Technical Manual

for

Model No. SB1B-14
Linear Standby Regulator

With Over-Voltage Protection

Including:
Installation Instructions;
Troubleshooting Guide; and
Instructions for Continued Airworthiness

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SB1B-14_Install, Rev. C (9/16/16)

NOTE

The SB1B-14 Linear Standby Regulator is not STC'd or PMA'd and is intended for installation on amateur-built aircraft only.

INTRODUCTION

This kit is applicable to any aircraft requiring external control and regulation of a B-type, wound-field Standby Alternator in a 14-volt one-bus, one-battery system.

DESCRIPTION OF INSTALLATION

(1) Remove engine cowl and disconnect aircraft battery.
(2) Remove existing regulator (if applicable).
(3) Install new Standby Controller (Regulator).
(4) Install 2A and 5A circuit breakers, Standby alternator master switch, and incandescent warning light on instrument panel.
(5) Wire the SB1B-14 Controller (Regulator), circuit breakers, alternator master switch, incandescent warning light, and Hall-effect current sensor (optional).
(6) Reconnect battery and replace engine cowl.
(7) Update ship's weight and balance, pilot operating handbook and maintenance records.

PARTS LIST

The following parts are supplied with the SB1B-14:

Qty.	Part No.	Description
1	SB1B-14	Standby Alternator Controller (Regulator)
8	S814R6	Terminal, Ring, 18-22AWG
1	S888-1-4	Warning Lamp, Incandescent, Yellow, 14v

The following parts are needed but **not** supplied with this kit:

Qty.	Part No.	Description
1	BC410-H, BC462-H (or equal)	Alternator
1	CB2 (or equal)*	Circuit Breaker, 2A
1	CB5 (or equal)*	Circuit Breaker, 5A
1	S700-2-3 (or equal)*	Switch, Toggle
AR	M22759/16-18-9*	Wire, 18 AWG, White, Tefzel
AR	M22759/16-22-9*	Wire, 22 AWG, White, Tefzel
2	AN4-4A*	Bolt
4	AN960-416L*	Flat washer
2	AN365-428A*	Locking nut

Items noted with an * above items are available as part of a basic installation kit (P/N: LR_INSTALL). An advanced installation kit (P/N: SBK-14) is also available to provide enhanced functionality. Please contact B&C Specialty Products, www.BandC.aero, phone: 316-283-8000, for more information.

CHANGE IN WEIGHT AND BALANCE

Installation of this item will impact aircraft weight by a nominal 0.6 pounds. Variations in airframe station references for eligible aircraft prevent the inclusion of pre-calculated weight and balance data.

INSTALLATION INSTRUCTIONS

Preparation

Step 1. Refer to applicable service manual instructions; remove and retain engine cowl. Disconnect ship's battery, Negative (-) terminal first.

Step 2. Refer to applicable service manual instruction; remove existing regulator.

Step 3. Select a suitable location to mount the SB1B-14. Mounting on the pilot's side of the firewall, or inside the cabin near the panel, is preferred (linear controllers are electrically "quiet," and create no noise when properly installed).

> **NOTE**
> Take care to choose a mounting location that will protect the SB1B-14 from heat, vibration, and water.

Step 4. Select a suitable location to mount the incandescent warning light (supplied) or "STBY ALT" annunciator (optional) in your instrument panel. The light should be positioned within the pilots' peripheral vision — generally, a 45-degree angle in front of the pilot. A panel location away from direct sunlight is preferred.

Step 5. Select a suitable panel location to mount the 2A and 5A circuit breakers. A panel location within the pilot's field of vision and reach is recommended.

Step 6. Select a suitable panel location to mount the Standby alternator field switch. A panel location immediately adjacent to the ship's battery master is recommended, if practicable.

Regulator Installation

Step 7. Mount the SB1B-14 to the firewall or selected location, with the terminal strip oriented down (preferred). On a metal firewall, AN4-4A bolts, AN960-416L flat washers, and AN365-428A locking nuts, will be adequate to secure the regulator.

Step 8. Wire the SB1B-14 power and control circuits using M22759/16 Tefzel wire and the supplied S814R6 ring terminals, according to the wiring diagram on page 10.

