

Battery Differences

Maintenance-free batteries (gel cells / AGM / closed-case) have thin plates. They're ideal for a charging system that maintains a typical charge between 12.5V – 14.4V, but not for outboards, where batteries are commonly drained by accessories while fishing, etc. i.e. when there is no charge applied to a battery while the battery is in use. Its thin plates cannot withstand constant discharging and charging. It will develop weak and/or dead cells due to this behavior.

Maintenance-free batteries should not be used because their life span is shortened when used on an outboard application. A new fully-charged, maintenance-free battery will work fine at first, but under constant discharging and charging, something that style battery is not designed for, it will eventually become weak and/or develop dead cells, thus unable to accept a full charge, thus putting a rectifier/regulator at extreme risk of failure.

Non-maintenance-free batteries (lead-acid flooded cell; has vent caps on its top) have heavy, thick plates. They're ideal for outboards, where batteries are commonly drained by accessories while fishing, etc. i.e. when there is no charge applied to a battery while the battery is in use. Its heavy plates can withstand constant discharging and charging. These batteries have much more reserve time and are much more suited for this behavior.

The recommended type of battery for outboards is a single (NOT more than one) 850+ CCA dual purpose or cranking/starting non-maintenance-free battery. Make sure to charge any battery off of a battery charger BEFORE installing. NEVER allow the stator to charge a battery. The stator is designed to maintain the battery's voltage at an optimum charge. It's not designed to charge a dead or weak battery. Make sure the battery is always charged off of a battery charger before each use of the boat to maintain optimum performance and life of the battery, stator and regulator. If multiple accessories are used, a 2nd battery, NOT connected to the starting battery, is recommended. If desired, a make-before-break switch can be used between the two batteries. Make sure to also charge this battery off of a battery charger before each use.

NEVER jump-start a battery while an outboard engine is running. This can cause damage to the rectifier/regulator. Always use a battery charger to charge a battery. If no battery charger is available, the rectifier/regulator's Red wire may be disconnected while jump-starting to avoid damaging the rectifier/regulator.

Troubleshooting Battery Charging Issues

Regardless if the charging issue is overcharging or not charging at all, the #1 cause of all charging issues is the battery often due to improper style and/or charging neglect. #2 is the battery's connections. #3 is the rectifier/regulator. #4 is the stator.

The battery and/or its connections often cause the rectifier/regulator (and in rare cases, the stator) to become faulty, thus often creating more than one faulty component (Example: Bad battery causing the rectifier/regulator to become faulty). The rectifier/regulator is more susceptible to failure than the stator because its diodes are more fragile than the stator's typical 12-18 gauge wire encompassing its frame.

A rectifier's job is to convert the stator's AC signal into DC to charge the battery. In non-regulated applications (rectifier only), the battery acts as its own regulator, which is not designed to do. When it can no longer self-regulate proper voltage from the rectifier, usually due to dead and/or weak cells, it poses a serious threat to rectifier failure and thus needs replacing. This is why a regulator is crucial to a healthy charging system. A regulator's job is to regulate battery voltage between 12.5 – 14.4V.

In this case, it is recommended to replace the rectifier with a combination rectifier/regulator and replace the battery with a dual purpose or cranking/starting non-maintenance-free battery. This way, the battery will no longer have to self-regulate. The rectifier/regulator will take that responsibility, thus giving the entire charging system optimum life.

1. Check all battery connections, particularly at engine ground. Make sure all connections are corrosion-free and tight. Do NOT use wing nuts. They will loosen over time due to vibration, causing battery and/or rectifier/regulator failures.
2. If no change, remove all batteries and try a single (NOT more than one), known-good, fully-charged off a battery charger, 850+ CCA dual purpose or cranking/starting non-maintenance-free battery (NOT a closed-case battery). Make sure the battery is a lead-acid flooded cell (has vent caps on its top). Make sure to charge any battery off of a battery charger BEFORE installing. NEVER allow the stator to charge a battery. The stator is designed to maintain the battery's voltage at an optimum charge. It's not designed to charge a dead or weak battery. Recheck all connections, making sure they are corrosion-free and tight. NEVER jump-start a battery while an outboard engine is running. This can cause damage to the rectifier/regulator. Always use a battery charger to charge a battery. If no battery charger is available, the rectifier/regulator's red wire may be disconnected while jump-starting to avoid damaging the rectifier/regulator.

