



Significant Incident Report No. 239

Subject: Low-voltage arc flash during switching operation

Date: 11 March 2016

Summary of incident

In September 2014, an electrician was performing a low voltage (415 V AC) switching operation on a switchboard. While working through the switching program there were problems isolating an individual switch (rated for 4,000 A).

The worker attempted to operate the switch a number of times by pressing the open button on the front panel, but the switch failed to open. After opening the switch panel door, he removed the glove on his right hand (Category 4 arc-flash rated) to spray an aerosol lubricant on to the tripping mechanism to free it up.

With the panel door open and glove off, the worker then tried to operate the switch by activating the tripping mechanism with a two-metre wooden broomstick. At this point there was an explosion and an arc flash. The worker received second-degree burns to his right hand.

The switch was severely damaged and much of the evidence destroyed. However, the arc flash seems to have propagated from the cluster contacts (where the switch plugs into the switchboard). It appears that the lubricant ignited, initiating the arc flash.

Note: It had become common practice to open the panel door when the switch failed to open, spray lubricant on the switch mechanism and activate the switch's mechanical trip function with an insulated object.



Damage to 4,000 A switch following incident

Direct causes

- The cluster contacts had a history of losing their spring tension and creating a hot joint.
- The aerosol lubricant was flammable when atomized and subject to a heat source.

- Work was performed outside of the safe work instruction and without performing a risk assessment for the change in the isolation process.

Contributory causes

- The switch had not been subject to a maintenance, test and repair program.
- The aerosol lubricant, labelled by the manufacturer as non-flammable and suitable for electrical equipment:
 - did not meet classification criteria for non-flammable aerosol
 - had an incorrect material safety data sheet (MSDS).
- The arc flash was not fully contained due to the open panel door on the switch enclosure.
- The electrical worker removed the glove (arc-flash rated) on his right hand.
- The arc-fault clearing time of the upstream over-current protection device was outside that prescribed in Clause 2.5.5.3 of AS/NZS 3000 *Electrical installations*.

Actions required

The following actions are recommended to reduce the potential for low-voltage arc flash incidents.

Inspection, testing and maintenance

- Routinely inspect, test and maintain electrical switchgear in a safe condition, having regard for the original equipment manufacturer's specifications.
- Report all defects identified with electrical equipment to the electrical supervisor.
- Set protective devices to limit, as far as is practicable, the harmful effects of a switchboard internal arcing fault (by automatic disconnection).

Safe systems of work

- Provide safe work instructions that cover the specific work undertaken.
- Assess workers as competent in electrical isolation before undertaking electrical work.
- Monitor the effectiveness of, and compliance with, safe systems of work.
- Confirm that workers are wearing appropriate personal protective equipment (PPE).
- Consider remote switching of all protection circuit breakers, which removes the operator from the arc flash danger zone. Conduct a protection coordination study of electrical power systems.

Further information

- Standards Australia, www.standards.org.au

AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)

- Department of Commerce, EnergySafety,
www.commerce.wa.gov.au/sites/default/files/atoms/files/cop_safe_low_volt_0.pdf

Safe low voltage work practices by electricians – code of practice

This Significant Incident Report was approved for release by the State Mining Engineer on 11 March 2016