

# **BALMAR<sup>®</sup>**

## **ALTERNATOR**

### **&**

## **REGULATOR**

# **INSTALLATION/ OWNERS MANUAL**

27010 12<sup>TH</sup> AVE N.W. STANWOOD, WA 98292

360-629-6100 PHONE

360-629-3210 FAX

**A. GENERAL INFORMATION**

## LIMITED PRODUCT WARRANTY

BALMAR and LESTEK INTERNATIONAL, INC. warrants to the original consumer/purchaser the product is free from any defects in material or workmanship for a period of one year from the date of purchase. If any such defect is discovered within the warranty period, LESTEK INTERNATIONAL, INC will repair or replace the alternator free of charge, subject to verification of the defect or malfunction upon delivery or shipping prepaid to LESTEK INTERNATIONAL, INC. Approved model regulators are covered by BALMAR directly and should be returned to BALMAR for warranty service.

This warranty **DOES NOT** apply to defects or physical damage resulting from abuse, neglect, accident, improper repair, alteration, modification, or unreasonable use of the products resulting in breakdown, cracked or broken cases nor are parts damaged by fire, water, freezing, collision, theft, explosion, rust, corrosion or items damaged in shipment in route to LESTEK INTERNATIONAL, INC. or BALMAR for repair. LESTEK INTERNATIONAL, INC. or BALMAR assumes no responsibility for consequential damage or loss or expense arising from these products or any labor required for service or repair. Alternators are not covered when used with manual regulation devices.

**IMPORTANT:** Please **DO NOT** return the product to the store where it was purchased. BALMAR AND LESTEK accept the responsibility of keeping **YOU** a satisfied customer.

BALMAR OR LESTEK INTERNATIONAL INC. WILL NOT repair or be held responsible for any product sent without proper identification and return address or RA number clearly marked on the package. You must include proof of date and place of purchase (photocopy of purchase invoice) or we cannot be responsible for repairs or replacement.

In order to expedite warranty claims more efficiently, LESTEK, AND BALMAR, asks prior to returning a defective product for repair, you call their customer service department for a warranty return authorization number (RA).

If factory service is required, you can contact our Customer Service Department Monday through Friday 8:00 AM to 5:00 PM  
LESTEK (CST)1-817-284-0821 or BALMAR (PST)1-360-629-6100

Material required for the repair or replacement for the defective part or product is to be supplied free of charge upon delivery of the defective alternators to the LESTEK factory 6542 Baker Blvd. Ft. Worth, TX 76118, regulators to BALMAR 27010 12<sup>TH</sup> AVE N.W. STANWOOD, WA 98292. Customer is responsible for all return transportation charges and any air or rush delivery expense. LESTEK/BALMAR reserves the right to determine whether to repair or replace defective components.

**THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS. NO PERSON, AGENT, DEALER IS AUTHORIZED TO GIVE ANY WARRANTY OR REPRESENTATION ON BEHALF OF THE ABOVE MANUFACTURES UNLESS MADE IN WRITING BY AN OFFICER OF THE ABOVE COMPANIES.**

**This is not a step by step guide on How to Install an Alternator. If you are not experienced in alternator installations, a qualified marine electrician may be a wise investment. An alternator is only as good as the wiring and battery installation.**

1. THE **BALMAR**<sup>®</sup> MARINE ALTERNATOR is engineered for superior performance and reliability over any comparable size stock alternator. Care must be taken during installation to provide adequate mounting strength and correct belt alignment to ensure proper output and service life.

2. RATING:

The AMPERAGE RATING on the alternator is a conservative number that can usually be reached even at lower RPM or under hot operating conditions. See the RPM table on page 11 for more detailed information.

3. VOLTAGE CALIBRATION:

All externally regulated alternators are factory set at the proper charging voltage for most lead acid and Gel-Cell type batteries. You may make adjustments to meet your battery mfg. recommendations, if different. To do so locate the small plastic slotted screw on top of the **BRS**. Using a small blade screw driver gently turn the screw clockwise to increase voltage and counter clockwise to decrease voltage. **Do not adjust past stops.** See special instructions for **ARS II**.

