ENGINEERING BULLETIN

Ref Document No.	EB17004	Issue No.	1
Subject	Mining Repairs Flameproof Alternators Supplying Intrinsically Safe Equipment		
Release Date	15th June 2017		

Purpose

– To provide a response and information to owners, operators and designers with reference to Safety Alert SA17-06 - Flameproof Alternators Supplying Intrinsically Safe Equipment released by the NSW Resources Regulator.

Applicability

– All installations using a Mining Repairs alternator 12 Volt applications
– All COALTRAM® owners/operators 12 & 24 Volt systems

Information

Potential Alternator Transient Over-Voltage Concern:

The NSW Resources Regulator has released SA17-06 to the industry raising potential safety concerns around the suitability of the connections between flameproof alternators and intrinsically safe equipment. The transient over-voltages produced by an alternator could exceed the maximum rating of the interconnected intrinsically safe equipment.

PPK Mining Equipment have performed Load Dump testing of the 12 and 24V Flameproof Alternators and have considered the ISO16750 series recommendations. The tests were conducted at a range of RPM's and various electrical loads (Refer attached PPK Report ER17005).

An oscilloscope set to single shot capture was used to measure the voltage spike during the Load Dump period. The calibration of the oscilloscope was verified against NATA certified calibrated lab test equipment.

Associated testing methodology and results are contained within the attached report ER17005.

24V Alternator

With respect to the test results and allowing for the addition of errors in the measuring equipment and small interconnection losses; a worst case peak supply voltage of 26V has been nominated.

COALTRAM Interface Connection Detail

The 24V Alternator only supplies power to the IECEx certified MONEx Engine Management System and is not connected to any other system (as supplied new by PPK) in PPK COALTRAM® CT08, CT10, CT10LP and CT13 machines.

The alternator connects to the following equipment (Certificates of Conformity attached for reference):

- Power Distribution Manager Module 11307 (PDM) - This module is Ex certified (IECEx MSC 14.0026X) and has the following Ex marking code "Ex mb e ia I".
- Explosion Protected Battery Module 11306 - This module is Ex certified (IECEx MSC 14.0025X) and has the following Ex marking code "Ex mb e ia I".

The cables from the alternator directly connect to the 11307 PDM. The PDM then acts as a pass through of the alternator connection to the removable Battery Module 11306 via connector P4. The protection concept covering the pass through is "Ex e". The nominal electrical parameters relating to the "Ex e" connection are Un=24V and In=20A. All I.S. connections (P2, P3, P7..P10) are adequately segregated from the "Ex e" terminals by a distance greater than 50mm as required by IEC 60079-11:2011.

As detailed above, the 11306 Battery Module receives the alternator power via the PDM on connector P4. The nominal electrical parameters relating to the "Ex e" connection are Un=24V and In=20A. This equipment can be considered an associated apparatus and has been given a Um rating = 60V. Once inside the associated equipment, the hazardous area is now protected by Ex m with a voltage rating of 90V. The 11306 Battery Module uses a combination of adequately rated infallible transformer isolation and galvanic isolation for connections to the hazardous area "Ex i" protection.

In conclusion, the Load Dumps presented by the 24V alternator testing are well within the Um specifications of the interconnecting equipment or associated apparatus.

12V Alternator:

With respect to the test results (PPK Report ER17005) and allowing for the addition of errors in the measuring equipment and small interconnection losses; a worst case peak supply voltage of 40V. Additional information external to PPK has been provided detailing higher voltages through similar test methods. As such, a worst case peak supply voltage of 45V has been nominated to account for this information.

As installed on PPK COALTRAM® CT08, CT10, CT10LP and CT13 machines the 12V alternator is used to supply power to the lighting and ancillary equipment, such as, methane detectors, camera systems, lighting etc.

Potential Alternator Earth Leakage Protection Device Concern:

The NSW Resources Regulator also addresses that "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."

PPK has bench tested the Mining Repairs 24 & 12 Volt Alternators to determine the maximum possible voltage potential between the alternator supply rail and the chassis (frame) earth. For further clarification of test methodology and results refer to PPK report ER17006.

24V Alternator:

Under normal operation with no leakage to frame current flow, the alternator supply rails are equally balanced with respect to the chassis potential.

The worst case earth leakage voltage potential difference available between the chassis and an alternator supply rail is 16.8VDC (refer PPK report ER17006).

12V Alternator:

Under normal operation with no leakage to frame current flow, the alternator supply rails are equally balanced with respect to the chassis potential.

The worst case earth leakage voltage potential difference available between the chassis and an alternator supply rail is 9.10VDC (refer PPK report ER17006).

Note:

Both 12 and 24V alternator test results in the PPK Report ER17005 & ER17006 are indicative and based on the test equipment accuracy as depicted within the report. Testing is inclusive of both MR110 & MR111 Alternator Models (different reset mechanism only).

PPK has reviewed the design and interconnections regarding the MONEx Engine Management System (as fitted to PPK COALTRAM®'s) and Earth Leakage Detection System utilised within Mining Repairs 24V Alternators (connections to machine frame).

The protection concept utilised by the MONEx Engine Management System is galvanic isolation. By design the Intrinsically Safe connections on the MONEx equipment are isolated from the machine frame.

For MONEx to Alternator interface specifics, please refer to the section above regarding PPK COALTRAM® Interconnection Details.

Regarding recommendations listed in this bulletin, PPK would like to specifically reference AS/NZS 60079.25:2011 Clause 11:

"Screens shall be connected to earth or the structure in accordance with IEC 60079-14. Where a system is intended for use in an installation where significant potential differences (greater than 10V) between the structure and the circuit can occur, the preferred technique is to use a circuit galvanically isolated from external influences such as changes in ground potential at some distance from the structure. "

Recommendations

Plant Owners and operators review all diesel machinery utilising 12V and 24V Mining Repairs Alternators with respect to supplied information contained within this bulletin.

Where intrinsically safe equipment is used, both safe and hazardous area connections should be re-assessed in accordance with AS/NZS 60079.25 *Explosive atmospheres* to ensure compliance.

Attached References

- ER17005 - Mining Repairs Alternator Load Dump Testing
- ER17006 - Mining Repairs Alternator leakage to frame testing
- IECEx MSC 14.0025X – Explosion Protected Battery Module 11306
- IECEx MSC 14.0026X – Power Distribution Manager Module 11307

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