Resuscitation System Model 100

AutoPulse® Power System User Guide

P/N. 12457-001 Rev. 13
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Notice

About this Guide

The information in this User Guide applies to the ZOLL AutoPulse® Power System designed for the AutoPulse Resuscitation System Model 100. The AutoPulse Power System consists of the AutoPulse Multi-Chemistry Battery Charger (Battery Charger) and the AutoPulse Li-Ion Battery.

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Preface

This document describes the operating steps and maintenance requirements for the AutoPulse Power System for use as part of the AutoPulse Resuscitation System Model 100. The AutoPulse Power System consists of the AutoPulse Multi-Chemistry Battery Charger (Battery Charger) and the AutoPulse Li-Ion Battery.

Proper use of the AutoPulse Power System requires a thorough understanding of the Power System, and appropriate training and practice using the Power System.

Please read the entire AutoPulse Power System User Guide and AutoPulse User Guide before using the AutoPulse Power System.

Who Should Read this Guide

This document should be read by personnel who are tasked with the care and maintenance of the Power System used to operate the AutoPulse System.

General Warnings and Precautions

Warning:

- Always charge a new Battery upon receipt. Failure to charge a Battery may cause reduced Battery performance.
- Always charge a stored Battery before placing the Battery into active operation. The Battery slowly self-discharges when not in use. Failure to charge a Battery before use may cause device power failure. In no case should any Battery be used if it has not been charged within the previous 60 days.
- No modification of the Battery Charger or the AutoPulse Li-Ion Battery is allowed.
- Unplug the Battery Charger power cord before replacing the fuses. Use only fuses specified in Table C-2.

Caution: United States federal law restricts this device to sale by or on the order of a licensed physician.

Caution: The AutoPulse System is designed to be used only with ZOLL-approved accessories. The AutoPulse System performs improperly if non-approved accessories are used.

Caution: Do not short the Battery leads. Electrical connection (short) between the Battery power leads on the connector permanently damages the Battery and renders the Battery inoperable.

Caution: Always charge AutoPulse Batteries at temperatures between 41ºF (5ºC) and 95ºF (35ºC). Charging Batteries at temperatures below 41ºF (5ºC) or above 95ºF (35ºC) prevents the Battery from reaching its full capacity (operational time) and may lead to irreversible Battery damage.

Caution: Do not block the Battery Charger's ventilation slots.

Caution: Do not operate the Battery Charger in a confined space.

Caution: Do not position the Battery Charger so that it is difficult to unplug the power cord.

Caution: Keep the Battery Charger away from moisture.

Caution: Do not remove the Battery Charger cover. The Battery Charger has no internal user-serviceable parts.

Caution: Use the Battery Charger only with the ZOLL AutoPulse Multi-Chemistry Battery Charger Power Cord, as supplied.

Caution: Do not touch any Battery Charger conductive parts and the patient simultaneously.

Caution: The AutoPulse System is designed to be used only with ZOLL-approved Batteries. The AutoPulse System performs improperly if non-approved batteries are used. The use of other batteries may cause permanent damage to the AutoPulse System and voids the warranty.

Caution: ZOLL Batteries are to be used only with the AutoPulse Platform or with ZOLL Battery Chargers. Use of a Battery in other applications may damage the Battery and voids the warranty.

Caution: Do not store a Battery in the AutoPulse Platform when not in active service. Storage in the AutoPulse Platform longer than a week may result in irreversible damage to a Battery. The battery can lose up to 10% of its charge each day that it remains in the AutoPulse Platform.

Caution: Do not store an AutoPulse Battery in an unpowered Battery Charger (unplugged or AC power is off). Irreversible damage to the Batteries occurs within 10 days, depending on the initial state of charge.

Caution: Always inspect a Battery for damage prior to insertion into either the AutoPulse Platform or the Battery Charger. Never place a damaged Battery into the AutoPulse Platform or Battery Charger. If damage to a Battery is found, contact ZOLL Technical Service.

Caution: ZOLL AutoPulse Batteries are mechanically keyed to the AutoPulse Platform and Battery Charger to facilitate correct installation. Insert a Battery, connector first, into the AutoPulse Battery Bay or Battery Charger until it properly latches into position. Do not force a connection if you cannot easily connect Battery to either the Battery Charger or the AutoPulse Platform. Doing so may result in damage to the Battery, Battery Charger, and/or AutoPulse Platform.

Caution: The Battery is intended to be used by trained professionals. Keep out of the reach of children.

Caution: Do not attempt to swallow the Battery in whole or in part.

Caution: Do not use a Battery that has cracks in the Battery case exposing internal components. Do not strike or throw a Battery. Do not use a Battery to strike another object. Mishandling of a Battery may lead to physical damage and present a fire or shock hazard.

Caution: Do not immerse any portion of a Battery in water or other fluids. Do not allow fluids to enter a Battery or a Battery Connector. Fluid immersion or spillage may permanently damage the Battery or present a fire or shock hazard.

Caution: If Battery pack leaks, do not allow the liquid to come into contact with skin or eyes. If contact has been made, do not rub. Rinse skin or eyes with clean running water and immediately seek medical attention.

Caution: Do not heat, burn, or incinerate a Battery. Never expose a Battery to an open flame. Exposure to heat above 158ºF (70ºC) may irreversibly damage the Battery. Incinerating the Battery may result in flames or explosion.

Caution: If the Battery gives off an odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging, or storage, immediately remove it from the AutoPulse Platform or Battery Charger and stop using it. Otherwise, the problematic Battery may develop acid and/or electrolyte leakage, overheating, smoke emission, bursting and/or ignition.

Caution: Do not transport or store Battery pack together with metal objects such as necklaces, keys, zippers, etc. Contact with these and other similar metal objects may cause the Battery to short and generate high heat and burns.

Caution: Do not attempt to open a Battery.

Caution: Clean the Battery Connector and contacts only with a clean dry cloth and/or a non-conductive brush.

Caution: Do not autoclave the AutoPulse Battery or the Battery Charger.

Caution: Retain the original product literature for future reference.

Caution: To avoid the risk of electric shock, connect the charger only to a supply mains with protective earth.

Caution: Risk of fire or burns. Do not open or crush.

Caution: Do not use or stack the unit with other equipment. If the unit is used or stacked with other electrical equipment, verify proper operation before using it.

Caution: Any serious incident that has occurred in relation to the device should be reported to the manufacturer and the competent authority of the Member State in which the user and/or patient is established.

Symbols

The symbols below may be found in this User Guide, on the Battery Charger, or Li-Ion Battery.

	Follow instructions for use
	Date of Manufacture
	Manufacturer
EC REP	EU Authorized Representative
SN	Serial Number
Li-Ion	Recycle
+113°F (+45°C) -4°F (-20°C)	Temperature Limitations
	Dispose of in accordance with local governing ordinances and recycling plans for lithium ion batteries.
	Rechargeable Battery
	Do Not Incinerate
	Fuse
	DC Voltage
	Caution: Charging
	Ready

	Fail
	Test Cycle
	Power
	Caution
REF	Catalog number
Rx ONLY	Prescription use only
	Importer
MD	Medical device

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1 Introduction of the AutoPulse Power System

The AutoPulse Power System consists of the AutoPulse Li-Ion Battery and Battery Charger.

Battery: The AutoPulse Li-Ion Battery is a proprietary, rechargeable, removable battery that is specifically designed to supply power for AutoPulse Platform operation.

Battery Charger: The Battery Charger is a stand alone unit designed to charge and automatically maintain the AutoPulse Li-Ion Battery.

The AutoPulse Platform 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 Platform and Battery check into their daily equipment check procedures. Like other life supporting equipment, good battery management practices are essential to provide proper operation, and to avoid problems during use.

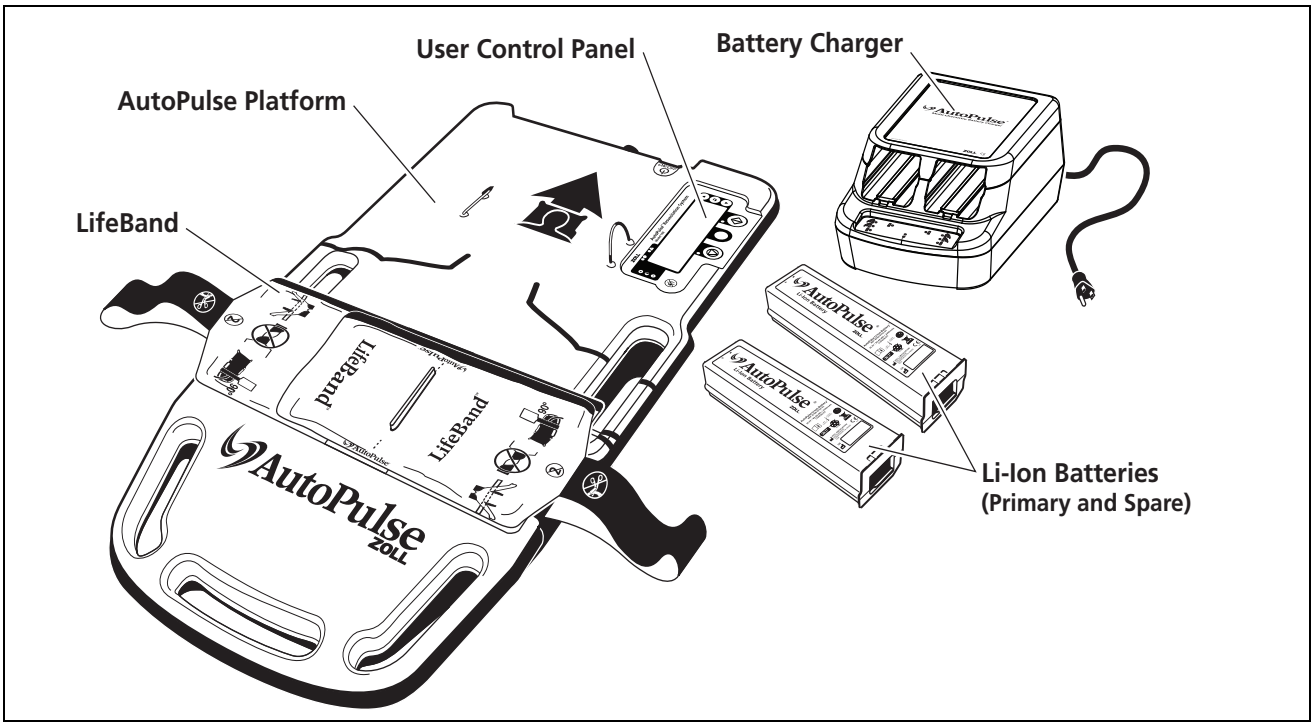

Figure 1-1 AutoPulse System

1.1 Recommended Battery, Battery Charger and AutoPulse Platform Ratios

An AutoPulse Platform 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 one to two being charged to support the next shift change, exchange or replacement after a patient use (see Figure 1-2 below).