**Do not make changes unless absolutely necessary**

4. ROTATION:

**BALMAR** alternators are designed to operate in a Clockwise rotation when looking at the pulley. If you are going to install the alternator as a second alternator facing the engine or on an opposite rotation (left hand) engine, the pulley **SHOULD BE KEYED OR PINNED**. The nut should also be secured with Loctite. We can provide a keyed unit, or key an existing one, and include bi-directional fan for \$ 50.00 net.

5. GROUNDING:

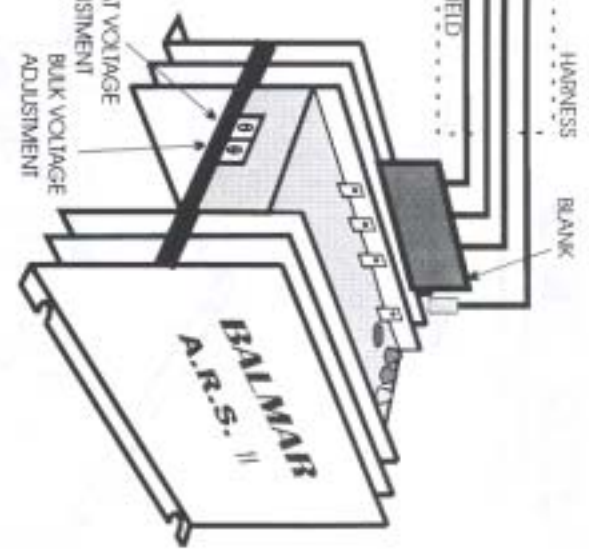
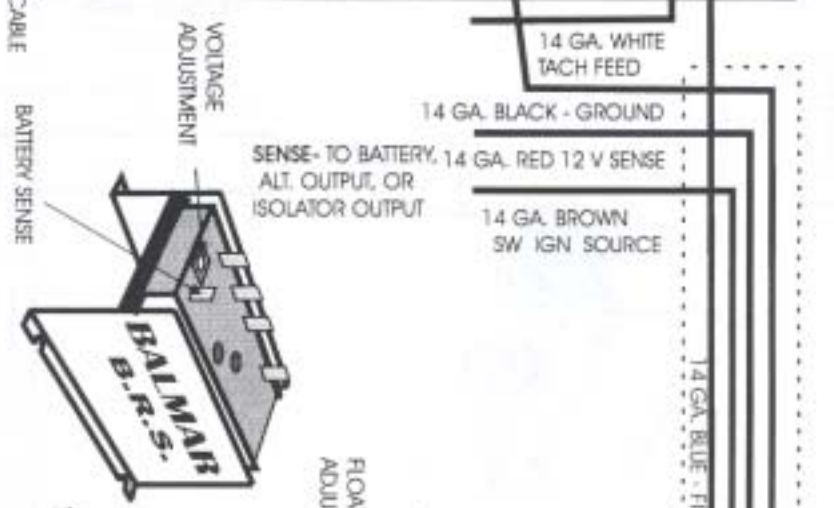
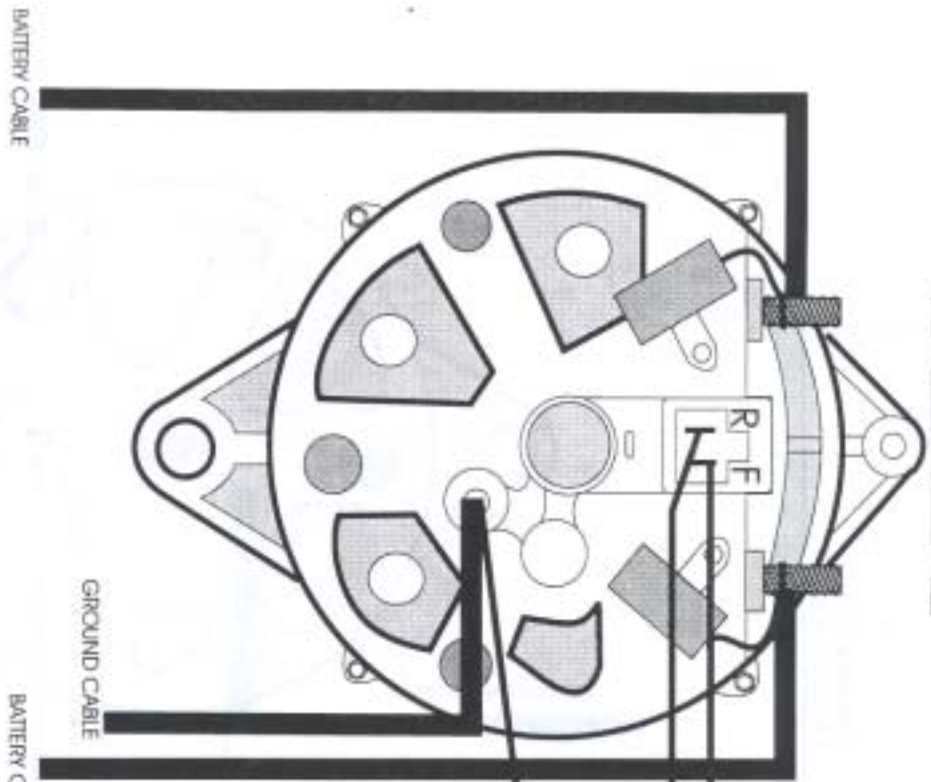
**BALMAR** alternators are case ground. **IT IS EXTREMELY** important that the alternator is properly grounded. We strongly recommend you run a cable (same size as output cable) from the rear of the alternator to the battery or ground buss. This hole is 5/16 x 18 thread. Some applications require a completely **isolated (floating) ground**. All 'D' (dual output) models are available in this configuration (one pos., one neg. terminal). NOTE: This now becomes a single output with the ground totally isolated from the case. Cost: **\$50.00 net**

