



U.S. Department of
Transportation
Federal Aviation
Administration

MAJOR REPAIR AND ALTERATION (Airframe, Powerplant, Propeller, or Appliance)

Form Approved
OMB No. 2120-0020

For FAA Use Only

Office Identification

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form. This report is required by law (49 U.S.C. 1421). Failure to report can result in a civil penalty not to exceed \$1,000 for each such violation (Section 901 Federal Aviation Act 1958)

| | | |
|--------------------|--|---|
| 1. Aircraft | Make PIPER | Model PA-22 |
| | Serial No. 22-259 | Nationality and Registration Mark UNITED STATES N948A |
| 2. Owner | Name (As shown on registration certificate) KOCH MICHAEL R D | |
| | Address (As shown on registration certificate) 4001 S WOODWIND LN SIOUX FALLS, SOUTH DAKOTA 57103-4618 | |

3. For FAA Use Only

The data identified herein complies with applicable airworthiness requirements and is approved only for the above described aircraft subject to conformity inspection by a person authorized in CFR 14 part 43.7

[Signature]

1-24-2007
Date

Rapid City Flight Standards District Office GL-27

4. Unit Identification

| Unit | Make | Model | Serial No. | 5. Type | |
|------------|--|-------|------------|---------|------------|
| | | | | Repair | Alteration |
| AIRFRAME | ~~~~~(As described in item 1 above)~~~~~ | | | | |
| POWERPLANT | | | | | X |
| PROPELLER | | | | | |
| APPLIANCE | Type | | | | |
| | Manufacturer | | | | |

6. Conformity Statement

| | | |
|---|---|---|
| A. Agency's Name and Address Dan Gilbert 300 Ash st Lennox SD | B. Kind of Agency <input checked="" type="checkbox"/> U.S. Certificated Mechanic <input type="checkbox"/> Foreign Certificated Mechanic <input type="checkbox"/> Certificated Repair Station <input type="checkbox"/> Manufacturer | C. Certificate No. AP 3045130 |
|---|---|---|

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

| | |
|---------------------|--|
| Date 14-Dec-2006 | Signature of Authorized Individual <i>Dan Gilbert</i> |
|---------------------|--|

7. Approval for Return to Service

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is APPROVED REJECTED

| | | | | | |
|-----------|-----------------------------|----------------|-------------------------------------|---|-----------------|
| BY | FAA Fit Standards Inspector | Manufacturer | <input checked="" type="checkbox"/> | Inspection Authorization | Other (Specify) |
| | FAA Designee | Repair Station | | Person Approved by Transport Canada Airworthiness Group | |

| | | |
|---|--|--|
| Date of Approval or Rejection 24 Jan '07 | Certificate or Designation No. AP3045130 IA | Signature of Authorized Individual <i>Dan Gilbert</i> |
|---|--|--|

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. Description of Work Accomplished

(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)

N #: N948A

S/N: 22-259

REMOVED:

Delco Remy 12 Volt Generator P/N: 1101899, generator mounting brackets and Kelly Aerospace 14 Volt P/N: V300-14-20 Voltage Regulator.

INSTALLED:

Installed Plane Power FAA-PMA P/N: AL12-50 12 volt 50 Amp Alternator kit with mounting brackets to replace original Delco generator. Installed MS25171-S2 terminal nipple on the 6mm output terminal and torqued terminal to 50 in. lbs per manufactures instructions. Installed MS25171-1S terminal nipple on F1 at rear of alternator and torqued to 20 in. lbs per manufactures instructions. Install Ground wire and to 5mm stud and torqued to 35 in lbs. per manufactures instructions. Installed Zefronics FAA-PMA P/N: R15VOL Electronic Voltage Controller. Installed 14V Over Voltage Warning Lamp on instrument panel in accordance with Manufactures Installation Drawings. Installed new Dayco 36 degree, .051 inch top width X 33.54 inch effective length V-belt P/N: 77335 meeting of exceeding SAE J636 and J637 specifications (Cross-references to Gates P/N: 9335HD).

Installation was performed in accordance with AC43.13-1B. Wiring was in accordance with AC43.13-1B Chapter 11, AC43.13-2A Chapter 10, Section 2. Wire sizing was accomplished with AC43.13-1B Chapter 11, Section 4 & 5. All wire used in this application was Tefzel wire Mil Spec 22759/16 of appropriate gauge per AC43.13-1B Chapter 11, Section 6 (Reference wiring installation and diagram on FAA Form 337 approved dated 23 January 2007).

Operational Ground Checks:

Operational ground and function checks of the alternator system were performed. Found system to be operating properly and did not interfere with the normal operation of the other equipment installed nor does the entire system, cause a current draw exceeding 80% of the rated alternator output. It has been determined that the interrelationship between this change and any other previously approved modifications will introduce no adverse effect upon the airworthiness of this aircraft.

Documents and References:

Zefronics R15VOL Drawing & Installation Instructions, dated 1/7/04. Plane Power, LTD AL12-50 Installation Instructions Drawing Number 10-8001, dated 12/15/05, Revision J.

Instructions for Continued Airworthiness:

The manual(s) listed above, and attached Instructions For Continued Airworthiness will provide guidance for any continued airworthiness tests that may arise in the future. Other than regular periodic functional checks, maintenance of the above system is on condition only. Inspect in accordance with FAR 43 Appendix D and AC 43-13-1B Chapter 12. See attached ICA's R15VOL Electronics Altenator Controller and AL12-50 Altenator

-----END-----

Additional Sheets Are Attached

Part No. 10-8001

Installation Instructions (InterAV Replacement on Lycoming Engine)

1. Disconnect aircraft battery.
2. Install alternator per included drawing.
3. Refer to appropriate engine and airframe service manuals for belt tension and bolt torques.
4. Install battery and Reg + wires with MS25171-2S terminal nipple on 6mm output terminal. Replace Reg + wire ring lug with proper size. Torque to 50 in. lb.
5. Install ground wire to any of the three 5mm studs on rear of alternator and torque to 35 in. lb.
6. Install field wire with MS25171-1S terminal nipple to F1 terminal on rear of alternator and torque to 20 in. lb.
7. NOTE: F2 terminal to remain grounded with ground strap.
8. Reconnect aircraft battery.
9. Start aircraft and check alternator output for proper operation.