> **NOTE**
> The SB1B-14 senses bus voltage through terminal #3. If the warning light is not desired, terminal #5 may be left unconnected; however terminal #3 ***must still be connected*** to the bus through a fuse or circuit breaker. If terminal #3 is not connected to power, the SB1B ***will not work***. Do not connect or "jumper" terminal #3 to terminal #6.

Step 9. Wire the SB1B-14 to ground using M22759/16 Tefzel wire and the supplied S814R6 ring terminals, according to the wiring diagram on page 10. Be certain to establish ground connections to both terminal #7 and the threaded ground stud below the terminal strip.

NOTE

This step is important for all airframes, and ***crucial*** for composite aircraft. The SB1B obtains a redundant connection to ground through the threaded stud. A jumper between terminal #7 and the ground stud will not provide this. Ground connections must be totally independent and not rely on common fasteners. Select 18AWG wire (or larger) and ring terminals for these connections.

Step 10. Wire the 2A and 5A circuit breakers and Standby alternator field switch using M22759/16 Tefzel wire, according to the wiring diagram on page 10.

NOTE

If panel space is limited, a 2A in-line fuse may be substituted for the 2A circuit breaker associated with terminal #5. The 5A circuit breaker associated with terminal #6 MUST be used. Connecting terminal #6 directly to the bus or using "solid-state breakers" (PTC thermistors) will damage the regulator if there is an over-voltage condition.

Step 11. Standard installation: wire the incandescent warning light using M22759/16 Tefzel wire, according to the wiring diagram on page 10. Place heatshrink (supplied) over each wire for the warning light base, solder the wires onto the base terminals, and shrink the heatshrink over the connection. Proceed to Step 12.

Optional installation (with SBK-14): wire the "STBY ALT" annunciator assembly and the Hall-effect current sensor, according to the wiring diagram on page 10. The current sensor may be secured to a location on the engine-side of the firewall near the Standby alternator. Proceed to Step 12.

Step 12. Connect ship's battery, Negative (-) terminal last, and replace engine cowl.

Step 13. Test system function, as follows —

Standard installation: Start the engine according to normal procedure. With the engine running and the battery master switch ON, turn the Primary alternator field switch and Standby alternator field switch ON. Reduce system electrical loads to approximately 10-15 amps. Set engine to a minimum of 2100 RPM. Turn Primary alternator field switch OFF; the Standby alternator incandescent warning light should illuminate. Turn the Primary alternator master switch ON again. Check to see that the warning light extinguishes. Verify that the Primary alternator is carrying the load by referencing the load meter, voltmeter, or ammeter (as applicable). Return the engine to idle RPM. Shut down engine according to normal procedure. Proceed to Step 14.

Optional installation (with SBK-14): Start the engine according to normal procedure. With the engine running and the battery master switch ON, turn the Primary alternator field switch and Standby alternator field switch ON. Reduce system electrical loads to approximately 10-15 amps. Set engine to a minimum of 2100 RPM. Turn Primary alternator field switch OFF; the "STBY ALT ON" annunciator should illuminate. Increase

system load to approximately 20 to 25 amps. The “STBY ALT ON” annunciator should begin to flash. Reduce RPM and system load. The “STBY ALT ON” annunciator should return to steady illumination. Turn the Primary alternator master switch ON again. Check to see that the “STBY ALT ON” annunciator extinguishes. Verify that the Primary alternator is carrying the load by referencing the load meter, voltmeter, or ammeter (as applicable). Return the engine to idle RPM. Shut down engine according to normal procedure. Proceed to Step 14.

Step 14. Update ship’s weight and balance, pilot operating handbook and maintenance records.

OPERATION OF THE SB1B-14

The SB1B-14 regulator is designed to control a Standby alternator in a one-bus, one-battery electrical system. The Standby alternator’s output is connected in parallel with the Primary alternator’s output. Since the SB1B-14 is on the same bus and senses the same voltage as the Primary regulator, both the Primary alternator and Standby alternator field switches should be ON in normal operation. If the bus voltage falls below 13.0 volts for any reason, such as a Primary alternator or Primary regulator failure, the SB1B-14 will energize the Standby alternator, and cause the Standby alternator indicator light (or optional annunciator) to illuminate.