6. NOISE:

1. MECHANICAL. A slight whine from the alternator under load is normal. When you hear the whine, you will know the alternator is charging. When the alternator is producing high amperage, it will be very hot. A new alternator may drag or stick when spun by hand, this is caused by the wood separators in the stator and will wear in as the alternator is used.

2. ELECTRICAL. The product has been designed to minimize electrical noise. However, in some cases noise or interference may persist. Filters are available for special problems.

**BALMAR®**  
**DUAL OUTPUT ALTERNATOR**  
**90 or 91 SERIES**



**VOLTAGE REGULATOR**

MODEL	OUTPUT / GROUND WIRE SIZE MINIMUM	OVER 12 FEET
90 / 91-75	#4	#2
90 / 91-100	#2	#0
90 / 91-150	#0	#00

**BALMAR®**

DRAWING CONNECTION DIAGRAM FOR BALMAR  
 DUAL OUTPUT ALTERNATORS  
 AND REGULATORS.

DATE, ORIGINAL 2/5/96

BY STEPHEN KROM

REVISION DATE

FILENAME REGCONN1

## 7. MAINTENANCE:

Your alternator is corrosion proofed and white powder coated to help prevent deterioration in a marine environment. Keep the alternator clean and dry. Check belt tension regularly, replacing any suspect belts. Check the mounting brackets for cracks or wear. Clean and tighten electrical connections periodically. **CHECK YOUR GROUNDS.**

## 8. What should I carry for spares?

We offer an offshore parts kit (**OPK**) which includes brushes, bearings and regulator for each model alternator. You should also carry a couple of extra belts. For extended cruising, a spare alternator is highly recommended. Check bearings for excessive noise after 1000 to 2000 hours of heavy use. Complete service overhaul is available at the factory.

## 9. MANUFACTURER:

**BALMAR** High Output Marine Alternators are special marine models manufactured exclusively for **BALMAR** by Lestek Mfg. For warranty service call 1-800-433-7628. Designs of these alternators are protected under U.S. patents. For service on the voltage regulators contact **BALMAR** directly.