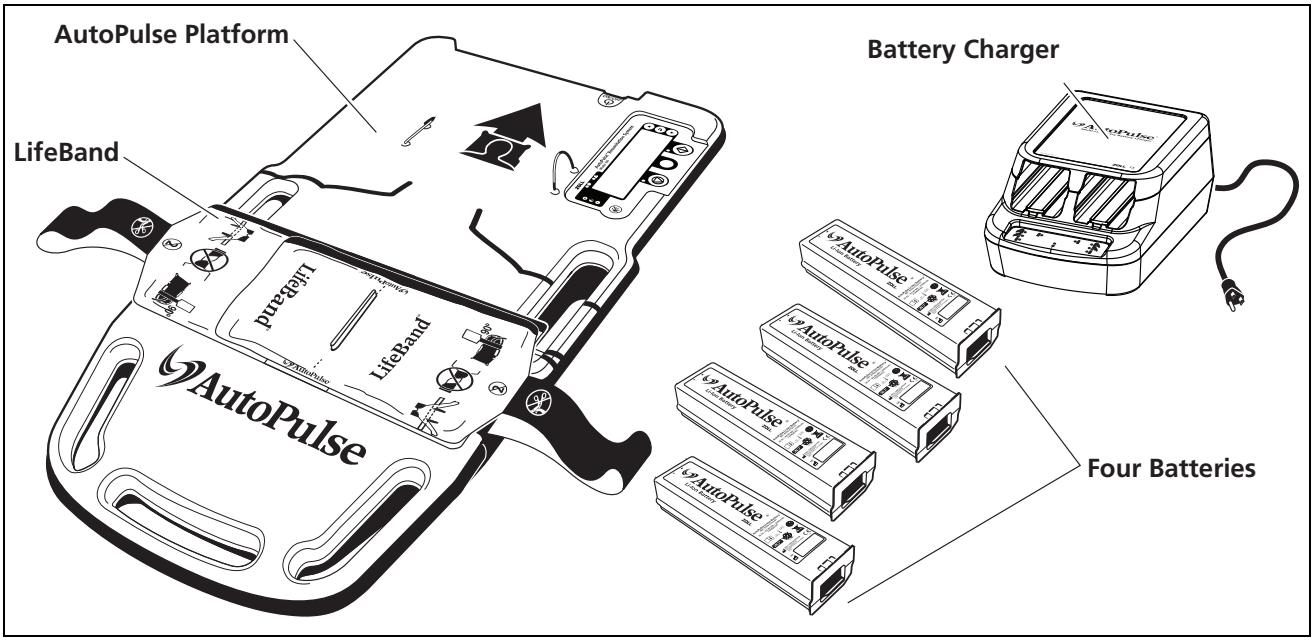

Figure 1-2 Recommended component ratios

A one-to-one AutoPulse Platform to Battery Charger ratio is recommended. It is important that there be sufficient capability to both charge and Test-Cycle Batteries while supplying the recommended minimum of two Batteries for use.

2 AutoPulse Li-Ion Battery

The AutoPulse Li-Ion Battery (see Figure 2-1) is a proprietary, rechargeable, removable Lithium-Ion battery that is a power source for the AutoPulse Platform.

One end of the AutoPulse Li-Ion Battery contains connections for power and communications. A Battery Status Check button illuminates the AutoPulse Li-Ion Battery's status light-emitting diodes (LEDs).

ZOLL recommends that users change AutoPulse Li-Ion Batteries daily or after each use. Charged AutoPulse Li-Ion Batteries left for an extended period in the AutoPulse Platform or as a spare may not have sufficient capacity to operate effectively.

Warning: Always charge a stored Battery before placing the Battery in active operation. Battery slowly self-discharges when not in use. Failure to charge a Battery before use may cause device power failure. In no case should any Battery be used if it has not been fully charged within the previous 60 days.

Caution: Remove the protective plastic cap from the Battery before charging the Battery or inserting the Battery into the AutoPulse Platform.

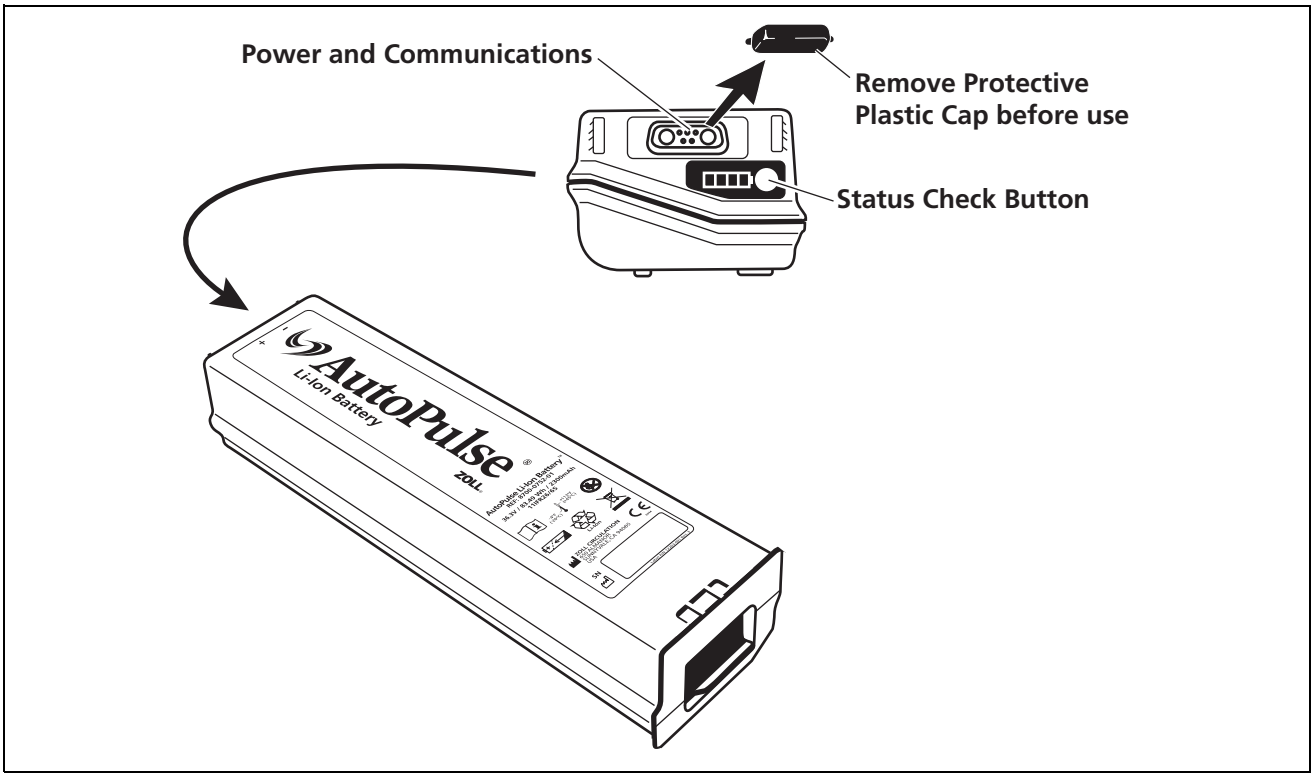

Figure 2-1 The AutoPulse Li-Ion Battery

2.1 Expected AutoPulse Li-Ion Battery Life

The expected service life of a properly maintained AutoPulse Li-Ion Battery is five years from its date of manufacture. ZOLL recommends that customers plan to purchase batteries on intervals that reduce the likelihood that they will have all batteries due for replacement simultaneously. A specific replacement interval may be difficult to establish until use and charging patterns are well established. Some customers may want to replace batteries on a preventative basis regardless of the Battery's capacity or remaining life.

Note: The Battery does not operate after five years from its date of manufacture.

2.2 Handling New AutoPulse Li-Ion Batteries

New AutoPulse Li-Ion Batteries should be unpacked and fully charged immediately upon receipt. Do not store for an extended period. Before putting new AutoPulse Li-Ion Batteries into service, they must be placed into the Battery Charger. The Battery Charger charges and test the Battery, and may automatically initiate a Test-Cycle. If a test cycle is initiated, do not remove the AutoPulse Li-Ion Battery from the Battery Charger until the Test-Cycle is complete. This process could take up to 12 hours.

If a Battery has been charging for 12 hours and the Battery Charger Status LED does not show Ready (see Table 3-1 on page 3-4), remove the Battery and reinsert it into the Battery Charger.

3 The Battery Charger

The Battery Charger is a stand alone unit designed to charge, test, and automatically maintain the AutoPulse Li-Ion Battery. The Battery Charger has two charging bays, each with its own indicators.

Batteries should always be properly maintained and be fully charged so that they are ready for use before deploying the AutoPulse Platform.

