

Safety. First.

Deep Cycle Battery Handling, Maintenance & Test Procedures

Zoeller Deep Cycle Battery

The chemistry and plate design of deep cycle batteries are totally different than that of automotive starting batteries. The grid metal used in the deep cycle battery plate is specifically formulated to increase the adhesion of high-density active paste material. This provides the best available running time, cycle life and charge acceptance.

Zoeller deep cycle wet battery employs a low-maintenance design. It does require periodic maintenance and effective charging service to ensure dependable service life. The purpose of this service guide is to help you understand the characteristics, operation and care of the battery so that all of their advantages may be fully realized.



Product may not be exactly as illustrated.

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Inspection & Handling

- 1** Do not allow the battery to tip or operate at a severe angle in any direction. This would allow the battery electrolyte to push through the battery vent assembly.
- 2** Charge the battery in a well-ventilated area.
- 3** Upon receipt, examine the battery for signs of wetness or impact (which may indicate damage in shipment or that the battery was tipped beyond a 45° angle during transit).
- 4** If there is evidence of damage – notify Zoeller Pump Co. to make a damage report.
- 5** Charge the battery before placing in service. Simply connect the battery charger and allow it to run until it automatically shuts off.



Operating Guidelines

Battery life is usually measured in cycles – but in practical terms, your battery should work well for three years from the beginning date of service.

However, battery maintenance and charging procedures will either prolong or shorten battery life, depending upon how well recommended practices are followed.

Other Factors That Affect Battery Life and Performance:

- Batteries are rated in ampere-hours (Ah) and are designed to perform a specific workload within an established period of time. Increasing either and/or both of these will over-discharge the battery and result in shortened life.
- Limit discharging the battery beyond 1.75 volts per cell – or 1.125 specific gravity per cell.
- Batteries should always be recharged immediately following a complete discharge period. Never allow the battery to remain in a fully discharged condition, otherwise permanent damage will result.
- Under normal circumstance the temperature of the battery electrolyte must not exceed 110° F (43° C). If the battery is continuously operated at or above this point the service life of the battery will be severely diminished. Under normal conditions, battery electrolyte condition should range from 60° to 100° F (15° to 38° C).
- If a battery is ever hot to the touch, allow it to cool to ambient temperature before charging or discharging.
- Keep battery connectors and cabling in good condition. When disconnecting the battery connector from the equipment, pull on the connector – not the cable. Damage to the connectors and/or cables will result in poor battery performance.

Preventative Maintenance

- Battery covers and terminals should be kept clean, dry and free of corrosion. Battery vent caps must be secured to the batteries during use and charging period. Remove vent caps only to inspect electrolyte levels or specific gravities.
- When batteries or terminals require cleaning, use only biodegradable cleaner-neutralizer solutions that can be safely applied and disposed of through a common sanitary sewer. Other chemical-based solutions are often dangerous, ineffective and cannot be disposed of in an environmentally safe manner.
- If electrolyte is spilled onto batteries or the battery compartment area, neutralize it with a cloth moistened with a solution of baking soda and water mixed in the proportion of one pound of baking soda to one gallon of water. When the electrolyte is neutralized, wipe the affected area with a water-moistened cloth to remove all traces of soda.
- Inspect cable-to-terminal connections to ensure connections are tight and free of corrosion. Battery cables must be intact with no exposed wires.
- Preventative maintenance practices should include periodic inspection of battery specific gravity and open circuit voltage. An imbalance of specific gravity and open circuit voltage is usually a sign of improper charging, service infrequency, or a bad cell condition.

Watering Service

Deep cycle batteries begin service consuming relatively low amounts of water. The real need to add water to batteries may vary from weekly service to monthly service depending upon the operating environment and other external factors. As batteries age they will use more water, and in warmer climates batteries will require more frequent service. Equipment owners and users must be vigilant in performing regular watering service to ensure premium performance and life.