## B. GENERAL MOUNTING TYPE INFORMATION

1. **90** series fits many of the import styles with double mounting foot. Hitachi 55 amp are often direct fit, their 80 amp model requires a 10mm bushing (\$5.00 net from **BALMAR**) and their 35 amp (6mm) mounting is usually drilled out to accept a 5/16 hardened bolt. The Mitsubishi 50 amp requires a spacer approx. 1". Due to the many domestic and international configurations, your installer may have to adapt the basic mounts to fit your needs.

2. **91** series replaces most domestic styles using a single mounting foot. The foot is machined to 1" and spacers are provided for other widths. A special 2" Delco style foot is available on special order (912 series).

## C. GENERAL ALTERNATOR RECOMMENDATIONS PER BELT AND ENGINE SIZE

Use our model 90/91-75 75 amp. alternator if your engine uses one 3/8 V belt, or you have small engine.

Use our model 90/91-100 100 amp. alternator if your engine uses two 3/8" V belts or one 1/2" V belt and your engine is over 20 HP. Remember a smaller engine can be used, but less power will be available for propulsion.

Use our model 90/91-150 150 amp. alternator if your engine uses two 3/8" or two 1/2" belts and your engine is over 30 HP. Generally one 1/2" belt will suffice, but your belt life will be reduced and may require frequent tensioning.

You may use any of our alternators if your engine uses two (A) 1/2" or (B) 5/8" V belts, and your engine is over 40 HP.

Our 75 and 100 amp. small case units come with a deep V pulley that will accommodate from 3/8" to 1/2" single belts or metric equivalents. Dual deep V pulleys are available.

If you determine that the desired size alternator will **just not** replace the existing alternator, one excellent option may be to leave the existing alternator in place and

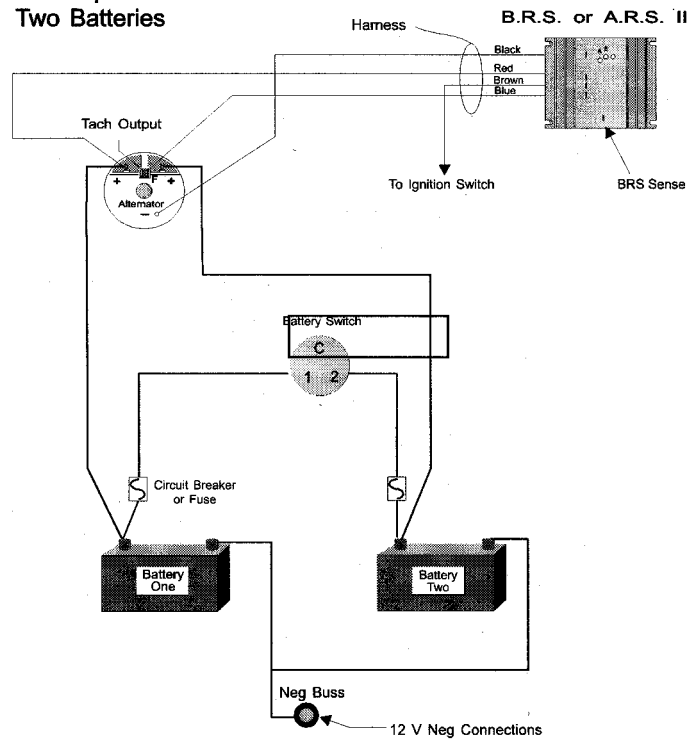
**Typical RPM Table**

Model		Typical Amps 80° F				
ALT ROTOR RPM 2.7 Pulley		1750	2250	3500	4000	5000
Eng RPM w/6" Crank(2.5:1 ratio)		700	900	1400	1600	2000
90 or 91-75	75 Amps	35	60	85	95	105
90 or 91-100	100 Amps	45	80	108	120	130
90 or 91-150	150 Amps	25	60	125	145	160
90 or 91-24	80 Amps(24V)	15	25	75	85	95
9200	135 Amps (24V)		33	94	115	131
9435	160 Amps	65	105	144	149	153
9400	115 Amps	85	96	106	109	112
94-200	200 Amps	50	100	185	195	205
9612	225 Amps	90	135	190	200	210
9612-DD	275 Amps	40	140	250	260	268
9624	150 Amp (24V)	20	60	118	127	137

At 200° F Output may decrease 5% to 20%

## TYPICAL ALTERNATOR/ REGULATOR WIRING DIAGRAMS

Dual Output Alternator  
Two Batteries



purchase a dual groove crank pulley for the front of the engine (in addition to the existing pulley). Then have a special mount fabricated, or use the **BALMAR** Remote Alternator Bracket #5276, to accommodate the new larger alternator.