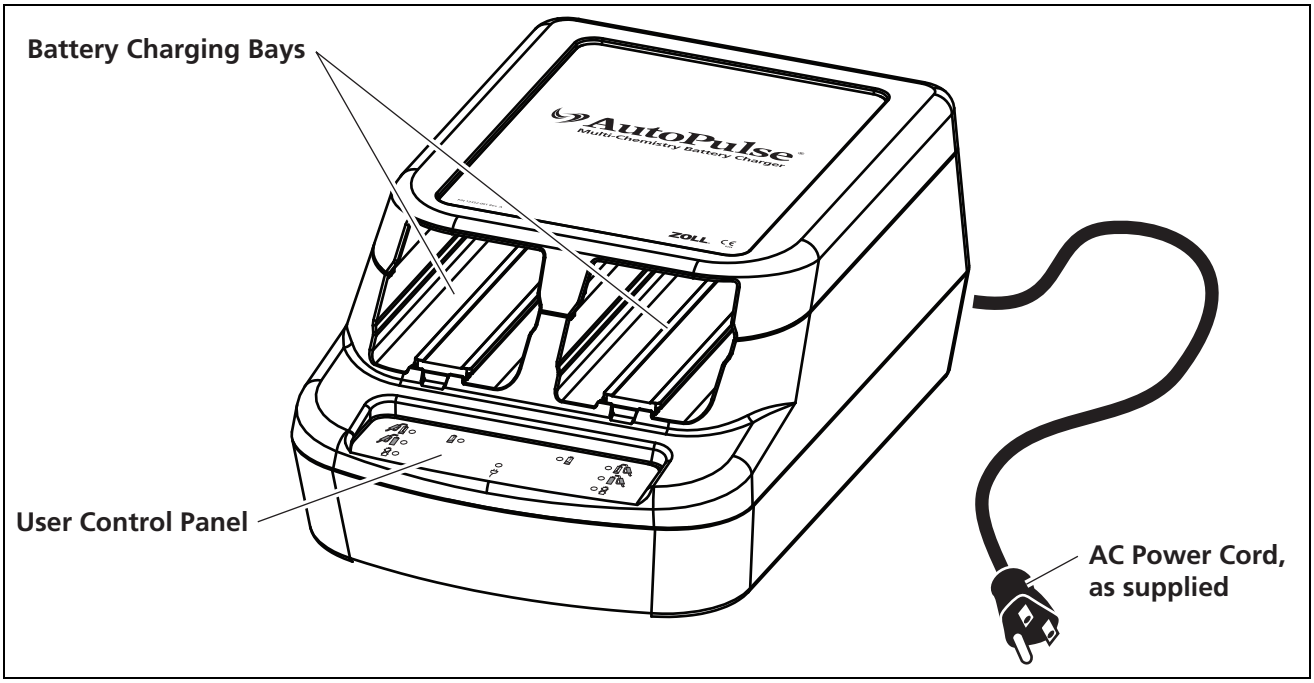

Figure 3-1 Battery Charger

3.1 Setting Up the Battery Charger

The Battery Charger must be plugged into a wall outlet using the power cord included with the Battery Charger. Unplug the power cord from the wall outlet to remove power from the Battery Charger.

Caution: The Battery Charger's AC plug is the only way of isolating the Battery Charger from the AC mains. Position the Battery Charger so that its AC plug is easily accessible at all times.

To prepare the Battery Charger for use:

1. Plug the alternating current (AC) power cord into the power receptacle on the back of the Battery Charger.
2. Plug the AC power cord into an appropriate wall outlet receptacle.
3. When the Battery Charger is powered on, all the LEDs illuminate briefly as the Battery Charger performs a self test.

Note: While the self test is being performed, if the indicator lights remain illuminated or if one of the indicator lights fails to illuminate, contact ZOLL.

4. When the power indicator (green LED) on the Battery Charger's Control Panel illuminates, the Battery Charger is ready for use. (If the green Power light on the Control Panel does not illuminate, read Section 6.2, "Replacing a Battery Charger Fuse")

Note: USB port is for technician use only.

Note: The Battery Charger is a Class II type equipment where no protective earthing/grounding is provided.

3.2 Operating the Battery Charger

The Battery Charger charges and maintains the AutoPulse Li-Ion Battery.

To charge a Battery, follow these steps:

1. Slide the Battery into an available charging bay (see Figure 3-2). Make sure that the Battery locks into place (locking bar engaged).

Note: For optimal charging, make sure that the Battery is at room temperature before insertion into the Battery Charger.

Note: If a Li-Ion Battery's internal temperature is below a nominal 41ºF (5ºC), the Battery fails to charge in the Battery Charger. If a Battery is retrieved from cold storage or extensive exposure to cold weather, allow the Battery to warm to room temperature (may take up to three hours) before insertion into the Battery Charger.

Note: Do not slam a Battery into a Battery Charger because doing so may cause damage to the Battery's Connector.

Note: The Battery is mechanically keyed so that it can only be inserted in one orientation. Do not force the Battery into a charging bay. If resistance is met, check for appropriate orientation, and check to ensure that there are no obstructions to battery insertion.

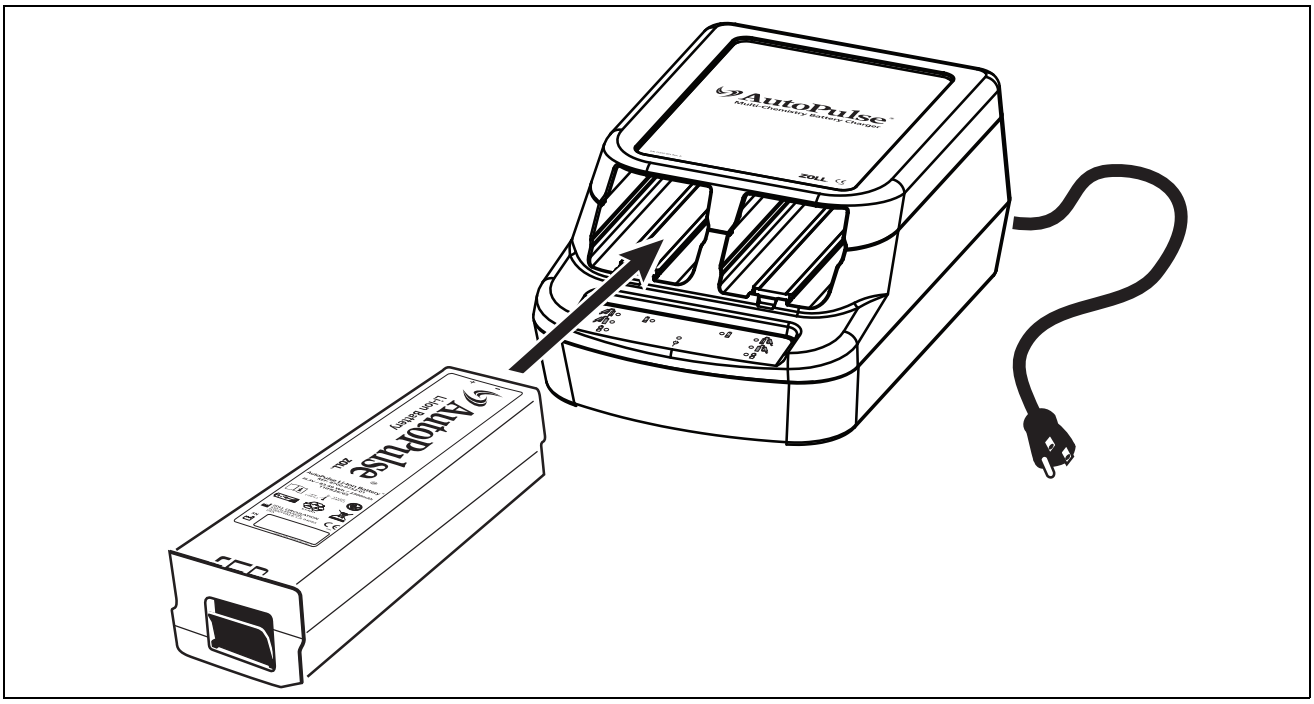

Figure 3-2 Sliding the Battery into a Battery Charger Charging Bay

2. The Battery Charger automatically detects the presence of a Battery within 5 seconds.
3. The Battery Charger's status is indicated on the control panel (see Figure 3-3 and Table 3-1).

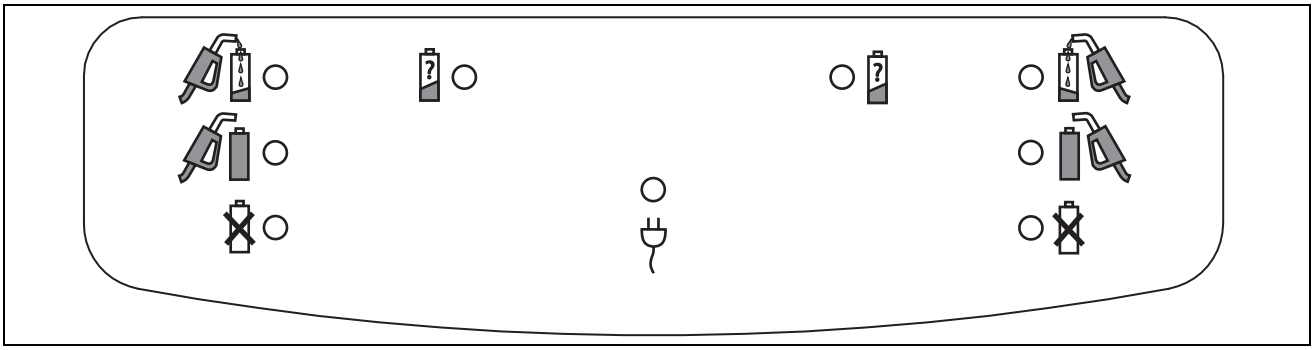

Figure 3-3 Battery Charger Control Panel

4. AutoPulse Li-Ion batteries placed in a charging bay are automatically charged and tested for minimal performance (Charging LED illuminated) in less than 4¼ hours.

