

PJB Installation Notes

a division of  [P.J.B. Alternator, ANZ Ex. Scheme]

Scope

These notes are provided to assist competent tradespersons to install, connect, operate and ensure the safety of PJB Alternators to underground coal mining free-steered vehicles.

Standards

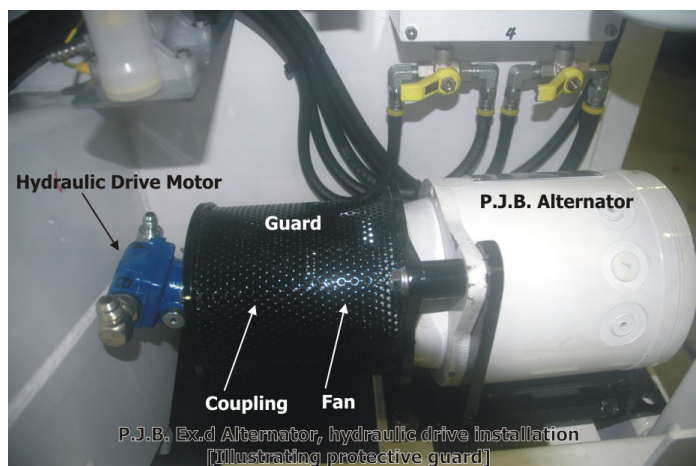
ASNZS 3584 Diesel Engine Systems for Underground Coal Mines

The requirements of this Standard for the mechanical installation of the Alternator (including guarding) shall be complied with.

ASNZS 4871.6 Electrical equipment for Coal Mines for use Underground, Part 6 Diesel Powered Machinery and Ancillary Equipment.

The requirements of this Standard for the electrical installation of the Alternator [including cable, (temperature and current)] shall be complied with.

Guarding



It is a requirement of the certification of this Alternator that a cooling fan be fitted to the shaft of the Alternator.

The cooling fan shall be guarded to prevent unintended contact and harm to persons.

Guards should meet IP 2* (Degree of Protection)

The design and installation of guards should ensure that they may not create a hazard by becoming loose or deformed and rubbing on any rotating part.

Risk analysis should be undertaken to ensure that the guarding fitted provides an adequate barrier to harm.



Cable Entry

The Alternator may be supplied with a number of cable entries. Plastic Plugs may be fitted to entries to provide protection from the ingress of water during transport and storage. These must be replaced with certified flameproof glands (M20) or flameproof Plugs/Stops on installation.

Plastic Plugs are not flameproof and MUST be replaced.

The entries provided for the cable are M20 COND. Only certified 20mm (metric) glands may be employed.

M20 Certified flameproof Glands must be used.

Cable [Connection]

The cable used to connect the Alternator shall be a Type 1 Cable meeting the requirements of ASNZS 1972 (or equivalent) and shall be rated:-

- At least 30 Amps current capacity at 12 V
- At least 200 deg C at 30 Amps current

The screen of the cable shall be connected to the 'Earth' terminal on the Alternator. (and shall be connected to earth in each enclosure within the vehicle circuit.

Note PJB Part No. GE01498 & GE01499 cables meet this requirement.

Protection and Routing

- All cable shall be protected using FRAS Cable trunking hose (as a minimum) for the entirety of the 'run' length
- All cable shall be routed away from hot, sharp, moving, abrasive or corrosive objects and materials.



**Title PJB Alternator – Ex.d Alternator, Form / Testing
[AS/NZS 3800]**

File Ref F:\WD\Qual 2008\WorkInst\Quality Manufacturing manuals\ANZ Ex
Devices\Alternator\Work Instruction-Form Testing.doc

Page No.	Rev No.	Date	Change References
All	19	24.04.07	Full & complete re-draft.
15-18	20	01.08.07	Appendix 2 & 3 added
All	21	30.11.07	Revisions made to include both AUS Ex & ANZEx versions of the Alternator.
1 3 7	22	18.12.07	NPG Logo, Certificate & Licence No.s added Red paint to cast logo added Previous test data added
4	23	04.02.08	Quality Management. Specific references to documents moved to 'Preface'. General statement substituted.
1 & 2	24	04.02.08	Installation Instructions added
9	25	13.05.08	Earth impedance Test – Megger revised to 'calibrated' and 1000V Fluke 1507 Instrument specified.
22	26	04.02.09	Page added

Change Approved by

..... on date – 4 February 2009
[Signature]

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Part 1. Pre-testing

Build Configurations

There are six (6) build configurations for flameproof (Ex.d) Alternators.

ALTERNATORS MANUFACTURED UNDER THE AUS Ex SCHEME

Fitted with 'imperial' (external) fasteners

External colour 'sea' green

- GE00037 ALTERNATOR Self Ex 12V fuse
- GE00037-X ALTERNATOR earth/OC electronic protect
- GE00037-BC ALTERNATOR batt charge

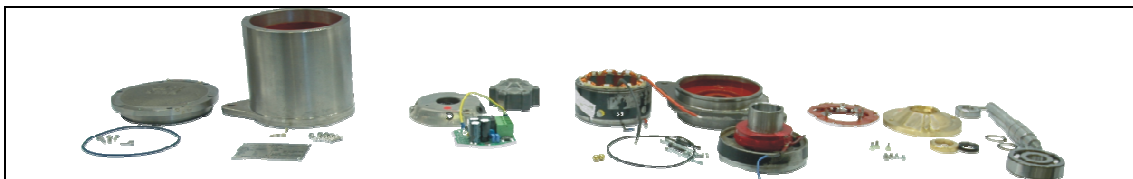
ALTERNATORS MANUFACTURED UNDER THE ANZEx SCHEME

Fitted with 'metric' (external) fasteners

External colour 'sky' blue

- GE00037M ALTERNATOR Self Ex 12V fuse
- GE00037M-X ALTERNATOR earth/OC electronic protect
- GE00037M-BC ALTERNATOR batt charge

Logo to 'Cover end termination' (GE00051M) – red.



All PJB manufactured and purchased parts are managed under the AS/NZS (ISO) 2000 (Registered) Quality Assurance Management System.

Quality Management

This Work Instruction is specific to the Product nominated and the scope of the document.

Conformance to the requirements of this Work Instruction alone does not ensure a compliant Product or that the Product is 'fit-for-purpose'.

There are many ancillary or associated activities and functions that require quality management to ensure that the Product is compliant and 'fit-for-purpose'. A list of these documents is included in the Preface to the Product Quality Manual that includes this Work Instruction.

Inspection (Prior to Test)

While there is reasonable assurance that all assembled component parts supplied for test are:-

For new manufacture

1. Purchased against a Specification and are therefore compliant and 'fit for purpose', or
2. Correctly manufactured from compliant materials to the current issue of drawings, and
3. Have been dimensionally checked for compliance/conformance prior to being added to Inventory, and
4. The parts have been correctly assembled in accordance with the relevant Work Instruction

For repair/overhaul/inspect-test

1. Purchased against a Specification and are therefore compliant and 'fit for purpose', or
2. Correctly manufactured from compliant materials to the current issue of drawings, and
3. Have been dimensionally checked for compliance/conformance in accordance with the requirements of the Work Instruction, prior to being re-used, and
4. The parts have been correctly assembled in accordance with the relevant Work Instruction

There remains some chance of damage in storage or transport after assembly.

The assembled Alternator must be carefully inspected prior to any test. Any damage or evidence of non-conformance requires that testing does not proceed until remedial action is taken.

The management of non-conforming Parts (product) shall be in accordance with the requirements of Standard Procedure 13.0.

Note:-

See Departmental incident Logs.

SCOPE

This Form must be completed for all :-

- Repaired and/or overhauled alternators, 12 Volt 30 Amp (Part Numbers GE00037, GE00037-X, GE00037M, GE00037M-X).

or

- New Alternators; 12 Volt 30 Amp (Part Numbers GE00037, GE00037-X, GE00037M, GE00037M-X).

No alternator may be released for dispatch if it fails to meet the performance parameters set in this document.

A completed copy of the form is a required deliverable document to the customer.

INSTRUCTION

Undertake the following tests and complete the information (data) required.

Notes

The GE00037 and GE00037X P.J.B. Alternators are identical in their mechanical components, output performance and mechanical assembly.

The difference between the two units is the Automatic Voltage Regulator (Protection system).

- *The GE00037 Alternator is fitted with a Regulator (Pt. No. GE00047) that includes an output fuse and field fuse protection only.*
- *The GE00037X Alternator is fitted with a Regulator (Pt. No. GE00047X) that includes a field fuse, electronic overload protection and electronic earth fault protection systems.*

The "X" version requires additional testing. (See 2.10)

**Part 2.0
ALTERNATOR PERFORMANCE TESTING**

2.1 SCOPE: This Performance Test & Acceptance, Report must be completed for all Alternators, 12 Volt 30 Amp. (Part Number GE00037, GE00037-X GE00037M, GE00037M-X). [No Alternator may be released for dispatch if it fails to meet the parameters set in this document.]

2.2 DATA SUMMARY: On completion of all of the following tests, complete the following.

Test and Data Summary AS/NZS 3800			
Date of Test	/ /	PJB Job No.	
Date of Previous Test	/ /	Previous Test by (Name)
		Test Ref No.	
Ser. No./Report No.		Mfd Date	/ / <i>[From Ident. Plate]</i>
Min. excitation speed	rpm <i>[Must be less than 1800 rpm]</i>	Max output volts	V DC <i>[Must be less than 13.8V]</i>
Max Temp. rise	°C <i>[Must be less than 30°C]</i>	Min earth impedance	MΩ <i>[Must be greater than 1.0MΩ]</i>
FOR GE00037X ALTERNATORS ONLY			
Over-current trip operation OK?	[tick box]	Earth fault trip operation OK?	[tick box]

Testing undertaken by
[Print Name]

Signature

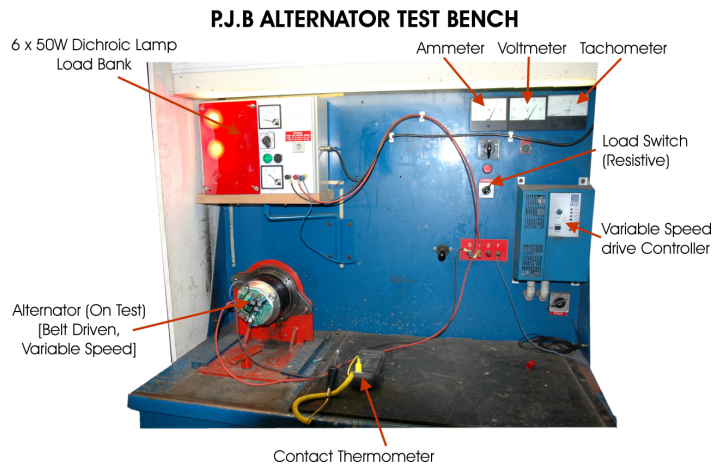
Test result verified by [Signature]
[Competent Person Ex.* Electrical] on Date/...../.....

2.3 Equipment

Testing must be conducted on a purpose built test facility, including variable speed drive, load banks and calibrated instrumentation.

Instruments must include:-

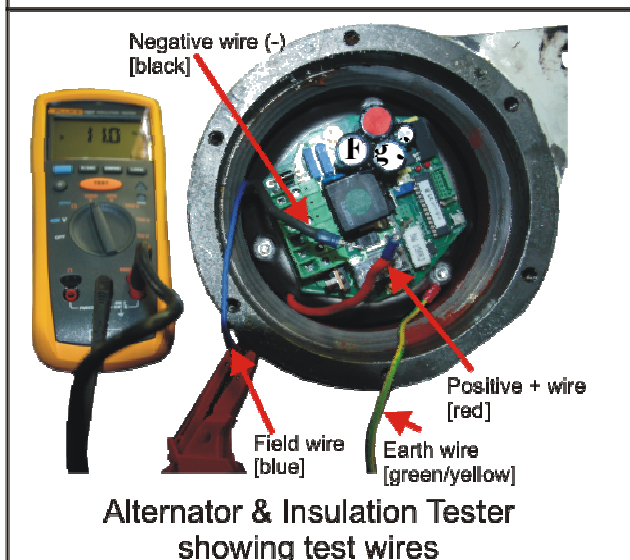
- DC Voltmeter
- DC Ammeter
- Tachometer
- Megger (1000V)
- Surface Temp. Thermometer



2.4 Earth Impedance Test



FLUKE 1507 1000V Insulation Tester



PJB Alternators are isolated from earth. [i.e. There is no connection of positive, negative or field wires to the frame of the Alternator (earth)].

Tests must be undertaken to ensure that the entirety of the Alternator is isolated from earth (frame).

Instruction

- i. Using a calibrated 'Megger' of at least 1000V rating, test from the frame of the Alternator (earth) to each of the 3 connections (wires) in the positive direction.
- ii. Reverse the 'Megger' connections (+ & -) and repeat the Test. Record the lowest earth impedance measured.

MΩ
[Must be greater than 3.0MΩ]

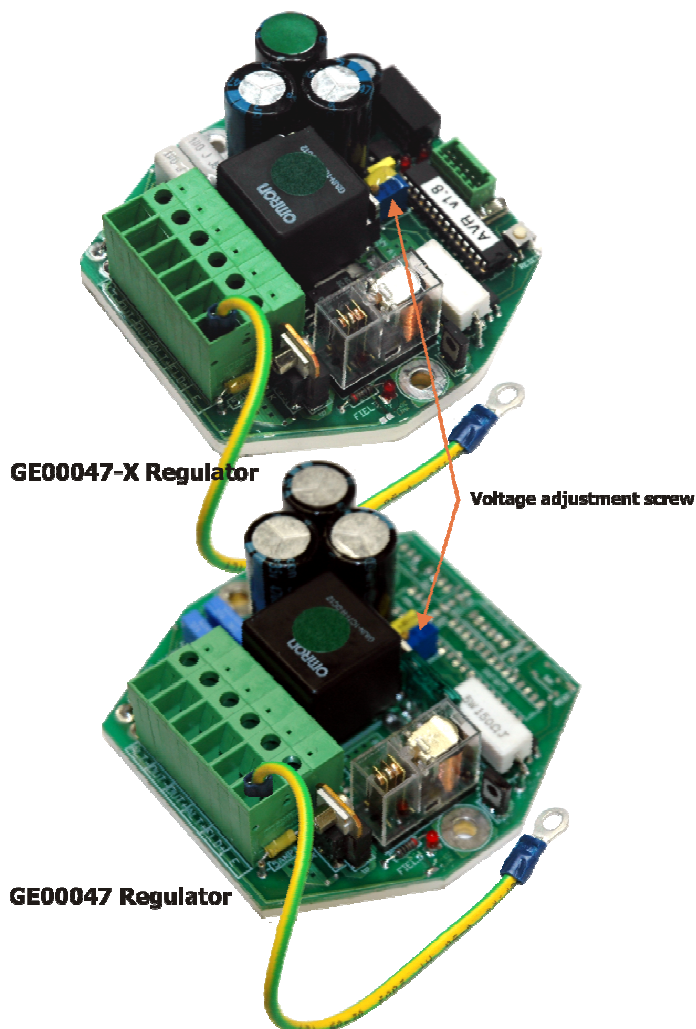
Any reading of less than 3.0 M Ω will require all tests to be suspended, the Alternator removed from the Test Rig, dismantled and the fault located and rectified.

Notes

- i. A single (one) connection to earth (frame) within the Alternator or elsewhere in the wiring or devices that may be connected to the Alternator (load), may not be apparent.
- ii. Two earths within the system at the same time may create an arc, spark or flame. **This may be a high-risk hazard.**

TIP If an earth is found on the Alternator the most probable location is on or around the Heat Sink Assembly (Rectifiers). Look for off-centre mounting and interference with the Front End Cover or damaged insulation.

2.5 Preliminary Output Voltage Adjustment



PJB Alternators are nominally a 12.0V DC (rms) output device. The output voltage must never exceed 13.8 V DC (rms) under any condition of load or speed. Unsafe over-heating may occur to connected devices if this voltage is exceeded.

