

AutoPulse Battery Management Program

TECHNICAL NOTE



AutoPulse Battery Management Program

Battery Management for the AutoPulse

The AutoPulse is intended to be deployed with other emergency equipment and should always be kept in a state of high-readiness. Customers should integrate an AutoPulse and battery check into their daily equipment check procedures.

Introduction

Like other life-supporting equipment, proper management and maintenance of batteries is important to reduce the possibility of problems during use of the equipment and to ensure that the useful life of the battery is optimized.

The AutoPulse is powered by a rechargeable, exchangeable battery comprised of multiple nickel metal hydride cells. The battery is made for the AutoPulse to provide the unique load-distributing band dynamics that create blood flow in cardiac arrest patients. Because of this unique application and the expense of the batteries, good battery management practices are essential to provide proper operation, long life, and to avoid problems during use.

Expected Battery Life

The expected service life of the AutoPulse battery is 100 charge cycles or 2 to 4 years depending on battery maintenance and usage patterns. We recommend that customers plan to purchase batteries at intervals that reduce the likelihood that they will have all batteries due for replacement simultaneously. A specific replacement interval may be difficult to predict until use and charging patterns are well established. Some systems may want to replace batteries on a preventative basis regardless of the batteries' capacity or remaining life.

Handling New Batteries

New batteries should be unpacked immediately and not left awaiting unpacking for any extended period. Before putting new batteries into service they must be placed into an AutoPulse Battery Charger and run through a TEST cycle by pressing the "START TEST" button. Once the "START TEST" button is pressed, do not remove the battery until the TEST cycle is complete. This process will take at least 10 hours. Performing a TEST cycle on a new battery helps to optimize its capacity for proper operation and long battery life.

AutoPulse with One Battery Charger and 3 to 4 Batteries.



Recommended Battery, Charger, and AutoPulse Ratios

An AutoPulse unit in general should be equipped with three to four batteries to allow for two with the device (one for operation and one as a spare and for extending operation), and one to two for being recharged or conditioned to support the next shift change, exchange or replacement after a patient use.

A one to one charger to AutoPulse ratio is recommended, but under some circumstances with infrequent use of the AutoPulse the ratio may be less. It is important that there be sufficient capability to both charge and condition (TEST Cycle) batteries while supplying the recommended minimum of two batteries for use.

Self Discharge

Unlike some other batteries, Nickel Metal Hydride cells have a relatively high rate of self discharge. These batteries will lose 1.6% of their capacity each day they are on a shelf at nominal temperatures. If storage is at high temperatures (e.g., above 70°F / 21°C), the self discharge rate is significantly accelerated. We recommend, therefore, that users change batteries daily or after each use. Charged batteries left for any extended period, either in the AutoPulse or as a spare, may not have sufficient capacity, resulting in unexpected cessation of operation during use and inadequate warning of low battery condition during use.

Damage to the Battery from Storage

It is very important that spare batteries be included in the daily rotation to maintain readiness for active use in the AutoPulse. Batteries stored outside the Charger for longer than 4 weeks may be subject to irreparable damage.

