



Mines Safety Significant Incident Report No. 192

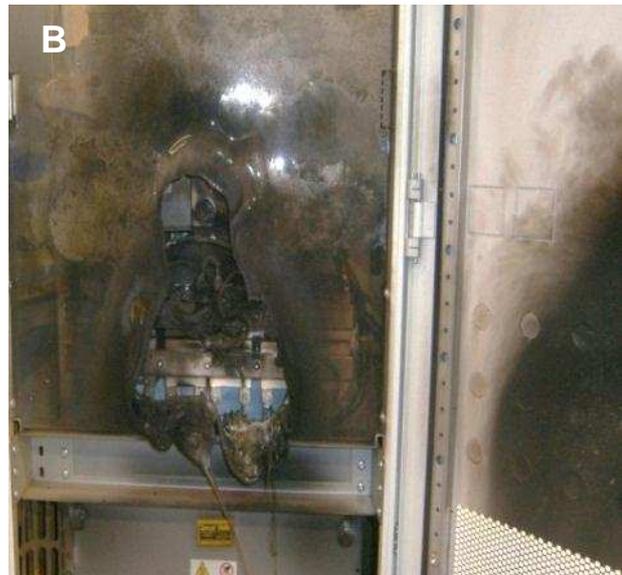
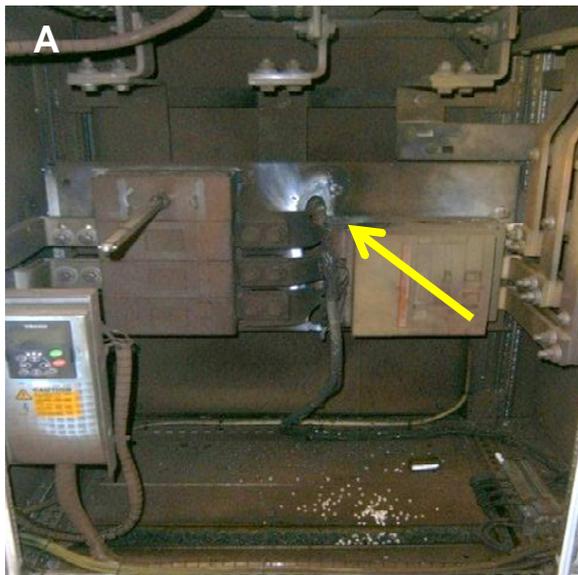
Short circuit fault in a variable speed drive results in fire, arcing and equipment damage

Summary of incident

Four 1000 kW drive motors were being used to drive an overland conveyer. A 5.5 MVA transformer powered a 690 V motor control centre (MCC), which fed three variable speed drives (VSDs), each controlling a drive motor. A fourth motor was controlled separately.

A short circuit fault in one variable speed drive developed into a line-to-ground fault. The resulting thermal stress caused a fire and arc flash within the variable speed drive.

The electrical installation, including cables, the 690 V motor control centre and three variable speed drives, was severely damaged. Electro-mechanical forces generated by the short circuit fault ripped the cables from the cable ladders. Fortunately, no-one was in the vicinity.



Photographs showing (A) location of initial short circuit fault in the VSD and (B) resultant arc damage to internal components

Probable causes

Direct:

- The variable speed drives were designed for a distribution system with a direct earth connection, at the neutral point of the supply transformer. The earth connection was separated from the neutral point and, therefore, the protection failed to operate.
- The designer failed to identify hazards associated with site earthing and protection on the engineering drawings and documentation.

Indirect:

- Testing of electrical equipment was only carried out at factory level. Site earthing and protection verification was not carried out.
- Site procedures and competencies were not adequate to ensure safe electrical installation.
- The cables were not secured to the cable ladder using clamps rated for potential short circuit current.

Actions required

Electrical installations at a mine site must comply with Part 5 of the Mines Safety and Inspection Regulations 1995. In particular, regulation 5.3 requires electrical installations and equipment at a mine to be designed, installed and tested in accordance with Australian Standard AS/NZS 3000 *Electrical installations* (known as the Australian/New Zealand Wiring Rules).

To achieve this:

- design electrical installations to meet fundamental electrical safety principles, including protection against overcurrent (Wiring Rules clause 1.5.9) and earth fault current (clause 1.5.10)
- provide engineering drawings and documentation with sufficient information to allow electrical equipment to be installed and maintained in a safe manner
- verify the installation, as far as practicable, prior to it being placed in service or use (clause 1.8)
- develop, implement and maintain competency-based training systems so workers are aware of the critical tasks involved with verification of the electrical installation.

Note: Regulations 6.3, 6.4 and 6.5 of the Mines Safety and Inspection Regulations 1995 require a designer to:

- *identify hazards associated with plant and assess the risks*
- *consider whether the risk of exposure can be reduced*
- *provide sufficient information for the plant to be manufactured in accordance with the design specifications*
- *provide sufficient information relating to installation, operation and maintenance of the plant.*



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