

CIRCUIT BREAKER TESTING - JOB SAFETY ANALYSIS

Title: Circuit Breaker Testing	
Purpose and Scope: Provide guidelines for testing of Circuit Breakers.	
Staffing Resources: Staff will have the minimum requirement of an Electrical Fitter/Mechanic Licence and be trained in the safe use of the required test equipment. Work will be carried out with a Safety Observer.	
Documentation/References: Condition Monitoring Acceptance Criteria (CMAC) AS 1931 – 1996 – High Voltage Test Techniques Parts 1 and 2 AS 2650 – 2005 – Common specifications for High Voltage A.C. Switchgear And Controlgear AS 2467 – 2008 – Maintenance of Electrical Switchgear AS 2067 – 2008 – Substations and high voltage installations exceeding 1kV AS62271.200 – 2005 - High Voltage Switchgear and Controlgear – Part 200: A.C. Metal-enclosed switchgear 1kV up to and inc. 52kV Circuit breaker Manual / Manufacturer’s Drawings Carry Out Field Testing SWP SP0506 Circuit Breaker Testing JSA SP0509R01 Circuit Breaker HV Withstand Test Report SP0509C02 Circuit Breaker Testing Competency Assessment SP0509C03 Commissioning Tool - Circuit Breaker SP0509C05	
Key Tools and Equipment: HV test equipment 5/10kV insulation tester. Variable DC voltage supply as required Timing Equipment. Micro-ohmmeter – minimum 50 amp capacity	
Development Team: Based on recloser testing JSA developed by Paul Blyth, Tony Lenz, Dean Maltby from Bowen, Robert Bates and Helena Tholsgard	Date Completed: 5 June 2003
Reviewed By: Robert Bates	Date Completed: 21 September 2004
Related SWP No.: SP0509	SWP Owner Approval:
Key Stakeholders:	

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Task No.	Task Step	Hazard	Most Likely Breakdown Event (Loss Of Control)	Most Likely Outcome (Incident Outcome)	Risk Score	
					Existing Controls	Additional/ Alternate Controls
5.1	Visual Inspection	Chipped or broken porcelain insulators, sharp metal edges Hazardous substances – insulating oil	Failure to inspect circuit breaker for hazards before commencing work	Cuts and lacerations	Low	Low
5.2	Insulating Medium Quality	Leaking bottles & hoses, release of SF6, contact with insulating oil	Failure to tighten fittings correctly, failure to inspect all hoses & fittings.	Asphyxiation, personal injury(frost bite), environmental damage	Low	
5.3	Insulation Resistance	High Test Voltages	Failure to keep all bystanders clear while testing	Minor shock and discomfort	Low	
5.4	HiPot Test	High Test Voltages	Failure to keep all bystanders clear while testing Failure to isolate, discharge and earth after testing	Electric Shock, burns	Low	
5.5	Contact Resistance	Heating from high test currents	Apply test current for excessive duration	Minor discomfort	Low	
5.6	Timing	Contact with control and measurement voltages	Failure to keep clear of live test voltages Failure to reduce or remove voltage sources before adjusting or moving test leads	Electric Shock, burns	Low	

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Existing Control Measures

Task No.	Elimination	Substitution	Engineering	Administration	Personal Protective Equipment	Risk Ranking			
						C = Consequences	E = Exposure	P = Probability	Risk Score
5.1	Control measures are in place as described in the JSA "Carry Out Field Testing" SP0506R01 and it's related SWP SP0506 as well as the SWP "Circuit Breaker Testing" SP0509 and in the "HSECH Risk Control Guide" ES000901R102				PPE – Long sleeve shirt and long trousers, safety footwear and protective eyewear.	1	6	5	Low
5.2						4	4	5	Low
5.3						1	4	5	Low
5.4						3	5	5	Low
5.5						1	5	6	Low
5.6						4	6	6	Low



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Additional/Alternative Control Measures

Task No.	Elimination	Substitution	Engineering	Administration	Personal Protective Equipment	Risk Ranking			
						C = Consequences E = Exposure P = Probability			
						C	E	P	Risk Score

1: DETERMINE CONSEQUENCE: - The most likely outcome of a potential incident resulting from exposure to the identified hazard.

Level	Descriptor	Definition
5	Disaster	Fatality; toxic release off-site with detrimental effect; financial loss (>\$1,000,000).
4	Very Serious	Extensive injuries (e.g. permanent disability, amputation) requiring medical treatment, hospitalisation and long term rehabilitation; off-site release with no detrimental effects loss of production capability; financial loss (\$500,000 to \$1,000,000).
3	Serious	Disabling injuries requiring medical treatment and rehabilitation (e.g. broken limbs, hospitalisation); on-site release contained with outside assistance; financial loss (\$50,000 to \$500,000).

2	Substantial	Medical treatment required (e.g. stitches, removal of foreign body); on-site release immediately contained financial loss (\$5,000 to \$50,000).
1	Minor	First aid treatment; negligible environmental damage; financial loss (<\$5,000).

2: DETERMINE EXPOSURE: - How often a person interacts with a hazard.

Level	Descriptor	Definition
1	Continuous	Many times a day.
2	Frequent	Daily.

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3	Occasional	Weekly.
4	Infrequent	Between weekly and monthly.
5	Rare	Between monthly and yearly.
6	Very Rare	Less than once a year.

3: DETERMINE PROBABILITY

The likelihood of the breakdown event and nominated consequences occurring once the person is exposed to the hazard.

Level	Descriptor	Definition
1	Almost Certain	Breakdown event will almost certainly occur from exposure to hazard.
2	Quite Possible	Not unusual for breakdown event occurring, even 50/50 chance.
3	Unusual but Possible	Unusual for breakdown event to occur but possible.
4	Remotely Possible	Remote possibility of breakdown event occurring but history of occurrence exists within industry.
5	Conceivable but Unlikely	No known history of breakdown event occurring after years of exposure but is conceivably possible.
6	Practically Impossible	Practically impossible for breakdown event to occur. Has never occurred before and is not likely to occur.

4: RISK ASSESSMENT MATRIX

Consequences (How Bad?)	Probability x Exposure				
	1 to 2	3 to 5	6 to 10	11 to 23	24 to 36
	Likelihood (How often?)				
	Almost certain will occur	Quite possible could occur	Possible	Unlikely but possible	Extremely unlikely
5. Disaster	Extreme	Extreme	Extreme	High	Moderate
4. Very Serious	Extreme	Extreme	High	Moderate	Low
3. Serious	Extreme	High	High	Moderate	Low
2. Substantial	High	Moderate	Moderate	Low	Low
1. Minor	High	Moderate	Low	Low	Low

5: RISK TREATMENT STRATEGY

Risk Score	Required Actions
Low	Implement control measures and verify compliance by routine monitoring.
Moderate	Action required within agreed timeframe to minimise risk to "As Low As Reasonably Practicable" (ALARP). Further action may be required and management responsibility specified to take this action. The ALARP principle implies that controls have been determined such that the level of risk-reducing action is in proportion to the benefit obtained.
High	Action as soon as possible to minimise risk to acceptable level. Requires attention by senior management and measures should be put in place to reduce the probability, exposure and/or consequence of the outcome occurring to ALARP.
Extreme	Same treatment as for high risks however immediate action required to minimise risk to acceptable level.

(Adapted from AS/NZS 4360:1999 Risk Management and NSCA Risk Score Calculator, 2001)