Built-in Charge Cycle Counter

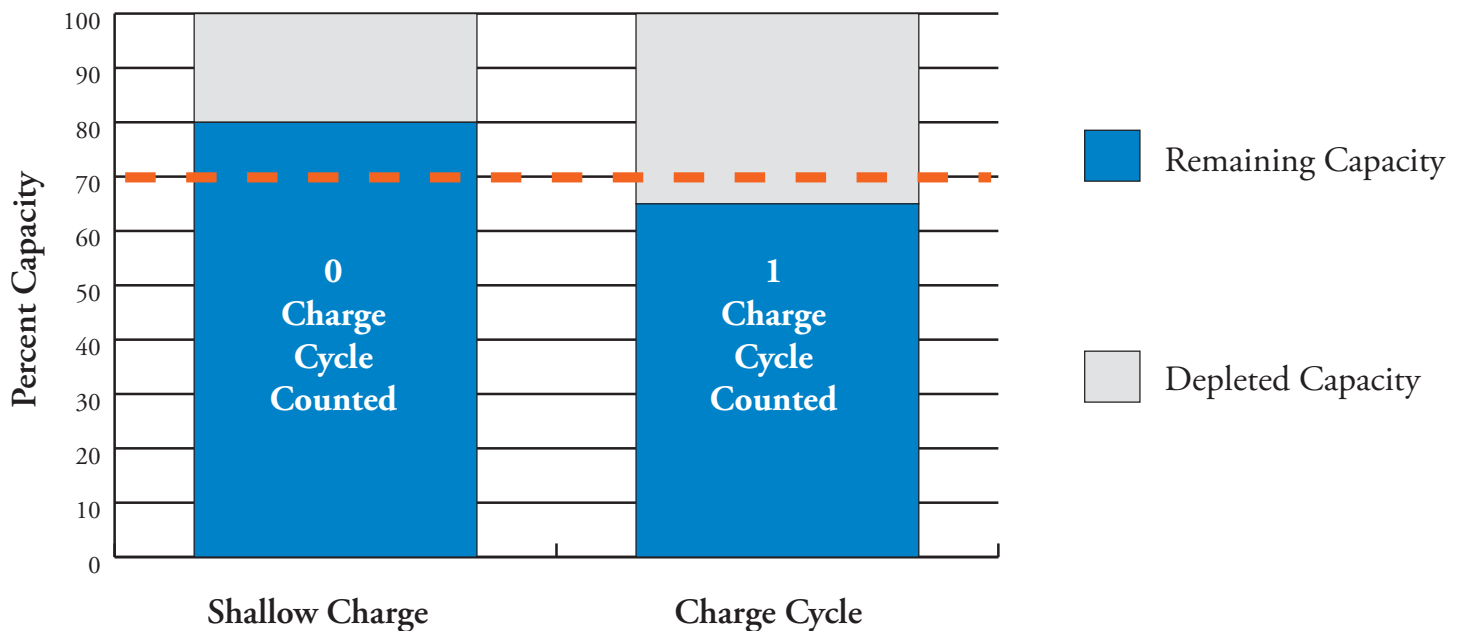
A Charge Cycle Counter (CCC) built into each battery increments when the battery charger detects that the battery was depleted more than a third of its capacity. The CCC is also incremented each time the “START TEST” button is pressed on the Charger. The Charger will automatically perform a condition cycle, similar to when the “START TEST” button is pressed, after every 10 charge cycles.

Shallow charges, typical of daily swap outs without deployment, will not increment the CCC since the capacity will not have been depleted by more than a third.

Reconditioning Test Cycles

Each battery should be conditioned a minimum of once per month to maintain optimal performance, which is typical for many types of cells that power battery-operated devices. Relying on the Charger to automatically condition batteries after every 10th charge cycles is not recommended, as the internal CCC will not be incremented if the AutoPulse is used infrequently or for shorter periods of time. We recommend

Type of Charge After an Event



optimizing capacity and battery life by manually conducting a monthly test and conditioning cycle. This is done by placing the battery in the Charger and manually initiating the cycle by pressing the “START TEST” button.

Once the “START TEST” button is pressed, do not remove the battery until the test is complete. This process will generally take 10 hours per battery. For severely discharged batteries, the condition cycle may need to be repeated a second or third time if FAIL is indicated on the Charger following the test cycle.

Customers should consider this in terms of determining the number of batteries required to allow this testing, while providing adequate capacity for use of the AutoPulse. This process will help to ensure that all batteries are conditioned and treated regardless of the depth of discharge when used in the AutoPulse, and is also the best practice for optimizing the batteries useful life.



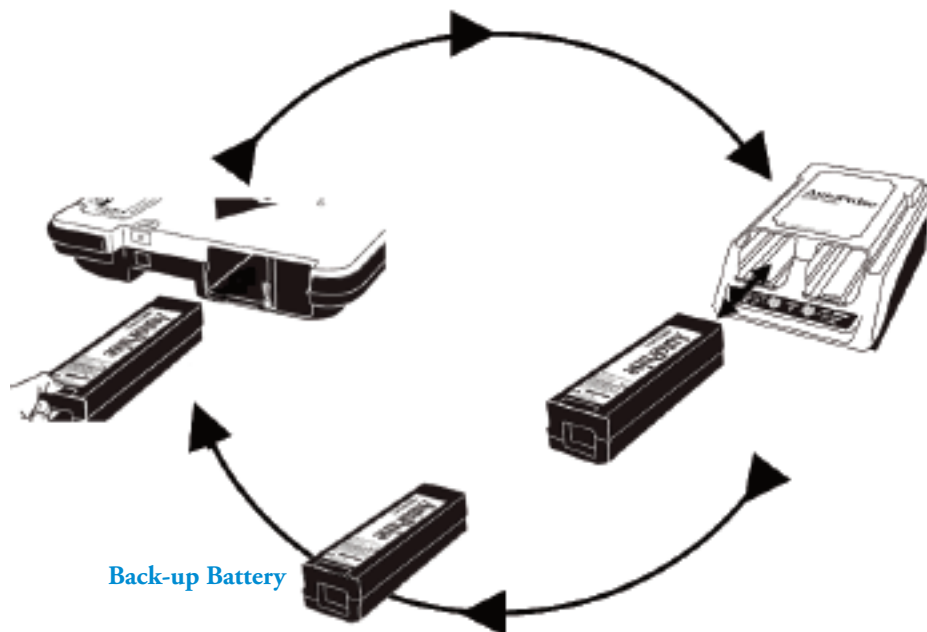
Daily Battery Management

Battery Rotation

After every resuscitation event, the battery in the AutoPulse should be removed and placed in a Charger.

