower of major motors connected to the system from 50 Hp and above.
 - e. Plant standard names of all panels and equipment.
 - f. Room numbers for location of all panels and equipment.
 - g. Arc Flash Incident Energy Levels at each point in Cal / cm²
 - h. Transformer sizes
 - i. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- vii. Feeder and Transformer Data
 1. Table of SKM input data for cables, transformers, utilities, etc.
 2. Single Line diagram with data blocks indicating the following values:
 - a. Transformer Data
 - b. Cable Data
 - c. Fuse/Circuit Breaker Data
 - d. Calculated Fault Currents Shown at Busses
 - e. Calculated PPE Requirements Shown at Busses
- viii. Summary of Calculated Fault Currents
 1. Narrative summary of findings and brief description of analysis.
 2. “Dapper Unbalanced Fault Report” Separate Fault Reports shall be included for each utility and standby power scenario.
- ix. Coordination Curves, Device Settings (As Found) – **Construction Related projects when project has existing structures when applicable.**
 1. Narrative summary.
 2. Device information and settings and associated Time vs Current curves on facing pages.
- x. Coordination Curves Device Settings
 1. Narrative summary.

2. Device information and settings and associated Time vs Current curves on facing pages.

f. Final Report Contents – **Non-Construction Related**

- i. Table of Contents: Report shall contain a table of contents with numerical chapters and page numbers indicated.
- ii. Introduction: Report shall contain brief summary of the study, including the project name, building name and name and contact information for the AFC. The introduction should describe the format of the report and what is contained within each chapter.
- iii. Findings and Recommendations: This section of the report shall be separated into three areas:
 1. AFC shall identify on a line by line basis all locations with a greater than Category 2 hazard level and include an accompanying recommendation to lower the incident energy to achieve a PPE Category of 2 or lower.
 2. AFC shall identify on a line by line basis any Overcurrent Protective Device coordination issues and include an accompanying recommendation to improve coordination.
 3. AFC shall identify any protective devices that appear to have inadequate interrupting capacity.
- iv. Table of Calculated Arc Flash Data (As Found)
 1. Narrative summary.
 2. Table Arc Flash Evaluation IEEE 1584 Bus + Line Side Report. (Table shall be based on running multiple scenarios to report the worst case condition.)
- v. Table of Calculated Arc Flash Data (Recommendations Implemented)
 1. Narrative summary.
 2. Table Arc Flash Evaluation IEEE 1584 Bus + Line Side Report. (Table shall be based on running multiple scenarios to report the worst case condition.)
- vi. Single Line Diagrams:
 1. Narrative description and schedule of drawings included.
 2. An accurate detailed One-Line electrical diagram of the system shall be created as part of this project. Information on the One-Line Diagram shall include, but not be limited to:
 - a. Electrical Structure
 - b. Voltage at each point (e.g. 480/277, 120/240, 120/208, etc.)

- c. Bolted short circuit current available at each point in the system.
 - d. Horsepower of major motors connected to the system from 50 Hp and above.
 - e. Plant standard names of all panels and equipment.
 - f. Room numbers for location of all panels and equipment.
 - g. Arc Flash Incident Energy Levels at each point in Cal / cm²
 - h. Transformer sizes
 - i. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- vii. Feeder and Transformer Data
 - 1. Table of SKM input data for cables, transformers, utilities, etc.
 - 2. Single Line diagram with data blocks indicating the following values:
 - a. Transformer Data
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 - d. Calculated Fault Currents Shown at Busses
 - e. Calculated PPE Requirements Shown at Busses
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 - 1. Narrative summary of findings and brief description of analysis.
 - 2. “Dapper Unbalanced Fault Report” Separate Fault Reports shall be included for each utility and standby power scenario.
 - 3. Narrative summary of findings and brief description of analysis.
- ix. Coordination Curves, Device Settings (As Found)
 - 1. Narrative summary.
 - 2. Device information and settings and associated Time vs. Current curves on facing pages.
- x. Coordination Curves Device Settings (Recommendations Implemented)
 - 1. Narrative summary.
 - 2. Device information and settings and associated Time vs. Current curves on facing pages.
- g. Computer Files and Libraries
 - i. Narrative / Reports: A complete soft copy of report shall be submitted in PDF format.

- ii. Spreadsheets: All tables located in and referenced within the report shall also be submitted in Microsoft Excel format.
 - iii. SKM System Analysis Files: A complete set of project data files, libraries and output files in their native format.
 - iv. Drawing Files: Single line diagrams shall be submitted in AutoCAD DWF format.
- h. Labels
- i. Labels shall be standardized and comply with the requirements of the Arc Flash Label Standard that are attached as an exhibit to this document.
 - ii. Labels shall be printed for Line Side Incident Energy Levels only.
 - iii. Labels shall be supplied, printed and installed by the AFC. (The AFC shall turn over all extra label stock to the University.
 - iv. Labels shall be placed on the exterior surface of equipment and panel boards. Surface shall be properly prepared to receive the label. (Exception: Panel boards located in public corridors shall be labeled on the inside of the panel board door that is accessible without exposing energized parts.)
 - v. Refer to Arc Flash Label Standard for additional information.