Charging voltage for the SB1B-14 has been pre-set at 13.0 volts. This voltage does not normally need to be changed; however if adjustment is required, simply remove the 3/4" round plug from the side of the SB1B-14 and use a small screwdriver to turn the small adjustment screw (clockwise to increase voltage, counterclockwise to decrease voltage; approximately 1/2 turn per .16 volts). Use a digital voltmeter at the battery for this measurement.

OVER-VOLTAGE PROTECTION: the SB1B-14 regulator has been designed with “smart” over-voltage protection capable of maintaining control of the Standby alternator even if/when the Primary alternator system has been taken offline due to its own over-voltage condition. Under normal conditions, with a bus voltage above 13.0 volts and the Standby Alternator indicator/annunciator light OFF, the SB1B-14 over-voltage protection circuit is internally disabled.

NOTE

The SB1B-14 will not intervene if the Primary alternator system experiences an overvoltage condition – ***the task of managing a Primary alternator overvoltage condition is reserved for the Primary regulator***. Consult the manufacturer’s specifications or installation documents for your Primary alternator controller/regulator.

If/when the Primary alternator system is offline, the SB1B-14 will sense low voltage, energize the Standby alternator, and enable the Standby alternator overvoltage protection; this will be confirmed by the presence of voltage at the Standby alternator field and illumination of the indicator/annunciator light. Should system voltage exceed 16 volts after this point, the overvoltage protection will activate, causing the installed 5A Standby alternator field circuit breaker to open, thus taking the Standby alternator offline. As soon as the field control current drops to zero, the protection circuit is reset and ready to operate again. A few minutes should be allowed before the circuit breaker is closed to allow the circuit breaker time to cool. Should the circuit breaker open a second time, assume that further investigation and/or maintenance is required.

INSTALLATION TIPS

1. Avoid deviating from the installation instructions and wiring diagram. The SB1B-14 has been designed to integrate into your aircraft electrical system in a very specific way, with separate bus connections for "sense" and "control". Similarly, the SB1B-14 also requires other associated components, such as circuit breakers and an alternator field switch, which meet certain specifications. These connections and associated components are vital to proper system function.

2. Use time-proven components in your installation. Our technical staff has found that a reliable installation is often made or broken by the associated parts used to install the SB1B-14. Here are several specific choices that can help you avoid trouble:

    - Select a "toggle-type" rather than a "rocker-type" switch for the alternator field switch. Our tear-down analysis of the internals of each type has shown that the mechanical properties and basic materials used in a simple toggle switch will provide superior service over time. Avoid "split-rocker" switches in particular (a common source of reliability woes as they accumulate time in service).

    - Use KLIXON or Mechanical Products circuit breakers, frequently used in general aviation. These well-constructed, single-purpose devices are reasonably economical, and will serve you well over time. Avoid combination "switch-circuit breakers" (another common source of reliability issues).

    - Use nylon pre-insulated ring terminals (supplied), and crimp these with the correct tool. Route wiring along existing harnesses, where they exist, and secure with nylon wire ties. Insure that all wiring is tied away from chafe points and clear of all flight control mechanisms throughout the entire range of control movements. Use a 5-lb pull test to check crimped connections; verify the terminal is crimped on the wire, not the insulation.

    - Avoid substituting an LED indicator light for the supplied incandescent warning light. The SB1B-14 is designed to drive an incandescent light only; an LED will not provide satisfactory results (viz. it will remain constantly illuminated, regardless of whether there is an actual over-voltage or low-voltage condition).

    - Insure the integrity of your alternator field connector and associated wiring. The SB1B-14 connects to the alternator by means of a single wire; an intermittent connection at the alternator will result in erratic (and unstable) operation.

TROUBLESHOOTING GUIDE

Refer to the wiring diagram found on page 10 and use a high impedance (preferably digital) volt/ohmmeter (DVM) to make the following checks. Please note that the engine should not be running, the mags should be off, and there should be no auxiliary power applied to the aircraft electrical system:

1. Turn all switches OFF. Use the lowest resistance scale on the DVM. Check resistance between the battery negative (-) terminal and both pin 7 of the regulator and the engine case. Measurements over 0.5 Ohm to either would be cause for investigation. In this case, check the engine ground strap, battery ground strap, and regulator ground wire for loose or contaminated connections, broken conductors or bad crimp joints. If these measurements are less than 0.5 Ohm, any of these three points may be used as reference (-) for the following measurements.

