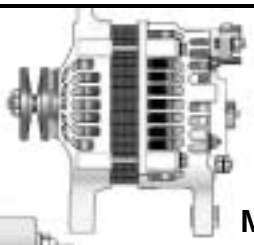
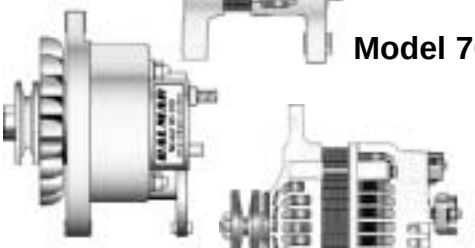
TIPS TO SELECTING A HIGH OUTPUT ALTERNATOR REPLACEMENT FOR YOUR ENGINE



Model 70



Model 90

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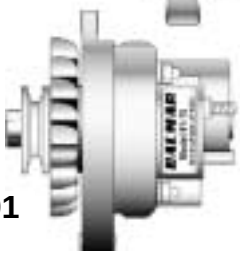

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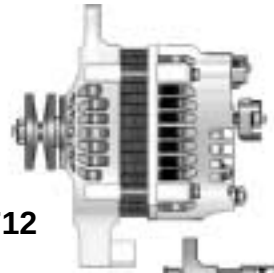


Model 712

Model 812

Model 912

I want to replace my existing OEM position alternator. How do I know which Balmar Alternator to order?

Consider your engine fuel type:
1. Diesel - All of our models are appropiate
2. Gasoline - (see below for more information)

Determine your mounting style:
1. Dual Foot (Imports) - 70-Series, 90 Series, 901 Series
2. Single 1" Foot - 71-Series, 81 Series, 91 Series
3. Single 2" Foot - 712-Series, 812 Series, 912 Series
4. Aids to Selection:
   a. See: Engine Mounting Guide (pg. 2)

Determine your belt configuration:
1. Single belt, approximately 3/8" - choose no more than 75 amps 12v or 65 amp 24v
2. Single belt, approximately ½" - choose up to 100 amps 12v or 65 amps 24v
3. Dual / Dedicated / Serpentine belts - choose up to 150 amps 12v or 80 amp 24v
4. Need more info on sizing to belt?
   a. See: Alternator Output / Belt Configuration (pg.3)
   b. See: RPM Chart (pg. 4)

Consider your options:
1. Dual Output - Charge two banks -
   a. See: Dual Output Option (pg. 6)
   b. See: Dual Output Wiring Diagram (pg 7)
2. Isolated Ground - Negative terminal, as well as positive, isolated from case
3. Reverse Rotation - Bi-directional fan

Consider Your Batteries:
1. Total Amp Hour Capacity
   a. See: Alternator Rating / Battery Capacity Formula (pg. 4)
   b. See: RPM Chart (pg 4)
2. Type of Batteries
   a. See: Batteries and Resistance

Choose Your Regulator:
1. Regulator Comparison Chart (pg. 8)

ALTERNATORS & GASOLINE ENGINES

All Balmar alternators are Marine Certified and comply with Coast Guard and B.I.A. standards, which includes ignition protection certification.

Balmar offers a line of alternators that meet a higher standard of ignition protection, certified through J-1171 testing. The Balmar models that meet this higher standard, and are suggested for gasoline engines, include the 70, 71 and 712-Series; 81 & 812 Series, as well as the extra-large case 98-Series brushless alternators.

Alternator Mounting Guide

The following guide provides a basic reference for matching High-Output Balmar alternators to your specific engine type. Keep in mind that "real world" factors, including engine age, engine model, engine marinizer, distributor and/or installer, can all have a dramatic effect on the actual mounting configuration you'll find on your specific engine.
In addition to your alternator's mounting style, it is essential to ensure that your alternator's amperage capacity is matched to the size of your drive belt. If your engine uses a 3/8" drive belt, we recommend our 75-amp alternator. If your existing drive belt measures 1/2", we recommend our 100-amp alternator. If your engine is equipped with a dual 1/2"-belt system, our 150-amp alternator would be the recommended choice for your system. Large case, high-output alternators should be driven by a minimum of two 1/2" belts. We strongly recommend you examine your engine to determine both mounting style and drive belt size before you order a replacement or upgrade alternator.

