ACIFICORP ENERGY A DIVISION OF PACIFICORP **Generation Engineering** Document Type New Generation Plant Construction Standard Document Number **GEN-ENG-RELAY-0002** 5 Revision Number SUBJECT: Arc Flash Hazard Standard Date: 5/10/2010 Review Date: 5/10/2010 Written By: Justin Rosenkrantz Approved By: Reviewed By: Mike Collins Mike Collins **Relay Department** 5/10/2010 Title of Approver Date: Manager

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:

Standard (© IEEE 1584 (NFPA 70E 2 (Industry's Pr	2002/2004a Edition © NFPA 70E-2000/2004/ 2009 Annex D.7) (NFPA 70E 2009 Annex ferred Method)	/2009 Edition C NESC 2007 Edition : D.5)
Flash Boundan Above 1 kV, Equipment Be	Calculation Adjustments rip Time <= 0.1s: Use 1.2 cal/cm^2 (5.0 J/cm^2) ow 1 kV: Use Incident Energy Equation to Calc Report as Category 0 if Fed by XFMR < 125 kVA) for Boundary Cal
Units © English	Incident Energy	Distance and Boundary
C Metric		OK Cancel Help

Standard and Unit Fault Current Report	t Options
Max Arcing Duration	Reduce Generator / Synchronous Motor Fault Contribution To
Use Global Max Arcing Time	300.0 % of Rated Current after 10.0 cycles
> 240 Volts: 2.0 sec	Apply To Generators
<= 240 Volts: 2.0 sec	Recalculate Trip Time Using Reduced Current
C Enter for Each Bus Max Arcing Time for Each Bus	Induction Motor Fault Contribution
Arcing Tolerances	Include for: 5.0 cycles Exclude if < 75.0 hp
Pre-Fault Voltage	
Fixed or Movable for Each Bus	Treat Fuses As
 Include Transformer Tap Include Transformer Phase Shift 	Use 1/2 or 1/4 cycles trip time if arcing fault is in current limiting range
Define Grounded as SLG/3P Fault >= : 15.0 %	Arc Flash Equations for Breakers and Fuses
	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.

IEEE 1584 Standard					or 1
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Low Voltage Open Air High Toler	ance:	0.0	%	L	
Low Voltage In Box Low Tolerand	ce:	-15.0	%	<u>_</u>	Teib
Low Voltage In Box High Toleran	ce:	0.0	%		
Medium/High Voltage Open Air L	ow Tolerance:	-15.0	%		
Medium/High Voltage Open Air H	ligh Tolerance:	0.0	%		
Medium/High Voltage In Box Low	v Tolerance:	-15.0	%		
Medium/High Voltage In Box Hig	h Tolerance:	0.0	%		
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Medium/High Voltage Equipment Low Voltage: Bus Voltage <= 1000 Vo Medium/High Voltage: Bus Voltage >	s: 100.0 : olts 1000 Volts	% of Bolted Faul	t Curre		
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	Color One-line Upstream Mis-Coordination Options Image: Bus Image: Check Upstream devices for mis-coordination Image: Bus Upstream Levels to Search: Image: Prot. Device Image: Mis-Coordination Ratio: Image: Options Cleared Fault Threshold: Image: Options Increase PPE Category by 1 for high marginal IE	n
-	Vevice Default Label # Prefix: #	

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:

