

SAFETY BULLETIN

Uninterruptible power supply (UPS) installations at mines

BACKGROUND

Uninterruptible power supplies (UPS) are not a new technology but over recent years their application to the mining industry has increased in terms of volume and rated power. UPS installations come in various shapes and sizes that are specific to each application and the associated electrical installation.

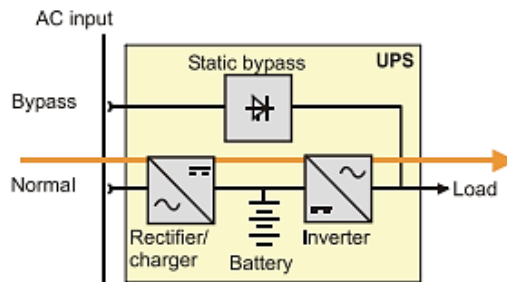


Figure 1 – Typical UPS installation with static bypass function

SAFETY CONSIDERATIONS

Due to the internal design of UPS installations, there are a number of safety considerations that need to be made on the associated electrical installation to ensure the circuit is fit for purpose. These considerations include:

- is the UPS design compatible with the earthing systems that form part of the mine's electrical installation? Is the earthing system IT impedance earthed or TN solidly earthed?
- for TN earthing systems, are supply neutrals switched or un-switched on the mains supply to the UPS?
- for IT earthing systems, are isolation transformers installed? **Neutrals should not be used** (refer to appendix A5.6 of AS/NZS 3007:2013)
- are the type and number of poles of circuit breakers and other protection devices on the mains supply side of the UPS of an adequate rating and have an adequate number of switched poles?
- have other backup supplies been considered that could change the neutral/earthing system configuration during automatic or manual change-over, that is, standby generator supplies?
- are protection and functional earth references to the UPS hardwired or plugged to maximise their integrity?
- are large battery systems a part of the UPS installation?

- do earth fault currents have a direct current component that prevents standard earth leakage units from operating?

KEY RISKS

With the increase in complexity of the design of UPS supplied applications comes the increased risks when staff do not sufficiently understand the key electrical issues that need to be managed. Incorrect UPS selection or installation can result in:

- missing or poor neutral reference to UPS incoming supply
 - this can result in voltage transients and failed circuit earth leakage protection
 - nuisance tripping may occur if the incoming neutral/earth reference is broken at any time while the load is energised
- the reticulation of neutral conductors in an IT earthing system
 - this can result in defeating any earth fault limitation on the complete installation if designed incorrectly, or if a neutral to earth fault occurs
 - neutral conductors should not be utilised
- a failure of earth leakage protection on outgoing UPS circuits
 - due to the batteries fitted to a UPS, the UPS must be considered as its own electrical source and upstream protection devices do not remove power from outgoing circuits on a UPS
 - earth leakage units may not be suitable for the output waveform of the UPS under fault conditions and not being able to trip
- nuisance tripping of incoming or outgoing circuit protection devices during change-over between alternate/backup supply sources (interruption of the neutral)
 - this can result in loss of power to safety critical supplies
- safety risks associated with the battery units, such as arcing faults, explosion or fires
 - batteries cannot be turned off and require appropriate safety procedures to minimise risks when work is being undertaken on or near the battery units
 - risks may be created by arcing, fire, fumes or acids/chemicals associated with the batteries.

RECOMMENDATIONS

Not all UPS installations are suitable for connection to electrical installations at mine sites. Specialist consultants should be involved in the design of the installation to ensure the application is fit for purpose. Most UPS manufacturers or original equipment manufacturers have detailed application and installation manuals that provide guidance on the appropriate configuration of the UPS installation.

Mine operators should consider having their UPS installations audited by a suitably qualified engineer as part of routine planned maintenance.

Any installations found not to conform to the UPS design requirements must be actioned appropriately by the mine to ensure the installation provides for the necessary level of safety.

FURTHER INFORMATION

- Queensland Department of Natural Resources and Mines
 - [Mines Safety Alert No. 264 - Hazard Of Backfeed On Some UPS Units](#)
- Australian Standard
 - AS 62040 – Uninterruptible Power Systems (UPS)
- Australian and New Zealand Standard
 - AS/NZS 3000 – Wiring Rules
 - AS/NZS 3007:2013 – Electrical equipment in mines and quarries – Surface installations and associated processing plant

NOTE: Please ensure **all relevant people** in your organisation receive a copy of this Safety Alert, and are informed of its content and recommendations. This Safety Alert should be processed in a systematic manner through the mine's information and communication process. It should also be placed on the mine's notice board.

Dave McLean
Chief Inspector of Mines
Appointed pursuant to Work Health & Safety (Mines) Act 2013

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Disclaimer

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