

40 Amp 24 Volt for Wet-Flodded Batteries
115 Volt AC

Minuteman[®]

BATTERY CHARGER

PART NO. 957718

PLEASE SAVE THESE IMPORTANT SAFETY AND OPERATING INSTRUCTIONS

For correct operation of the equipment, it is important to read and be familiar with this entire manual before installing and operating the charger.
DO NOT DISCARD THIS MANUAL AFTER READING.



LOOK FOR THIS SYMBOL TO POINT OUT SAFETY PRECAUTIONS. IT MEANS: BECOME ALERT—YOUR SAFETY IS INVOLVED. IF YOU DO NOT FOLLOW THESE SAFETY INSTRUCTIONS, INJURY OR PROPERTY DAMAGE CAN OCCUR.

INTRODUCTION

This battery charger is designed to recharge deep-cycle, lead-acid batteries. A ferroresonant transformer is used to provide a highly reliable, line compensating unit with a minimum of moving parts, designed for long, trouble-free service. A patented electronic timer turns the charger on and off automatically. This electronic timer determines full charge of the batteries by measuring the rate at which the battery voltage increases during charge. When the voltage stops rising, the battery is fully charged and the charger turns off.

INITIAL INSTALLATION

The AC line to which the charger is to be connected must be of the proper voltage as indicated on the nameplate of the charger and in TABLE 1. The line must also be capable of supplying 15 amperes to this charger.

TABLE 1

Part No.	Input Voltage
957718	120

⚠ CAUTION: TO REDUCE THE RISK OF FIRE USE THIS CHARGER ONLY ON CIRCUITS PROVIDED WITH A MAXIMUM OF 20 AMPERE BRANCH CIRCUIT PROTECTION (CIRCUIT BREAKER OR FUSE), IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, ANSI/NFPA 70, AND ALL LOCAL CODES AND ORDINANCES.

The use of an extension cord with the charger should be avoided.

The use of an improper extension cord could result in a risk of fire or electric shock. If an extension cord must be used, use a three-conductor, No. 12 AWG cord with ground, properly wired, in good electrical condition and keep it as short as possible. Make sure that the pins on the plug of the extension cord are the same number, size, and shape as that of the plug on the battery charger.

Locate all cords so that they will not be stepped on, tripped over, or otherwise subject to damage or stress.

Do not operate this charger with a damaged cord or plug. Do not operate this charger if it has received a sharp blow, was dropped or otherwise damaged in any manner; refer to a qualified service agent.

Provide adequate ventilation for the batteries and charger. The convection-cooled design requires an unobstructed flow of cooling air for proper operation. Keep all charger ventilation openings at least two inches (2") (5cm) away from walls and other objects. Do not allow clothing, blankets, or other material to cover the charger.

⚠ WARNING: CHARGERS CAN IGNITE FLAMMABLE MATERIALS AND VAPORS. DO NOT USE NEAR FUELS, GRAIN DUST, SOLVENTS, THINNERS, OR OTHER FLAMMABLES.

⚠ WARNING: KEEP DRY. DO NOT EXPOSE CHARGER TO RAIN. FOR STORAGE, KEEP IN A BUILDING. REPLACE WORN, CUT, OR DAMAGED POWER CORDS OR WIRES IMMEDIATELY.

GROUNDING INSTRUCTIONS

This battery charger must be grounded to reduce the risk of electric shock. This charger is equipped with an electric cord having an equipment-grounding conductor and a grounding-type plug. This plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electrical Code and all local codes and ordinances.

⚠ DANGER: IMPROPER CONNECTION OF THE EQUIPMENT-GROUNDING CONDUCTOR CAN RESULT IN A RISK OF AN ELECTRIC SHOCK.

The conductor with insulation having an outer surface that is green, with or without yellow stripe(s), is the equipment-grounding conductor. If repair or replacement of the electric cord or plug is necessary, do not connect the equipment-grounding connector to live terminal.

NORMAL OPERATION

REFER TO, READ, and FOLLOW ALL the instructions and safety precautions printed on the charger before every use!

⚠ WARNING: DO NOT MAKE ANY CONNECTIONS UNTIL YOU READ THE CHARGER NAMEPLATE AND VERIFY THAT THE CHARGER IS FOR USE ON THE INTENDED INPUT POWER (BOTH VOLTAGE AND FREQUENCY), BATTERY SYSTEM VOLTAGE, BATTERY TYPE, AND BATTERY AMP-HOUR CAPACITY SIZE!

1. With the charger DC output cord disconnected from the batteries, connect the power supply cord to the needed AC voltage and frequency as specified on the charger nameplate.

⚠ WARNING: TO REDUCE THE RISK OF AN ELECTRIC SHOCK, CONNECT THE AC POWER SUPPLY PLUG ONLY TO A PROPERLY GROUNDED, SINGLE PHASE (3-WIRE) OUTLET. REFER TO GROUNDING INSTRUCTIONS.

⚠ CAUTION: MAKE SURE THE BATTERY PACK IS THE CORRECT NUMBER OF SERIES CONNECTED LEAD-ACID CELLS, SYSTEM VOLTAGE, AND AMP-HOUR CAPACITY AS SPECIFIED ON THE CHARGER. USE

OTHERWISE MAY DAMAGE THE CHARGER AND/OR BATTERIES.

⚠ DANGER: TO PREVENT ELECTRIC SHOCK, DO NOT TOUCH UNINSULATED PARTS OF THE CHARGER OUTPUT CONNECTOR, BATTERY CONNECTOR, OR BATTERY TERMINALS. MAKE SURE THAT BOTH THE CHARGER AND BATTERY CONNECTORS ARE IN GOOD WORKING CONDITION.

