



# Electrical Engineering Safety

## Decision Sheet 6.1

### DC Systems used Underground

***A basis for consistent application of Electrical Engineering Safety issues across NSW***

*Decision Sheets are developed by the Inspectors of Electrical Engineering in response to issues raised or questions asked by others in the DPI, in particular Mine Safety Operations and from our external clients. They are for use by any staff in Mine Safety Operations, but primarily by Electrical Engineering staff. They can be distributed externally to the DPI.*

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## Preamble

The use of Direct Current (DC) systems in underground mining operations has the potential to increase and it is used widely for magnets, automotive electrics, traction drives on mobile machines and is also used for battery powered mobile machines.



## Issue

Questions are often asked as to whether the DC system should be earth fault limited and what type of protection is required.

## Position

An engineering assessment that takes into account the application (intended use and foreseeable misuse) and associated tolerable risk levels, equipment and environment must be undertaken in accordance with mine OHS & Engineering Management Systems.

Short circuit protection is required on every dc circuit. Where the dc circuit has a battery source of power, that short circuit protection must be as close as possible to the battery terminals and the unprotected parts of the circuit should be double insulated, protected from damage from foreseeable damage sources (impact, vibration, chemicals, water and so on) and located to minimise the risk of deterioration. An analysis of the risk of a short circuit failure must establish that the risk of “unprotected” parts of the circuit is less than or equal to the mine’s specified tolerable risk level.

Where the DC is supplied from an AC source for example, via a transformer and a rectifier, an earth reference should be created on the secondary of the supply transformer and then the earth fault limitation and earth fault protection will protect the DC circuitry.

DC systems that use a mains powered supply to a transformer with an isolated secondary winding need to have earth fault detection where the voltage exceeds ELV. The design must provide protection that will result in faults being quickly identified and automatically disconnected before the fault becomes a hazard to humans.



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**DC Magnets.** Generally, a mains powered DC system will be referenced to earth on the AC side of the rectifier. Protection can be arranged to disconnect the AC secondary voltage (as first means) and the primary voltage as a back up.

**Automotive electrics.** There is no expectation that ELV dc automotive circuits be earth fault limited (Compliance with MDG15, AS4242 and AS/NZS4871.6 as appropriate is expected).

**DC Traction.** There is an expectation that DC traction circuits operating above ELV will be earth fault limited and will have protection to detect an earth fault. (Compliance with AS/NZS4871 as appropriate is expected)

**Battery powered mobile machines.** Compliance with AS/NZS4871.5 is required. It should be noted that the traditional earth fault detection circuit has earth fault limitation inherent in its design.

