

# Arc Flash Study of VA Medical Center Fort Wayne, IN

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- 1 Building 6 & 17 One-Line Drawings (2 Pages)
- 2 Building 6 & 17 Arc Flash Calculations (1 Page)

## 1.0 Introduction

A large amount of energy exists in electrical systems. In the event of a fault in electrical equipment, this energy can be released in the form of an arc flash. An arc flash is an explosion releasing superheated plasma temperatures exceeding 5000 degrees Fahrenheit. This blast can expel molten metal and shrapnel capable of serious injury and frequently death to electrical workers. A study must be conducted to determine the amount of incident energy present at all locations in an electrical distribution. This study specifies the amount of personal protective equipment (PPE) should be worn while performing work on energized electrical equipment.

This document reports on the results of arc flash hazard study of the commercial power system as displayed in Attachment 1.

The goal of the study was to calculate the arc flash incident energies and arc flash protection boundaries at locations that pose an arc flash hazard risk, and produce NFPA 70E-compliant arc flash hazard labels for such locations.

## 2.0 Overview of Electrical Distribution System

Attachment 1 presents the one-line diagrams of the power system under study. The electrical system is a campus-wide distribution fed by two 12,470 Volt utility circuits located at Building 16.

- Building 6 is fed from Circuit 18 in the 480V switchgear in Building 1.
- Building 17 is fed from 480V Switchboard South in Building 1.

## 3.0 Arc Flash Study Results

The objectives of the arc flash hazard compliance study were to calculate the arc flash incident energies and arc flash protection boundaries at locations that pose an arc flash hazard risk, and produce arc flash hazard labels compliant with the VA Electrical Design and with NFPA 70E-compliant for such locations.

NFPA 70E-compliant arc flash computations were performed per IEEE 1584 with the Arc Flash Evaluation module of the SKM Power Tools for Windows Electrical Software and are listed in Attachment 2.

Arc flash incident energies are calculated and grouped into five categories based on the personal protective equipment (PPE) necessary to wear or equip while performing maintenance on electrical equipment.

Category 0: 0 – 1.2 cal/cm<sup>2</sup>

Category 1: 1.2 – 4.0 cal/cm<sup>2</sup>

Category 2: 4.0 – 8.0 cal/cm<sup>2</sup>

Category 3: 8.0 – 25 cal/cm<sup>2</sup>

Category 4: 25 – 40 cal/cm<sup>2</sup>

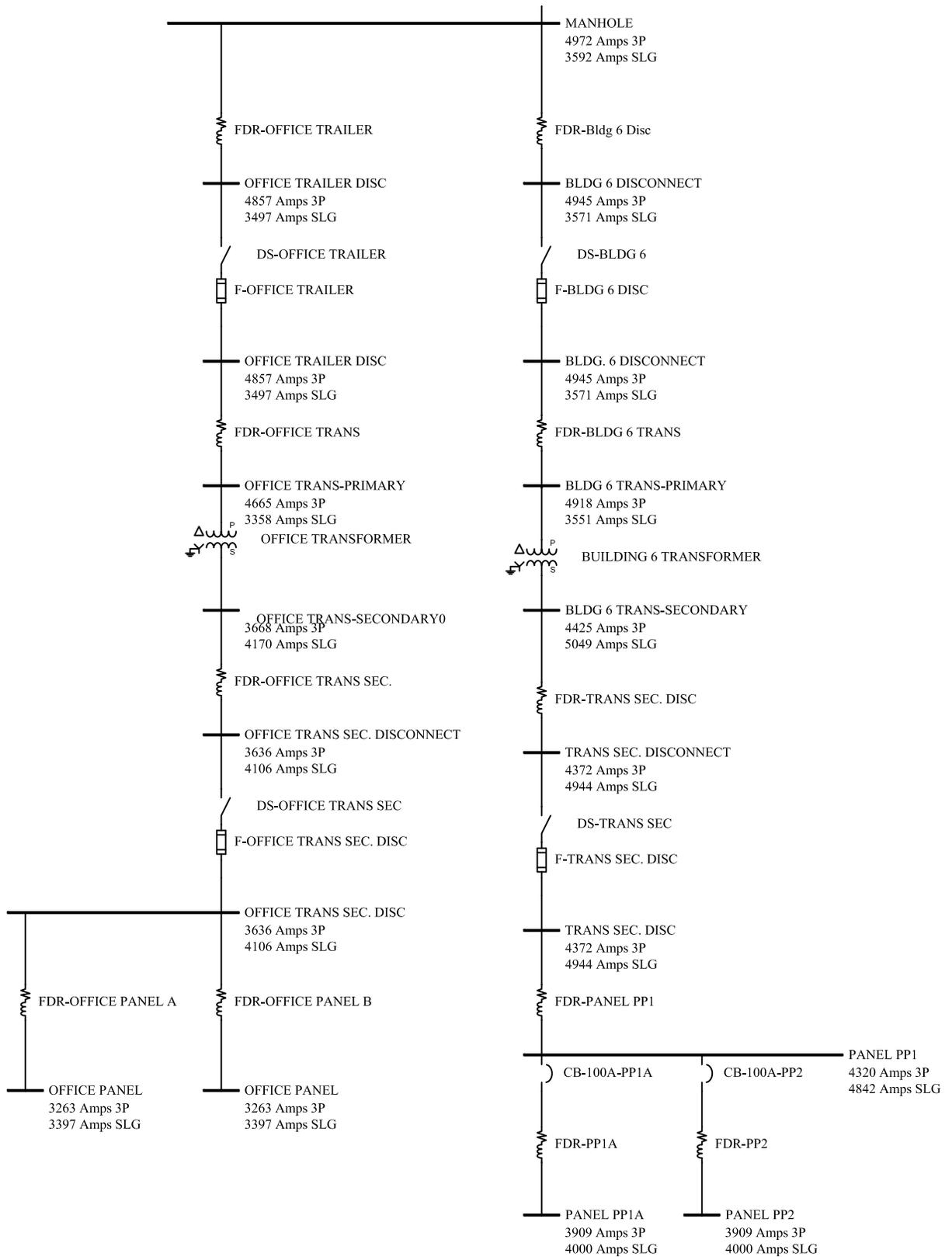
**Dangerous: greater than 40 cal/cm<sup>2</sup> No PPE exists to protect workers at this level. No work should be completed on energized equipment with a Dangerous label.**