Resistance from battery to pin 7:_____Ohms; from battery to engine case:_____ Ohms

2. Turn ON the battery master and alternator field switches. Measure the voltage on the battery bus and on pin 3 of the regulator. The voltages should be equal within 0.2 volts. A difference of greater than 0.2 volts may be caused by using a breaker as the source for pin 3 that supplies another device of considerable load. Change to a lightly loaded breaker or a breaker dedicated to pin 3 and the low voltage lamp. It is recommended that pin 3 NOT be jumpered to pin 6. If pin 3 has no voltage, the regulator will operate but low voltage warning and over-voltage protection will be lost.

   Bus voltage:_____ volts Pin 3 voltage:_____volts

3. Measure the voltage on pin 6 of the regulator. It should be within 0.5 volts of the bus voltage. A difference of greater than 0.5 volts may be caused by poor contacts in the field breaker or field switch, or poor crimp joints/loose screw terminals in the wiring between the bus and pin 6. Absence of voltage on pin 6 will prevent the regulator from operating.

   Pin 6 voltage:_____volts

4. Check the voltage on pin 4 of the regulator. The voltage should be approximately 1.2 volts less than the voltage on pin 6. A difference significantly less than 1.2 volts between pins 4 and 6 may indicate an open field circuit from pin 4 through the alternator to ground (-). Voltage differences of several volts could indicate a bad regulator. An ideal pin 4 voltage would be approximately 10.9 to 11.4 volts on a 12.6 volt bus.

   Pin 4 voltage:_____volts

5. Move to the engine compartment. Measure the field voltage at the alternator as follows –

   L-40, L-60, BC410-H, and BC425-H Alternators: Use a thin probe or small gage wire wrapped around the probe to reach through the connector body and measure the voltage on either male blade coming out of the alternator. Do not disconnect the field connector for this measurement.

   BC460-H and BC462-H Alternators: Turn OFF the battery and alternator master switches. Disconnect the field connector from the alternator. Use an 18 AWG jumper with an alligator-clip (or fashion an 18 AWG jumper wire) approximately 6” in length to temporarily link either active field connector terminal with the corresponding male blade coming out of the alternator. Turn ON the battery and alternator switches. Use DVM probe to measure voltage at the alligator clip. Turn OFF battery and alternator master switches, remove jumper, and reinstall field connector.

Observed voltage in the above should measure within 0.5 volts of the measurement on pin 4 of the regulator. A lack of voltage may indicate an open circuit between pin 4 of the regulator and the field terminal, or a damaged/failed regulator.

If an open field circuit is suspected, the battery and alternator master switches may be turned OFF, the alternator field connector removed, and a resistance measurement made between the

connector and pin 4 of the regulator. Look for near 0 Ohms. Field resistance of the alternator may also be checked at this time by measuring from either male field terminal blade to alternator case; typically, this should measure between 3 and 10 Ohms. Values other than these may indicate a broken field wire, or heavily worn alternator brushes and slip rings (respectively).

Field terminal voltage:_____volts Alternator field resistance:_____Ohms

6. With the switches ON, check the voltage between the alternator output post (or "B"-lead) and ground. It should be battery voltage. If not, check the wiring between the alternator "B"-lead and the battery positive (+) terminal. Look for loose or contaminated connections, broken wires, or an open breaker or fuse.

   Alternator "B"-lead voltage:_____volts

7. If all of the voltages in the first 6 steps are close to the value specified, the charging system should be operative. If not, check for a broken or loose alternator belt; or if the alternator is spline driven, check that the shear coupling has not sheared. In certain installations, it is possible that engine speed will have to be near run-up RPM or more for the system to provide useable output.

Intermittent problems are the hardest to find. In composite aircraft a common root cause is poor system grounds; metal aircraft can exhibit this defect, also, if proper system grounding is not a priority.

