CHARGING TIPS

Always leave filler caps in place, tight and secure to reduce the risk of battery explosion and serious injury! **Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.** Do not charge batteries without proper instruction.

1. Batteries should be charged if hydrometer reading is below 1.225 specific gravity, or open circuit voltage is below 12.4 volts, or if the first load test is below 9.6 volts as noted previously.
2. Carefully read and follow the instructions that came with the charger to avoid serious injury, property damage and/or battery damage.
3. Unplug the charger before connecting or disconnecting a battery to avoid dangerous sparks which can cause a battery to explode.
4. Do not leave a battery on charge for more than 48 hours to avoid damaging the battery by over-charging. If gassing or spewing of electrolyte occurs, or the battery case feels hot, reduce or temporarily halt charging to avoid damaging the battery.
5. Stop the charge when two hydrometer or voltage readings recorded two hours apart indicate no increase. Further charging would be useless and may damage the battery and shorten its life. If the battery won't come up to full charge, replace it.
6. **NEVER attempt to charge a frozen battery.** To avoid explosion and serious injury, allow it to warm to 60°F (16°C) before charging.
7. **NEVER** leave a battery on a trickle charger longer than 48 hours. Serious damage to the battery WILL occur.

12 VOLT BATTERY CHARGING TIME TO FULL CHARGE @ 80°F

BATTERY VOLTAGE	SPECIFIC GRAVITY	STATE OF CHARGE	MAXIMUM RATE @ 50 AMPS	30 AMPS	20 AMPS	10 AMPS
12.6	1.265	100%	— FULL CHARGE —			
12.4	1.225	75%	20 min.	35 min.	48 min.	90 min.
12.2	1.190	50%	45 min.	75 min.	95 min.	180 min.
12.0	1.155	25%	65 min.	115 min.	145 min.	280 min.
11.8	1.120	0%	85 min.	150 min.	195 min.	370 min.

NOTE:

Times are approximate and depend upon battery condition, age and design, the efficiency of the charger, line voltage and other factors.

OFF-SEASON STORAGE

Batteries that are not in use during the off-season must be cared for as follows to extend battery life and reliability:

1. Disconnect the batteries to avoid self-discharge due to parasitic loads such as clocks, ground faults, etc.
2. Put into storage fully charged and keep them above 75% state-of-charge. Check state-of-charge every 90 days and recharge if necessary.
3. Ideally, store batteries in a cool, dry place with temperatures not below 32ºF (0ºC) or above 80ºF (27ºC). Typically, batteries will self-discharge at faster rates at higher temperatures. For example:

TEMPERATURE	SELF-DISCHARGE RATE
100ºF (38ºC)	.3 Pts. Specific Gravity per day
80ºF (27ºC)	.2 Pts. Specific Gravity per day
50ºF (10ºC)	.1/2 Pt. Specific Gravity per day
30ºF (–1ºC)	.1/10 Pt. Specific Gravity per day

NOTE:

This is only an example. Self-discharge may be higher or lower depending upon battery chemistry, lead alloys, age and other factors.

E.P.M. Form No. 0273 Rev. 10/14

California Proposition 65 Warning

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **Wash hands after handling.**

Marine / RV Battery Care & Maintenance

FOR FLOODED BATTERIES

- **STARTING**
- **DEEP-CYCLE**
- **DUAL PURPOSE**

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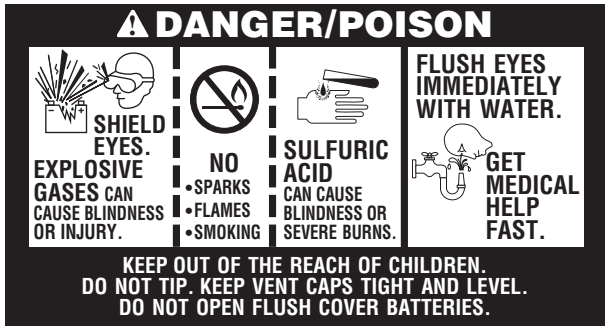
RECYCLING IS CRITICAL

Did you know lead-acid batteries are virtually 100% recyclable? They have a higher recycling rate than other waste products such as aluminum, paper, glass and plastic.
Be sure to return your lead-acid batteries to a dealer.
In most states it is illegal to discard a battery in the trash.

BE CAREFUL!

WARNING: Batteries produce explosive gases. Keep sparks, flames, and cigarettes away from batteries at all times. Protect your eyes at all times. Never lean over battery when jumping or performing other maintenance. Remember... always wear safety glasses when working around batteries!