Speaking of V Belts, as you may have noticed, we have emphasized belt sizes and how many. Belts are not created equal, and in most instances you get what you pay for. Buy a good belt like a Gates "Tri-Power", Dayco "Topco", or equivalent industrial rated type.

If your battery banks or your load capacity is extremely large, or your engine cannot accommodate the proper size belt or belts to run a High output alternator, you may consider one of our **Power Charger** or **Aqua-Pacs** to solve your charging requirements.

You may also want to turn the alternator off if your engine is very small, or you will be motoring for long periods and you know your batteries are fully charged. On our externally regulated models you may turn the alternator off by installing a high quality toggle switch, rated at 6 amps, in the Brown ignition wire of our regulator harness.

**Call us for information or help with non standard installations.**

## D. INSTALLATION

1. MOUNTING: Remove the existing alternator and compare mounting points. Many alternators are directly replaceable. However, if your unit is not, a simple bracket can be fabricated at a local machine shop. A variety of adjustment arms are available from a local auto supplies, or Balmar offers the UAA arm. Make sure your belt alignment is correct.

2. PULLEY: Small case 75 and 100 amp models come standard with a single deep V 2.7" pulley. All other have dual 1/2" standard. Other sizes are available. The 92, 94, 95, and 96 series alternators should be generally used with dual belts. When changing pulleys or using your original pulley, tighten the shaft nut to 40-60 foot pounds. If a torque wrench is not available, insert a 15/16" hex wrench in the end of the shaft and tighten the nut until the spring washer is just flattened.

3. BELTS: Install a new belt of proper size. **THE BELT MUST BE TIGHT.** Run the engine for 15 minutes and retighten. To test for proper tension with the ENGINE OFF, use a 15/16" socket on the hex nut of the alternator pulley and try to turn it (clockwise). If the pulley turns, the belt can slip. A slipping belt will create heat and cause premature bearing failure (not covered by warranty). If possible check the belt tension EACH TIME the engine is first started, just as you would the oil and water. This is especially important on single belt installations. **ALWAYS CARRY SPARE BELTS.**

## E. WIRING: **BRS** (standard) and **ARS II** (optional)

1. REGULATOR AND PLUG: All alternators use an external regulator (**BRS** is standard). Install the regulator (wiring harness provided) on a flat vertical surface near the engine. The area should be as cool and dry as possible. Regulator wires **MUST NOT** be extended to a length greater than 10 feet.

2. The **DUPLEX PLUG** plugs into rear of the alternator. Make sure both connectors are firmly seated. Pushing on the back of the female slip-on terminal with a small blade screw driver can be used to press them home. The **FOURPLEX** (one slot is not used) plugs into the regulator with the blank closest to the single ground terminal.

**MOST CHARGING SYSTEM PROBLEMS** will be corrected by performing the above checkout. Failing to do the above steps first, can cause you to waste valuable time in the other trouble shooting procedures which follow:

Most common electrical system problems.

\* **BAD GROUND SOMEWHERE IN SYSTEM**

- \* Poor or dirty battery cable connections
- \* Improper wire size
- \* Loose fan belts
- \* Sulfated or worn out batteries
- \* Failed regulator

Batteries which have remained in a discharged state for long periods will often be sulfated and will NOT accept a charge from the alternator. See your battery expert.

90% of all Alternator front bearing failures are the result of a loose fan belt. A Discolored pulley and alternator shaft is evidence of this condition.

Test the BROWN wire at the regulator plug. Key OFF, no voltage. Key ON, approximately battery voltage (within 1 volt).

Test the RED (A) wire at the regulator. It must ALWAYS read battery voltage.