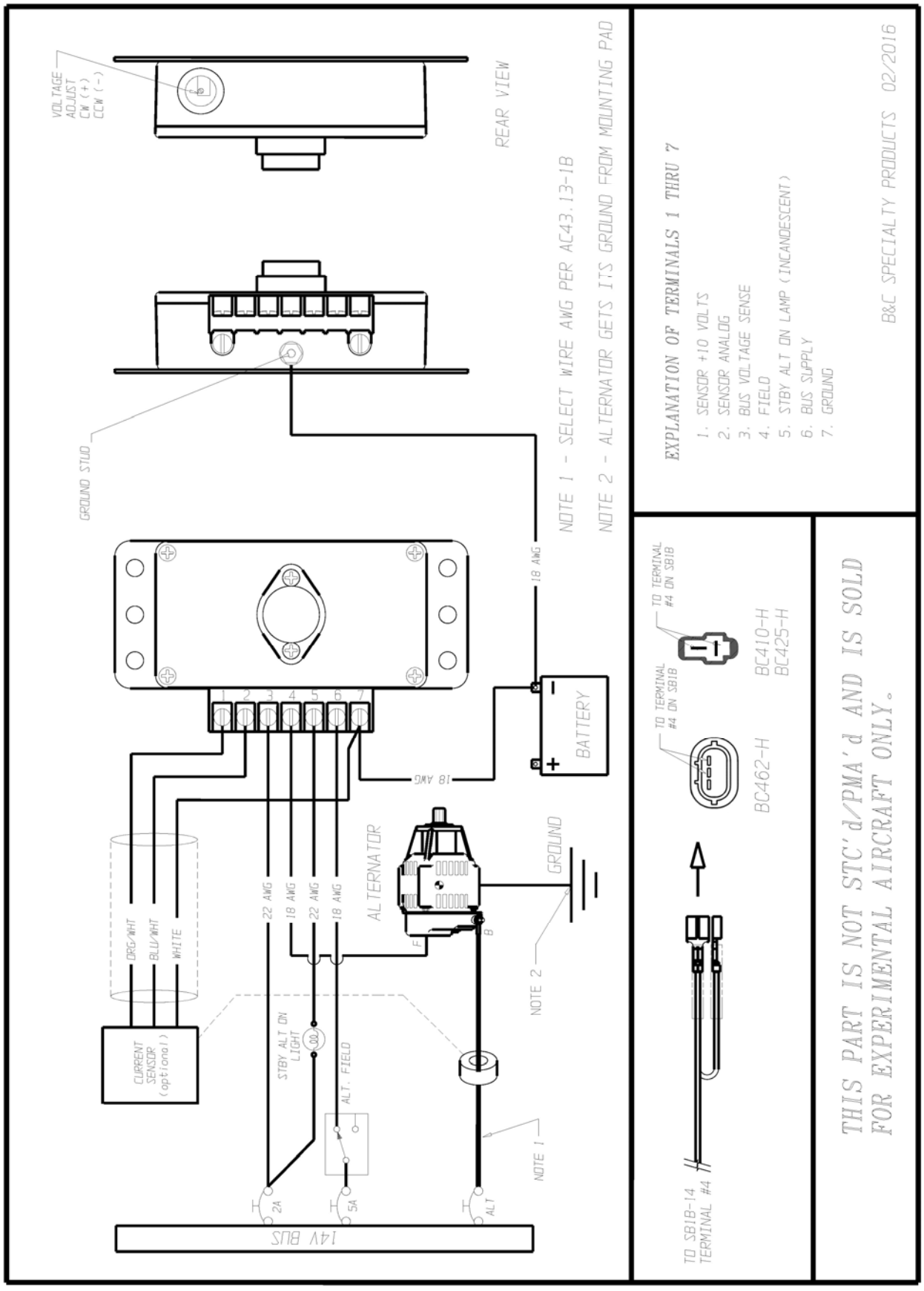
Noise problems can also be challenging. To manage system noise problems, consider the following:

- A unitized grounding system helps prevent noise problems by preventing voltage differences between different ground points.
- The battery acts as a noise filter in the system. Poor connections to the battery, or a battery in the initial stages of failing, can add to or even cause noise problems.
- Shielding of low level audio leads (especially microphone leads or headset leads) is a necessity. Sometimes the shields in the cables can separate from repeated flexing; so a check of shield continuity with an ohmmeter may prove illuminating.
- Wire routing is important. Separate noise-carrying conductors (like "P"-leads) from other wiring. Avoid running noisy wiring parallel to other wiring in the same bundle.