Instructions For Continued Airworthiness

Annual / 100 hour inspections:

1. Remove drive belt and turn alternator rotor to check condition of bearings for abnormal noise or roughness.

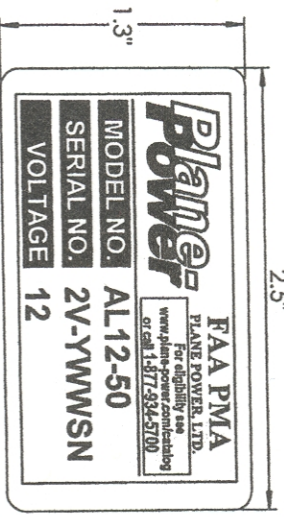
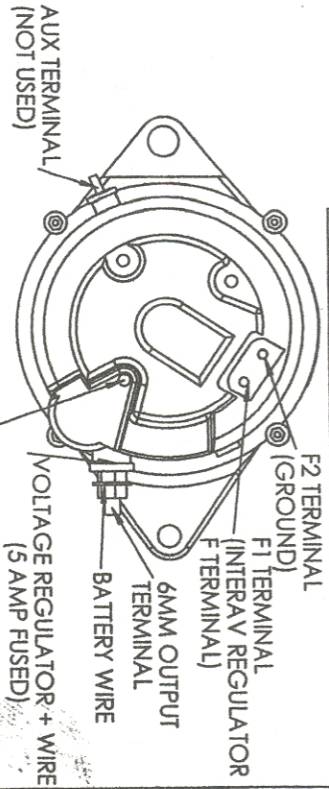
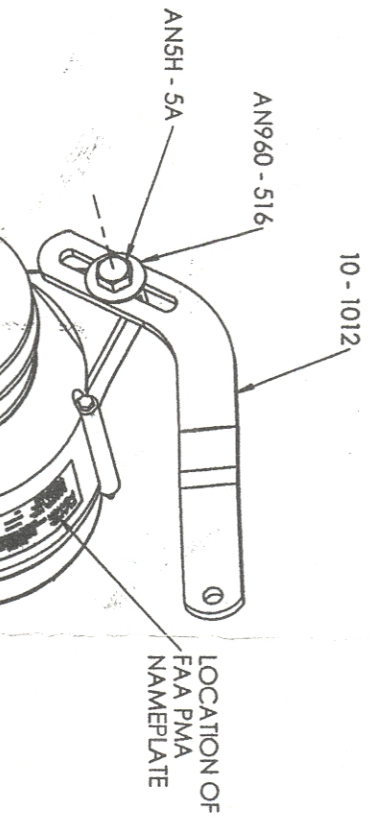
5 year or 1,000 hour intervals:

1. Repeat: Annual / 100 hour inspection.
2. Remove field brush assembly and inspect brushes for excess wear. Replace brush assembly if brushes extend less than .250" from edge of brush holder case.

NOTE: SAFETY WIRE TENSION ARM BOLT (AN5H-5A) WITH .032" SAFETY WIRE.

REVISIONS

| LTR. | DESCRIPTION | DATE | ARR. |
|------|--|---------|------|
| B | BRACKET/HDW. CHANGE | 6/06/05 | SJK |
| C | CORRECTED BOLT LENGTH | 6/10/05 | SJK |
| D | CORRECTED TENSION ARM AND INSTRUCTIONS | 6/16/05 | SJK |
| E | UPDATED PMA TAG | 8/12/05 | SJK |
| F | COMPANY NAME CHANGE | 8/17/05 | SJK |
| G | ADDED PART TAG DIM. & LOC. | 9/09/05 | SJK |
| H | ADDED U - BRACKET | 4/13/06 | SJK |
| J | CHANGED REG. WIRE ANNOTATION | 6/05/06 | SJK |



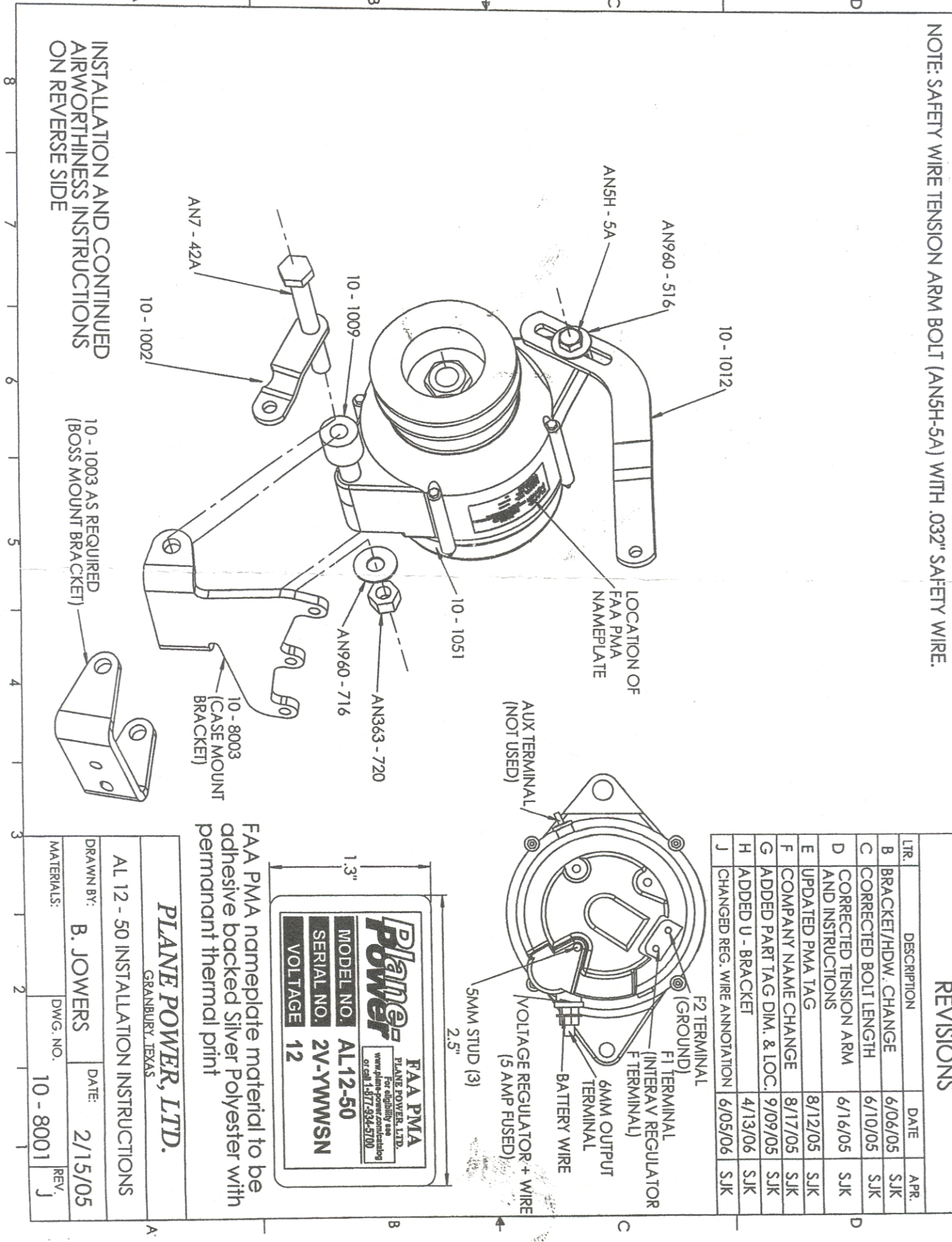
FAA PMA nameplate material to be adhesive backed Silver Polyester with permanent thermal print