Engine /Alt. Make	Series (Case size or type)	Mounting Foot Size (M.F.)
Bukh	71, 91 series	1" M.F.
Caterpillar	Not Standard, usually isolated ground, 91 or large case	Varies by model
Chrysler	70, 90 series with spacers	Varies by model
Crusader	71, 81 or 91 series	1" M.F.
Cummins	92/94 TCU series(dual foot), 95 series or 912	Varies by model
Delco 55 Alt.	(W/2" M.F.) 912 series 2" (Delco style) M.F. (or 91 w/ 1" M.F. & 1" spacer)	2" M.F.
Detroit Diesel	92/94 series (specify dual foot), some 912 series	Varies by model
Flagship	71, 91 series	1" M.F.
GMC	71, 91 series for most (can use 92/94 series)	Varies by model
Greymarine	71, 91 series	1" M.F.
Hawk Marine Power	71, 91 series	1" M.F.
Hitachi Alternator	70, 90 series	(dual foot 3.15" separation)
Indmar	71, 91 series	1" M.F.
Isuzu	70, 71, 91 series	1" M.F., drill hole to 1/2"
John Deere	71, 91 series	1" M.F.
Lehman(Ford)	71, 91 series	1" M.F. Call American Diesel
Lehman(Sabre)	901-75 or 901-100 series	(dual foot 3.15" separation)
Lugger 6125	Lugger mounting kit for the 6125 465 hp engine	
Lucas Alt.	901-75 or 901-100 series (all isolated ground)	(dual foot 3.15" separation)
Mann	No standard. (Can use 92/94 series)	
Mercedes	90 series	(dual foot 3.15" separation), with spacers common
Mercrusier	71, 81 or 91 series	1" M.F.
Mitsubishi	70, 90 series case	(dual foot 3.15" separation) 1" spacer 3/8 bolt
Motorola Alternator	71, 91 series	1" M.F.
MTU	No standard (Can use 92/94 series)	
Namni	70, 90 series	(dual foot 3.15" separation)
Nippondenso Alt.	70, 90 series	(dual foot 3.15" separation), Modify engine mount.
OMC	71, 91 series	1" M.F.
Pathfinder*	912 series	2" (Delco style) M.F.
Perkins 4-107,108	912 series	2" (Delco style) M.F
Perkins (other)	71, 91 series	1" M.F.
Perkins-Volvo M series	901-75 or 901-100 series	(dual foot 3.15" separation), isolated grounds
Pleasurecraft	71, 91 series	1" M.F.
Prestolite Alt.	71, 91 series	1" M.F.
Universal Atomic 4	712, 812, 91 or 912 series	1" M.F. with 1" spacer
Universal 30, 50 -1982	71, 91 series	1" M.F.
Vetus-Denouden	70, 90 series	(dual foot 3.15" separation)
Volvo - 2001 -2003	712, 912 series	2" (Delco style) M.F. (turbo - swing arm mod.)
Volvo - Driven off Flywheel		Alternator must have a special 3/8" x 4" pulley
Westerbeke 46 4107, 4108 (1979) 1" M.F.		91series
Westerbeke 46 (1986)	70, 90 series	(dual foot 3.15" separation)
Yamaha (IO)	71, 91 series	1" M.F.
Yanmar **	70, 90 series	(dual foot 3.15" separation)

*Remove original pulley and mount on BALMAR ® alternator; or move U bracket forward
**Yanmar Mounting: 35 amp uses 6 mm Mt. bolt, 55 amp 8 mm Mt. bolt, 80 amp special 10 mm bushing.

Alternator Output / Belt Configuration

When replacing an alternator in the stock engine position, you're really facing the issue of physical limitation on the belt and side load on the water circulation pump. We don't drive more than a 75 amp high output Balmar marine alternator on a single 3/8" undedicated belt, or a 100 amp on a 7/16"-1/2" undedicated belt. Even though the numbers might not seem much higher than say a 55 amp stock automotive type alternator, most people see a huge improvement in performance between the two. That is because the alternators are designed to perform two very different jobs: the stock alternator is designed for handling light constant loads (such as lights, fans, radios, etc.) and the high output marine alternator is designed to charge banks of batteries. To move up to our 150 amp alternator, a dual dedicated belt is required.

As to the question of 'can't I just change pulleys?', consider this: Yes, you can get a variety of pulleys for the alternator. Yes, you can probably get a suitable pulley for the shaft from the engine manufacturer or in the worst case have one fabricated. But what about the water circulation pump? Even if you were to come up with a pulley for that, you must consider side load. The physical design limitations of what can be done in the stock alternator position on a single belt can't be ignored. The output of the alternator you select is simply limited by the original belt configuration.