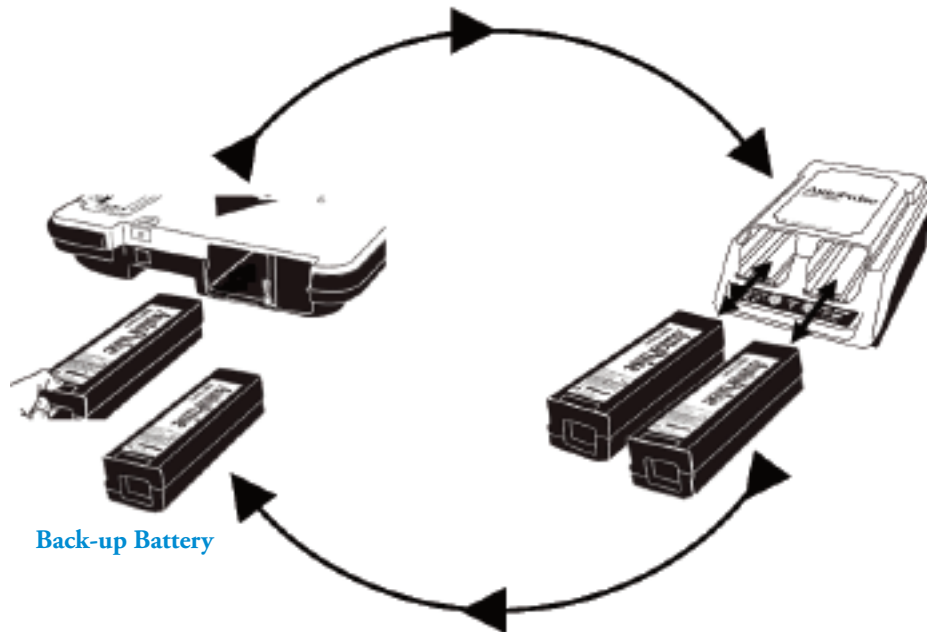
At the beginning of each shift the battery in the AutoPulse should be removed and placed into a Charger. The rotation of the back-up battery depends on which schedule is in place at your site.

3-Battery Rotation - To Be Done After Every Event and Once Per Shift.



1. Remove the battery from the AutoPulse and place it in the Charger.
2. Place the back-up battery in the AutoPulse, check for green light before installing.
3. Remove the fully charged battery from the Charger and use it as the back-up battery.
4. Power on AutoPulse and ensure no faults are displayed.
5. When a battery is placed in the Charger, check for the last date that a TEST cycle was performed. If the TEST cycle was performed more than 1 month ago, press the START TEST button on the Charger.

4-Battery Rotation - To Be Done After Every Event and Once Per Shift.



1. Remove the battery from the AutoPulse and place it and the back-up battery in the Charger.
 2. Remove the two fully charged batteries from the Charger, check for green light and place one in the AutoPulse and use the other as a back-up battery.
 3. Power on AutoPulse and ensure no faults are displayed.
 4. When a battery is placed in the Charger, check for the last date that a TEST cycle was performed. If the TEST cycle was performed more than 1 month ago, press the START TEST button on the Charger.
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Battery Status check

Before putting a charged battery into the AutoPulse, the battery's status should be checked by pressing the test button on the battery. The battery should only be used if the green light comes on. An amber light indicates that the battery is not fully charged and should be placed in the Charger for routine charging. Batteries that show a flashing red light are defective and must be removed from service. Call ZOLL Technical Service for assistance at 1-800-348-9011.

AutoPulse Battery Installation

Insert the keyed battery, connector first, into the AutoPulse battery receptacle taking care not to damage the receptacle or the battery by using unnecessary force. Make sure you press firmly with both thumbs until you hear it click into place. If a battery guard is present, rotate over the battery to hold it in place.

When a fully charged battery is placed into the AutoPulse, users should turn on the AutoPulse and check battery status on the display. If the battery graphic icon does not indicate that the battery is fully charged (4 bars), the battery must be replaced with a fully charged battery.

Spare Battery Maintenance

For longest battery life, store and charge the batteries at room temperature (70°F / 21°C).

If batteries are typically left in the Charger for a week or more, manually condition batteries every 2 weeks instead of once a month by pressing the START TEST button on the Charger.

Before deployment, inspect battery connector and case for damage. If damaged, do not use and contact ZOLL Technical Support at 1-800-348-9011.

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