PLANE POWER, LTD.
GRANBURY, TEXAS

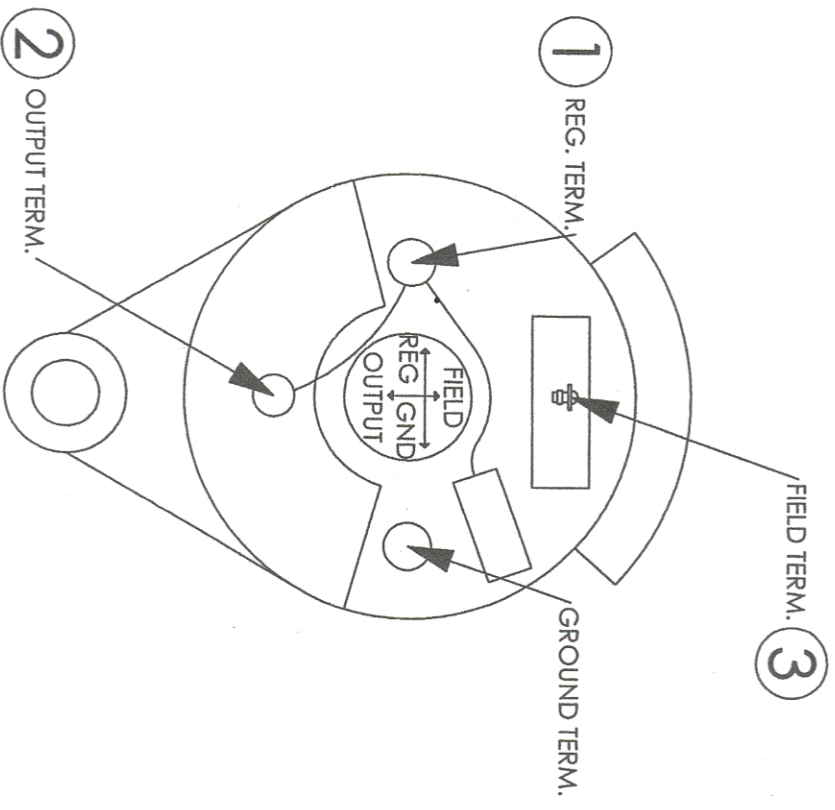
AL 12 - 50 INSTALLATION INSTRUCTIONS

| | | | |
|------------|--------------------|-------|---------|
| DRAWN BY: | B. JOWERS | DATE: | 2/15/05 |
| MATERIALS: | DWG. NO. 10 - 8001 | REV. | J |

INSTALLATION AND CONTINUED AIRWORTHINESS INSTRUCTIONS ON REVERSE SIDE

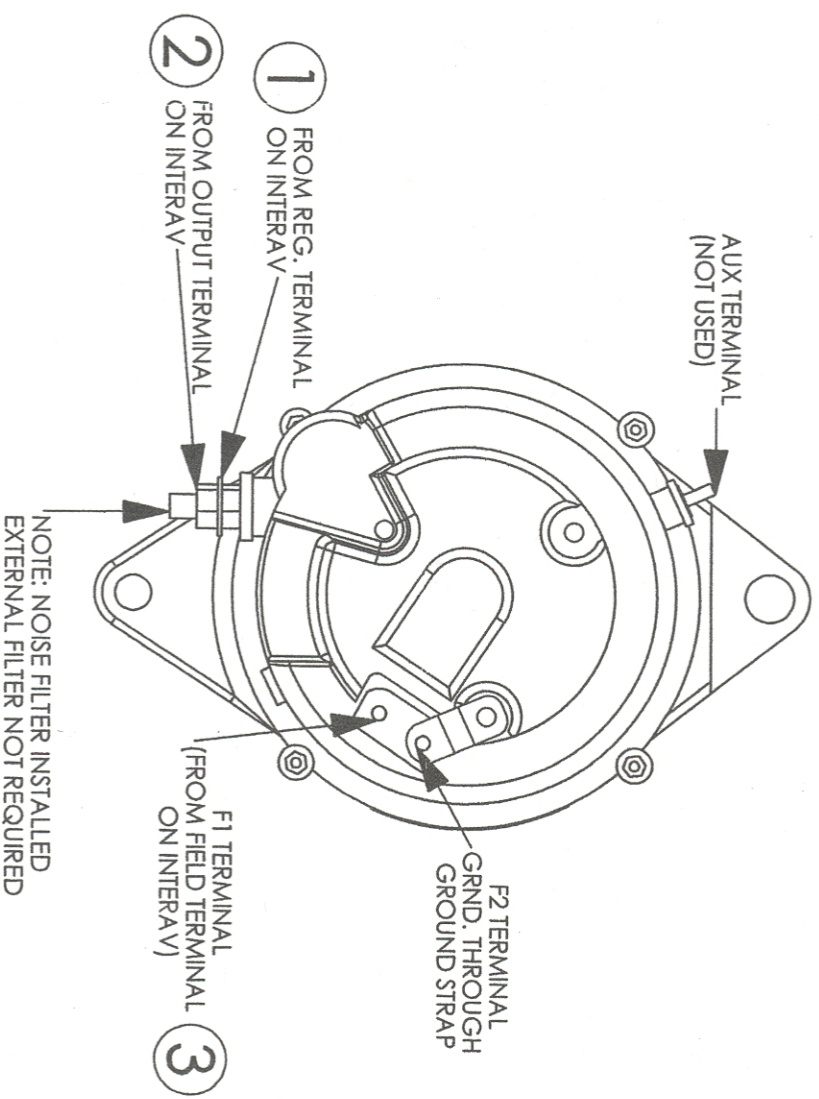


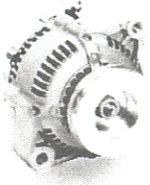
INTERAV ALTERNATOR WIRING



PLANE POWER ALTERNATOR WIRING

AL12-50 OR AL12-50C





FAA-PMA Approved Alternator Catalog

Valid 9/5/2006

Plane-Power alternators are FAA PMA certified to replace the alternators listed for the following aircraft and/or engines:

| Alternator | Description | Replaces | Eligible On |
|------------|--|--|--|
| AL12-P70 | 12 Volt / 70 Amp w/3/8" groove pulley | Lycoming LW-14316 | 235, 320, 360, 540, 720 series engines. Commander 112, 112B, 114, 114A, 114B, 112TC, 112TCA, 114TC |
| | | Kelly Aerospace ALE-8105A, ALE-8406 | Beechcraft 19A, B23, B19, C23, M19A, A24, 23, A24R, B24R, C24R, A23-19, A23-24 |
| | | Lycoming LW-14310 | Grumman AA-1, AA-1A, AA-1B, AA-1C |
| | | Kelly Aerospace ALY-6420, ALY-6420-G, ALE-6420 | |
| | | Piper 751 346 | Piper PA-44-180, PA-44-180T |
| | | Kelly Aerospace ALX8421LS | |
| | | Piper 551 984 | Piper PA-28-151, PA-28-32R-301 (SP), PA-32-301T, PA-32R-301 (HP), PA-32R-301T (SP), PA-32-301, PA-34-200, PA-38-112 |
| | | Kelly Aerospace ALY-8420, ALY-8420R | Beechcraft 76 Duchess, 77 Skipper |
| | | Kelly Aerospace ALY8420 | American Champion 7ECA, 7GCAA, 7GCBC, 7KACB, 8GCBC, 8KCAB, Mooney M20C, M20E, M20F, M20G, M20J |
| | | Kelly Aerospace ALX-8403 | Mooney M20C, M20E, M20F, M20G, M20J |

