

Document Type	New Generation Plant Construction Standard			Document Number	GEN-ENG-RELAY-0002
				Revision Number	5
SUBJECT:	Arc Flash Hazard Standard				
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Title of Approver	Relay Department Manager	Date:	5/10/2010		

SCOPE and DEFINITION

This standard covers the arc flash safety requirements for new generation plant construction. This standard is designed to protect personnel from serious injury or death in the event of an arcing fault.

CONSTRUCTION REQUIREMENTS

1. An arc flash study shall be performed based on the current version of IEEE standard 1584 and using SKM Power*Tools for Windows (PTW) software.
2. All electrical equipment shall be designed such that the incident energy levels from arc flash events shall be limited to 25 cal/cm² (a hazard category of 3). Where this is deemed infeasible, PacifiCorp Energy's protective relaying group shall be consulted.
3. Type 2B medium voltage arc resistant switchgear tested per the latest revision of IEEE Std C37.20.7 shall be installed for all applicable medium voltage locations.
4. The PTW model shall be based on the following (PacifiCorp Energy's protective relaying group should be consulted when any questions arise):
 - a. A two second arc flash duration shall be assumed for all locations where deemed feasible. Where location constraints or other concerns make this assumption invalid, the arc flash calculations shall be appropriately modified.
 - b. For 4160 VAC and above, the working distance shall be 36 inches. For all other voltages the working distance shall be 36 inches for drawout type breakers and 18 inches for all other equipment.
 - c. SKM Parameters should be consistent with the following screenshots:

Study Options [Close]

Standard and Unit | **Fault Current** | Report Options

Standard

IEEE 1584 - 2002/2004a Edition
 (NFA 70E 2009 Annex D.7)
 (Industry's Preferred Method)

NFPA 70E-2000/2004/2009 Edition
 (NFA 70E 2009 Annex D.5)

NESC 2007 Edition

Flash Boundary Calculation Adjustments

Above 1 kV, Trip Time <= 0.1s: Use 1.2 cal/cm² (5.0 J/cm²) for Boundary Cal

Equipment Below 1 kV: Use Incident Energy Equation to Calculate Boundary

< 240 V Report as Category 0 if Fed by XFMR < 125 kVA

Units

English Incident Energy: J/cm² cal/cm² Distance and Boundary: in feet
 Metric

OK Cancel Help

Study Options [Close]

Standard and Unit | **Fault Current** | Report Options

Max Arcing Duration

Use Global Max Arcing Time:
 > 240 Volts: 2.0 sec
 <= 240 Volts: 2.0 sec

Enter for Each Bus
 Max Arcing Time for Each Bus...

Arcing Tolerances...
 Pre-Fault Voltage...
 Fixed or Movable for Each Bus...

Include Transformer Tap
 Include Transformer Phase Shift

Define Grounded as SLG/3P Fault >= : 15.0 %

Reduce Generator / Synchronous Motor Fault Contribution To

300.0 % of Rated Current after 10.0 cycles

Apply To Generators Apply To Synchronous Motor
 Recalculate Trip Time Using Reduced Current

Induction Motor Fault Contribution

Include for: 5.0 cycles Exclude if < 75.0 hp

Treat Fuses As

All Current Limiting All Standard Specified in Library
 Use 1/2 or 1/4 cycles trip time if arcing fault is in current limiting range

Arc Flash Equations for Breakers and Fuses

Use Equipment Specific Arc Flash Equation in Protective Device Library

OK Cancel Help

*Although grounded is defined as 15% as shown in the options above, that is mainly to help SKM complete the calculations. Field verification should be made and anything that is resistively grounded or ungrounded should be marked as ungrounded in the study, per IEEE 1584.

Arcing Fault Current Tolerances

IEEE 1584 Standard

Low Voltage Open Air Low Tolerance:	<input type="text" value="-15.0"/>	%
Low Voltage Open Air High Tolerance:	<input type="text" value="0.0"/>	%
Low Voltage In Box Low Tolerance:	<input type="text" value="-15.0"/>	%
Low Voltage In Box High Tolerance:	<input type="text" value="0.0"/>	%
Medium/High Voltage Open Air Low Tolerance:	<input type="text" value="-15.0"/>	%
Medium/High Voltage Open Air High Tolerance:	<input type="text" value="0.0"/>	%
Medium/High Voltage In Box Low Tolerance:	<input type="text" value="-15.0"/>	%
Medium/High Voltage In Box High Tolerance:	<input type="text" value="0.0"/>	%

Buttons: OK, Cancel, Help

NFPA 70E - Calculate a second Incident Energy at

Low Voltage Equipments:	<input type="text" value="38.0"/>	% of Bolted Fault Current
Medium/High Voltage Equipments:	<input type="text" value="100.0"/>	% of Bolted Fault Current

Low Voltage: Bus Voltage <= 1000 Volts
Medium/High Voltage: Bus Voltage > 1000 Volts