Test the BLUE (Leave connected) (F) wire at the Regulator and at the Alternator Plug. KEY ON & ENGINE OFF, 7-12 volts. KEY ON & ENGINE RUNNING, 4-12 volts. This terminal supplies power to the alternator, and the voltage will vary depending on load.

**4. TESTING: ALL ALTERNATORS.**

Test the ALTERNATOR FIELD. With the KEY ON and the ENGINE OFF, take a screw driver and hold it close (1/2") to the nut inside the pulley, or to the center of the rear of the alternator. After the start up time delay you should feel a strong magnetic field (pulling the screw driver towards the alternator). If so, the alternator rotor and brushes are OK. If not, please contact the factory for instructions.

**5. ASSISTANCE:** If you have gone through the above procedure and cannot identify the problem, please have the following information handy, BEFORE you call us.

- The model of the alternator.
- The approximate age of the alternator.
- The number and capacity of your battery banks.
- If you have an isolator, the amperage rating and manufacturer
- The make, model and horse power of your engine



3. BROWN wire connects to the ignition switch or an oil pressure activated switch. This wire **MUST** be connected to a switched + direct 12 VDC source. If this wire is not switched, you will have up to a 6 amp draw and a hot alternator. If this wire, when connected to the key switch source, causes the yellow light to come on first on the ARS II, see section H-1, troubleshooting.

4. BLACK ground wire connects to the alternator ground terminal

**GROUND MUST BE GOOD!!! LOSS OF GROUND WILL DESTROY THE ARS II !!!**

5. BLUE wire is used to excite the alternator field. This called the F or field wire. A 6 amp in line fuse is recommended per ABYC.

6. RED wire, is the power wire on the BRS and is attached to a larger **alternator** output terminal marked "bat" located near the duplex plug on the back of the alternator. If a battery isolator is used, connect it to the output of the isolator feeding the smallest battery or bank of batteries. This wire is the sense wire on **ARS II**. It can be connected to the common terminal of the battery selector switch. A six amp in line fuse is recommended per ABYC. USE THE BEST FUSE HOLDER POSSIBLE !

7. BATTERY SENSE INFORMATION: These connections provide the regulator information about the batteries state of charge. The BRS has one sense wire, covered by a blue spade connector. This should be connected to the battery or to the common terminal of the battery selector switch. A one amp in line fuse is recommended per ABYC. Note: the brown wire is always sensing in the BRS.

The **ARS II** uses the red wire to sense. This is hooked to a common point in the system that CANNOT be switched out with the selector switch i.e., the alternator output, starter solenoid, or common point of the battery switch.

We have many questions regarding sensing wires. This wire senses voltage only. When the set voltage point is reached, the regulator cuts back the field voltage, keeping the battery voltage in the safe range. The amperage is minimally affected by this, with the alternator still able to produce the rated amperage at a given r.p.m. It is also important to remember the batteries are the most important factor in amperage production. A lead acid bank can absorb about 25% of the banks size per hour, gels perhaps 10% more. Both types must be discharged to 50% capacity to see this rate of charge, and will dramatically plateau at 85% state of charge. This is your useable bank size. Most users will experience the fastest charge by discharging to a 12.2 static voltage (no loads on) and recharging until a plateau is reached, where the amps will seem to 'stick' at a certain level. Once a month, recharge to 100 % state of charge to avoid sulfation. This may be done in a long motoring situation or by shore power as burning fuel is not the most efficient way to do this.