When you need more output than a single belt can handle, the correct thing to do is come up with a PTO (power take-off) for the shaft. This is usually available through the engine manufacturer, or you can have it fabricated. Now you've got some major sheaves to work with. Next job is to come up with some bracketing to hang a second alternator, that will have dedicated dual belts and be dedicated to the job of charging the house bank. The most popular models for this application are the large case models 9400 series, with 160 amp output and a 2" single mounting foot, and the 9500 or 9800 series, with 160-300 amp (12v) output and a J-180 mount (dual foot, 4" between feet).

When you need more amperage than can be provided by a second alternator, your next option is the DC genset, for example the PC-750. This is a 2-cylinder Yanmar engine direct coupled with our largest brushless alternator. Available in a variety of voltages. Please see our website or contact Balmar for more information on these stand-alone chargers with the 40 gph watermaker option.

APC 750 3.5Kw DC Genset with 40 g.p.h. watermaker

Need a custom pulley or bracket for your large case or auxiliary alternator?

The following manufacturers provide a wide variety of pulleys and bracketry designed to convert your engine to accept BALMAR high-output alternators.

HS Marine Parts
Issaquah, WA
(425) 557-7820
(888) 946-3929
hms@aa.net

ZRD
P.O. Box 968
Titusville, FL 32781-0968
(321) 264-3243
http://www.zrd.com

RPM Chart

Alternator RPM Table - Not all models are listed here. Further information is available upon request. Please note that all outputs are given in alternator RPM. Engine RPM is typically about 1/2 (50%) or less because of the pulley ratio. Example alt. pulley 2.5", engine crank pulley of 5" equals a 2 to 1 ratio, 2500 alt. rpm = 1250 engine rpm.

Note:Table reflects outputs at 122° F using 14 or 28 volts with 2.5" pulley O.D.. Output at 12 or 24 volts could be 5 to 10 % lower or higher. Actual output on your boat will vary with wire size and condition, voltage sense point, battery age and condition, operating temperatures, and other installation criteria.

Alternator rotor rpm	**1250**	**1500**	**1750**	**2000**	**2500**	**3000**	**3500**	**4000**	**4500**	**5000**	**6000**
Engine rpm (5" crank)	625	750	875	1000	1250	1500	1750	2000	2250	2500	3000
Engine rpm (6" crank)	520	625	730	833	1040	1250	1460	1665	1875	2080	2500
12-Volt Models											
70, 71, or 712-80	15	25	40	56	63	74	80	82	83	85	
70, 71, or 712-110	14	22	38	60	80	86	95	100	108	114	
81, or 812-50	15	25	36	40	42	45	48	49	50	51	52
81, or 812-65	12	18	35	45	55	60	61	63	64	65	66
81, or 812-100	10	18	28	35	60	80	90	95	98	100	110
90, 91, or 912-75	15	25	37	55	70	80	84	87	89	91	93
90, 91, or 912-100	15	25	38	51	77	93	101	107	109	112	115
90, 91, or 912-150	10	18	32	44	82	106	122	133	139	145	155
94-100 (9400)	30	52	66	79	88	92	96	99	101	102	104
94-160 (9435)			70	90	120	135	145	152	157	160	162
94-165	20	50	70	90	110	121	128	152	156	158	165
94-190 (9465)			25	65	110	135	154	165	174	179	180
94-200		10	38	71	128	152	180	190	197	203	210
95-165	20	50	70	90	110	121	128	152	156	158	165
95-200		40	62	78	125	135	160	185	195	205	215
96-185	50	80	115	120	155	170	180	182	185	187	190
96-275		40	90	121	168	205	235	250	270	275	290
9812-300-BL		83	125	168	212	242	258	275	282	291	303
24-Volt Models											
90, 91, or 912-24-65				10	35	40	50	55	60	65	70
90, 91, or 912-24-80				15	40	55	70	75	80	85	95
94-24-120-D (9200)				20	30	60	75	90	110	125	130
94-24-135-MHD					45	82	90	130	135	148	156
94-24-MSL			20	45	85	110	115	120	130	132	135
9624-140				20	65	100	118	128	138	144	160
9824-220-BL			60	110	170	205	225	250	260	270	272

Alternator Rating / Battery Capacity Formula

Rule of thumb is that the alternator output equal 25% of the battery capacity, so for a 400 amp hour bank, our 100 amp alternator would be a wise choice. You can figure 1 hp draw per 25 amps (12 volt) at maximum output.