Pre-Fault Voltage

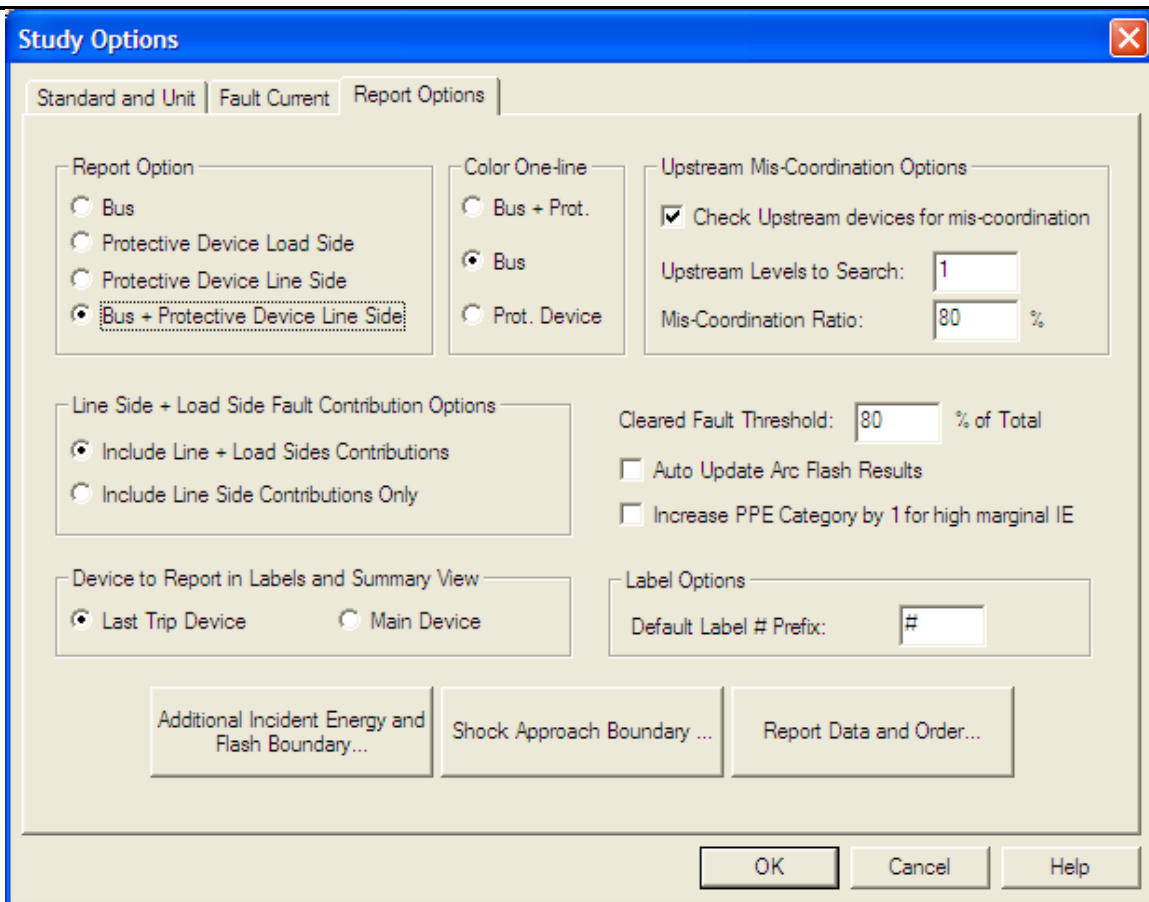
Load Flow Results

Per Unit Voltage For All Buses

Per Unit Voltage

No Load with Tap

Buttons: OK, Cancel



The PPE Table for SKM should be requested by Consultant from Company and the latest revision will be provided for loading into SKM.

5. Create a detailed report to include the topics in order as listed below. Two printed copies in three ring binders with section dividers shall be provided, along with a CD in each binder which should include electronic copies of report documentation and the SKM model project files (including PTW library file used for the study). Before the report is printed and any labels are created, the study results shall be discussed with Company. Any changes discussed shall be included in the final report.
 - a. Title Page (should include name of Consultant responsible for the arc flash review and the date the review was completed)
 - b. Table of Contents
 - c. Report summary (include a copy of the AF Summary results from SKM)
 - d. Description of different system operating configurations used for SKM scenarios
 - e. List of any assumptions
 - f. Screenshots of SKM options and Help -> About screen showing SKM version used.
 - g. SKM one-line diagram
 - h. List of all data used in the arc flash study (i.e. transformer, motor, and generator data, cable information, and protective device settings)
 - i. Any other documentation the Consultant deems appropriate to include
6. All applicable equipment shall be labeled with weather-resistant (and UV resistant where exposed to sunlight) arc flash labels using the following design as an example:



WARNING

Arc Flash and Shock Hazard

Appropriate PPE Required

36 inches	Flash Hazard Boundary
3.6 cal/cm²	Flash Hazard at 18 inches
Category 1	Cotton Underwear + FR Shirt & Pants + Face Shield + Std PPE(inc. hearing)
480 VAC	Shock Hazard when cover is removed
00	Glove Class
42 inches	Limited Approach
12 inches	Restricted Approach
1 inches	Prohibited Approach

Location: MCC-A1-3

10-28-09 UPDATE