ARC FLASH HAZARD ANALYSIS

GENERAL OVERVIEW

1 The purpose of the analysis is to determine arc flash energy levels and required PPE categories at various points in the existing electrical power distribution system. The analysis is based on existing field data that represents the system "as installed". In addition to identifying what current arc flash levels are, the analysis will attempt to minimize arc flash levels by recommending changes to fusing and breaker trip settings to try and keep PPE categories to levels 0, 1 and 2 throughout the facility. This isn't always possible, but a reasonable attempt will be made.

2 In order to accomplish the above, detailed data is required on the existing power distribution system. The most critical data involves overcurrent devices such as fuses, breakers and protective relays. Overcurrent device data is critical because the time it takes to clear a fault is related to the arc flash level. The quicker the fault clears, the lower the arc flash level. To simplify the data collection process, we have developed Field Data Sheets to be used by qualified electrical personnel.

3 The analysis will typically include all transformers, cables, switchgear, panelboards, motor control centers (MCCs), and fused disconnect switches. On-site generators will also be included in the study. The analysis typically begins at the Utility Transformer(s) and includes the above equipment through the 480 volt level. Only 240/208 volt panels are included in the detailed analysis if they are fed from a 125 kVA transformer or larger (reference IEEE 1584). The 240/208 panelboards that are not included will still get generic warning labels with a minimum NFPA 70e PPE classification. We will just need to know how many panels, so that we can print the correct number of generic labels.

4 MCCs will get one Arc Flash Rating per MCC. This rating will be the worst case for the MCC (typically at the Main Lugs or Main Fuse/Breaker). During a fault, motors act as generators and momentarily contribute current to the fault. For this reason, we require motor load data for each MCC. We typically group motors into two groups (<= 50 HP and >50 HP).

5 Data will be input into EasyPower software for detailed analysis. The analysis is based on a combination of the IEEE 1584 and NFPA 70E calculations for arc fault currents.

6 If cable data is not available, the analysis will assume cable sizes based on cable ampacities as detailed in the National Electrical Code (NEC).

7 When the analysis is complete, the following reports and data will be provided to customer:
   a. A copy of the EasyPower (*.dez) file.
   b. One-Line Diagram(s) printed directly from EasyPower showing the following information:
      i. Arc Flash Boundary at each bus
      ii. Incident Energy at each bus
      iii. Recommended PPE Category at each bus
   c. A spreadsheet report showing the above information plus additional details including fault currents and clearing times. This report will be provided as a hard copy report and electronically as a CSV file for opening in Microsoft Excel.
   d. Arc Flash Warning Labels printed on Brady die-cut White/Orange Vinyl with black letters.
   e. Coordination curves may be provided where necessary to illustrate a specific point with regard to minimizing arc flash levels.

9417 Raven Hollow Rd. Brentwood, TN 37027
Contact: Michael Goslak, P.E. (615) 500-4242 mgoslak@ThorEngineer.com

DATA SHEET INSTRUCTIONS

1 The goal is to provide one Arc Flash Warning Label per Bus or Panel Board or stand-alone disconnect switch. In other words, for a Motor Control Center with 28 motor starters, we will still only have 1 warning label. The warning label will be based on the Arc Flash Energy at the Main Lugs or Main Breaker. A label will be placed on each vertical section, but it will be the same label.

2 Use 1 data sheet for each type of equipment in the system. For example, if there are 50 Panelboards, then you will need to print 50 Panelboard data sheets.

3 Start with an accurate facility one-line diagram and use it as a guide. Highlight or mark-off each piece of equipment on the one-line as you complete it.

4 The Equipment ID on the data sheet needs to match the Equipment ID on the one-line. For example, if it is called MCC-01 on the one-line, then make sure the data sheet reads MCC-01.

5 A Panelboard consists of multiple breakers or fused switches. Use the Panelboard sheet followed by a breaker sheet for every breaker in the Panelboard.

6 A Substation will comprise of a panelboard/breakers plus a transformer. You'll need all the sheets together to make up the substation.

7 For an MCC, we are asking for the largest motor info. so that if we have to adjust the upstream overcurrent device trip setting, we can use the motor starting curves to ensure the motor will still start (coordination). In addition, to the largest motor for each MCC we need to know total connect horsepower. For each MCC, add up all the motor HPs that are <=50 HP and record that number, then add up all the motor HPs that are >50 HP and record that number.

8 If the MCC feeds another 480 volt panel, then attach a breaker sheet, feeder cable sheet and then continue on to the panel.

9 Remember: The sheets should all work together to tell a story. Provide Equipment ID's that make sense or match the One-Line. In some cases, the customer has no accurate facility one-line diagram and we have to build a one-line diagram from these sheets.