3. If no change, measure DVA voltage across the stator's battery charge wires (typically Yellow wires) while connected to the rectifier/regulator. At idle, DVA should be between 17-25V DVA. If not, disconnect the Yellow wires from the rectifier/regulator and retest for 17-50V DVA at idle. If not, the stator is possibly faulty. Visually inspect the stator for browning, varnish dripping and any signs of overheating. If the stator shows any signs of overheating, replace the stator.
4. If the stator DVA checks and visually looks good, test the rectifier/regulator as given below.

Rectifier/Regulator Tests

1. With all wires connected and the engine running at approximately 1500 RPM, check the DVA voltage from each battery charge wire (typically Yellow wire) to engine ground. The two readings must be within 1.5 volts of each other (i.e. if one is reading 20 volts, the other has to read between 18.5 and 21.5 volts). If the readings are not equal, go to step 3. If they are equal, go to step 2.
2. Check DVA voltage from each of the Yellow wires to the Red wire going to the solenoid. The two readings must be within 1.5 volts of each other. If the readings are unequal, go to step 3. If they are equal on both this step and step 1, the rectifier/regulator and battery charging portion of the stator are good.
3. If the readings are unequal, place a mark across the connection between the stator and rectifier/regulator that measured low. Turn the engine off and swap the stator leads. Crank the engine up and retest. The component (stator or rectifier/regulator) that has the marked wire with the low reading is bad.
4. Disconnect the regulator's Gray wire. At 800-1000 RPM, check the DVA voltage on the Gray wire FROM THE REGULATOR measured to engine ground. The reading should be at least 8V DVA. If below 8V DVA, see TACHOMETER TESTS below.

Rectifier/Regulator Bench Tests

1. *Diode plate check:*
With all wires disconnected from the rectifier/regulator, using a meter set on its Diode scale, test the diodes from each of the two battery charge wires/terminals (typically Yellow wires/terminals) to the Red wire/terminal. You should get a reading one way but not the other. Check the resistance from each of the Yellow wires/terminals to case ground. You should have a high reading, typically in the M range. The Red wire/terminal should not read to ground, but may show a very high reading (25M ohms or more).
2. *Tachometer Circuit:*
With all wires disconnected from the rectifier/regulator, check resistance between the Gray wire and engine ground. You should read approximately 10K (10,000) ohms. Both (Gray to Red) and (Gray to each of the Yellow) wires should be a high reading, typically in the M range.

Tachometer Tests

1. Disconnect the regulator's Gray wire. At 800-1000 RPM, check the DVA voltage on the Gray wire FROM THE REGULATOR measured to engine ground. The reading should be 8V+ DVA. If not, replace the regulator.
2. If at least 8V DVA, run a jumper wire from the Gray wire out of the harness to one of the stator's Yellow wires.
3. If still no tachometer signal, try a known-good tachometer.
4. If still no tachometer signal, replace the stator.

Checking Maximum Battery Output

1. Install an ammeter capable of reading the maximum output in line on the Red wire connected to the starter solenoid.
2. Connect a load bank to the battery.
3. In the water or on a Dynamometer, start the engine and bring the RPM up to approximately 3500.
4. Turn on the load bank switches to increase the battery load to match the rated output of the stator.
5. Check the ammeter. If the amperage is low:
 - A. Check the Purple wire for voltage while the engine is running. You should see the same voltage as the battery.
 - B. Connect a jumper wire from the Positive battery cable to the Purple wire and recheck the ammeter. If the amperage is now correct, there is a problem in the harness or key switch.
6. If the amperage is correct, but the battery voltage remains low, replace the battery.