B&C is always ready to assist our customers with technical problems during construction and thereafter. The safety of our friends and reliability of our products are top priority. If this guide has not solved your problem, please feel free to contact us –

Phone: 316-283-8000 (Monday – Friday, 8:00am to 4:30pm Central time)

E-mail: tech@bandc.aero


Wiring Diagram for SB1B-14 Voltage Regulator
VOLTAGE ADJUST CW (+) CCW (-)
REAR VIEW
GROUND STUD
NOTE 1 - SELECT WIRE AWG PER AC43.13-1B
NOTE 2 - ALTERNATOR GETS ITS GROUND FROM MOUNTING PAD
18 AWG
BATTERY
1 2 3 4 5 6 7
ORG/WHT
BLU/WHT
WHITE
CURRENT SENSOR (optional)
22 AWG
18 AWG
22 AWG
18 AWG
ALTERNATOR
GROUND
NOTE 2
STBY ALT ON LIGHT
ALT. FIELD
NOTE 1
2A
5A
ALT
14V BUS
EXPLANATION OF TERMINALS 1 THRU 7
1. SENSOR +10 VOLTS
2. SENSOR ANALOG
3. BUS VOLTAGE SENSE
4. FIELD
5. STBY ALT ON LAMP (INCANDESCENT)
6. BUS SUPPLY
7. GROUND
B&C SPECIALTY PRODUCTS 02/2016
TO TERMINAL #4 ON SB1B
TO TERMINAL #4 ON SB1B
BC462-H
BC410-H
BC425-H
TO SB1B-14 TERMINAL #4
THIS PART IS NOT STC'd/PMA'd AND IS SOLD FOR EXPERIMENTAL AIRCRAFT ONLY.

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Instructions for Continued Airworthiness
for
B&C Specialty Products SB1B-14 Regulator

The SB1B-14 Standby Alternator Controller has solid state circuitry and has no required replacement interval. Voltage adjustment of the SB1B-14 is not normally required. Deviation from the factory set point of 13.0 volts by more than 0.2 volts may indicate the need for repair or replacement. If this set point is in question, it should be checked using a calibrated digital voltmeter sensing directly between terminals 3 and 7 of the regulator with the engine at over 2000 RPM and Bus load under 3 amps.

The SB1B-14 contains internal over-voltage protection. Grounding for both regulation and overvoltage protection is achieved through terminal 7 of the regulator, through the case mounting bolts and through the grounding stud provided under the terminal strip. At Annual inspections, check the security of the case mounting bolts and the wires attached to terminal 7 and the grounding stud. In addition, the over-voltage protection may be tested for correct operation in one of two ways:

1. Connection to terminal 6 may be isolated from the aircraft wiring at a convenient point and a 10 ohm, 10 watt resistor wired between terminals 6 and 4. Connect a current limited power supply with an output voltage adjustable between zero and 18 volts to terminals 6 and 7 with the positive lead on terminal 6. Limit the output current to 5 amps or less and gradually raise the power supply voltage until the controller shorts the output of the power supply. The power should be removed from terminal 6 within 5 seconds of achieving the shorted condition. The short should occur between 16.0 and 16.5 volts. No short indicates the failure of the over-voltage protection circuitry of the controller and necessity for repair or replacement of the controller. If the test is satisfactory, remove the 10 ohm resistor and reconnect terminal 6.

2. Connection to terminal 6 may be isolated from the aircraft wiring at a convenient point and a 10 ohm, 10 watt resistor wired between terminals 6 and 4. Connect a 5 amp in-line fuse from the aircraft bus to the negative terminal of a 6 volt lantern battery. Energize the aircraft Bus and momentarily connect the positive terminal of the lantern battery to terminal 6 of the regulator. The fuse should blow immediately. If the fuse does not blow, the over-voltage protection circuit has failed and the regulator must be replaced or repaired. If the test is satisfactory, remove the 10 ohm resistor and reconnect terminal 6.

Failure due to broken wires or damaged connectors may be corrected using repair procedures complying with the latest revision of AC 43.13-xx. All other physical damage or incorrect operation should be referred to the manufacturer for evaluation and repair.

IF THIS UNIT IS TO BE INSTALLED ON A TYPE-CERTIFICATED AIRCRAFT IT MUST BE ACCOMPANIED BY AN STC OR BY A ONE-TIME FIELD APPROVAL