Note: Do not remove a Battery from the Battery Charger until its charging completes, or the Battery's run time may be reduced.

5. The AutoPulse Battery Charger automatically conducts a Performance Test on the AutoPulse Li-Ion Battery to ensure the Battery meets performance standards. The Performance Test occurs every time a Battery is placed into the Battery Charger.
6. When the Ready green LED on the Battery Charger bay illuminates, the Battery is fully charged and has successfully passed the Performance Test. The Battery is ready to use.

Table 3-1 Battery Charger Status LEDs

Battery Charger Mode	Battery Charger Status LEDs Used	Definition	Action
Caution: Charging	Caution: Charging (yellow LED)	The Battery is charging.	Leave the Battery in the Battery Charger until the Ready (green) LED illuminates. **Caution:** When the Caution: Charging LED is on, do not remove the Battery from the Battery Charger. Otherwise, the battery's charge level is not guaranteed.
Test-Cycle	Test (amber LED)	Typical Test-Cycles last up to 12 hours.	Leave the Battery in the Battery Charger until the Test-Cycle completes and the ready (green) LED illuminates.
Ready	Ready (green LED)	The Battery is fully charged and has successfully passed the Performance Test. The Battery is ready to use.	• Leave the Battery in the Battery Charger to ensure that the Battery is fully charged when needed or • Install in the AutoPulse Platform or • Store in a cool location.
Fail	Fail (red LED)	• The Battery Charger was unable to charge the Battery or • the Battery has failed the Performance Test or • the Battery has failed a test cycle or • the Battery has reached its end of life.	Remove and re-insert the Battery into the Battery Charger. If the Fail LED remains illuminated, contact ZOLL.
Idle	None	The Battery Charger is unable to recognize the Battery.	Remove and re-insert the Battery. If the status is still Idle, refer to Appendix B, "Troubleshooting" for more information.

Note: Newly-charged Batteries can be warm to the touch. This is a consequence of normal operation.

3.2.1 Battery Charger Test-Cycle mode

In addition to the Performance Test, the Battery Charger periodically executes a more extensive test on the Battery. The "Test-Cycle" measures a Battery's charge holding capability by cycling the Battery through a charge-discharge-recharge sequence. At the end of the sequence, the Battery is tested to ensure performance standards are met.

The Battery Charger automatically performs a Test-Cycle every 10th charge/discharge cycle or at a minimum of every 30 days. When a Battery is placed in the Battery Charger under those conditions, the Test-Cycle amber LED illuminates and the Battery Charger automatically begins the Test-Cycle.

Note: Do not remove a Battery from the Battery Charger during a Test-Cycle, or the Battery's run time may be reduced. If a Battery is removed during a Test-Cycle, the Battery Charger automatically restarts the Test-Cycle the next time the Battery is inserted into it.

AutoPulse Batteries that pass the Test-Cycle remain ready for use. After the Test-Cycle has been completed, the Battery is either restored to ready (green LED on the Control Panel) or has failed and should be replaced (red LED on the Control Panel). The normal Test-Cycle requires up to 12 hours.

If a Battery has failed the Test-Cycle (Fail LED), it is out of service. In the U.S., contact ZOLL Technical Service at 1-800-348-9011. Outside the U.S., contact your local ZOLL representative.

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4 Using the AutoPulse Battery

4.1 AutoPulse Li-Ion Battery Status Check

To determine if an AutoPulse Li-Ion Battery needs to be charged, press the Status Check button on the AutoPulse Li-Ion Battery (see Figure 4-1).

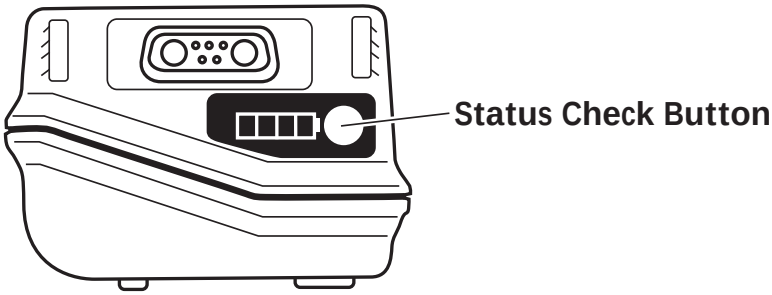

Figure 4-1 AutoPulse Li-Ion Battery Status Check Button and Status LEDs

The AutoPulse Li-Ion Battery status light-emitting diodes (LEDs) illuminate (refer to Table 4-1).

Table 4-1 AutoPulse Li-Ion Battery Status LEDs (Page 1 of 2)

Status LEDs	Definition	Action
Green	The AutoPulse Li-Ion Battery is fully charged.	The AutoPulse Li-Ion Battery is ready for use in the AutoPulse.
Yellow	The AutoPulse Li-Ion Battery is not fully charged.	Charge the AutoPulse Li-Ion Battery. Refer to Section 3.2, “Operating the Battery Charger” for more information.
Green flashing	The AutoPulse Li-Ion Battery has exceeded three years from its date of manufacture; nonetheless, it is fully charged.	ZOLL recommends replacement of Batteries that have exceeded three years; however, this AutoPulse Li-Ion Battery is fully charged, and can be used in the AutoPulse Platform.
Yellow flashing	The AutoPulse Li-Ion Battery has exceeded three years from its date of manufacture, and is not fully charged.	ZOLL recommends replacement of Batteries that have exceeded three years from its date of manufacture. Charge the AutoPulse Li-Ion Battery to determine if it remains functional. Refer to Section 3.2, “Operating the Battery Charger” for more information.
Red-flashing	The AutoPulse Li-Ion Battery has • failed the Performance Test • failed a Test-Cycle • exceeded five years from its date of manufacture	The AutoPulse Li-Ion Battery has failed and should not be used. Refer to Section 5.2.5, “Disposing of AutoPulse Batteries” for more information.

Table 4-1 AutoPulse Li-Ion Battery Status LEDs (Page 2 of 2)

Status LEDs	Definition	Action
None	The AutoPulse Li-Ion Battery voltage is too low to illuminate the LEDs.	Charge the AutoPulse Li-Ion Battery by placing it into the Battery Charger.

4.2 AutoPulse Li-Ion Battery Installation

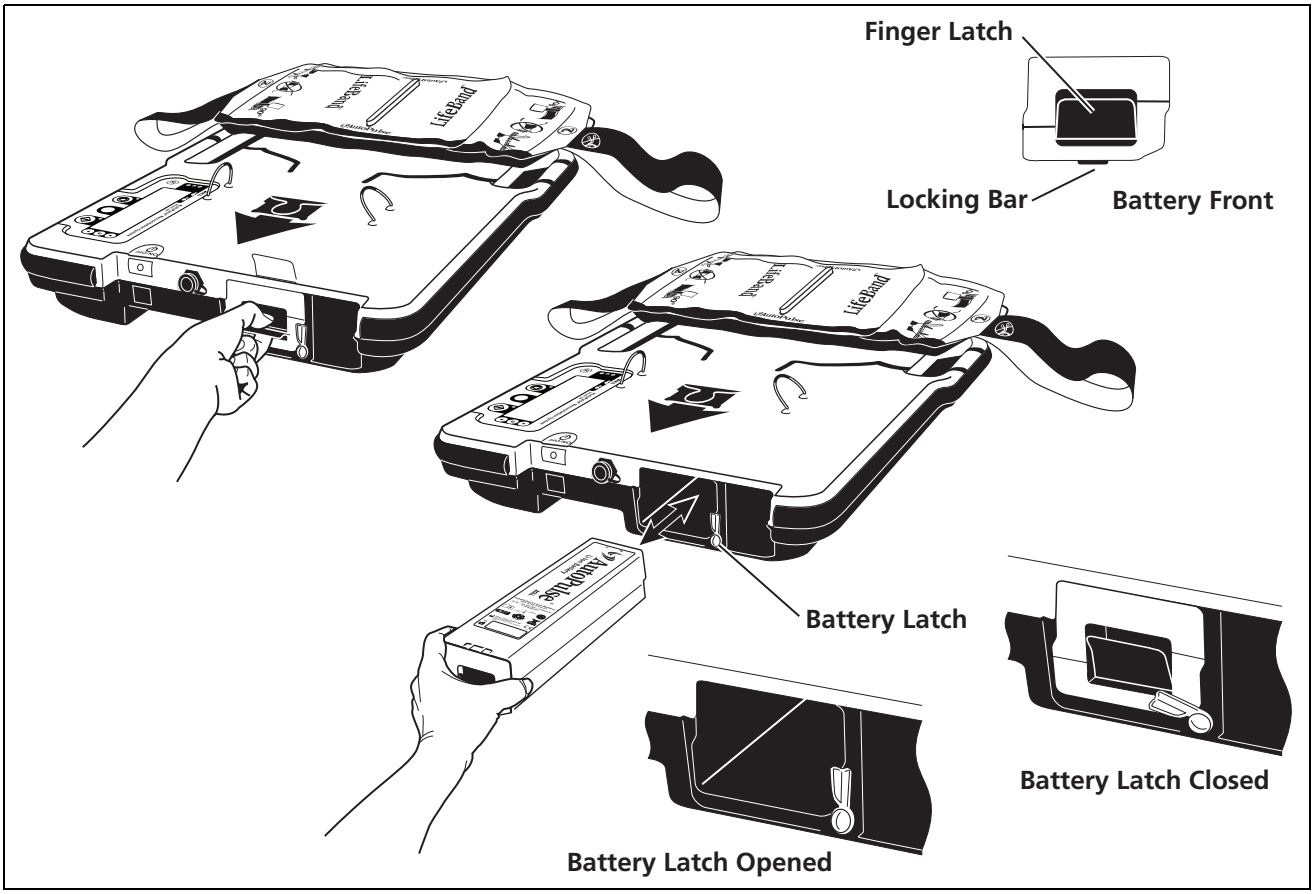

Figure 4-2 AutoPulse Li-Ion Battery Installation and Removal

To install the AutoPulse Li-Ion Battery, first make sure the Battery Latch is rotated out of the way so that the AutoPulse Li-Ion Battery can slide into the Battery compartment (see Figure 4-2). Then slide the AutoPulse Li-Ion Battery into the Battery compartment in the AutoPulse Platform. The AutoPulse Li-Ion Battery should snap into place and mount flush with the AutoPulse Platform. The Finger Latch for the AutoPulse Li-Ion Battery should also be flush with the AutoPulse Platform such that the red strip on the inside of the Finger Latch is not visible. Then rotate the Battery Latch into position.

