

SA17-06

## Flameproof alternators supplying intrinsically safe equipment

This safety alert provides information on a serious issue and safety advice for the NSW mining industry.

### Safety issue

Potential safety concerns have been identified regarding the suitability of flameproof alternators that supply power to intrinsically safe systems fitted to mobile diesel machines intended for use in hazardous zones of underground coal mines.

**Please note: The Resources Regulator will be undertaking risk-based follow-up activities with duty holders to assess the actions taken to address the identified concerns.**

### Recommendations

Equipment designers should consider the recommendations of standards such as the ISO 16750 series when designing mobile diesel equipment that will be fitted with voltage sensitive electrical components that are supplied by voltage sources that may generate transient over-voltages.

Equipment designers must consider the compatibility of interconnected explosion protected electrical apparatus during component selection to ensure that designs are fit for purpose. Where intrinsically safe equipment is used, both safe and hazardous area connections should be assessed in accordance with AS/NZS 60079.25 *Explosive atmospheres*.

Mine operators of underground coal mines that utilise mobile diesel machines that are fitted with intrinsically safe apparatus supplied by alternators should contact the machine manufacturer to confirm that the intrinsically safe equipment fitted to machine is not being operated or exposed to overvoltage conditions that may exceed the certified safe levels of the intrinsically safe equipment.

### Background

Alternators control their output voltage through field regulators. Changes in load conditions result in fluctuations of alternator output voltage due to the slow response times of the field regulators. Batteries associated with engine starting act to stabilise alternator output voltages. As there are no starting batteries installed on diesel vehicles for underground coal mining, a sudden reduction of load on the alternator can result in voltages in excess of the name plate voltage rating of the alternator appearing at the output terminals. This condition is often referred to as a 'load dump'. As a result of voltage fluctuations and transient over-voltage conditions, alternators are allocated a nominal voltage for the output circuit, and not a maximum voltage.

Associated safe area intrinsically safe apparatus has a maximum permissible input voltage ( $U_m$ ) nominated on the explosion protection certification. Supply voltage transients that exceed the  $U_m$  can compromise the explosion protection properties of the device by exceeding the minimum clearance distances between the explosion protected and the non-explosion protected circuits, or by damaging electronic components. Where this  $U_m$  may be exceeded, the equipment can no longer be considered as being explosion protected.

Australian standard AS/NZS 60079.25 *Explosive atmospheres—Part 25: Intrinsically safe electrical systems* supplements AS/NZS 60079.11 *Explosive atmospheres—Part 11: Equipment protection by intrinsic safety 'i'* and contains specific requirements for assessment of intrinsically safe electrical systems, including requirements for descriptive system documents, earthing and bonding, surge protection and cabling.

On-board alternator earth leakage protection devices use a 'leakage to frame' detection technique that applies a reference voltage to the frame of the mobile diesel machine. The frame reference voltage may compromise the explosion protection properties of associated intrinsically safe apparatus by exceeding the minimum clearance distances between explosion protected and non-explosion protected circuits if a common frame reference is used.

The explosion protection certification of flameproof alternators only covers the flameproof properties of the alternator and does not assess the magnitude of voltage transients associated with load dump conditions. It also does not assess the potential electrical impacts or compatibility with other electrical apparatus that may be fitted to the mobile machine.

The electrical specifications referenced on flameproof alternator certificates of conformity are generally a rated nominal voltage and current at a set number of revolutions per minute (RPM). These values are used to provide a reference for alternator heat load tests and establish maximum surface temperatures of the alternator. These electrical specifications do not consider transient over-voltages or situations such as a 'load dump' condition.

Equipment designers and mine operators are reminded they have a duty to eliminate risks to health and safety in accordance with Work Health & Safety Regulation 2011 clause 35. If this is not reasonably practical, then the hierarchy of control measures must be applied in accordance with clause 36 of the regulation.

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Issued by

**Garvin Burns**

Chief Inspector of Mines

Appointed pursuant to Work Health & Safety (Mines and Petroleum Sites) Act 2013

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