| Alternator | Description | Replaces | Eligible On |
|------------|--|---------------------|---|
| AL12-F60* | 12 Volt / 70 Amp w/3/8" groove pulley | Ford DOFF-10300J | Grumman AA-5, AA-5A, AA-5B, AG-5B, GA-7 |
| | | Cessna C611501-0101 | Cessna 177, 177A, B, 210B, C, D, E, F P206A, B, C, D, E, 207, U206, A, B, C, D, E |
| | | Cessna C611501-0102 | Cessna U206C, D, E, F, G, 207, P206C, 188, 172K, L, M, N, P, 177, A, B, 177RG, 180H, J, K, 185E, F, 182J, K, L, M, N, P, Q, R |
| | | Cessna 1570213-6 | Cessna 188, A188, 210G, 210H |
| | | Cessna 0750217-1 | Cessna 180H, 185D, 182G, H, 210E |
| | | Beech 33-38009-1 | Beechcraft 19A, B23, B19, C23, M19A, A24, 23, A24R, B24R, C24R, A23-19, A23-24 |

| Alternator | Description | Replaces | Eligible On |
|------------|--|----------------|---|
| AL12-C60 | 12 Volt / 70 Amp w/1/2" groove pulley | Piper 69670-00 | PA-28-140, PA-28-150, PA-28-151, PA-28-160, PA-28-180, PA-28-235, PA-28R-180, PA-28R-200, PA-32-260, PA-32-300 |
| | | Piper 69670-03 | PA-28-140, PA-28-151, PA-28-161, PA-28-180, PA-28-235, PA-28R-200, PA-32-300 |
| | | Piper 69670-04 | PA-28-151, PA-28-161, PA-28-181, PA-28R-201, PA-28R-201T, PA-28-236, PA-32-300, PA-32RT-300, PA-32RT-301T |

| Alternator | Description | Replaces | Eligible On |
|------------|--|-------------------|---|
| AL12-50C | 12 Volt / 70 Amp w/3/8" groove pulley | InterAv 015-01237 | Cessna 182, 182A, B, C, D, E, F, G, Cessna 210, 210A, B, 210-5 (205), 185, 185A, B, C, 180, 180A, B, C, D, E, F, G, 206, P206 Lockheed 402-2 Navion D, E, F, G Meyers 200, 200A, B, C, D Beechcraft A35, B35, C35, D35, E35, F35, G35, H35, J35, K35, M35, N35, P35, 35-33, 35-A33, 35-B33, 35-C33, 35, |

| Alternator | Description | Replaces | Eligible On |
|------------|--|---------------------|---|
| AL24-F60* | 24 Volt / 70 Amp w/3/8" groove pulley | Cessna C611503-0102 | Cessna 152, A152, 172M, N, P, 172RG, 177RG, 180J, K, 182P, Q, R, 207, R182, U206E, F, G, 210K, L, M, N, R |
| | | Cessna 1570213-7 | Cessna 188, A188A, 188A, A188B, 188B, A188, 207 |

| Alternator | Description | Replaces | Eligible On |
|------------|--|-------------------------------|--|
| AL24-P70 | 24 Volt / 70 Amp w/3/8" groove pulley | Lycoming LW-14324 | 235, 320, 360, 540, 720 series engines. |
| | | Commander 78314 | Commander 500S |
| | | Kelly Aerospace ALU-8421LS | Grumman AG5B Partenavia P68, P68B, P68C, P68C-TC, P68 & P68TC "Observer", P68 "Observer 2" |
| | | ALU-8421 | Beechcraft Duchess 76 |
| | | ALU-8421R | Beechcraft B19, C19, C24R |
| | | ALU-6421LS | Mooney M20J |
| | | ES-4009LS | Mooney M20M |

| Alternator | Description | Replaces | Eligible On |
|------------|--|-------------------|---|
| AL12-50 | 12 Volt / 50 Amp w/1/2" groove pulley | InterAv 015-01237 | AeroCommander A (Intermountain, Calair) Alliance Aircraft H250, 500 Varga 2150A Bellanca 14-19 Camair 480 Mitchell Super-V Mooney M20, M20A, B, C, D, E, F, G Piper PA-12, PA-12S, PA-16, PA-16S, PA-18, PA-18A (Restricted), PA-18A "135" (Restricted) PA-18A "150" (Restricted) PA-18S, PA-18 "105" (Special), PA-18S "105" (Special), PA-18A, PA-18S "125" (Army L-21A), PA-18S "125", PA-18AS "125", PA-18 "135" (Army L-21B), PA-18A "135", PA-18S "135", PA-18AS "135", PA-18 "150", PA-18A "150", PA-18S "150", PA-18AS "150", PA-19S, PA-19 (Army L-18C), PA-20, PA-20S, PA-20 "115", PA-20S "115", PA-20 "135", PA-20S "135", PA-22, PA-22-108, PA-22-135, PA-22S-135, PA-22-150, PA-22S-150, PA-22-160, PA-22S-160, PA-23, PA-23-160, PA-23-235, PA-23-250, PA-E23-250, PA24, PA-24-250, PA-25, PA-25-235, PA-25-260, PA-28-140, PA-28-150, PA-28-160, PA-28-180, PA-28-235, PA-28S-160, PA-28S-180, PA-28R-180, PA-28R-200, PA-30 Colonial C1, C2, Lake LA-4 Beechcraft 23 Schweizer 269A, 269A-1, 269B, 269C, 269C-1 |

* Teledyne Continental alternator installations use a wide variety of V-belts. Plane Power, Ltd. recommends the use of TCM P/N 539547-32.00 for most installations of AL12-F60 and AL24-F60 alternators on TCM engines.



www.plane-power.com
info@plane-power.com

346 HOWARD CLEMMONS RD
GRANBURY, TEXAS 76048
TOLL FREE 877.934.5700
PHONE 817.573.5700
FAX 817.573.5716

INSTALLATION INSTRUCTION FOR R15V0L ALTERNATOR CONTROLLER

1. REMOVE THE EXISTING ALTERNATOR CONTROL UNIT.
 - a. Connect the R15V0L in its place.
 - b. Using the existing hardware, mount the unit on the airframe.
 - c. Ensure that all connections are secure. A loose connection causes poor conduction of electricity, and can create a fire hazard. **SAFETY FIRST!**
2. Ensure that all wires are clear from all moving parts and controls. Weight and balance change: None.
3. POST INSTALLATION CHECK - after installation is complete, perform the following tests.