To remove the Battery, first rotate the Battery Latch into the open position as shown in Figure 4-2. Then hold the AutoPulse Platform firmly and grip the Battery while pulling the finger latch outwards to disengage the locking bar (see Figure 4-2), then pull the Battery straight out until it fully clears the battery compartment.

4.3 Battery Rotation

At the beginning of every shift, insert a fully-charged Battery into the AutoPulse Platform.

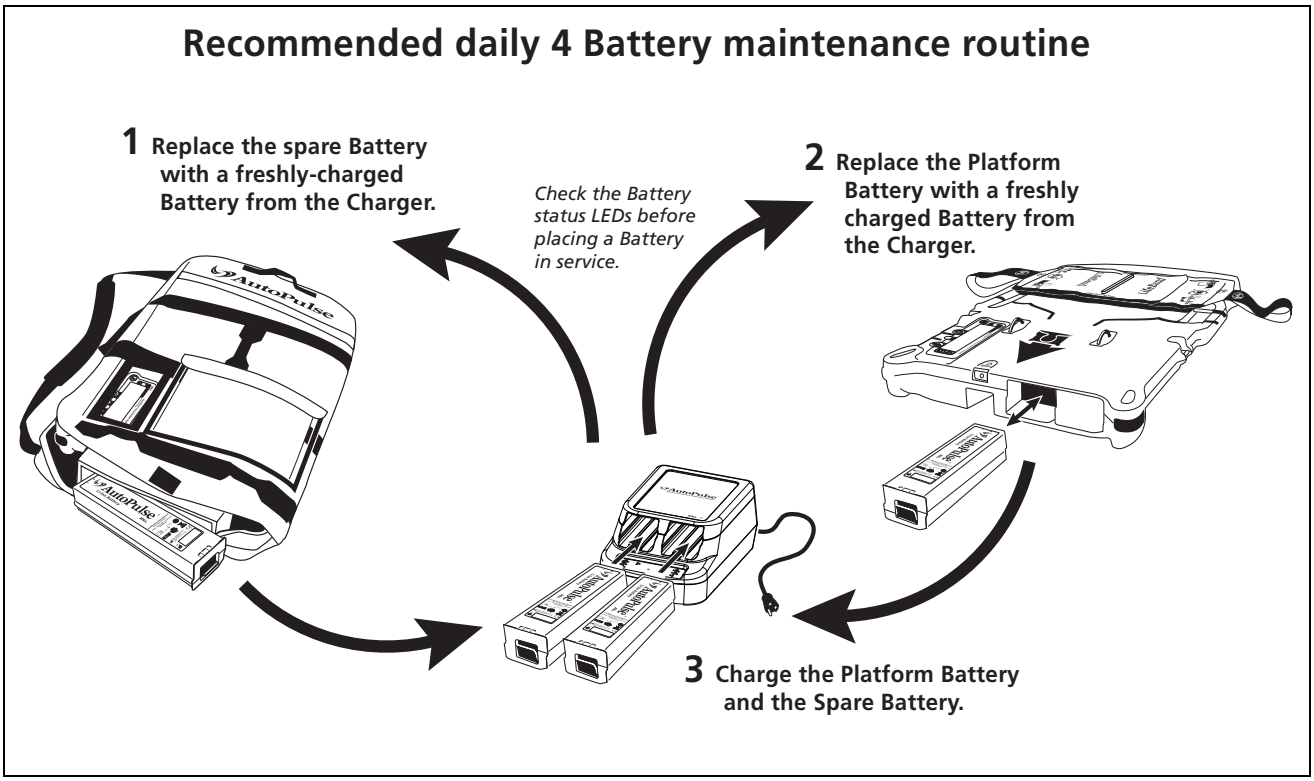

Figure 4-3 Four Battery rotation

Four Battery Rotation—to be done after every use and/or once per shift (see Figure 4-3 above).

- Remove the used Battery from the AutoPulse Platform, and place it into the Battery Charger.
- Remove the spare Battery, and place it into the Battery Charger.
- Take two fully charged Batteries from the Battery Charger, check for four green LEDs on each Battery, and place one into the AutoPulse Platform, and use the second as a spare.
- Power on the AutoPulse Platform and ensure no faults are displayed.

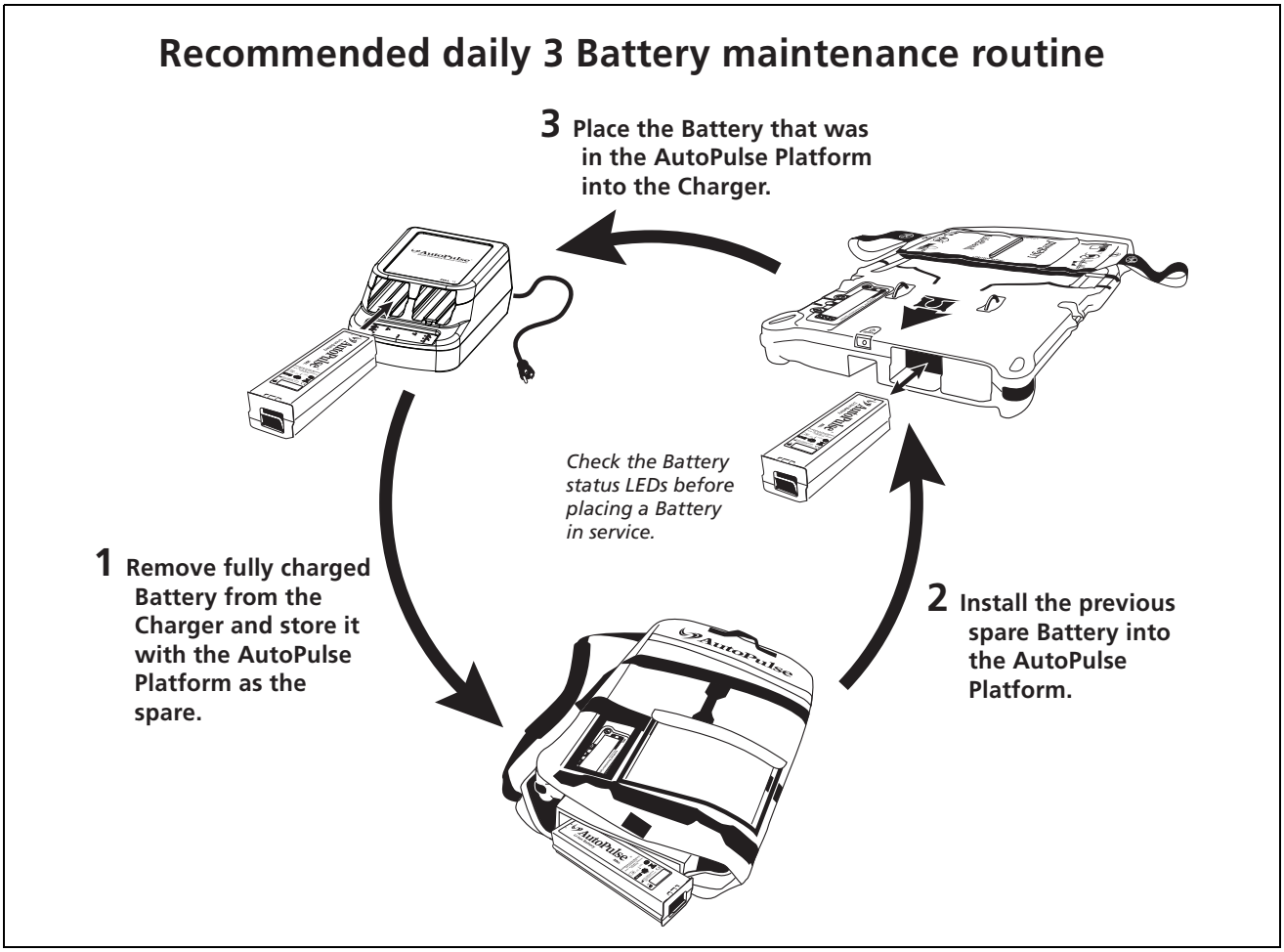

Figure 4-4 Three Battery rotation

Three Battery Rotation—to be done after every use and/or once per shift (see Figure 4-4 above).

- Remove the used Battery from the AutoPulse Platform and place into the Battery Charger.
- Check the spare Battery for four green LED's, and then place it in the AutoPulse Platform. (If the spare Battery is not fully charged, place it in the Battery Charger and use one that is fully charged.)
- Remove a fully charged Battery from the Battery Charger and use it as the spare Battery.
- Power on AutoPulse Platform and ensure no faults are displayed.

5 Managing the AutoPulse Power System

5.1 AutoPulse Battery Management

The AutoPulse System is intended to be deployed in a state of high-readiness. Therefore, daily AutoPulse System checks should be integrated into Emergency Medical Service (EMS) rig-check or hospital procedures. AutoPulse Batteries that are not fully charged (Battery Status LED is yellow/amber or there are less than four bars on the AutoPulse User Control Panel), will result in shorter AutoPulse Platform run times. AutoPulse Batteries that are not fully charged should be replaced with ones that are fully charged (green Battery Status LED or has four bars on the AutoPulse User Control Panel). A recommended AutoPulse Daily Checklist is located in Appendix A.