Instruction

At 3000 rpm (shaft speed) and 30 Amps load, adjust the output voltage to 12.3V DC (-0V + 0.1V)

Notes

- i. As an Alternator reaches (full load) operating temperature, the output voltage at all speeds and loads will reduce marginally.
- ii. A full load (30A) voltage set (cold) at 12.3V DC (rms) will normally correspond to an open circuit (no load) voltage in the order of 13.1 > 13.4 V DC.

Note

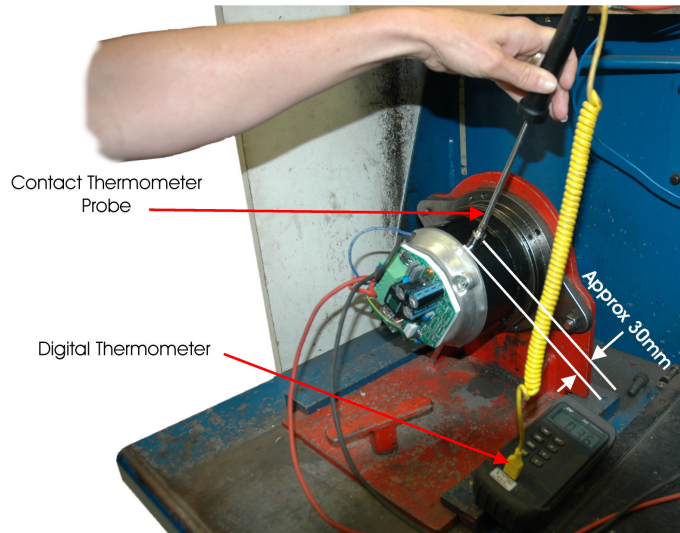
At any operating speed, the output voltage drops marginally with increased load.
(Nominally 1V full load > no load).

2.5 Temperature Rise Test

The maximum surface temperature of any Approved/Certified Ex.d device is limited by Standards.

Excessive operating temperatures may indicate a fault including:-

- A winding failure
- A bearing failure
- A seal failure
- A lack of lubrication
- Mechanical misalignment

**Instruction**

With the Alternator shaft speed set to 3000rpm and the load to 30A DC, run the Alternator for 15 mins.

Measure the ambient (air) temperature.

Check the surface temperature at the point illustrated.

The temperature rise (difference between ambient temperature and the measured surface temperature) must not exceed 30°C. Note the temperature rise.

°C
[Must be less than 30°C]

2.7 Speed/Load Curve

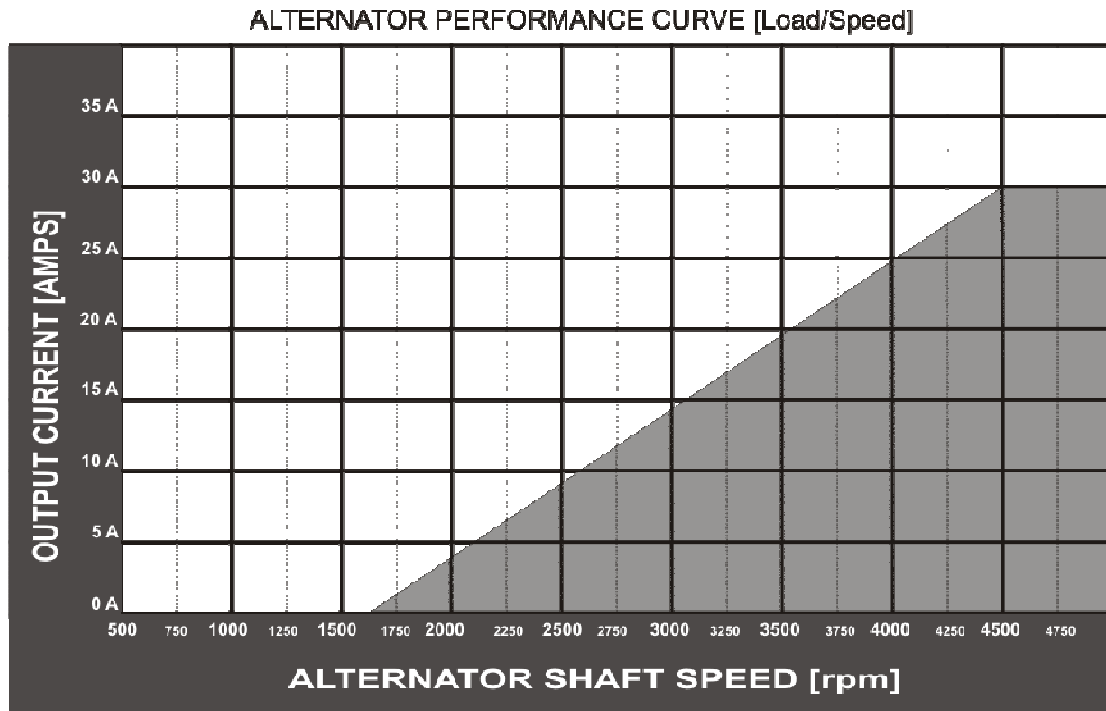
The current (Amps) available at rated load is proportional to the shaft speed of the Alternator. At low shaft speeds, the current available is limited.

Instruction

Determine the speed/load curve at (nominal) voltage.

- 1) Mount Alternator to Test Bench & connect to switchable (resistive) load.
- 2) At each of the speeds nominated on the curve (following), adjust (increase) the load (Amps) until the voltage falls to 12V DC.

- 3) Note the speed (rpm) and current and mark each point on the graph (below)
- 4) Join the marks with a curve of best fit.