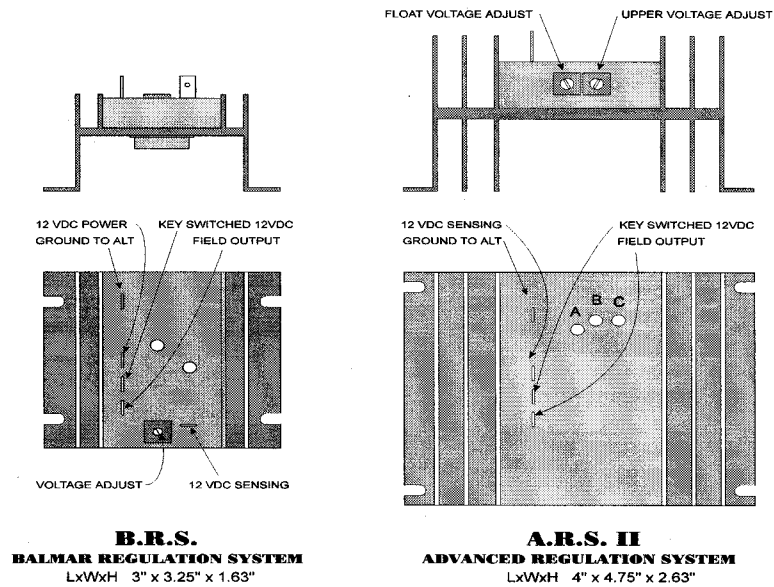
8. ISOLATION:

Dual output models: Each terminal provides proper charging to a separate battery or bank. Bridging or connecting the two terminals makes the output single. DO NOT OPERATE without each main output terminal connected to a battery or bridged. To charge a third or fourth separate battery, a two bank isolator (I-952, I-122 or larger) must be installed on each output terminal. The D models have two small terminals on top of the alternator. These power the optional PB (Power Boost) feature and are otherwise not used.

9. BATTERY ISOLATORS:

f) Adjust the left (float voltage) pot as necessary using the meter. Your upper and lower voltages are now set.

Note: The float (lower) voltage can only be adjusted down if the batteries are in a slightly discharged state.



**Do not force the adjustment pots past their stops. This will void all warranties on the regulator.**

## H. TROUBLE SHOOTING

### 1. USING THE L.E.D. FOR DIAGNOSTICS:

a. Both lights on the BRS should come on with the key switch. IF the lights do not turn on, check both red and brown wires with a meter or light bulb. Remember on the **ARS II voltage controls** this light. If the **YELLOW** light (C) comes on first, you have a bad ground or the voltage to the brown wire also leads to ground through a solenoid or similar device. The problem may be solved by adding a 12 volt relay to power up the brown wire from a 'clean' 12 volt source, and have the ignition wire activate this relay.

b. The second (B) light indicates the regulator has reached the upper set voltage (14.1v). Note on the **BRS**, both L.E.D.'s turn on at once. If you have a short in the field, or a bad ground, the regulator will shut down. (ARS II only)

### 2. TEST EQUIPMENT:

- A good test quality volt meter (preferably digital).
- In an emergency, a light bulb can verify power available or a working ground
- A battery hydrometer with thermometer.
- An amp meter (not required but helpful).

### 3. GENERAL CHECK OUT PROCEDURE:

- Remove and clean all charging system electrical connections (this includes the ground side).
- Charge all batteries to their proper full charge state and determine if they are serviceable.
- Check and tighten fan belts.

A battery isolator may be used with any single output model. Its capacity must equal the maximum load or alternator output at the maximum RPM operated. To compensate for the .5 to .8 volt drop, sensing must be on the battery side. **BALMAR** offers a full range of stand alone Isolators.

#### 10 METERS:

Most standard in-line Amp meters are UNDER RATED for our alternators and along with idiot lights, must be removed from the system. You may replace it with a standard volt meter. Should you wish to read output Amps, a high capacity 0-100 or 0-200 amp external shunt type meter such as our DCA-100 or DCA-200 must be used.

#### 11. TACHOMETERS:

The alternator tachometer is energized by the pulse frequency generated by the alternator, which in turn is dependent on the alternator's rotor speed.

Large case **BALMAR** alternators (92,94,95,95, series) have 12 poles and the small case alternators (90/91 series) have 14 poles.

Most standard tachometers are engineered for engines with alternator pulley to crankshaft ratios of 1.8 to 2.8 to 1 on alternators with 12 poles.

The WHITE wire may be used for electric tachometers not having their own sending unit. Tachometers will have to be adjusted and calibrated as necessary. We suggest running the engine up to a cruise RPM (2000) marking the throttle position BEFORE the original alternator is disconnected. After the installation is complete, run throttle up to mark and set tachometer to appropriate RPM. If you cannot set the tach, a 14 pole tachometer should be purchased if this reading is desired.