The labels included as Attachment 3 have been produced in accordance with the values listed above and provide information regarding the required PPE. These labels include mitigated incident energies that include circuit breaker setting changes as noted in section 3.1. However, the labels do not include any mitigation strategies noted in sections 3.2 or 3.3.

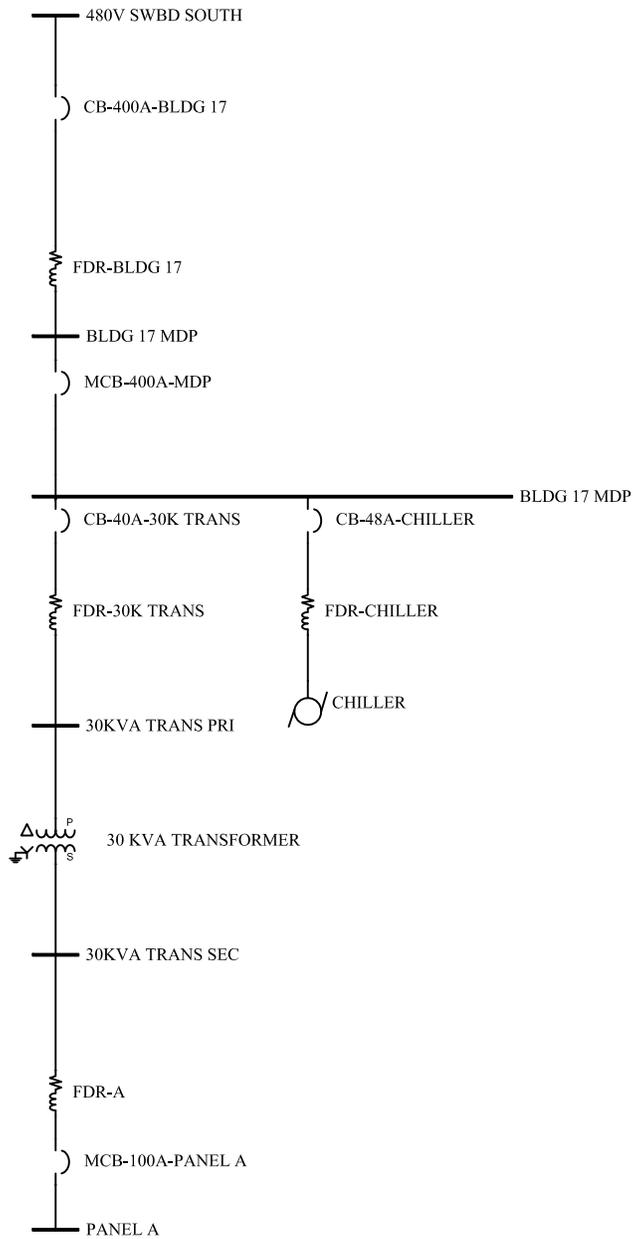
## 4.0 Assumptions & Limitations

The underlying assumptions and limitations of the results of this report are listed as follows:

- 4.1 The arc flash study of this report is limited solely to the determination of information to meet the arc flash labeling requirement of NFPA 70E and the VA Electrical Design Guide. The results of this study do not address worker protection from electric shock or the serious physical injuries that can result from the arc blast event. As a result, even if the worker is outfitted with Personal Protective Equipment based on the results of this study, there is no guarantee that the worker will be protected from injury due to an arc flash event.
- 4.2 The arc flash study of this report is not a substitute for electrical safety training and an ongoing electrical safety program to direct both in-house and contracted workers who work on or near energized electrical equipment. Simply affixing arc flash labels to electrical equipment does not satisfy OSHA and NFPA 70E requirements to reduce worker exposure to electrical hazards. In accordance with NFPA 70E, the arc flash study results and arc flash labels of this report shall be reviewed within five years of the report date or sooner for any change in the electrical system.
- 4.3 The studies of this report do not address compliance of electrical and safety codes.
- 4.4 The accuracy, effectiveness and completeness of the results of this report are contingent on the accuracy and completeness of the information (i.e. diagrams, drawings, field data, etc.) that was utilized in the preparation of this report. Therefore, any inaccuracy, inconsistency, or absence in or change to this information shall invalidate the results of this report and necessitate a redo of these studies at additional cost to the Client and/or User.
- 4.5 The accuracy, effectiveness and completeness of the results in this report are contingent on the expected performance of the electrical equipment from the manufacturers' literature. As such, any deviation from the expected performance of the electrical equipment (due to detrimental service conditions, excessive duty, excessive wear or aging, exposure to prior overloading or faults, manufacturing tolerances, incorrect operation, inadequate maintenance and testing, out-of-calibration, manufacturing defects, poor installation practice, etc.) shall invalidate the results of this report and necessitate a redo of these studies at additional cost to the Client and/or User.
- 4.6 All technical information is correct to the best of Apogee Consulting Group's knowledge; however, liability is disclaimed as to the accuracy, exclusion of printing errors, of the information provided in connection with these studies in this report.



BUILDING 6



BUILDING 17

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault	Prot Dev Bolted Fault	Prot Dev Arcing Fault	Trip/Delay Time	Equip Type	Gap (mm)	Arc Flash Boundary	Working Distance (in)	Incident Energy (cal/cm <sup>2</sup> )	Required Protective FR Clothing
BLDG 6 DISCONNECT	MaxTripTime @2.0s	0.480	4.94	4.94	3.59	2	PNL	25	106	18	22	Category 3
BLDG 6 TRANS-PRIMARY	F-BLDG 6 DISC	0.48	4.92	4.92	3.04	0.145	PNL	25	19	18	1.33	Category 1
BLDG. 6 DISCONNECT	F-BLDG 6 DISC	0.48	4.94	4.94	3.05	0.142	PNL	25	19	18	1.31	Category 1
OFFICE PANEL	F-OFFICE TRANS SEC. DISC	0.240	3.26	3.26	2.04	2	PNL	25	18	18	1	Category 0
OFFICE PANEL	F-OFFICE TRANS SEC. DISC	0.240	3.26	3.26	2.04	2	PNL	25	18	18	1.2	Category 0
OFFICE TRAILER DISC	MaxTripTime @2.0s	0.480	4.86	4.86	3.54	2	PNL	25	105	18	22	Category 3
OFFICE TRANS SEC. DISC	F-OFFICE TRANS SEC. DISC	0.24	3.64	3.64	2.20	2	PNL	25	18	18	1.20	Category 0
OFFICE TRANS-PRIMARY	F-OFFICE TRAILER	0.48	4.66	4.66	2.91	0.062	PNL	25	11	18	0.54	Category 0
OFFICE TRANS-SECONDARY0	F-OFFICE TRAILER	0.24	3.67	3.67	2.22	2	PNL	25	18	18	1.20	Category 0
PANEL PP1	F-TRANS SEC. DISC	0.21	4.32	4.32	2.41	2	PNL	25	18	18	1.20	Category 0
PANEL PP1A	CB-100A-PP1A	0.21	3.91	3.91	2.25	0.022	PNL	25	5	18	0.15	Category 0
PANEL PP2	CB-100A-PP2	0.21	3.91	3.91	2.25	0.022	PNL	25	5	18	0.15	Category 0
TRANS SEC. DISC	F-TRANS SEC. DISC	0.21	4.37	4.37	2.43	2	PNL	25	18	18	1.20	Category 0
30KVA TRANS SEC	CB-40A-30K TRANS	0.208	1.50	1.50	1.15	2	PNL	25	18	18	1.20	Category 0
BLDG 17 MDP	CB-400A-BLDG 17	0.480	10.48	10.38	6.76	0.04	PNL	25	15	18	0.88	Category 0
PANEL A	MCB-100A-PANEL A	0.208	1.41	1.41	1.10	1.946	PNL	25	18	18	1.20	Category 0