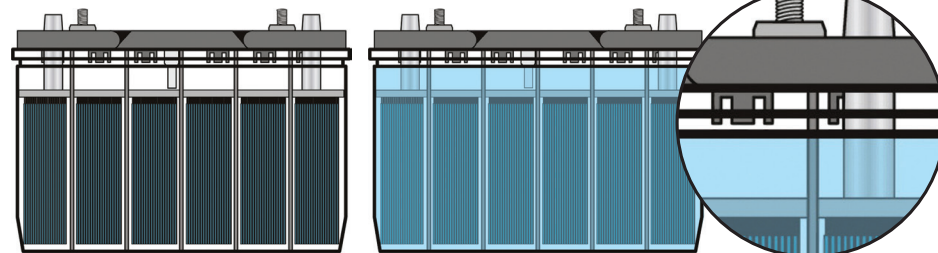
There are two conditions when watering can be harmful to your batteries:

- Over-Watering
- Under-Watering

Over-Watering dilutes the sulfuric acid levels inside the battery – which results in poor battery performance. Under-Watering batteries leads to a service-related overcharge condition, which will shorten battery running times and life.

You can prevent watering-service related problems by using the illustration shown above as a reference point. Maintain battery liquid levels above the top of the battery plates – but no higher than the battery cover vent well. Never fill batteries to the brim of the cell or to a point where they overflow.

Several other rules apply when watering:

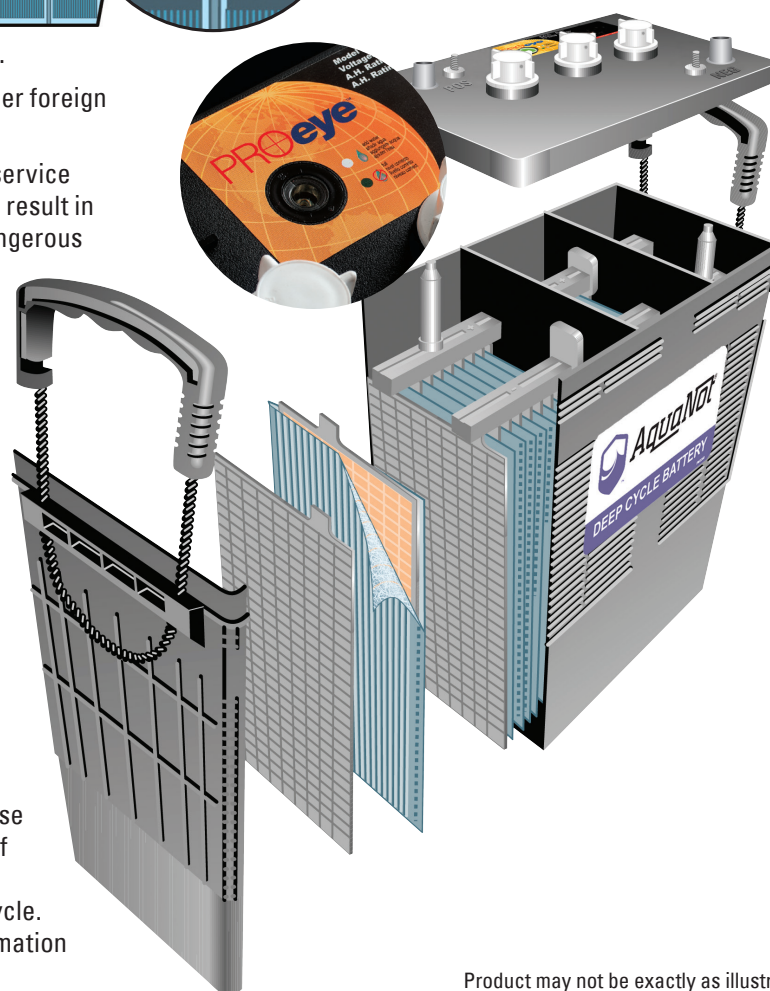


- USE ONLY DISTILLED or DE-MINERALIZED WATER.
- Never add battery acid, commercial additives or other foreign material to the battery.
- Watering service should occur only after charging service is completed. Watering before charging service will result in overflow of the battery's electrolyte – causing a dangerous chemical spill condition and loss of battery capacity.
- Never charge the battery if the battery plates are found to be uncovered/un-submerged in electrolyte. If this condition is detected before charging service, fill the battery only until the top of the battery plates are covered with liquid.

Zoeller deep cycle wet battery features the PROeye indicator that shows users when watering service is required. When the color of the eye is:

- Green = No water service is required
- Clear or White = Watering service is required

The PROeye is an indicator only – and is designed to aid users with determining when individual cell inspection and/or watering service is required. Because watering service is most effective at the completion of charging service – the PROeye should be inspected at the completion of charge or before the start of duty cycle. Contact Zoeller's technical department for more information regarding this product feature at 1-800-928-7867.