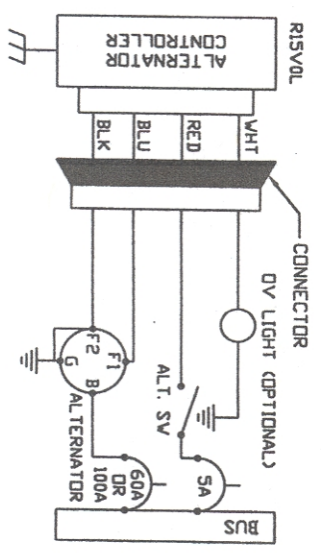
Turn on BATTERY and ALTERNATOR SWITCH. Observe that the color of F/F light on unit is GREEN. If F/F is RED, the ALTERNATOR field has a ground fault problem. Repair ALTERNATOR or correct ground short. If F/F lights NEUTRAL (i.e. no color) then check for open/defective ALTERNATOR switch/wiring/or circuit breaker. If the light is GREEN, turn ON the engine and check for bus voltage. Bus voltage should be 13.8 to 14.4V. If ALTERNATOR does not come on line, turn off the engine and look for an open ALTERNATOR field or wiring.

The R15V0L is a part of a family of alternator control/protection products. Also available are Voltage Regulators, ACU, paralleling and OV relays.

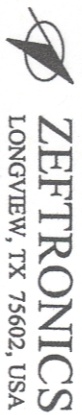
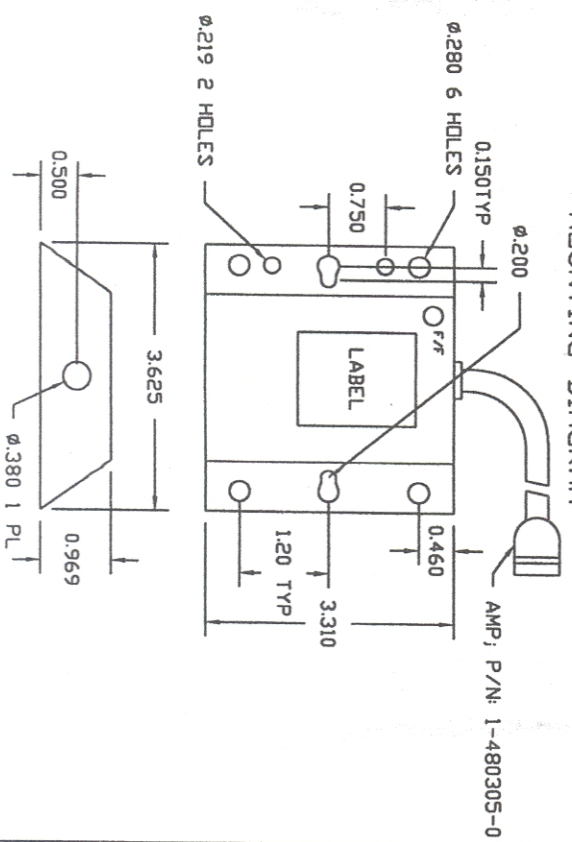
| Reference | Description | Qty. |
|-----------|-----------------------------------|------|
| 1. R15V0L | ZEFFTRONICS alternator controller | 1 |

Document: Product Eligibility Catalog #Z00PEC; Troubleshooting notes.

WIRING DIAGRAM



MOUNTING DIAGRAM



ZEFFTRONICS
LONGVIEW, TX 75602, USA

This drawing is proprietary and confidential with all rights reserved by this company. Permission to use it must be granted in writing.

TITLE : INSTALLATION DRAWING

| MODEL # | REV | REV |
|----------|--------------------|------|
| R15V0L | | |
| DWG # | Z00DD0 | REV |
| DRAWN BY | CORINA GARCIA | DATE |
| APPRD BY | <i>[Signature]</i> | DATE |
| ORG DWN | FEM IBIAYO | DATE |
| | | 90 |

| | | | |
|---------------|--|-----------|-----------|
| REV A | REDRAWN TO CLARIFY. ADDED POST-INSTALLATION. | MINOR (X) | MAJOR () |
| CHANGE CLASS: | | MINOR (X) | MAJOR () |
| REV B | REDRAWN TO ADD DIMENSIONS TO MOUNTING DIAGRAM. | MINOR (X) | MAJOR () |
| CHANGE CLASS: | | MINOR (X) | MAJOR () |
| REV C | | MINOR () | MAJOR () |
| CHANGE CLASS: | | MINOR () | MAJOR () |
| REV D | | MINOR () | MAJOR () |
| CHANGE CLASS: | | MINOR () | MAJOR () |
| REV E | | MINOR () | MAJOR () |
| CHANGE CLASS: | | MINOR () | MAJOR () |
| ECN # | | DATE | |
| ECN # | | DATE | |
| ECN # | | DATE | |
| ECN # | | DATE | |
| ECN # | | DATE | |

NOTES:

Frequently Asked Questions & TECHCARD Notes

14V Type B alternator system on Piper, Beech, etc

TROUBLE-SHOOTING THE SYSTEM

ZEPHRONICS SOLUTIONS

Flickering / oscillating ammeter and panel lights.
Check the 5 Amp breaker, ALT switch, and connections between the bus and the input to the ACU for high resistance or intermittent connection.

No voltage regulation

With the master switch on and Battery voltage measured on the ACU input, the ACU output voltage should be 0.5 to 2V less the bus voltage.

- If there is no Bus voltage on the ACU input, look for a broken wire, bad connection or input device (5A circuit breaker or Alt switch) between the ACU and the bus.
- If the input voltage is more than 0.2V lower than the bus voltage, look for and correct or replace the input device that is causing the problem.
- If the output voltage is 0V and the input has battery voltage, look for a grounded alternator field or field wire (as indicated by a Red ACU TSL). If the field resistance is correct as shown in step 5 of the installation tests and the ACU's Trouble-Shooting Light (TSL) is off, send the ACU in for test/repair.
- If the TSL is Red, repair the field ground fault or replace the alternator.
- If the output voltage is the same as the input voltage, look for an open alternator field or field wire. If the field resistance is higher than what is shown in step 5 of the installation tests, send the alternator in for test/repair. If the field resistance is correct, send the ACU in for test/repair.

Bus voltage remains at battery voltage (about 12V)
To solve this problem, see **No voltage regulation**.

Alternator carries only about half its rated output.

Look for an open stator wire or open diode in the alternator. In Piper PA 28 & 32 series, check the condition of the diode between the bus (J) and alternator output (F). Check the stator and alternator output wires indicating an alternator that is current limiting.

Bus voltage drops with load increase

To solve this problem, see **Alternator carries only about half its rated output**.

OUR GOAL IS TO HELP YOUR SYSTEM OPERATE BETTER

AND HELP YOU UNDERSTAND ITS OPERATION.