9417 Raven Hollow Rd. Brentwood, TN 37027
Contact: Michael Goslak, P.E. (615) 500-4242 mgoslak@ThorEngineer.com

A Sample Field Data Collection Sheet

(for a circuit breaker)

BREAKER DATA SHEET		
Parameter	Actual Nameplate Data	Example
Description / PanelBoard ID:		PP-01
EQUIPMENT ID:		MCB-01
Feeds Equipment ID:		MCC-01
Manufacturer		GE
Series/Model		AKR-30H
Voltage		13.8 KV
Continuous Rating		800
Interrupting Rating		65 K AIC
Trip Unit Manufacturer		GE
Trip Unit Type		MVT Plus
Trip Unit Series/Style		MCCB-SG
Sensor		1200
Plug		800
Long Time Trip Setting/Dial		.5 (A)
Long Time Trip Delay		1 second
Short Time Trip Setting/Dial		1.5
Short Time Trip I^2t (in/enabled or out/disabled)		in
Short Time Trip Delay		5 seconds
Ground Fault Trip Setting/Dial		1.5
Ground Fault Trip I^2t (in/enabled or out/disabled)		in
Ground Fault Trip Delay		5 seconds
Instantaneous Trip Setting/Dial		1.5
Comments		

9417 Raven Hollow Rd. Brentwood, TN 37027
Contact: Michael Goslak, P.E. (615) 500-4242 mgoslak@ThorEngineer.com

A Sample Arc Flash Warning Label

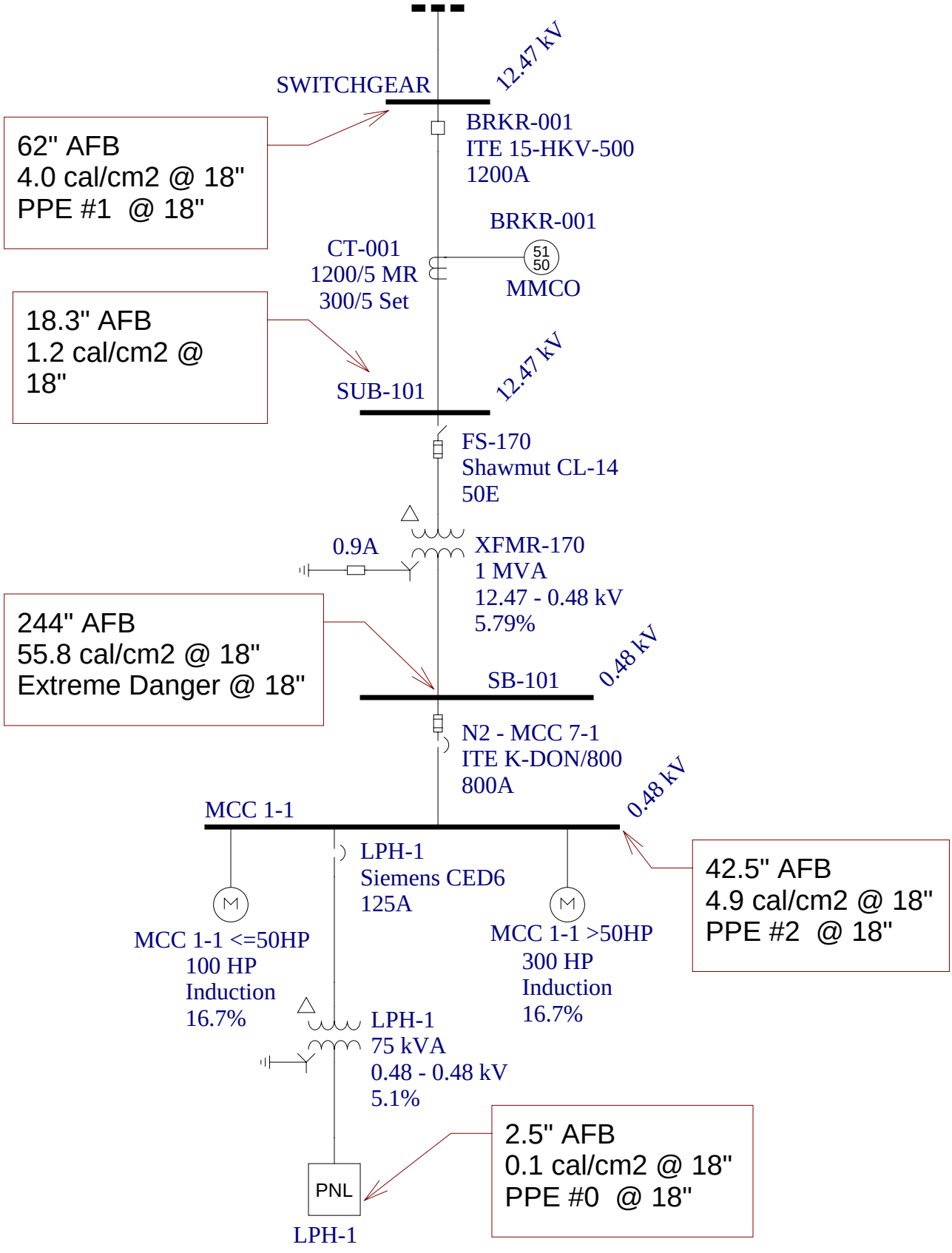
(generated by EasyPower)