Be sure to read the information about batteries and resistance, on the following page. There are many factors that play into the correct sizing of the alternator to the battery bank.

BATTERIES & RESISTANCE

Automotive type alternators that come standard on engines are typically designed for light load handling and are not up to the task of charging large banks of batteries. It is simply not what they are designed to do. Rule of thumb is that most people see at least a 50% increase in performance due to replacing an automotive type alternator with a similarly rated high output marine alternator.

Our rpm table rates the output at 122 degrees F and at 14 or 28 volts. The highest rated alternator that we recommend on a single belt in the factory alternator position is 100 amps. That is if the belt is ½". If the belt is 3/8", we would recommend the 75 amp model be used. The Balmar 100 amp alternator can actually put out about 120 amps. HOWEVER, the alternator will only put out as much current as the batteries can accept. There are many factors that determine how much current the batteries will accept.

Often it is not the output of the alternator, or even its regulation that causes the disappointing recharge scenario. This can many times be attributed to the rate of charge the batteries can accept. Typically, batteries absorb current at a rate of about 20-30% of their capacity. Your battery manufacturer can answer questions that you may have in this regard.

With the new AGM type batteries, we see a very substantial increase in this percentage. (Note: when using AGM batteries, we highly recommend using our Max Charge regulator with battery and alternator temperature sensing.) The larger the battery bank, the more current the batteries will accept and the harder the alternator has to work.

You can picture a 200-amp alternator charging one small car battery, you will never see that battery accepting more than 30 or 40 amps. Yet a 1000 amp hr battery bank, when deeply discharged can make that 200 amp alternator work at it maximum output. If the alternator has a 100 amp capacity, and the batteries can absorb 60 amps, and you have an additional 40 amp load, there would be a 100 amp output. There are, however, many factors that will affect this and some of them are somewhat abstract.

The first, and probably most important, is to realize that the absorption rate of the particular type of batteries sets the charge rate. In other words, if we were to set the voltage at 14.1, the batteries, would absorb current at a certain rate. If you raise the voltage the batteries will absorb more current but you may damage them. Different types of batteries made by different manufacturers have a wide span of absorption rates.

One other small factor to consider is that a 100 amp alternator is rated at 100 amps when it has adequate voltage to create the magnetic flux. In other words, if your battery was down to 10 volts, the alternator would not have the energy (10 volts) required to come to its full potential. In a way, it has to earn its way up to its full potential.

So you see there are many abstracts. It is often disappointing to try to achieve that last 10 or 15% back into your batteries. We find that adding more batteries, in other words a larger resistive target for the alternator, increases the current flow and shortens the length of time that the engine must operate to replenish yesterdays use of energy.

Notes:

Dual Output Option / Charging Multiple Battery Banks

There are four ways to accomplish the charging of multiple battery systems:

1) Dual Output Alternator
2) Battery Isolator
3) Battery Combiner
4) A/B Switch

Everyone has their own preference and opinion about which is best. The old 'A/B Switch' is extremely reliable, but some people don't like to have to try to remember to use it. Any of the methods listed above will work. We prefer the dual output alternator method, where the output simply goes from the alternator to the two individual battery banks requiring charging - there is nothing to be remembered and there is no additional equipment to fail.

There are several ways to charge two groups of batteries with one alternator. Using a dual output alternator is probably one of the simplest, as the outputs can go directly to each battery terminal. Therefore, whenever the alternator is in operation, both sets of batteries are being topped out, without having to remember where the switch setting is set.

The dual output alternator is rather simplistic in its design. It offers two complete sets of isolated diodes and cooling plates . Whichever terminal sees a load will receive the current flow. Either terminal on the alternator can put out 100% of the alternator's capacity. Some people that use extremely heavy loads on the alternator choose to use it as a single output model, leaving the bonding strap on the two terminals, thus doubling the cooling capacity of the alternator.

A very standard scenario is that the cranking battery is fully charged, or nearly fully charged, and the house bank is brought down from regular daily activity. What occurs is that the house battery will consume all of the alternator output until it is brought up to the same voltage level as the cranking battery. At that point, the alternator will bring both banks up and top them off together. As you can imagine, the cranking battery takes very little of the current, therefore the full capacity of the alternator is directed to the house load.