SAFETY PRECAUTIONS:

1. **CAUTION:** All lead-acid batteries generate highly flammable hydrogen gas. If ignited, the gas may explode violently. When working near batteries, always wear safety glasses, do not smoke or use open flame near the batteries, remove watches and jewelry, and avoid causing sparks with tools.
2. Battery electrolyte is corrosive and can cause blindness or severe burns. If exposed to battery electrolyte, immediately flush with water and seek medical attention.
3. The batteries in your equipment are electrically live at all times. Keep the top of the batteries clean and dry to prevent ground shorts and corrosion.
4. Do not tip a battery beyond a 45° angle in any direction. This would allow battery electrolyte to push through the battery vent assembly.

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Troubleshooting

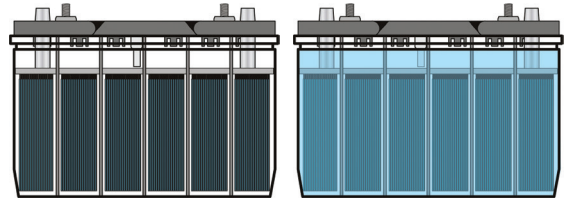
A common procedure for troubleshooting battery performance involves a three-point procedure:



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1. Visual Inspection:

Check battery age or length of service if available. Inspect battery for damage - when physical damage to the battery container or terminals is present, replace the battery. Be sure no open flame or spark is near while the battery's vent caps are removed from the battery. If none, check the battery's cell electrolyte levels. Fluid levels should be above the top of plates in all cells, and no higher than the top of the fluid level indicator:



If the battery is sufficiently filled with electrolyte – proceed to step two. If the top of the battery's plates are not covered with liquid, add water, replace vent caps and place the battery on charge.

2. Specific Gravity Inspection:

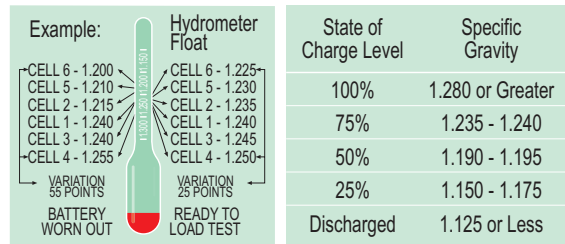
Hydrometer reading of all cells should be at least 1.235 and show less than 50 points difference between high and low. More than 50 points difference: replace the battery. Less than 50 points, but some cells read less than 1.235: recharge the battery. Replace the vent caps during recharge. Charge the battery using a properly matched automatic charger until all cells measure a specific gravity of 1.275 to 1.280. If charging won't bring up specific gravity, replace the battery.

3. Open Circuit Voltage and Electrical Load Test:

Battery open circuit voltage is an effective indication of battery state of charge. Determine the approximate state of charge from the chart at the right. Electrical load testing is an effective troubleshooting technique for identifying batteries with internal defects – but it is not an approved method for measuring deep cycle battery capacity. For this reason Zoeller recognizes load test results as useful only for identifying batteries having bad cell conditions.

Batteries with less than 75% state of charge should be charged before an electrical load test is applied to the battery. When load testing batteries, remove all battery cables, disconnecting the negative cables first. Make sure the battery terminals are free of corrosion and dirt.

Using a carbon pile load tester, apply a 50 to 75 ampere load for 15 seconds; remove the load. Refer to the chart at the right to determine the minimum passing voltage.



State of Charge Level	12 Volt Battery Open Circuit Voltage	6 Volt Battery Open Circuit Voltage
100%	12.6 or Greater	6.3 or Greater
75% - 100%	12.4 - 12.6	6.2 - 6.3
50% - 75%	12.2 - 12.4	6.1 - 6.2
25% - 50%	12.0 - 12.2	6.0 - 6.1
0 - 25%	11.7 - 12.0	5.95 - 6.0
0%	11.7 or Less	5.95 or Less

Chart Assumes a Fully Charged Gravity of 1.280.

State of Charge	Battery Voltage Under 15 Second Load		
	12 Volt	6 Volt	Specific Gravity
100%	12.66	6.33	1.280
75%	12.00	6.00	1.235

If the test voltage is above the minimum, return the battery to service. If test voltage is below the minimum, replace the battery.



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