See Section 4.3, “Battery Rotation,” on page 4-3 for required Battery management.

5.2 AutoPulse Battery Maintenance

5.2.1 Cleaning the AutoPulse Battery

Wipe all the surfaces of the Battery free of foreign matter and spills with a clean dry cloth or a disinfectant wipe such as Super Sani-Cloth (or equivalent).

Clean the surfaces of the Battery with one of the following approved cleaning products. Follow manufacturer instructions.

- 70% Isopropyl alcohol
- Chlorine bleach solution (3% bleach, 97% tap water)
- Super Sani-Cloth

Wipe the Battery completely dry with a clean dry cloth. Ensure the Battery is completely dry prior to placement in the AutoPulse Platform or the Battery Charger.

Inspect the Battery per Section 5.2.2.

5.2.2 AutoPulse Battery Inspection

The Battery should be physically and visually inspected on a regular basis to ensure it is in a state of operational readiness.

Caution:

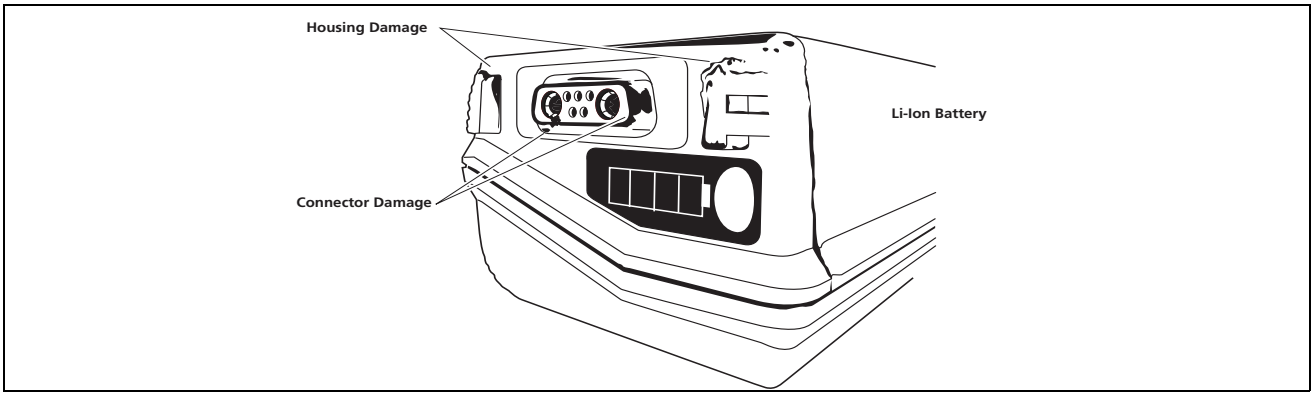

Figure 5-1 Examples of a damaged Battery connector and housing

Note: If the Battery is damaged, do not attempt to place the Battery into the AutoPulse Platform. This can cause damage to the internal connector of the AutoPulse Platform.

If damaged, do not use. In the U.S., contact ZOLL Technical Service at 1-800-348-9011. Outside the U.S., contact your local ZOLL representative.

5.2.3 Storing AutoPulse Batteries

Batteries may be stored in a powered Battery Charger (plugged in, AC power on) indefinitely. The Charger safely ensures the Battery is always at a maximum charge and ready for use

Caution: Never store a Battery in an unpowered battery charger (unplugged or AC power is off). Irreversible damage to the batteries occurs within 1 to 10 days depending on the initial state of charge.

AutoPulse Batteries stored outside the Battery Charger for longer than 6 months may be subject to irreparable damage.

Warning: Always charge a stored Battery before placing the Battery in active operation. Battery slowly self-discharges when not in use. Failure to charge a Battery before use may cause device power failure. In no case should any Battery be used if it has not been charged within the previous 60 days.

5.2.4 Reaching the End of AutoPulse Li-Ion Battery Service Life

The expected service life of AutoPulse Li-Ion batteries is five years from its date of manufacture and will be disabled by the Battery Charger. Refer to Table 4-1 on page 4-1 for more information.

Note: The AutoPulse Li-Ion Battery does not operate after five years from its date of manufacture. Once an AutoPulse Li-Ion Battery has reached the end of its service life, you should discontinue use of the AutoPulse Li-Ion Battery. Dispose of it properly. Refer to Section 5.2.5, “Disposing of AutoPulse Batteries” for more information.

Caution: Do not attempt to open the AutoPulse Li-Ion Battery. The AutoPulse Li-Ion Battery has no serviceable parts.

5.2.5 Disposing of AutoPulse Batteries

Do not throw your batteries away or send them to municipal dumps. Call your local waste management officials for proper disposal instructions.

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6 Battery Charger Maintenance

6.1 Cleaning the Battery Charger

Clean the external surfaces of the Battery Charger at least once a month only with a lint-free cloth that is either dry or slightly damp with water.

6.2 Replacing a Battery Charger Fuse

The only user-serviceable parts on the Battery Charger are the alternating current (AC) power fuses.

Warning: Unplug the power cord before replacing the fuses. Use only specified fuses.

To check if the fuse has burned out, follow these steps:

1. Unplug the Power Cord from the wall outlet and from the receptacle on the back of the Battery Charger. Wait one minute before going to step 2.
2. The fuse holder is located directly under the power receptacle on the back of the Battery Charger (see Figure 6-1). Open the fuse holder by pressing down on the locking tab and pulling the fuse holder straight out.

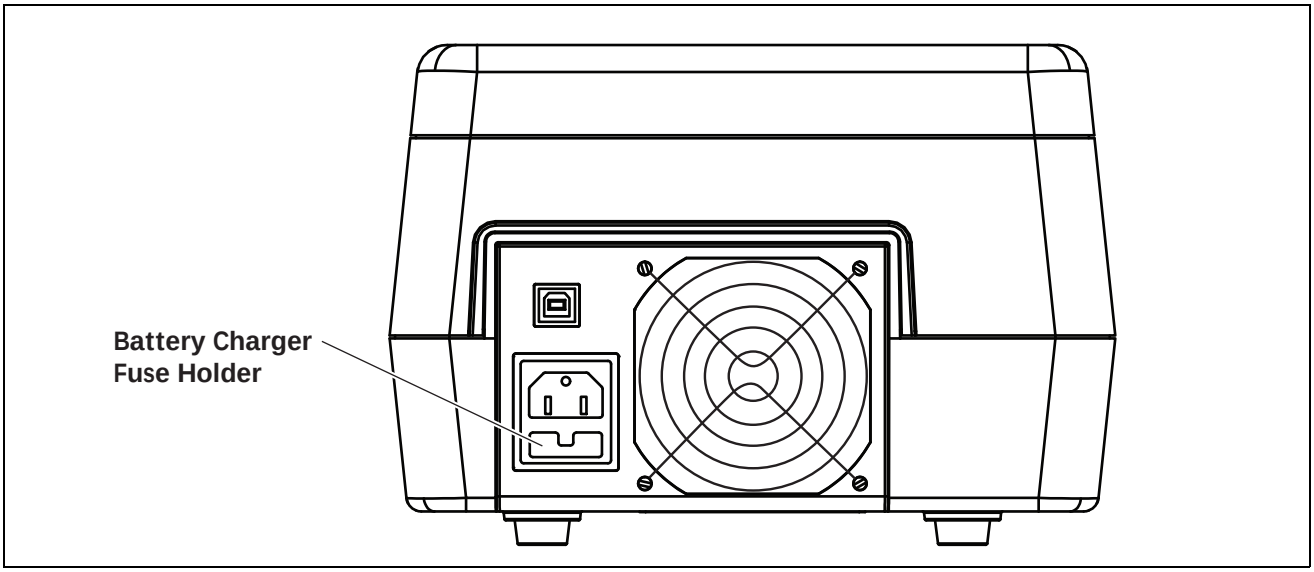

Figure 6-1 Battery Charger Fuse Location

3. Check both of the fuses. If a fuse must be replaced, follow these steps:
   a) Replace both of the original fuses with T 2.5 AH, 250 V, 5 x 20 mm (high breaking capacity: 1500 A minimum) fuses.
   b) Push in the fuse holder until the locking tab clicks into place.

c) Re-attach the Power Cord.

d) When the Battery Charger is powered on, all the LED's illuminate briefly as the Battery Charger performs a self test.

Note: While the self test is being performed, if the indicator lights remain illuminated or if one of the indicator lights fails to illuminate, contact ZOLL.

Appendix A AutoPulse Daily Checklist

Date	Battery Serial Numbers		AutoPulse Self Test Performed
	AutoPulse Platform	Spare	

Perform AutoPulse Self Test - Install a LifeBand and power on the AutoPulse Platform. On Power up, all LEDs on the display momentarily light up, then only the Green POWER LED remains lit. The Battery Charge Status Icon on the AutoPulse User Control Panel should also be visible with 4 bars, if not replace Battery with a fully charged Battery from the Battery Charger. If the AutoPulse Platform red ALERT LED remains on, refer to the Chapter 5, “Troubleshooting Procedures” in the AutoPulse User Guide. If the RED LED can not be resolved, contact ZOLL.

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Appendix B Troubleshooting

This Appendix details symptoms, possible causes, and recommended actions for difficulties you might have with your AutoPulse Power System. Table B-1 provides troubleshooting procedures for the Battery. Table B-2 provides troubleshooting procedures for the Battery Charger.