INSTALLATION TESTS. BEFORE INSTALLING THE UNIT, PERFORM TESTS:

1. Read pages 1 to 3 and this page.
2. Check for and replace open, frayed, or broken wires. Clean thoroughly or replace corroded, dirty, or oxidized connectors, terminals, contact, or poorly soldered wire junction.
3. Check for Open or Ground-shorted alternator field. Most 12V alternators have 3-6Ω field resistance. Ground shunted alternator field will damage most Voltage Regulation/ACU. Repair or replace an alternator has a field to ground short, do not connect the ACU to it.
4. With the engine off, Check voltage drops across the Field, Alt switch, Alt field circuit breaker and ACU. High voltage-drop means excessive junction resistance and will lead to many problems like fluctuation ammeters, charge-meters and panel lights.
6. Perform and record the following tests with the Master Switch Off:

| Field Resistance at ALT | Typical Values | Switch Off: |
|----------------------------|----------------|-------------|
| A. Field resistance at ACU | Ω | 3 - 60 |
| B. Field SN resistance | Ω | 3 - 60 |
| C. Field SN resistance | Ω | 0 - 0.10 |
| D. Field CBR resistance | Ω | 0 - 0.05Ω |
| E. ALT Out CBRK resistance | Ω | 0 - 0.05Ω |
8. Perform and record the following tests with the Master Switch On:

| BUS Volt Engine Off | Typical Values |
|-----------------------|----------------|
| A. ACU/Reg Input Volt | 12 - 13V |
| D. Field Voltage | 12 - 13V |
| F. Field Voltage | 0.5-2V < Bus |
7. Post Installation. If all tests are correct to or per steps 4 & 6, run the engine and record:

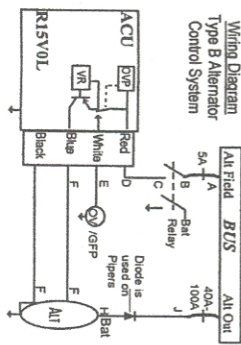
| 12V System | Typical value |
|----------------|---------------|
| A. Bus voltage | 13.8 - 14.3V |
| H. Bus voltage | 13.8 - 14.3V |
| J. Bus voltage | 13.8 - 14.3V |

For test help & other TechCards, call 903-758-6661

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ZEPHRONICS
Electronic Charging System Solutions

Wiring Diagram
Type B Alternator
Control System



In this Type B system, the ACU is between the BUS and the Alt field. To control the bus voltage, the unit switches power to one side of the field several times a second. The OVP opens when OV occurs.

R15V01

14V ELECTRONIC ALTERNATOR CONTROLLER

ZEPHRONICS SOLUTIONS

Features:

- Voltage Regulation, Pulse Width Modulated
- Field-to-Ground Fault Protection (GFP)
- Trouble-Shooting Light (TSL)
- Over-Voltage Protection
- Increased Regulator life. Reduced panel lights flicker
- Protects against grounded alternator field
- Identifies grounded field. Reduce trouble-shooting time.
- Protects system loads against overexcited alternator

Benefits:

Voltage Regulation: 14.2V ± 0.2V. Max Field Current: 5A. Field-to-Ground Protection @ Field current > 6A

VOLTAGE REGULATION.

The Voltage Regulator with Pulse Width Modulated (PWM) field control keeps the bus voltage constant by controlling the alternator's field current. Increasing it when the system load increases and decreasing it when the load drops.

OVER VOLTAGE (OV) PROTECTION.

The OV Protector (OVP) deactivates (turns off) the Voltage Regulator and the alternator if the bus voltage exceeds 16V to protect sensitive avionics equipment and the battery.

OV & FIELD-GROUND SHORT WARNING.

A warning light connected between the white wire and ground comes on to warn the pilot of the bus voltage exceeding the OV level or alternator Field-to-Ground Fault Protection (GFP).

FIELD TO GROUND SHORT PROTECTION.

If the alternator's field shorts to ground, the field-to-ground short protector will deactivate the Voltage Regulator, and switch on the unit's RED field-to-ground short indicator, and the GFP / OV indicator on the instrument panel.

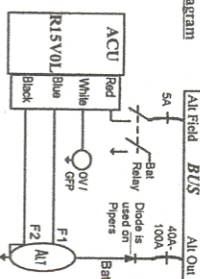
TROUBLE-SHOOTING LIGHT (TSL)

The TSL (on the unit) is designed to alert the user to the condition of the Alternator / ACU system.

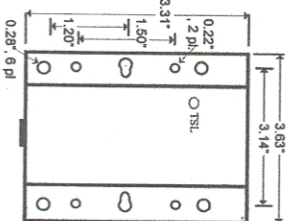
RED TSL Indicators: An internal or external ground

short in the alternator field circuit
Without the engine running but master switch on, GREEN TSL indicates that the ACU is supplying current to the alternator's field.
With the engine running, master switch on, and bus voltage @ about 14V, GREEN TSL indicates correct alternator output voltage.

Wiring Diagram



Mounting Diagram
Height: 1.0"



Trouble-Shooting Light Continued ...

With the engine running, master switch on, and bus voltage @ about 12V, GREEN TSL indicates that current is flowing from the ACU but the alternator field or field wire to it is open.
With the master switch on, if the TSL is off, that indicates that one power input device (e.g. switch, circuit breaker, or wiring) is open or the ACU is defective.

By Femi G. Ibiyayo
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R15V01-TTL-pub. Rev 1

1622 E. Whaley St., Longview, TX 75601, USA
Ph: 903-758-6661, Fax: 903-258-9706, Email: tech@zephronics.com
Ph: 1-800-362-8885, Web Site: www.zephronics.com

ZEPHRONICS
Electronic Charging System Solutions

By Femi G. Ibiyayo
©2003, ZEPHRONICS, Texas China Inc
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1622 E. Whaley St., Longview, TX 75601, USA
Ph: 903-758-6661, Fax: 903-258-9706, Email: tech@zephronics.com
Ph: 1-800-362-8885, Web Site: www.zephronics.com

ZEPHRONICS
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R15V0L

14V ELECTRONIC ALTERNATOR CONTROLLER

ZEPTRONICS SOLUTIONS

HOW THE SYSTEM WORKS

When the master switch is turned on, battery voltage is applied to the input of the R15V0L or similar alternator controller/voltage regulator through the input devices and wires from the bus. The current passing through the voltage regulator is applied to the field of the alternator. Without the engine running, the field voltage is typically 0.5-2V less than the bus or battery voltage.

Voltage Regulation

When the engine is running, the voltage regulator keeps the bus voltage constant by controlling the alternator's field current: increasing it when the system load increases and decreasing it when the load drops. The regulated bus voltage is normally about 14V unless the alternator is self-current limiting, or if there is a voltage drop in the input devices preceding ACU.

OVER VOLTAGE PROTECTION

To protect sensitive avionics equipment and other system loads, if the bus voltage exceeds 16V the OV Protector (OV) deactivates (turns off) the Voltage Regulator to remove the alternator's field current. The ACU stays latched off until the alternator switch is reset.

Field-to-Ground Short Protection

Should the alternator's field become shorted to ground the field-to-ground short protector turns off the Voltage Regulator, and switches on the ACU's Red field-to-ground short TSL, and the instrument panel's OV light.

