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## Test Procedure to Detect Failed Battery

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### Preparation for Testing:

1. Check that battery cables are in good condition. Replace any damaged or broken cables.
2. Check that all terminal connections are tightened to the proper torque specification.
3. Fully charge the batteries.
4. Let batteries rest for at least 8 hours once the charge is complete.

### Open Circuit Voltage Test

1. Check and record open circuit voltages of each battery.
2. If all the batteries are below 6V (6V battery), 8V (8V battery) or 12V (12V battery), check charger for proper output current and voltage and charge the batteries again with another charger to make sure they are being properly charged.
3. Let batteries rest for at least 8 hours once the charge is complete.
4. Check and record open circuit voltages on each battery.
5. If all the batteries are still below 6V (6V battery), 8V (8V battery) or 12V (12V battery) the set is failed. Replace the entire set of batteries. In this situation the battery set had either provided all its available energy or was severely abused. This would not be covered under warranty unless a manufacturing defect was found in that production run.
6. If all the batteries are above 6V (6V battery), 8V (8V battery) or 12V (12V battery), any battery that is 0.25V lower than the highest battery voltage (6V battery), 0.35V lower than the highest battery voltage (8V battery) or 0.5V lower than the highest battery voltage (12V battery) might have failed. Make note of these batteries.

### Discharge Test

1. Run a discharge test.
2. Record minutes (runtime) when discharge is complete  
Correct runtime minutes for temperature using the following formula:  
(Valid between 24°C (75°F) and 32°C (90°F))  
**$$M_c = M_r [1 - 0.009 (T - 27)]$$** where  **$M_c$**  is the corrected minutes,  **$M_r$**  is the minutes recorded and  **$T$**  is the temperature at the end of discharge in °C
3. If the set runs more than 50% of its rated capacity, the set is considered good and testing is complete.
4. If the set runs less than 50% of its rated capacity, replace the batteries that were noted in Step 6 of the Open Circuit Voltage Test to be low compared to the battery with the highest voltage in the set.

### Replacement Instructions

1. Replace failed batteries with good batteries in another piece of equipment that are around the same age. Try to avoid mixing new batteries in equipment with old batteries.
2. Put all new batteries in the same equipment.

Note: All batteries in a good set should be above 6.4V (6V battery), 8.5V (8V battery) and 12.7V (12V battery) when fully charged after at least 8 hours of rest.