Table B-1 Battery Troubleshooting Procedures

Symptom	Possible Cause	Recommended Action
Battery Status Check LEDs do not illuminate.	The Battery's status is unknown.	Place the Battery in one of the charging bays of the Battery Charger. 1. If its yellow Charging LED is illuminated, the Battery Charger is attempting to recharge the Battery. Refer to Section 3.2, "Operating the Battery Charger" for more information. 2. If the Battery Charger's red Fail LED is illuminated, the Battery has failed. Replace the Battery. Refer to Section 5.2.4, "Reaching the End of AutoPulse Li-Ion Battery Service Life" or Section 5.2.5, "Disposing of AutoPulse Batteries" for more information.
Battery does not fully insert into the Battery Charger.	• Protective plastic cap was left on the Battery. • The Battery may be damaged. • The Battery Charger's charging bay might be obstructed.	• Remove protective cap. • Inspect the guide rails around the Connector for damage. If the guides are damaged, replace the Battery. • Inspect the Battery Connector for damage. If the Connector is damaged, replace the Battery. • Unplug the alternating current (AC) from the Battery Charger. Check the charging bay to ensure that no debris has accumulated in the bay.
The Battery does not fully insert into the AutoPulse Platform.	• Protective plastic cap was left on the Battery. • The Battery may be damaged. • The AutoPulse Platform's Battery compartment might be obstructed.	• Remove protective cap. • Inspect the guide rails around the Connector for damage. If the guides are damaged, replace the Battery. • Inspect the Battery Connector for damage. If the Connector is damaged, replace the Battery. • Check the AutoPulse Platform's battery compartment to ensure that no debris has accumulated in the bay.

Table B-2 Battery Charger Troubleshooting Procedures (Page 1 of 2)

Symptom	Possible Cause	Recommended Action
Battery Charger's center green Power LED is not illuminated.	Battery Charger's alternating current (AC) power cord is not plugged in.	Refer to Chapter 3, "The Battery Charger" for more information.
Battery Charger's center green Power LED is not illuminated.	Blown fuse.	Refer to Section 6.2, "Replacing a Battery Charger Fuse" for more information.
Charging a Li-Ion Battery takes much longer than 4¼ hours.	The ambient temperature around the Battery Charger is too warm.	• Make sure that the Battery Charger is located in an environment where temperatures do not reach above 95°F (35°C). • Make sure that the Battery Charger's vents are not blocked. • Make sure that the Battery Charger has adequate ventilation.
Battery Charger's red Fail LED is illuminated.	The Battery has • Failed to charge or • Failed the Performance Test or • Failed the Test-Cycle or • Reached its end of life	Remove the Battery from the Battery Charger. Perform a Battery status check: 1. If the Battery status LED is flashing red, the Battery has failed. Replace the Battery. Refer to Section 5.2.4, "Reaching the End of AutoPulse Li-Ion Battery Service Life" or Section 5.2.5, "Disposing of AutoPulse Batteries" for more information. 2. If no status LEDs illuminate when you press the Battery's Status Check button, the Battery has failed. Replace the Battery. Refer to Section 5.2.4, "Reaching the End of AutoPulse Li-Ion Battery Service Life" or Section 5.2.5, "Disposing of AutoPulse Batteries" for more information. 3. If a Li-Ion Battery's internal temperature is below a nominal 41°F (5°C), it fails to charge. Remove from the Battery Charger, allow the Battery to warm to room temperature (may take up to 3 hours), and re-insert in the Battery Charger. 4. If the Li-Ion Battery status LEDs are green or yellow, remove and re-insert the Battery. If the Battery Charger's FAIL LED remains illuminated, contact ZOLL.

Table B-2 Battery Charger Troubleshooting Procedures (Page 2 of 2)

Symptom	Possible Cause	Recommended Action
One or both of the Battery Bay's indicator lights are all illuminated.	The Battery Charger has detected an internal error in one or both of the Battery Bays.	Remove the Battery from the Battery Charger. Disconnect the power cord from the wall outlet and then plug the Battery Charger back in. If the Indicator lights remain illuminated (the Battery Charger has failed the self-test), contact ZOLL.
After charging for 12 hours, the Battery Charger Ready Status LED does not illuminate.	The Battery Charger software may need to be reset due to an internal error.	Remove the Battery from the Battery Charger. Reinsert the Battery into the Battery Charger and attempt to charge again.

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Appendix C Technical Specifications

The specifications provided in this appendix apply to the AutoPulse Power System.

C.1 Li-Ion Battery Physical and Environmental

Table C-1 Li-Ion Battery Specifications (Page 1 of 2)

Category	Specifications
Manufacturer	ZOLL Circulation, Inc.
Model Number	8700-0752-01
Size (L×W×H)	11.5 in. by 3.2 in. by 2.2 in. (29.2 cm by 8.1 cm by 5.7 cm)
Weight	3.0 lbs. (1.3 kg).
Type	Rechargeable Lithium-Ion ($LiFePO_4$)
Battery voltage (nominal)	36.3 V
Capacity	2600 mAh (typical)
Current (maximum)	30 A continuous, 48 A pulse (96 ms max)
Initial Battery run time (nominal patient)	30 minutes (typical)
Maximum Battery charge time	Less than 4¼ hours at 77ºF (25ºC)
Battery Test-Cycle time	Less than 12 hours per Test-Cycle session
Recommended replacement interval	3 years from date of manufacture **Note:** The Battery will not operate after 5 years from date of manufacture.
Operating temperature	+32º to +113ºF (0º to +45ºC) ambient installed in device
Charge temperature	+41º to +95ºF (5º to +35ºC) ambient (68º to 77ºF [20º to 25ºC] preferred)
Storage/Transport temperature	-4º to +113ºF (-20º to +45ºC) ambient for up to six months with charging every four weeks, starting with a fully charged Battery.
Operating altitude	0 to 15,000 ft. (0 to 4,572 m)
Enclosure protection	Meets IP24 per IEC 60529
Shock	Meets IEC 60068-2-27 Basic Environmental Testing Procedures – Shock (50 g, 11 ms pulse, half sine wave)
Vibration	Meets IEC 60068-2-6 Basic Environmental Testing Procedures (10 to 150 Hz, 10 m/s^2) Meets IEC 60068-2-64 Basic Environmental Testing Procedures – Random Vibration Broad Band – General Requirements (f1:20, f2:2000, ASD 0.05)
Free fall	Meets IEC 60068-2-31 Basic Environmental Testing Procedures – Free Fall – Procedure 1.
Electrostatic discharge	Meets IEC 61000-4-2, Level 4

Table C-1 Li-Ion Battery Specifications (Page 2 of 2)

Category	Specifications
Radiated emissions	Meets CISPR 11/EN55011, Group 1, Class A FCC part 15, Class A
Radiated Immunity	Meets IEC-61000-4-3, 80-2500 MHz, Level 3
Safety	Meets IEC-60601-1 including UL310DV.1.1 for Lithium batteries

C.2 Battery Charger Physical And Environmental

Table C-2 Battery Charger Specifications (Page 1 of 2)

Category	Specifications
Manufacturer	ZOLL Circulation, Inc.
Model Number	8700-0753-01
Size (L×W×H)	16.01 in. by 9.50 in. by 6.54 in. (40.6 cm by 24.1 cm by 16.6 cm)
Weight	7.1 lbs. (3.23 kg)
Operating input voltage	100 to 240 V AC
Operating input frequency	50/60 Hz
Input current	2.0 Amps (maximum)
Maximum Battery charge time	Less than 6¼ hours (at 77ºF [25ºC])
Fuses	User-replaceable, T 2.5 AH, 250 V, 5 x 20 mm fuses (2 required) High breaking capacity: 1500 A minimum
Operating temperature	+41º to +95ºF (5º to +35ºC) (68º to 77ºF [20º to 25ºC] preferred)
Storage/Transport temperature	-40º to +158ºF (-40º to +70ºC)
Relative humidity	5% to 95%, non-condensing.
Operating altitude	0 to 10,000 ft. (0 to 3,048 m)
Enclosure protection	Meets IP22 per IEC 60529
Shock	Meets IEC 60068-2-27 Basic Environmental Testing Procedures – Shock (50 g, 11 ms pulse, half sine wave)
Vibration	Meets IEC 60068-2-6 Basic Environmental Testing Procedures (10 to 150 Hz, 10 m/s^2) Meets IEC 60068-2-64 Basic Environmental Testing Procedures – Random Vibration Broad Band – General Requirements (f1:20, f2:2000, ASD 0.05)
Free fall	Meets IEC 60068-2-31 Basic Environmental Testing Procedures – Free Fall – Procedure 1.
Electrostatic discharge	Meets IEC 61000-4-2, Level 4

Table C-2 Battery Charger Specifications (Page 2 of 2)

Category	Specifications
RF electromagnetic fields immunity	Meets IEC 61000-4-3, Level 2
EFT/burst	Meets IEC 61000-4-4, Level 3
Surge immunity	Meets IEC 61000-4-5, Level 3
Conducted RF disturbances immunity	Meets IEC 61000-4-6, Class A
Dips, interruptions, and variations	Meets IEC 61000-4-11
Harmonics current emissions	Meets IEC 61000-3-2, Class A
Radiated emissions	Meets CISPR 11/EN55011, Group 1, Class A FCC part 15, Class A
Safety	Meets IEC/EN60601-1

Note: These requirements provide reasonable protection against harmful electromagnetic interference in a typical medical installation. However, high level of radio-frequency emissions from electrical devices, such as cellular phones, may disrupt the performance of this device. To mitigate disruptive electromagnetic interference, position this device away from radio frequency transmitters and other sources of electromagnetic energy.

C.3 FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

C.4 Guidance and Manufacturer's Declaration–Electromagnetic Emissions

Table C-3 Guidance and Manufacturer's Declaration–Electromagnetic Emissions

Emissions test	Compliance	Electromagnetic environment - guidance
RF Emissions CISPR 11	Group 1	The Battery Charger uses RF energy for its internal function only. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby equipment.