Arc Flash and Shock Hazard
Appropriate PPE Required

2' - 0"	Flash Hazard Boundary
2.7	cal/cm2 Flash Hazard at 18 Inches
#1	PPE Level
	FR shirt and FR pants or FR coverall
0.48	kV Shock Hazard when cover is removed
3' - 6"	Limited Approach
1' - 0"	Restricted Approach - Class 00 Voltage Gloves
0' - 1"	Prohibited Approach - Class 00 Voltage Gloves

Equipment Name: FMCC-1

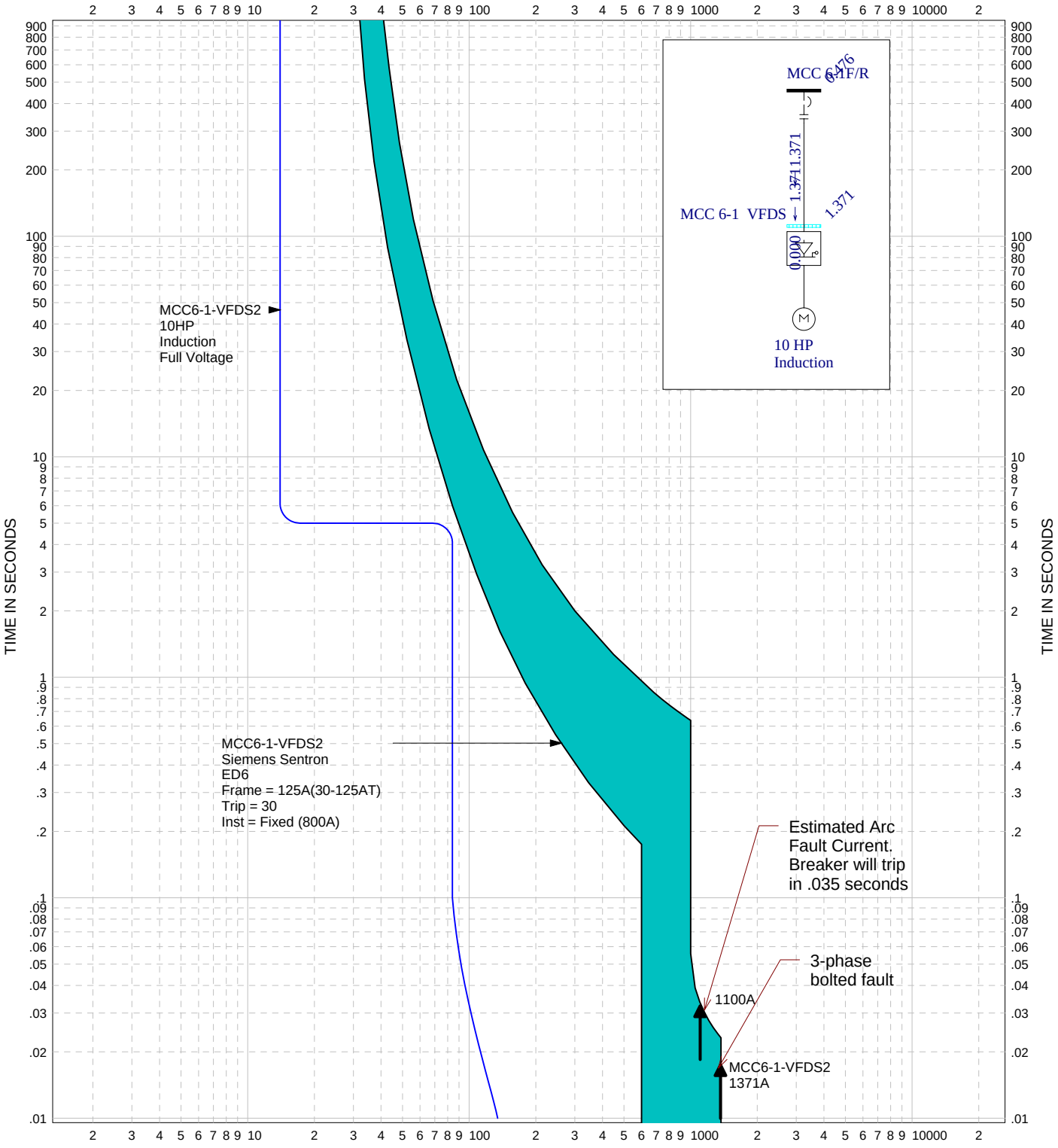
9417 Raven Hollow Rd. Brentwood, TN 37027
Contact: Michael Goslak, P.E. (615) 500-4242 mgoslak@ThorEngineer.com



Thor Engineering, LLC
9417 Raven Hollow Rd.
Brentwood, TN 37027

Sample Arc Flash One-Line

CURRENT IN AMPERES AT 480 VOLTS



CURRENT IN AMPERES AT 480 VOLTS

Thor Engineering	***EasyPower*** ® **TIME-CURRENT CURVES**	480 Volt MCCB
Curve of a 30 Amp 480 volt Molded Case Circuit Breaker. Arc Fault current is shown as well as the maximum 3-phase bolted fault current.		FAULT: DATE: Oct 25, 2005 BY: Michael J. Goslak, P.E. REVISION: 1

BROOKNEAL_ARCFLASH