

JOB SAFETY ANALYSIS CAPACITOR BANK TESTING



Title: Capacitor Bank Testing	
Purpose and Scope: Provide guidelines for testing and commissioning Capacitor Banks.	
Staffing Resources: EFM and Safety Observer.	
Documentation/References: Carry Out Field Testing SWP SP0506 AS 2897 – 1986 Power Capacitors – Shunt – Rated Voltages above 660 V AC Test Equipment Manuals Capacitor Bank Manual / Manufacturer’s Drawings Carry Out Field Testing SWP SP0506 Capacitor Bank Test Report SP0513C01 and SP0513C02 Secondary Systems Daily Risk Assessment and Plan P71B05C38	
Key Tools and Equipment: PPE – Long sleeve shirt and long trousers, safety footwear and protective eyewear. HVIA Operating Equipment. Barriers Approved and calibrated test equipment. HV Test Set, Insulation Resistance Tester (5000 Volt minimum), multimeter, capacitance bridge, high speed recorder, current and voltage injection test set	
Development Team: Based on development work by Kim Dawson and Helena Tholsgard	Date Completed: 29 May 2003
Reviewed By: Robert Bates	Date Completed: 15 June 2005
Related SWP No.: SP0513	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
1	Preliminary Checks	Normal Field Hazards Live Electrical Apparatus Working environment (heat, cold, sun wind, lighting levels) Working at Heights	Slips, trips and falls Insufficient rest pauses	Minor cuts, sprains or abrasions	Low	
2	Inspection	Live Electrical Apparatus Working environment (heat, cold, sun wind, lighting levels) Working at Heights Uneven or loose gravel working surfaces Manual handling	Incorrect manual handling techniques Slips trips and falls Insufficient rest pauses	Minor cuts, sprains or abrasions Fatigue	Low	
3	Conduct Test	Live Electrical Apparatus Live Test apparatus – lethal currents Trip hazards from test leads and test equipment Working environment (heat, cold, sun wind, lighting levels) Working at Heights Uneven or loose gravel working surfaces Manual handling	Incorrect manual handling techniques Slips trips and falls Insufficient rest pauses Inadvertent contact with test voltages	Minor cuts, sprains or abrasions Fatigue Electric Shock,	Low	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
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 "Capacitor Bank Testing" SP0513				PPE – Long sleeve shirt and long trousers, safety footwear and protective eyewear.	1	4	5	Low
2	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 "Capacitor Bank Testing" SP0513				PPE – Long sleeve shirt and long trousers, safety footwear and protective eyewear.	1	4	5	Low
3	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 "Capacitor Bank Testing" SP0513				PPE – Long sleeve shirt and long trousers, safety footwear and protective eyewear.	2	4	5	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	Risk Score
1				Signs and barricades erected Only staff actually conducting test permitted within test area Use Test Permits		1	5	5	Low
3			Interlocks on fencing around HV Test enclosures Dead Man switch for HV testing in the field	Isolate all test equipment from supply prior to attaching, adjusting or removing any test connections		1	5	5	Low

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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.
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)