TYPES OF FLOODED MARINE / RV BATTERIES

The various types of batteries used in Marine and RV service are:

- Maintenance-Free Non-Accessible Engine Starting with no filler caps
- Low-Maintenance Accessible Starting with filler caps
- Dual Purpose (Starting/ Cycling) with filler caps
- Deep Cycle with filler caps

You may have one or more of the same type or different types on board your boat or RV. Determine which type of battery or batteries you have and follow the correct set of instructions.

SERVICE TIPS

Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.

1. Perform a visual inspection. Inspect for defective or cracked case and cover, and loose or damaged terminal posts or cables. Replace battery and/ or cables immediately if any damage is found.

SERVICE TIPS *(continued)*

Look for loose connections or hold-downs. Tighten snugly if appropriate. DO NOT OVER-TIGHTEN TO AVOID BATTERY DAMAGE!

2. Keep the batteries and battery compartment clean and corrosion free. Dirty, corroded batteries can self-discharge, which will affect performance and life.

   Clean corrosion with a paste made from baking soda and water. Apply liberally. Any corrosion is neutralized when the solution stops bubbling. Wash off with large quantities of water to avoid environmental damage.

3. Shine lead posts and terminal ends with a wire brush or steel wool to clean corrosion and assure a low resistance connection. Reassemble and coat lead parts with petroleum jelly or a terminal protection spray.

   Repaint hold-down, tray and surrounding parts if necessary.

CHECK THE STATE OF CHARGE

Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.

- **MAINTENANCE-FREE NON-ACCESSIBLE TYPES, WITH NO FILLER CAPS:**

  1. Check the state-of-charge of the battery with a voltmeter. If the reading is above 12.4 volts, the battery is at least 75% charged and should be OK. If below 12.4 volts, see the *Charging Tips* section.

- **ACCESSIBLE TYPES, WITH FILLER CAPS:**

  1. Using a voltmeter: Check the state-of-charge of the battery. If the reading is above 12.4 volts, the battery is at least 75% charged and should be OK. If below 12.4 volts, see the Charging Tips Section. *Or,*

  2. Using a hydrometer: Check the state-of-charge of the battery by taking a reading from one cell. Use a different cell each time. If the reading is above 1.225 specific gravity, the battery is at least 75% charged and should be OK. If below 75%, see the *Charging Tips* section.

     Be careful of the sulfuric acid in the battery. It can burn eyes, clothing and damage paint and electronic equipment. **FLUSH EYES IMMEDIATELY WITH LARGE QUANTITIES OF COOL WATER. GET MEDICAL HELP FAST.**

     Specific gravity readings need to be corrected to 80ºF (27ºC) to allow for temperature of the electrolyte and to insure accurate readings. For each 10 degrees above 80ºF (27ºC), add four points to the hydrometer reading.

CHECK THE STATE OF CHARGE *(continued)*

For each 10 degrees below 80ºF (27ºC), subtract four points to the hydrometer reading. For example, at 90ºF (32ºC) a hydrometer reading of 1.250 would be corrected to 1.254. Likewise, at 70ºF (21ºC) a hydrometer reading of 1.250 would be corrected to 1.246.

If the electrolyte level is too low to read with a hydrometer, add distilled water as noted below and run the engine or equipment at least two hours to mix the electrolyte and avoid a false reading.

3. Check electrolyte levels in all cells. If necessary, add distilled water (or clear, odorless drinking water). Do not use water with high iron content to avoid battery damage. **Never add acid, only water to a battery**. If it will be necessary to charge the battery, bring the levels in all cells to just above the separators inside the cells to allow for expansion during charging. Top off after charging as noted below.

   If it is not necessary to charge the battery, (or after charging) top off by filling each cell with distilled water to just below the filler tube in each cell.

LOAD TESTING

Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.

Using a voltmeter or hydrometer will tell you if your battery is charged. But these tests will not indicate if a battery can "hold a load." A battery can be fully charged, but be so weak or worn out that it can no longer perform its function of starting an engine or running accessory loads. Therefore, you must also perform a load test to determine the state of health of your battery.

1. Follow the instructions on the variable load tester or ask your favorite service dealer to load test your battery.
2. If the battery maintains a minimum "on load" voltage of 9.6 volts for 30 seconds, it is in good condition. If not, recharge and load test again.
3. If it fails a second time, **replace the battery immediately**.