The curve must be outside of the shaded area of the graph at all points.

2.8 Minimum Excitation Speed

The minimum excitation speed provides a good indication of the performance of an Alternator under conditions often experienced on underground machines. A high excitation speed may indicate improper performance on a vehicle at low idle or while cornering at low speed.

Instructions

From the above curve, determine the speed at which the Alternator was able to supply 20Amps at or above 12V DC.

With resistive load 'switched in', corresponding to 20 Amps, stop the Alternator and re-start. (leave the speed set at the required speed.) Note the self-excitation speed on load.

The Alternator must self excite and accepted the nominated load.

On a resistive load,
The useful load self excitation speed (as tested) is

rpm
<i>[Must be less than 1800 rpm]</i>

Turn the resistive load to 'off' and switch in 4, 50W dichroic lamps. Stop the Alternator and re-start. Confirm that the excitation speed has not changed and that the Alternator is able to start the 4 lights at that nominated speed.

On a lamp load, The useful load self excitation speed (as tested) is	rpm
	[Must be less than 1800 rpm]

2.9 Voltage Confirmation Test

PJB Alternators are nominally a 12.0V DC (rms) output device. The output voltage must never exceed 13.8 V DC (rms) under any condition of load or speed. Unsafe over-heating may occur to connected devices if this voltage is exceeded.

Instructions

While the Alternator remains at operating temperature, set the Alternator speed to 3000rpm. Increase the load progressively. Note the steady state voltage at each Step.

Step	0	1	2	3	4	5	6	7	8	9	10
Volts											

The voltage may not exceed 13.8 V DC at any point.

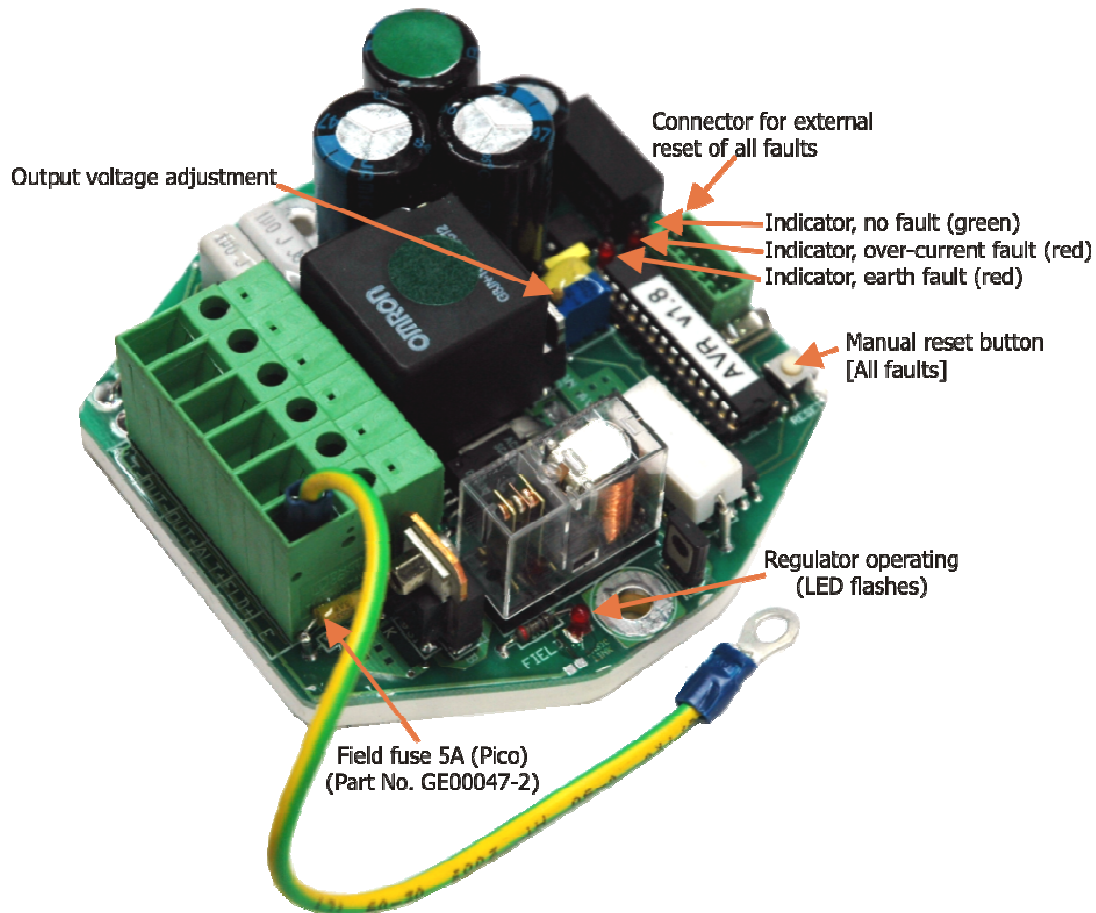
2.10 Electronic Protection systems tests [GE00037-X & GE00037M-X Alternators with GE00047-X Regulators (only)]

The 'X' version of the Alternator is fitted with a Regulator (Pt. No. GE00047-X) that includes a field fuse, electronic overload protection and electronic earth fault protection systems. The functionality of the protection systems must be tested.

The fitting of the G00047-X Regulator provides additional safety. PJB recommends the fitting of this protection system in all applications.