12. OUTPUT WIRE SIZE: Proper wire size must be used due to increased amperage. Use fine stranded wire. For 75 amp models, runs under 12' may use #4, over 12' #2. For models 100 amps and over, from 0'- 12' use #2 wire; from 12' - 20' use #0 wire. Because heavy wire is used, it must be supported to prevent breakage or shorting of the alternator ring lug. A short run of #2 wire (2'-3') to a terminal block, then heavy wire to the batteries would be one installation method. Consult standard wire size tables, 3% drop schedule, ABYC, BIA or your marine electrician for additional information

13. OUTPUT CONNECTIONS: The best choice is direct from the alternator to the battery. If the battery selector switch is closer, you may connect the wire (single output alternators) to the common output terminal. On D (dual output)t alternators, **remove the bridge for isolated output**, than connect the wires directly to the batteries or the input terminals of the battery switch. Make sure you DO NOT TURN THE SWITCH OFF while the engine is running, or you may blow the alternator diodes and damage the regulator. Transient spike protection in the regulator only helps prevent this, but it does not guarantee it in this case.

On dual output models extra protection for the output leg not supplying power to the regulator can be installed. The TSP (Transient Spike Connector) is \$15.95 list.

14. FUSING It is recommended that the alternator outputs be protected by a fuse or manual reset circuit breaker, such as the **BALMAR** 75, 100 AND 150 amp circuit breakers. Please follow ABYC and BIA circuit protection recommendations for all wires connected to the battery from both the alternator and the regulator.

**F. REGULATOR OPERATIONS, Note: For 24V. systems, see instructions with special regulator.**

#### 1. BRS

Your **BRS** is fully automatic in operation and requires no special attention. When the key switch or oil pressure switch is activated, the (A) L.E.D. and (B) L.E.D. lights will turn on.

## **G. SPECIAL INSTRUCTIONS FOR OPTIONAL ARS II REGULATOR**

This multi-stage, (3 step) regulator, is advantageous to users of larger banks of deep cycle lead acid or gel batteries which have been discharged to 50% and are being recharged to 85% capacity. This regulator also responds well when large D.C. loads are applied.

1. When the key switch is turned on, or after engine is started with oil pressure activated switches, the regulator waits for about 1 min. before activating. This gives the engine a chance to develop oil pressure and warm up a bit before the load of the alternator is applied. You will hear the 'whine' of the alternator and the engine 'load up' when the alternator comes on line in many instances.

2. When the red sense wire reaches its set voltage, the voltage will be held constant, and the batteries which may not have reached max voltage will receive most of the current. The (A) green LED will light when the battery has reached the float setting (factory 13.8) .

3. As the batteries reach the set upper voltage limit of 14.1 (factory setting) , the second green (B) LED will light. Flickering is normal. A timer will start at this point, and if no large DC loads are placed on the system, about 45 minutes later the yellow (C) LED will come on, indicating the regulator has latched onto the 'float' voltage of 13.8V. The batteries must remain at the upper voltage for the timed period for this to occur. Once in float mode the voltage will be limited to 13.8V 'float' until power to the brown key switch is removed.

4. **ARS II ADJUSTMENTS:** The regulator is factory calibrated and field calibration is **not required or recommended in most instances.** If you feel you must adjust the output voltage, follow this procedure:

a) Start engine , turning off all unnecessary electrical equipment.

b) Apply a digital voltmeter to the battery terminals.

c) Be sure the YELLOW light (C) on the ARS II is off.

d) Turn the right pot clockwise to increase upper voltage limit. Wait several minutes for the voltage to rise and for the center GREEN (B) light to turn on. This adjusts the absorption voltage.

e) Allow the engine to run for about 45 minutes, until the YELLOW light (C) comes on. The batteries are now at the voltage level now shown on the meter. To adjust the voltage down you must apply enough load to bring the voltage of the battery below the pre set 13.8 vdc, then adjust.