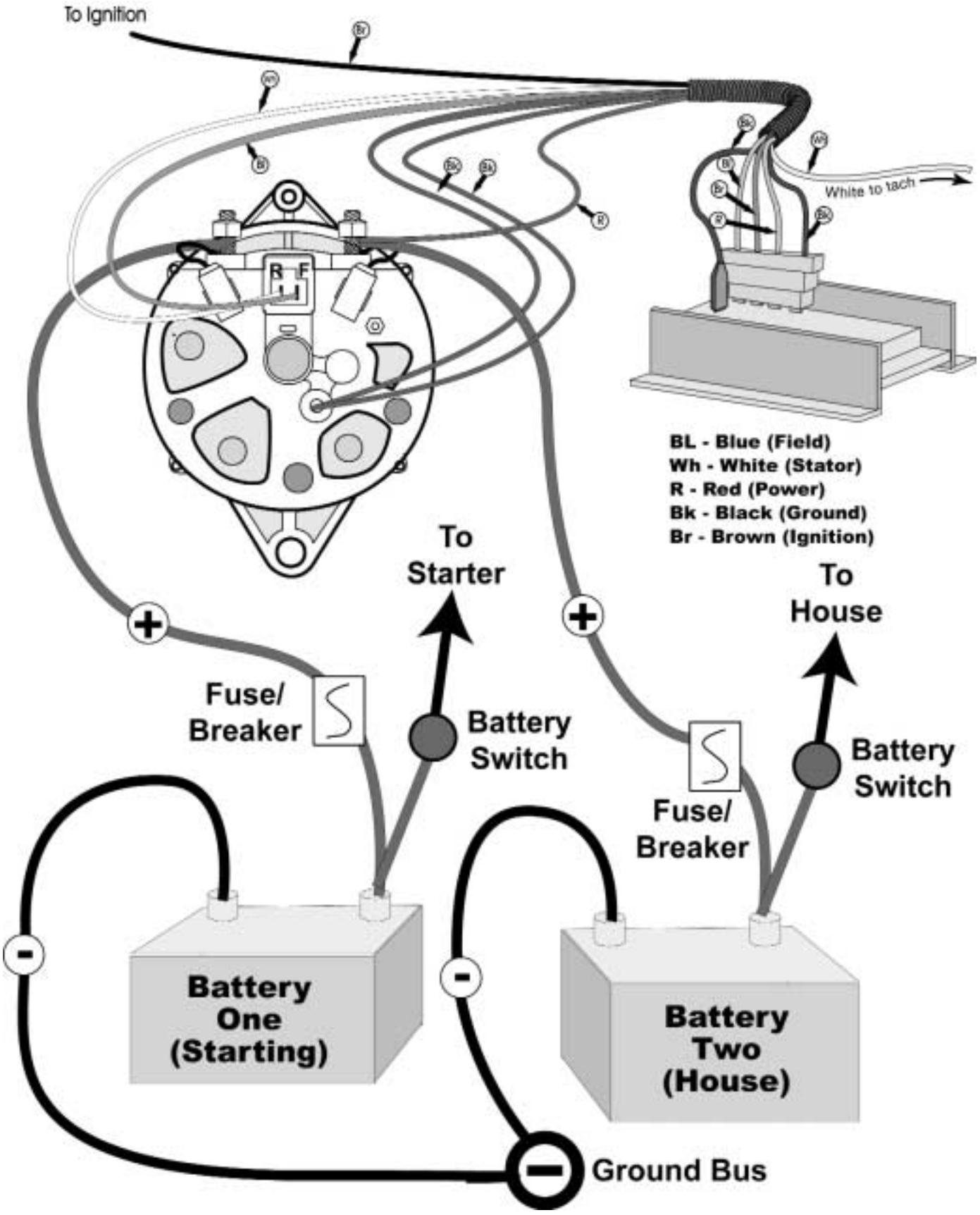
You do not need a separate regulator for each output. The regulator provides instructions to the alternator, and the alternator can only act upon one set of instructions. We usually regulate the heavy load, the house bank, and the regulator assures that the voltage on the system does not exceed the values set on the regulator. Again, with a dual output alternator, the red sense wire is used to sense the most heavily used (usually the house) bank. Connection may be may at the alternator output terminal, if the wiring is correctly sized. If the wiring is not correctly sized, there may be line loss to the battery. An alternative is to connect the red wire to battery positive.