Notes:-

- **AS/NZS 4871.1&6 requires this level of protection.**
- **The Statutory Authorities require this level of protection**



2.10.2 Over-current

Over-current protection is managed with a digital electronic system. The 'trip' curve is pre-programmed to provide an instant trip at 60 Amps, a 10 second trip at 35 Amps and a 200 second trip at 32 Amps.

Instructions

With the Alternator speed set to 3000rpm and the load at 30Amps, switch in two 50W dichroic lamps. The Regulator must disconnect the load within 3 seconds. The over-current indicator (centre of three) must indicate the fault.

Switch out the lamps and reset.

The Regulator must trip, disconnect power and indicate the fault.

Satisfactory [tick]

2.10.3 Earth Fault

Leakage to earth current protection is managed with a digital electronic system. The system will detect an earth fault within and external to the Alternator from either the positive (+) or negative (-) lines.

Instructions

With the Alternator speed set to 3000rpm and the load at 30Amps, clip the special test lead to earth (frame of Alternator).

Touch the test probe to the positive (+) output terminal. The Regulator must disconnect the load instantly. The Earth Fault indicator (three of three) must indicate the fault. (See Fig. 6 above). Remove the probe and reset.

Touch the test probe to the negative (-) output terminal. The Regulator must disconnect the load instantly. The Earth Fault indicator (three of three) must indicate the fault. (See Fig. 6 above). Remove the probe and reset.

Satisfactory [tick]

The Regulator must trip, disconnect power and indicate the fault.

Part 3. Appendices

**APPENDIX 1
SCHEDULE OF DRAWINGS**

Drawing No. M28800

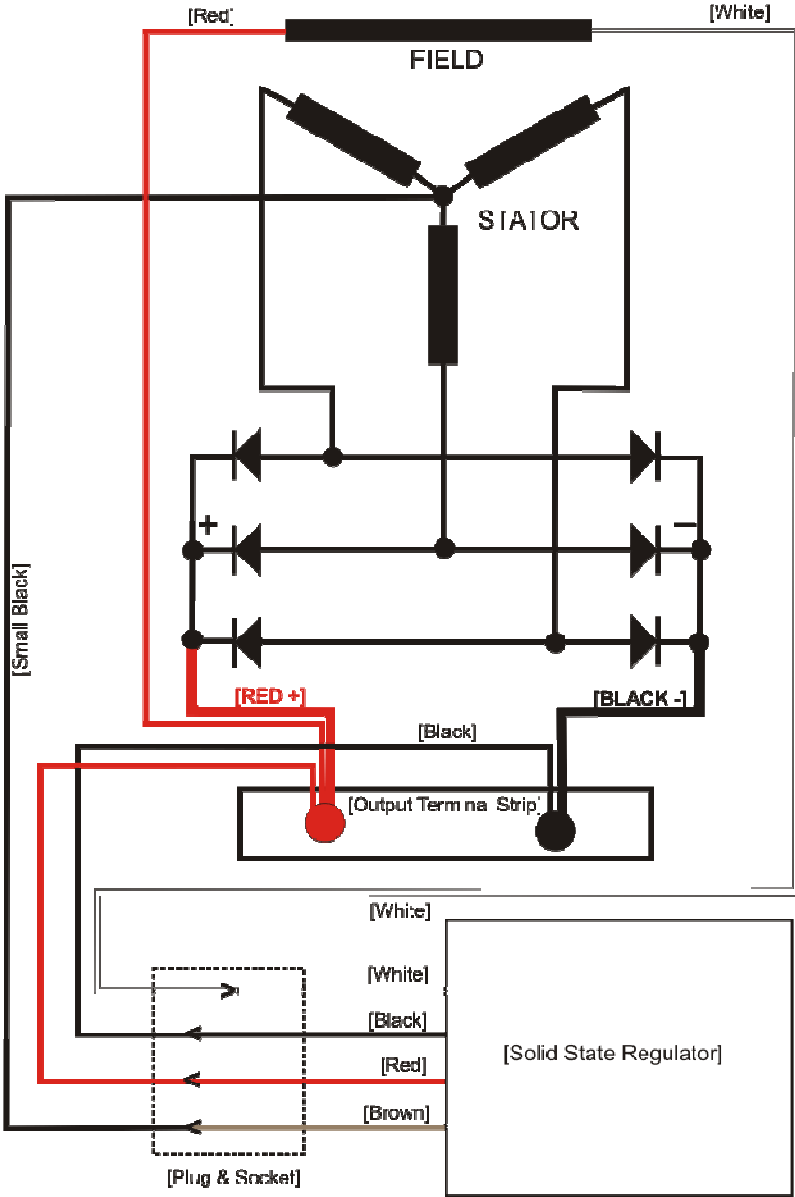
CERTIFICATION DRAWINGS	
Critical Parts - Arrangement	Sheet 1
Section, labels, circuits & parts list	Sheet 2
MANUFACTURING DRAWINGS (not for distribution)	
GLAND Ex.d front - detail	Sheet 3
COVER end front drive - detail	Sheet 4
BODY main - detail	Sheet 5
COVER end termination - detail	Sheet 6
SHAFT assembly - detail	Sheet 7
ROTOR laminated - detail	Sheet 8
FIELD assembly - detail	Sheet 9
PULLEY/COUPLING - details	Sheet 10

APPENDIX 2
[Series 3 – Battery Charging Alternators]

Up until 2007, PJB manufactured a battery charging version of the PJB Alternator for use on 'Dolly Cars' and like applications. The assembly of these Alternators (mechanically) is identical to self-excited Alternators. The electrical connection and excitation procedure is slightly different.