Table C-3 Guidance and Manufacturer's Declaration–Electromagnetic Emissions

RF Emissions CISPR 11	Class A	The Battery Charger is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes, provided the following warning is heeded. **Warning:** This equipment is intended for use by healthcare professionals only. This equipment may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the Battery Charger or shielding the location.
Harmonic Emissions IEC 61000-3-2	Class A	
Voltage Fluctuations / Flicker Emissions IEC 61000-3-3	Complies	
Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to EMC information provided in this document. **Note:** The EMISSIONS characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.		

Electromagnetic Immunity Declaration (EID)

Table C-4 Guidance and Manufacturer's declaration –Electromagnetic immunity for the Battery Charger

The Battery Charger is intended for use in the electromagnetic environment specified below. The customer or user of the Battery Charger should ensure that it is used in such an environment.			
Immunity test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic environment–guidance**
Electrostatic Discharge (ESD) IEC 61000-4-2	± 8 kV contact ±15 kV air	± 8 kV contact ± 15 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Electrical fast transient/ burst IEC 61000-4-4	±2 kV AC Mains ±1 kV I/O lines 5/50 100 kHz	±2 kV AC Mains ±1 kV I/O lines 5/50 100 kHz	Mains power should be that of a typical commercial or hospital environment
Surge IEC 61000-4-5	±1 kV Line to Line ± 2 kV Line to Earth	±1 kV Line to Line ± 2 kV Line to Earth	Mains power should be that of a typical commercial or hospital environment

Table C-4 Guidance and Manufacturer's declaration –Electromagnetic immunity for the Battery Charger

Voltage dips, short interruptions, and voltage variations on power supply input lines IEC 61000-4-11	>0% U_t,for 0.5 cycle* At 0ºC, 45ºC, 90ºC, 135ºC, 180ºC, 225ºC, 270ºC, and 315ºC	>0% U_t, for 0.5 cycle* At 0ºC, 45ºC, 90ºC, 135ºC, 180ºC, 225ºC, 270ºC, and 315ºC	Mains power should be that of a typical commercial or hospital environment. If user requires continued operation during power mains interruption, it is recommended the Battery Charger be powered from an interruptible power supply
	0% U_T, 1 cycle and 70% U_T, 25/30 cycles Single phase at 0ºC	0% U_T, 1 cycle and 70% U_T, 25/30 cycles Single phase at 0ºC	
Voltage interruptions	0% U_T, 250/300 cycles	0% U_T, 250/300 cycles	
Power frequency (50/60 Hz) magnetic field. IEC 61000-4-8	30 A/m	30 A/m	Power frequency magnetic fields should be at levels characteristic of typical location in a typical commercial or hospital environment.
Note: U_t is the a.c mains voltage prior to application of the test level.			

* Applicable only to ME equipment and ME systems connected to a single-phase AC mains.

Table C-5 Guidance and manufacturer's declaration – electromagnetic immunity

The Battery Charger is intended for use in the electromagnetic environment specified below. The customer or the user of the Battery Charger should assure that it is used in such an environment.			
Immunity test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic environment guidance**
Conducted RF IEC 61000-4-6	3 Vrms 1 kHz 0.15 – 80 MHz	3 Vrms 1 kHz 0.15 – 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of the Battery Charger, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance d = 1.17 √P 0.15 to 80 MHz d = 1.17 √P 80 to 800 MHz d = 2.3 √P 800 MHz to 2.7 GHz Where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,* should be less than the compliance level in each frequency range.** Interference may occur in the vicinity of equipment marked with the following symbol:
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz 6 V/m in ISM bands*** Spot frequencies 385 MHz – 5.750 GHz Pulse Modulation	3 V/m 80 MHz to 2.7 GHz 6 V/m in ISM bands*** Spot frequencies 385 MHz – 5.750 GHz Pulse Modulation	
Note 1: At 80 MHz and 800 MHz, the higher frequency range applies. Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.			

* Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Battery Charger is used exceeds the applicable RF compliance level above, the Battery Charger should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Battery Charger.

** Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

*** The ISM (industrial, scientific, and medical) bands between 0.15 MHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. The amateur radio bands between 0.15 MHz and 80 MHz are 1.8 MHz to 2.0 MHz, 3.5 MHz to 4.0 MHz, 5.3 MHz to 5.4 MHz, 7 MHz to 7.3 MHz, 10.1 MHz to 10.15 MHz, 14 MHz to 14.2 MHz, 18.07 MHz to 18.17 MHz, 21.0 MHz to 21.4 MHz, 24.89 MHz to 24.99 MHz, 28.0 MHz to 29.7 MHz, and 50.0 MHz to 54.0 MHz.

Note: The following degradations associated with essential performance were not allowed during test: component failure, changes in programmable parameters, resets to factory defaults, changes in operating modes, or data corruption.

Table C-6 Recommended separation distances between portable and mobile RF communications equipment and the Battery Charger

The Battery Charger is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Battery Charger can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Battery Charger as recommended below, according to the maximum output power of the communications equipment.

Radiated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz d = 1.17 √P	80 MHz to 800 MHz d = 1.17 √P	800 MHz to 2.5 GHz d = 2.33 √P
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.70	3.70	7.38
100	11.70	11.70	23.33

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters can be determined using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts according to the transmitter manufacturer.

Notes
At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.
These guidelines may not apply in all situations. Electromagnetic propagations affected by absorption and reflection from structures, objects, and people.

Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information in this manual.

Portable and mobile RF communications equipment can affect Medical Electrical Equipment.

The use of Accessories, transducers, and cables other than those specified by the manufacturer, may result in increased Emissions or decreased Immunity of the Battery Charger.

The Battery Charger should be observed to verify normal operation in the configuration in which it will be used.

C.5 Limited Warranty for AutoPulse Resuscitation System

ZOLL Circulation, Inc. (ZOLL Circulation) warrants to the initial Purchaser only that the "Warranted Product" purchased hereunder will be free from defects in workmanship or materials, when given normal, proper, and intended usage, for a specified period ("Warranty Period") from the date of its initial shipment to Purchaser. "Warranted Products" consist solely of those products whose description in this price list expressly states that the product includes a warranty for a specified time period (the Warranty Period for the product). Excluded from this warranty are expendable components and supply items such as the LifeBand® Load-distributing Band.

Warranty Period: The AutoPulse Resuscitation System Platform, the AutoPulse Li-Ion Battery, and the Battery Charger (collectively and individually referred to as "Product") are sold with a one year warranty period to the end-user. The warranty period begins at delivery.

ZOLL Circulation's sole obligations under this warranty are to repair or replace, at its option, any Warranted Product (or part thereof) that ZOLL Circulation reasonably determines to be covered by this warranty and to be defective in workmanship or materials provided that the Purchaser has given notice of such warranty claim within the Warranty Period and the Purchaser has complied with ZOLL Circulation's Return Material Authorization ("RMA") procedures. Repair or replacement of Products under this warranty does not extend the Warranty Period.

To request repair or replacement under this warranty, Purchaser should contact ZOLL Circulation at 2000 Ringwood Avenue, San Jose, CA 95131 U.S.A., 1-800-321-4CPR or 1-408-541-2140. ZOLL Circulation will inform purchaser of its then-current RMA procedure. ZOLL Circulation shall determine whether to repair or replace Products and parts covered by this warranty and all Products or parts replaced shall become ZOLL Circulation's property. In the course of warranty service, ZOLL Circulation may but shall not be required to make engineering improvements to the Warranted Product or part thereof.

Exclusions

This warranty does not extend to any Warranted Products or parts thereof that have (a) been subject to misuse, neglect or accident; (b) been damaged by causes external to the Warranted Product, including but not limited to failure of or faulty electrical power; (c) not been used in accordance with ZOLL Circulation's instructions; (d) been affixed to any nonstandard accessory attachment; (e) had the serial number removed or made illegible; (f) been modified by anyone other than ZOLL Circulation; (g) been used with any software not provided by ZOLL Circulation; or (h) been disassembled, serviced, or reassembled by anyone other than ZOLL Circulation, unless authorized by ZOLL Circulation. ZOLL Circulation shall have no obligation to make repairs, replacements, or corrections which result, in whole or in part, from normal wear and tear.

ZOLL Circulation makes no warranty (a) with respect to any products that are not Warranted Products, (b) with respect to any products purchased from a person other than ZOLL Circulation or a ZOLL Circulation-authorized distributor or (c) with respect to any product sold under a brand name other than ZOLL Circulation.

THIS WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY FOR ZOLL CIRCULATION'S PRODUCTS, EXTENDS ONLY TO THE PURCHASER AND IS EXPRESSLY IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTIES INCLUDING WITHOUT LIMITATION ANY WARRANTY AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ZOLL CIRCULATION'S MAXIMUM LIABILITY ARISING OUT OF THE SALE OF THE PRODUCTS OR THEIR USE, WHETHER BASED UPON WARRANTY, CONTRACT, TORT OR OTHERWISE, SHALL NOT EXCEED THE ACTUAL PAYMENTS RECEIVED BY ZOLL CIRCULATION IN CONNECTION THEREWITH. ZOLL CIRCULATION SHALL NOT BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL LOSS, DAMAGE OR EXPENSE (INCLUDING WITHOUT LIMITATION LOST PROFITS) DIRECTLY OR INDIRECTLY ARISING FROM THE SALE, INABILITY TO SELL, USE OR LOSS OF USE OF ANY PRODUCT (HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY), EVEN IF ZOLL CIRCULATION HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS. THE FOREGOING LIMITATIONS SHALL NOT APPLY TO ANY CLAIMS FOR BODILY INJURY OR DEATH TO THE EXTENT THAT LIMITATION OF DAMAGES FOR SUCH CLAIMS ARE UNENFORCEABLE OR AGAINST PUBLIC POLICY UNDER ANY APPLICABLE STATUTE OR RULE OF LAW.

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