The voltage level from the alternator is determined by the regulator. If the regulator is set at 14.2, both outputs will charge at 14.2 volts. The batteries acceptance rate of current is determined by the voltage setting. In other words, if the voltage setting of the regulator is 14.2 volts, a battery at 14.2 volts will accept very little current. On the other hand, if the battery is quite low, let's say at 12.2, it will accept 'X' amount of current, depending on the type and size of battery, an at a diminishing rate as it comes up to the set voltage. The higher the voltage is set, the more the battery will absorb. That is the fundamental philosophy of the 3 stage regulator. The batteries will simply come up to the given voltage. If they are both fully charged, very little current will flow. If one bank is low, the current will flow to that battery first. It doesn't matter if it is the house or the start battery.

Different types of batteries are a different story. Battery manufacturers and Balmar both suggest that all batteries in a system be of the same type. Different types of batteries often have different program parameters suggested for proper voltages and absorption rates.

For more information about small and large case dual-output alternators, see our website at: www.balmar.net

Suggested Wiring for 12V Dual-Output Alternator / Two Batteries



NOTE: Typical installations are most efficient when battery sensing takes place at larger (house) bank. If smaller (starting) battery indicates overcharging, move sense wire to smaller battery.

BALMAR

Year 2000 Regulator Comparison Chart

	Model #	Charge Volts	Charging Cycle	Battery Presets	Display Type	Temperature Sensing	Alarm Circuits	Advanced Programming
	MC-612 MC-624	12-V 24-V	**Multi-Stage** *1. 45-Sec. Delay* *2. Soft Ramp* *3. Bulk Charge* *4. Absorption* *5. Float*	*1. Universal Factory** *2. Deep-Cycle Flooded* *3. Gel Cell* *4. Glass Mat (AGM)* *5. Optima* *6. Standard Flooded* *7. Halogen (Voltage sensitive)*	***3-Digit Numeric*** *Display provides up to 43 informational readouts including data regarding programming, operation, system and regulator diagnostics.*	**Temp Sensing*** *1. Alternator* *2. Battery Bank #1* *3.Battery Bank #2* *Requires optional Alternator and Battery Temperature Sensors*	***Dash Lamp*** *Low bat. voltage. High bat. voltage. High field voltage. High stator voltage. High bat. temp. High alt. temp.* ***Advisory*** *Full alt. output. Small engine mode. Equalization mode.*	*1. Bulk Voltage* *2. Bulk Time* *3. Absorb Voltage* *4. Absorb Time* *5. Float Voltage* *6. Float Time* *7. Amp Manager* *8. Equalization Time/Voltage*
	MC-412 MC-424	12-V 24-V	**Multi-Stage** *1. 45-Sec. Delay* *2. Soft Ramp* *3. Bulk Charge* *4. Absorption* *5. Float*	*1. Universal Factory** *2. Deep-Cycle Flooded* *3. Gel Cell* *4. Glass Mat (AGM)* *5. Optima* **for standard flooded and no-maintenance batteries*	***8-LED Light Display*** *Color coded LED lamps display programming, operational and diagnostic data.*	**Temp Sensing*** *1. Alternator* *2. Battery Bank #1* *Requires optional Alternator and Battery Temperature Sensors*	***Dash Lamp*** *High voltage. Low voltage.* ***Advisory*** *Small engine mode. Full field. Equalization mode.*	*1. System Voltage** *2. System Time** *3. Amp Manager* *4. Equalization Time/Voltage* ** System time and voltage adjustments alter values equally in all charging stages*
	ARS-4	12-V	**Multi-Stage** *1. 45-Sec. Delay* *2. Soft Ramp* *3. Bulk Charge* *4. Absorption* *5. Float*	*1. Universal Factory** *2. Deep-Cycle Flooded* *3. Gel Cell* *4. Glass Mat (AGM)* *5. Optima* **for standard flooded and no-maintenance batteries*	***8-LED Light Display*** *Color coded LED lights display programming, operational and diagnostic data.*	**Temp Sensing*** *1. Alternator* *Requires optional Alternator Temperature Sensor*	***Dash Lamp*** *High voltage. Low voltage.*	*1. System Voltage** *2. System Time** *3. Equalization Time/Voltage* ** System time and voltage adjustments alter values equally in all charging stages*
	BRS-2 BRS-2-24	12-V 24-V	**Single-Stage** *Voltage adjustable approx. 13.7V-14.6V* **Single-Stage** *Voltage adjustable approx. 25.7V-28.6V*	**None**	***3 LED Display*** *Indicates power on, voltage at field and voltage at stator connections*	**None**	**None**	**None**
	ERS	12-V	**Single-Stage** *Fixed Voltage 14.1V*	**None**	**None**	**None**	**None**	**None**

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