The following information is provided for the repair/re-connection and testing of one of these older Alternators.

P.J.B. ALTERNATOR - SERIES 3 BATTERY CHARGING



To excite a Series 3 type Alternator

Procedure for Test Bench excitation

1. Disconnect the plug/socket to the Regulator. (Located under the Regulator).
2. Temporarily connect the white lead from the field to the Black (-) output terminal.
3. Start the Alternator and run at approximately 500 rpm
4. Slowly increase the shaft speed until the Alternator excites and then continue to increase the shaft speed slowly.
5. When the output voltage is approximately 12.8V DC, hold that speed for 5-10 minutes.
6. Remove the temporary connection and re-connect the plug/socket.
7. Test to ensure proper battery charging function. (Float across a lead acid battery and confirm the charge rate.)

If no Test Bench is available

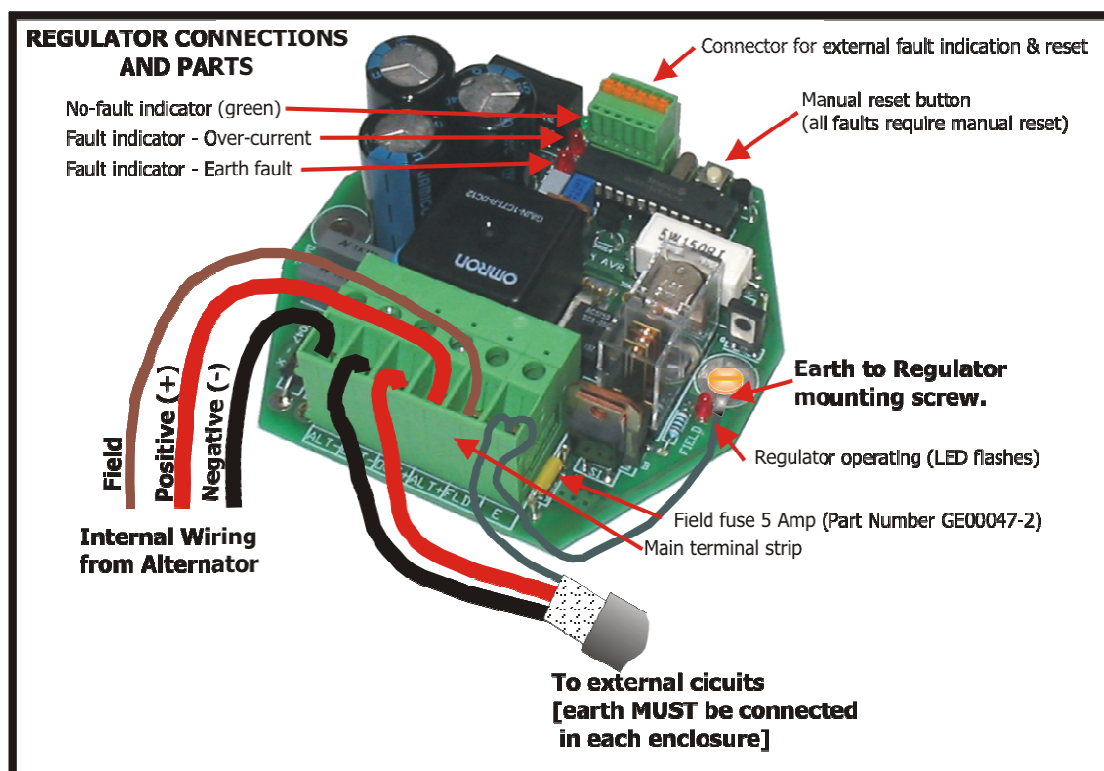
1. Disconnect the plug/socket to the Regulator. (Located under the Regulator).
2. Start the Alternator and run at approximately 3000 rpm
3. 'Flash' (tickle) a temporary wire from the (white) field lead to the (black) output terminal.
4. After the Alternator has excited, remove the temporary wire and re-connect the plug/socket.
5. Test to ensure proper battery charging function. (Float across a lead acid battery and confirm the charge rate.)

APPENDIX 3 GE00047-X Regulator

AS/NZS 4871.6 mandates the fitment of protection systems to ELV circuits on free-steered vehicles. The protection systems are required to protect against a hazardous condition arising from;

- Sustained over-current faults
- Faults to earth (ground)
- Under voltage faults
- Over Voltage faults

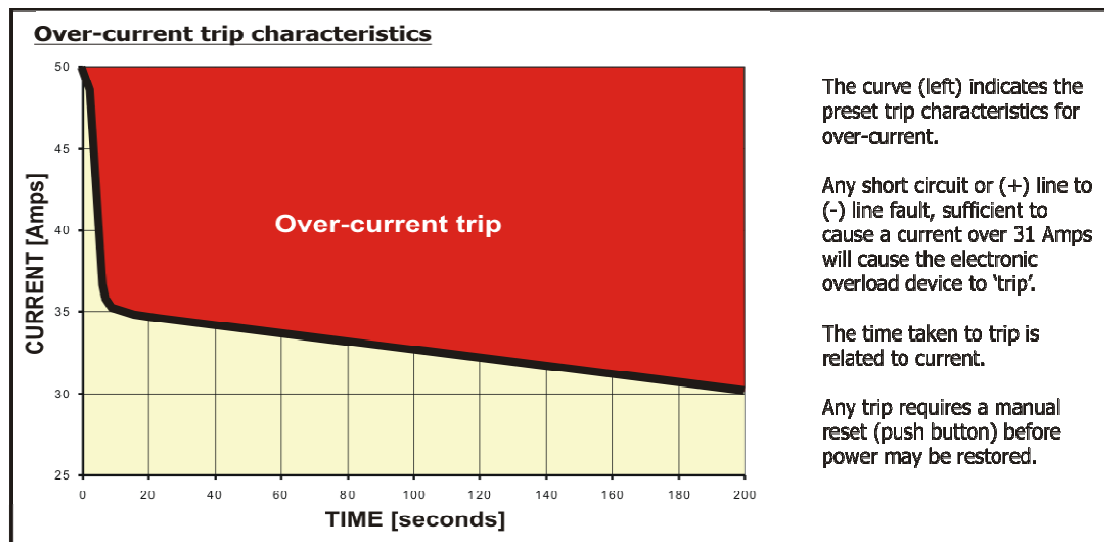
Fitting the GE00047-X Automatic Voltage Regulator to a PJB Ex.d Alternator provides the necessary protection. (When considered with the inherent characteristics of the Alternator.)