TROUBLE-SHOOTING LIGHT (TSL)

The TSL on the unit alerts the user to the condition of the Alternator / ACU system. The TSL has three color/status: Red, Green, and Off.

Red TSL indicates: An internal or external ground short in the alternator field circuit

Without the engine running but master switch on, Green TSL indicates that the ACU is supplying current to the alternator's field. An off TSL indicates that one of the power input devices is open or the ACU is defective.

With the engine running, master switch on:

A bus voltage @ about 14V, Green TSL indicates correct alternator output voltage.

A bus voltage @ about 12V, Green TSL indicates that current is flowing from the ACU but the alternator field or field wire to it is open.

A self-current limiting—internal characteristics of the alternator that causes it to limit its current and voltage output at a given speed.

R15V0L or similar ACU

14V Type B alternator system on Piper PA28 etc

ZEPTRONICS SOLUTIONS

OUR GOAL IS TO HELP YOUR SYSTEM OPERATE BETTER AND HELP YOU BETTER UNDERSTAND ITS OPERATION.

1. With the engine off, disconnect the ACU (Red and Blue wires). Take and record the following measurements with the Battery switch off, Alt switch on:

| Values | Typical Values |
|--|----------------|
| A. Field resistance at ALT (F1-F2) | 0 - 60 |
| B. Field resistance at ACU (F-Gnd) | 3 - 60 |
| C. Field Switch resistance (B-C) | 0 - 0.10 |
| D. Field Circuit breaker resistance (A-B) | 0 - 0.050 |
| E. ALT Out CB/R resistance (A-A) | 0 - 0.050 |
| F. Turn off the battery & alternator switches and connect the Red and Blue wire to the system. | |

2. With the engine off and Master switch on, perform and record the following voltage tests:

| Values | Typical Values |
|----------------------------------|----------------|
| A. BUS voltage (A to Gnd) | 12 - 13V |
| B. ACU Input Red wire (D) to Gnd | 12 - 13V |
| C. Field (Blue wire) to Gnd | 0.5-2V < Bus |

3. Post installation: If all tests are correct to or per steps 2 and 3, run the engine and record the bus voltage at:

| Values | Typical values |
|----------------------|----------------|
| A. 1000 RPM, no load | 13.8 - 14.3V |
| B. 1400 RPM, no load | 13.8 - 14.3V |
| C. 1800 RPM, no load | 13.8 - 14.3V |

HOW THE SYSTEM WORKS

With the engine off, when the master switch (Alt & Bat) is turned on, battery voltage (12V) is applied to the input of the ACU through the 5 Amp FLD circuit breaker, ALT switch and the OV Relay. The applied voltage causes current to flow to the alternator's field through the ACU to excite the alternator's field.

With the engine on and the master switch on, the ACU controls the excitation of the alternator to produce a Bus voltage of 13.8 - 14.3V. This regulated voltage charges the battery and allows the alternator to power all the electrical system loads in the aircraft. The 5 Amp circuit breaker opens if the current going to the ALT field exceeds 5 Amps, after a preset time lag, to protect the wire from the Bus to the field. Some wrongly expect this breaker to protect their non-Zeptronics ACU.

If the Bus voltage exceeds the preset over-voltage (OV) limit, the OV Relay, which is normally closed, will open up and disconnect the Bus from the ACU to remove excitation from the alternator's field.

When power is applied to a static (non-rotating) alternator through the ACU/regulator, the F1 voltage is 0.5-2V less than Bus voltage. When the alternator is rotating, F1 voltage will start low and increase with each load increase until the alternator current limits.

INSTALLATION INSTRUCTION

1. Disconnect and remove the present ACU.
2. At the ACU, measure the alternator's field resistance: i.e. resistance between the field and the ground wire. A resistance of 3.5 to 60 is normal. If the measured resistance is outside the specified range, check the alternator field and the connections/wire from the ACU's field wire to ground. 0Ω indicates a field to ground short. Correct the fault.
3. Mount and connect the new ACU to the system.
4. Perform the Post Installation Test Procedure.

POST INSTALLATION TEST PROCEDURE

5. Turn on the Master switch and observe: On the ACU the TSL light is on. A Red TSL indicates that the field or field wire is shorted to ground.
6. Measure the voltage on Red and Blue wires: The Red should read Battery voltage, while the Blue reads 1-2 volts less than the Red wire.
7. If the steps 5 and 6 are successful, perform step 8.
8. Turn off all the avionics and voltage sensitive loads. Start the engine. At 1500-1600 RPM measure bus voltage. It should read 13.8V - 14.4V. If the bus voltage exceed these limits, check for voltage drop in the 5A breaker, the Alt switch, and pre-ACU wires.

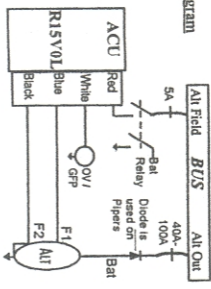
TROUBLE-SHOOTING THE SYSTEM

For help on how to solve problems in the system, see pages 3 and 4.

ICA: MAINTENANCE INSTRUCTION

The ACU is not field serviceable or repairable beyond what is described or prescribed in this document. Should the ACU no longer as described in the system works, and the service technician or engineer cannot resolve the system's problem by following the trouble-shooting notes. Contact Zeptronics for each help or send the unit to Zeptronics or its approved repair station. During each annual inspection perform a complete electrical charging system wiring inspection and the tests in steps 2, 5, 6, 7, 8 above.

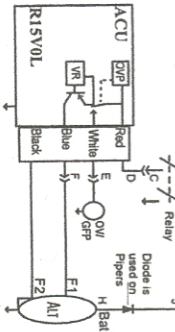
Wiring Diagram



TROUBLE-SHOOTING THE SYSTEM

14V Type B alternator system on Piper PA28 etc

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When the master switch (ALT & BAT) is turned on, battery voltage is applied to the Bus & OV Relay input.

Take all voltage measurements at test points A, B, D, E and F referenced to ground.

| | |
|-----------------|-----------------|
| A. _____ Volts. | B. _____ Volts |
| D. _____ Volts. | E. _____ Volts |
| F. _____ Volts. | F1. _____ Volts |

The voltages measured at A, B, D, and E should be the same. Bus voltage (around 12V). The voltage on F (field or alternator controller/voltage regulator output) will be 0.5 to 2V less than the voltage at A, B, D, or E. The voltage at F1 will be the same as F.

If the voltage at A is 0.2V more than that on D, check the 3 Amp breaker. ALT switch, and connections between the bus and D for high resistance or open circuit. A high resistance between A & D may lead to flickering, oscillating dimmer and dimmer lights. An open circuit between A & D will not allow current to get to the controller/regulator and subsequently no current to the alternator's field and no voltage regulation. When there is no voltage regulation, the Bus voltage remains at battery voltages.

If the voltage on F1 is 0.2V or more less than the voltage F, check for poor connection or open circuit between the controller/regulator output and F1 on the alternator. If the resistance between the F and F1 is higher than 0.5Ω, the alternator may not carry its rated load, showing a symptom similar one where there is an open stator wire or open diode in the alternator.

