Trojan®
BATTERY COMPANY

USER'S GUIDE

1 Safety

Since batteries deliver large amounts of power that can cause injury and even death, observing safety rules is of paramount importance. For your safety and the safety of those around you, please observe the following checklist when working on or around batteries.

Always	Never
Always wear protective clothing, gloves, and safety goggles	Never smoke near batteries
Always use insulated tools when working on batteries	Never wear jewelry or other metal objects when working on or around batteries
Always check connections for proper torque	Never make direct contact with the electrolyte (sulfuric acid). If this occurs, flush with large amounts of water.
Always charge batteries in well-ventilated areas	Never place objects on top of batteries.
Always keep sparks and flames away from batteries	Never add acid to a battery
Always use short cables of appropriate size to minimize voltage drop	Never charge a frozen battery
Always ensure plates are covered in water before charging	Never charge a flooded battery without securing vent caps on the cells
Always make sure charger is set for the appropriate battery type (flooded, AGM or gel)	Never charge a battery when the temperature is above 122°F (50°C)
Always charge batteries before installing	Never store batteries unless they are fully charged
Always neutralize small spills with baking soda and water. For large spills, contact the appropriate first responders.	Never leave an acid spill unattended

WARNING! Risk of fire, explosion, or burns. Do not disassemble, heat above 158°F (70°C), or incinerate.

2 Equipment Needed

Before **performing** maintenance of your batteries, have the following equipment available:

- Proper personal protective equipment (eye protection and acid resistant gloves)
- Distilled or deionized water
- Insulated tools
- Baking soda
- Terminal protector spray

3 Preventive Maintenance
3.1 Inspection

- Examine the outside appearance of the battery. The tops of the batteries and terminal connections should be clean, dry, and free of corrosion. Refer to *Section 4.3, Cleaning.*
- If fluids are present on the top of a deep-cycle flooded/wet battery, it may mean that the battery is being over-watered or overcharged. Refer to *Section 4.2, Watering,* for the proper watering procedure.
- If fluid is present on the top of a deep-cycle AGM or gel battery, it may mean that the battery is being overcharged, which can reduce battery performance and life.
- Check battery cables and connections. Replace any damaged cables and tighten any loose connections. Refer to *Section 3.5, Torque Values.*

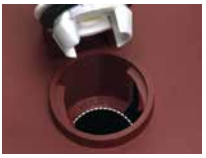
3.2. Watering (flooded/wet batteries only)

Deep-cycle flooded/wet batteries need to be watered periodically. The frequency depends on battery usage, charging and operating temperature. Check new batteries every few weeks to determine the watering frequency for your application. It is normal for batteries to need more watering as they age.

Water should NEVER be added to deep-cycle AGM or gel batteries.

Figure 5

Standard Vent Well


Vent Well with Level Indicator

- Use only distilled or deionized water. Tap water can contain contaminants that will damage the battery. Also, be aware that water can pick up impurities from containers, piping, and fixtures. *Table 4* contains the limits for impurities to avoid damaging batteries.
- Fully charge the batteries prior to adding water. Only add water to discharged or partially charged batteries if the plates are exposed. In this case, add just enough water to cover the plates and then charge the batteries. Once completed, continue with the watering procedure below.
- Check the electrolyte levels by removing the vent caps and placing them upside down so that dirt does not accumulate on the underside of the cap. For Plus Series™ batteries, simply flip open the cap.
- If the electrolyte level is barely covering the plates, add distilled or deionized water to the proper level as illustrated in *Figure 5.*
- After adding water, secure vent caps back onto batteries.

3.3. Cleaning

Check the battery for cleanliness at regular intervals and keep terminals and connectors free of corrosion. Terminal corrosion may adversely affect the performance of the battery and present a safety hazard.

- For flooded batteries, check that all vent caps are secured properly on the battery.
- Clean the top of the battery, terminals, and connections with a cloth or non-metallic brush, and a solution of baking soda and water comprised of 1 cup of baking soda to 1 gallon of water (60 ml of baking soda per liter of water). **Do not allow cleaning solution to get inside the battery.**
- Rinse with water and dry with a clean cloth.
- Apply a thin coat of terminal protector spray which can be purchased through your local battery dealer.
- Keep the area around batteries clean and dry.

4 Storage

The following tips will help ensure that your batteries emerge from storage in good condition:

- Charge batteries before placing them in storage.
- Store in a cool and dry location, protected from the elements.
- Disconnect from equipment to eliminate potential parasitic loads that may discharge the battery.
- Batteries gradually self-discharge during transit and storage, so monitor the specific gravity or open-circuit voltage of flooded batteries every 4 - 6 weeks. Monitor the open circuit voltage for AGM or gel batteries every 2 - 3 months.
- Batteries in storage should be charged when they decline to the following state of charge (SOC):
    - o Flooded batteries: 70% SOC
    - o AGM/gel batteries: 75% SOC
- Refer to *Table 7* for the relationship between SOC, specific gravity (flooded only) and open-circuit voltage. If charging is needed, follow the normal charging procedure outlined in *Section 5.2*.
- When batteries are taken out of storage they should be given an initial charge as outlined in Section 5 prior to use.

4.1. Storage in Hot Environments

Storage in hot environments (greater than 90°F or 32°C) can negatively impact batteries. Avoid direct exposure to heat sources, if possible, during storage. Batteries self-discharge faster at high temperatures. If batteries are stored during hot summer months, monitor State-of-Charge on a regular basis as follows:

- Flooded batteries: check specific gravity or voltage every 2 - 4 weeks.
- AGM or gel batteries: check voltage every 1 - 2 months.

4.2. Storage in Cold Environments

If possible, avoid locations where freezing temperatures are expected during storage. Batteries can freeze in cold temperatures (less than 32°F or 0°C) if they are not fully charged. If batteries are stored during cold winter months, it is critical that they be kept at a high state of charge as outlined above.

Freezing Point of Electrolyte		
Specific Gravity	Temperature	
	°C	°F
1.280	-68.9	-92.0
1.265	-57.4	-71.3
1.250	-52.2	-62.0
1.200	-26.7	-16.0
1.150	-15.0	-5.0
1.100	-7.2	19
Source: BCI Service Manual © 1995		