This Regulator may replace the (PJB) GE00047 (fuse protected) Regulator and any/all prior versions of Regulators. It fits and locates in exactly the same manner as previous Regulators and functions to control the output voltage of the Alternator in addition to providing electrical protection to final circuits.

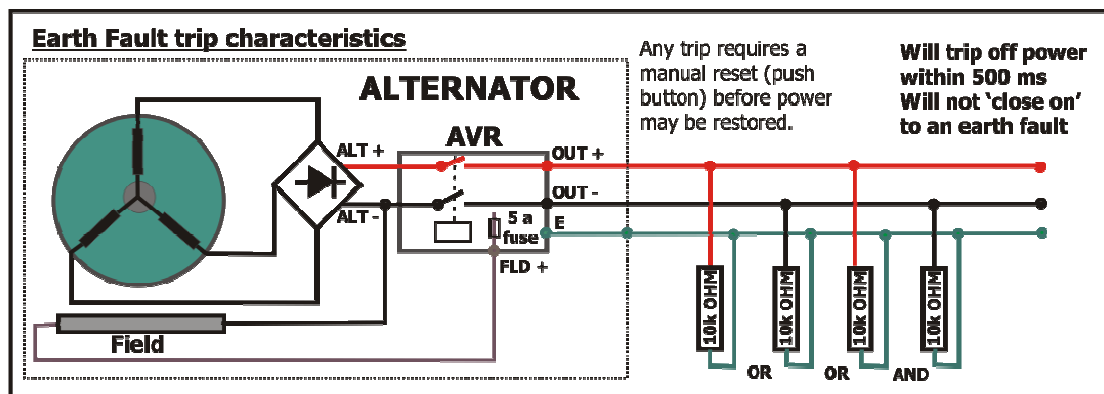
Over-current Faults

The Regulator will detect an over-current fault (in excess of rated current) and 'lock out'. A manual reset is required to restore output. (See trip curve following)



Earth Faults

The Regulator will detect a leakage of current to earth (machine frame) and 'lock out'. A manual reset is required to restore output. The Regulator will not permit electrical power to be connected to a circuit that has one or both 'legs' partially or fully 'earthed'.



Under-Voltage Faults

The Alternator is inherently a 'constant power' device. If load or some other circumstance causes the output voltage to drop to significantly less than its nominal rating, then the output current will increase. The Regulator will detect an over-current fault (in excess of rated current) and 'lock out'. A manual reset is required to restore output.

Over-Voltage Faults

Were the Regulator to

- fail totally, and
- the isolation relay to 'burn in', and
- the Field winding were to be connected directly across the Alternator output (i.e. in full shunt),

then it is possible (but highly improbable) for a hazardous over-voltage to be generated. Such a circumstance causes the field series fuse to blow.

TEST CERTIFICATE FOR FLAMEPROOF ENCLOSURES
PJB MK2 GE00037 ALTERNATOR
Australian Standard – AS/NZS 3800
Code D1 – Exd Flameproof Enclosures

NEW

P J Berriman & Co Pty Ltd is a Quality Endorsed Company (AS/NZS ISO 9001, Licence number 3620). The Quality System ensures that all approved products, assemblies and parts thereof meet the minimum requirements and specifications of 'Approval Drawings' particularly in respect of dimensions, tolerances and routine tests.

Equipment: GE00037 Alternator

Approval No.s:
MDA Exd R 2674
QMD 947331 X
AUS Ex 2012

Date: _____

Job No: _____

Colliery/Customer: _____

Order No: _____

Drawing No: M28800-1

Machine No: _____

Serial/Report No: PJB

Mfd. DATE: _____
(Original date off Ident. Plate)

CHECK LIST/SUMMARY

Item	Description of Check	Action taken	Remarks
(a)	Check for external and internal damage		
(b)	Dimensional check		
(c)	Check of all threaded holes		
(d)	Check of corrosion of flamepaths		
(e)	Check "o" rings for integrity		
(f)	Check of all windows and lenses		
(g)	Check of all bolt holes, studs, screws etc		
(h)	Check of all gland entries and fixing holes		
(i)	Check of all cable glands. (if applicable)		
(j)	Static Pressure Test	N/A. Passes 4 times reference pressure test.	
(k)	Check the integrity of internal wiring		
(l)	Check all required labels fitted		

Completed By: _____ Date: ____ / ____ / ____

Signature of Authorised Person: _____ Date of Issue: ____ / ____ / ____