The Arc Flash Hazard Assessment Label Standard shall be as follows:

A. General Label Requirements:

- a. Label shall be self adhesive.
- b. Label size shall be nominally 3.5" Wide by 4.75" Tall.
- c. Label with specific equipment information shall be provided and installed for every point in the system as identified in the Arc Flash Hazard Analysis Scope of Services .
- d. Labels shall be ANSI Z535 (American National Standard for Product Safety Signs and Labels) Compliant.
- e. Label shall be water proof and UV stable.
- f. Quantity of six different labels with one for each category (Cat): 0, 1, 2, 3, 4 and Dangerous.
- g. Approved manufacturer of preprinted label stock: Brady.

B. General Information Requirements

(All location specific data shall be right justified on the label.)

- a. Room:
 - i. <Data field with Room #>
 - ii. Format example: "3102"
- b. Date:
 - i. <Data field with Month (3 Letter Format) / Year (4 Digit Format)>

- ii. Format example: “Apr / 2011”
- c. Device Name:
 - i. <Data field with Device Name>
 - ii. Format example: “ELP3L-B-1”
- d. Fed From:
 - i. <Data field with upstream Device Name>
 - ii. Format example: “ESDPPH-1 EDS-3 Disc”
- e. Arc Flash Hazard Boundary:
 - i. <Data field with distance in inches>
 - ii. Format example: “4 inches”
- f. Incident Energy at:
 - i. <Data field with distance in inches> <Data field with incident energy in ### cal/cm²>
 - ii. Format example: “18 inches 6.00 cal/cm²” (Note that incident energy shall be indicated to two decimal places.)
- g. Shock Hazard Exposure:
 - i. <Data field with voltage in volts>
 - ii. Format example: “208 Volts”
- h. Limited Approach Boundary:
 - i. <Data field with distance in inches>
 - ii. Format example: “42 Inches”
- i. Restricted Approach Boundary:
 - i. <Data field with distance in inches>
 - ii. Format example: “Avoid Contact”
- j. Prohibited Approach Boundary:
 - i. <Data field with distance in inches>
 - ii. Format example: “Avoid Contact”
- k. Calculations per IEEE 1584 (Preprinted on label.)
- l. University of Chicago Logo (Preprinted on label.)”

C. Category 0-4 Label Requirements:

- a. Top of the label shall have the words “! Warning” in black letters with orange background.
- b. Just below the warning the label shall include the following: “Arc Flash and Shock Hazard Appropriate PPE Required” in black letters on white background.
- c. The bottom of the label will be color coded based on the category and will describe the minimum PPE requirements as well as the Category #:
 - i. Cat 0 – Black letters on white background.
 - ii. Cat 1 – Black letters on green background.
 - iii. Cat 2 – Black letters on yellow background.
 - iv. Cat 3 – Black letters on orange background.

- v. Cat 4 – Black letters on red background.

D. Category Dangerous Label Requirements:

- a. Top of the label shall have the words “! Danger” in black letters with red background.
- b. Just below the dangerous the label shall include the following: “NO SAFE PPE EXISTS” in black letters on white background followed by “ENERGIZED WORK PROHIBITED”.
- c. The bottom of the label will be color coded based on the category and will describe the minimum PPE requirements as well as the Category #:
 - i. Dangerous – Black letters on red background.

E. Project specific data shall be printed using Brady software and imported data from SKM via a Microsoft Excel Spreadsheet:

- a. The SKM program creates an “Arc Flash Evaluation” table showing the results of the analysis. In the SKM program this table can be “saved” as an excel spreadsheet.
- b. The saved excel spreadsheet is then modified for printing labels. (Note that one of the required manual modifications will include the addition of a column containing room numbers for the equipment.)
- c. The user must then create a template for printing the data onto the selected label. This template is unique based on the label making software, printer, and personal preferences of the user.
- d. The label making software allows importing data from an excel spreadsheet to be used with the template.
- e. Load the appropriate label roll into the printer and send the label file to the printer.
- f. Cut each printed label and sort for application.
- g. Text size and font shall match the attached examples.
- h. Custom labels are preprinted and obtained from Brady.
- i. The Brady part numbers are:
 - i. Cat 0 Y1442386
 - ii. Cat 1 Y1442387
 - iii. Cat 2 Y1442388
 - iv. Cat 3 Y1442389
 - v. Cat 4 Y1442390
 - vi. Dangerous Y1442391