If the voltage on F1 is 0V or close, check for a ground short on F1 on the alternator or wire from F on the controller/regulator. If there is a field-to-ground short, the R15V0L will turn itself off and turn its built-in Trouble-Shooting Light (TSL) Red.

An open stator wire or open diode in the alternator will make the alternator only able to carry about half its rated output. For example, a 70A 12V alternator has a 14V output with about 30A load on it. When the load is increased to 40A, the bus voltage drops to 12 to 13V, indicating an alternator that is current limiting.

By Fern G. Biboze 01/07/04

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R15V0L-01T1-00 Rev. 1

1622 E. Whaley St., Longview, TX 75601, USA
Ph: 802-754-8661; Fax: 802-258-9786 E-mail: Fern@zeptronics.com

Ph: 1-800-326-8818; Web Site: www.zeptronics.com
R15V0L-01T1-00 Rev. 1



ZEPTRONICS
Electronic Charging Systems Solutions

By Fern G. Biboze 01/07/04

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Ph: 802-754-8661; Fax: 802-258-9786 E-mail: Fern@zeptronics.com

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Instructions for Continued Airworthiness (ICA)

Page 1 of 3

Aircraft Make: PIPER **Aircraft Model:** PA-22
Aircraft S/N: 22-259 **Aircraft N:** N948A
Date: 14-DECEMBER-2006 **Revision:** 0

SYSTEM: PLANE POWER AL12-50 ALTERNATOR

This section provides assistance to the installing agency in preparing Instructions for Continued Airworthiness (ICA) in response to Bulletin Number HBA W 98-18, "Checklist for Instructions for Continued Airworthiness for Major Alterations Approved Under the Field Approval Process", effective 10/7/98.

Following is a suggested ICA for a AL12-50 ALTERNATOR installation. Some of the checklist items do not apply, in which case they should be marked Not Applicable ("N/A")

Introduction:

MAKE: PIPER **MODEL:** PA22 **S/N:** 22-259 **N #:** N948A

Content, Scope,

Purpose and Arrangement: This document identifies the Instruction for Continued Airworthiness for the modification of the above aircraft by installation of a PLANE POWER AL12-50 ALTERNATOR.

Applicability:

Applies to aircraft altered by installation of the AL12-50 ALTERNATOR.

Definitions and Abbreviations: None, N/A.

Precautions: None, N/A.

Unit of Measurement: None, N/A.

Referenced Publications:

Plane Power Installation Instructions, P/N: 10-8001

Plane Power Installation Drawing, Number: 10-8001 Rev J or Later

Distribution:

This document should be a permanent aircraft record.

Description:

Installation of the AL12-50, with interface to external Zeftronics Electronic Controller. (Refer to manual for interconnect information).

AL12-50 installation, removal and replacement should be in accordance with applicable provisions of AC43.13-1B and 43.13-2A.

Control:

N/A

Servicing Instructions:

N/A

Instructions for Continued Airworthiness (ICA)

Page 2 of 3

Maintenance:

Maintenance of the AL12-50 is 'on condition' only. Periodic maintenance is not required. Refer to the plane power Installation Instructions.

Troubleshooting Information:

Refer to the Installation Instructions.

Removal and Replacement Information:

Refer to Installation Drawing 10-8001. If the unit is removed and reinstalled, a functional check of the Equipment should be conducted.

Diagrams:

Refer to Installation Drawing.

Special Inspection Requirements:

Annual / 100 hour inspections:

1. Remove drive belt and turn alternator rotor shaft to check condition of bearings for abnormal noise or roughness.

5 Year or 1000 hour intervals:

1. Repeat: Annual / 100 hour inspection.
2. Remove field brush assembly and inspect brushes for excess wear. Replace brush assembly if brushes extend less than .250 inches from edge of brush holder case.

Application Of Protective Treatments:

N/A

Data: Relative to Structural Fasteners

AL12-50 installation, removal and replacement should be in accordance with applicable provisions of AC43.13-1A and 43.13-2A. Also, refer to section Installation Drawing.

List of Special Tools:

N/A

For Commuter Category Aircraft:

- a. **Electrical loads:** N/A
- b. **Method of balancing flight controls:** N/A
- c. **Identification of primary and secondary structures:** N/A

Instructions for Continued Airworthiness (ICA)

Page 3 of 3

For Commuter Category Aircraft Continued:

d. Special repair methods applicable to the aircraft: N/A

Recommended Overhaul Periods:

No additional overhaul time limitations.

Airworthiness Limitation Section:

N/A

Revision:

To revise this ICA, a letter must be submitted to the local FSDO with a copy of the revised FAA Form 337, and revised ICA. The FAA inspector accepts the change by signing Block 3 and including the following statement:

“The attached revised/new Instructions for Continued Airworthiness (date _____) for the above aircraft or component major alteration have been accepted by the FAA, superseding the Instructions Continued Airworthiness (date _____)”

Assistance:

Flight Standards Inspectors have the resources to respond to questions regarding the ICA.

Implementation and Record Keeping:

For major alterations performed in accordance with FAA field approval policy, the owner/operator operating under Part 91 is responsible for ensuring that the ICA is made part of the applicable section 91.409 inspection program for their aircraft. This is accomplished when a maintenance entry is made in the aircraft's maintenance record in accordance with section 43.9. This entry records the major alteration and identifies the original ICA location (e.g., Block 8 of FAA Form 337, dated _____) along with a statement that the ICA is now part of the aircraft's inspection/maintenance requirements.

Instructions for Continued Airworthiness (ICA)

Page 2 of 3

Maintenance:

Maintenance of the R15VOL is 'on condition' only. Periodic maintenance is not required. Refer to the Installation Manual.

Troubleshooting Information:

Refer to the Installation Manual.

Removal and Replacement Information:

Refer to section Installation Manual. If the unit is removed and reinstalled, a functional check of the Equipment should be conducted.

Diagrams:

Refer to Installation Manual.

Special Inspection Requirements:

During Annual Inspection:

Perform a complete electrical charging system wiring inspection and the tests described in steps 2, 5, 6, 7, and 8 of the **installation instructions and post installation test procedures**, found in the Installation Manual.

Application Of Protective Treatments:

N/A

Data: Relative to Structural Fasteners

iR15VOL installation, removal and replacement should be in accordance with applicable provisions of AC43.13-1A and 43.13-2A. Also, refer to Installation Manual.

List of Special Tools:

N/A

For Commuter Category Aircraft:

- a. **Electrical loads:** N/A.
- b. **Method of balancing flight controls:** N/A
- c. **Identification of primary and secondary structures:** N/A
- d. **Special repair methods applicable to the aircraft:** N/A

Instructions for Continued Airworthiness (ICA)

Page 3 of 3

Recommended Overhaul Periods:

No additional overhaul time limitations.

Airworthiness Limitation Section:

N/A

Revision:

To revise this ICA, a letter must be submitted to the local FSDO with a copy of the revised FAA Form 337, and revised ICA. The FAA inspector accepts the change by signing Block 3 and including the following statement:

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