⚠ DANGER: DO NOT USE THE CHARGER IF EITHER THE CHARGER OR BATTERY CONNECTORS ARE CORRODED, CRACKED, SHOW ANY SIGNS OF MELTING, ARE DAMAGED IN ANY WAY OR DO NOT MAKE A TIGHT CLEAN ELECTRICAL CONTACT. USING ANY CHARGER WITH ANY OF THE ABOVE SYMPTOMS COULD RESULT IN A FIRE, PROPERTY DAMAGE, OR PERSONAL INJURY. REPLACE DEFECTIVE, CRACKED OR DAMAGED CORDS OR WIRES IMMEDIATELY. DO NOT DISASSEMBLE CHARGER; TAKE IT TO A QUALIFIED SERVICE AGENT WHEN SERVICE OR REPAIR IS REQUIRED. INCORRECT REASSEMBLY MAY RESULT IN A RISK OF ELECTRIC SHOCK OR FIRE.

2. Connect the charger to a battery system of the voltage, type, and amp-hour capacity as specified on the charger. Connect DC output connector to the battery connector by grasping the plug body or handle and firmly pushing the plug straight into the receptacle until the connectors are fully engaged.

⚠ WARNING: DO NOT DISCONNECT THE DC OUTPUT CONNECTOR FROM THE BATTERY RECEPTACLE WHEN THE CHARGER IS OPERATING. THE RESULTING ARCING AND BURNING OF THE PLUG AND RECEPTACLE COULD CAUSE THE BATTERIES TO EXPLODE AND WILL DAMAGE THE CONNECTORS. IF THE CHARGER MUST BE STOPPED, DEPRESS THE STOP BUTTON UNTIL THE AMMETER DECREASES TO ZERO OR DISCONNECT THE AC PLUG FROM ITS RECEPTACLE. ONLY AFTER THE AMMETER HAS DROPPED TO ZERO, THEN DISCONNECT THE CHARGER DC OUTPUT PLUG FROM THE BATTERY RECEPTACLE.

Distinct steps occur in the process of the charger turning on and charging. Pay attention to these steps and monitor the initial charge rate on the ammeter at the instant the charger starts charging.

Three to five (3-5) seconds after the charger and battery connectors are engaged, the control relay inside the charger will pull in with a "click",

indicating complete electrical circuits between the electronic timer inside the charger to the equipment battery pack as well as to live AC power.

After the control relay pulls in with a click, the transformer will hum, indicating that the transformer has been energized by AC power.

After the transformer hums, the ammeter needle will deflect, indicating initial charge rate.

3. Monitor the ammeter for the initial charge rate.

The correct initial charge rate will vary due to numerous factors. Refer to the chart to determine the minimum and maximum initial charge rate for the specific current rating charger.

CORRECT INITIAL CHARGE RATE

Charger Current Rating	Minimum	Start Rating	Maximum
40	31	40	48

If the batteries are heavily discharged and the AC input line voltage is higher than nominal, the initial charge rate may exceed the maximum initial charge rate for the specific current rating charger. Under normal conditions, the charge rate will decrease to or less than the specified maximum charge rate in less than 120 minutes.

If the ammeter still reads in excess of the specified maximum charge rate after 120 minutes, turn the charger off by depressing the STOP button until the ammeter decreases to zero or disconnecting the AC plug from its receptacle.

⚠ CAUTION: TO PREVENT BATTERY DAMAGE, CHARGER OVERHEATING AND TRANSFORMER BURN OUT, DO NOT ALLOW THE CHARGER TO OPERATE FOR MORE THAN 120 MINUTES WITH THE AMMETER READING IN EXCESS OF THE SPECIFIED MAXIMUM CHARGE RATE. THIS MISUSE WILL CAUSE OVERHEATING AND TRANSFORMER BURNOUT WILL RESULT.

This high charge rate is caused if the charger is connected to a battery pack with a system voltage lower than, or Amp-Hour capacity greater than, specified on the charger. If battery maintenance has recently been performed, test to see if an individual battery in the battery pack has been connected reverse polarity. A common error is to install one or more of the 6 volt batteries in a battery pack in reverse polarity. Using a suitable DC voltmeter, test to be sure all batteries in a battery pack are correctly installed, and also test by measuring the battery system voltage at the equipment

battery connector, and compare it to the system voltage specified in the charger nameplate. After charging for 120 minutes at this excessive rate, the measured on-charge voltage should rise to the voltage specified by the charger nameplate. Voltage measurements, while charging, lower than the charger system voltage indicates an incorrect or failed battery pack that must be corrected before using the charger.

If the batteries have been recently charged, the battery is cold (temperature below 65°F), or the AC input voltage is lower than nominal, the initial charge rate may only reach the minimum initial charge rate at turn-on for the specific current rating charger.

If the initial charge rate is less than half of the specified minimum initial charge rate at the moment of turn-on, the charger may be malfunctioning due to electrical overload damage. Turn the charger off by depressing the STOP button until the ammeter decreases to zero or disconnecting the AC plug from its receptacle.

⚠ CAUTION: DO NOT USE THE CHARGER IF THE OUTPUT IS LOW. BATTERIES WILL NOT REACH FULL CHARGE, THEREBY INCREASING THE POSSIBILITY OF A HARMFUL DEEP DISCHARGE DURING THEIR NEXT USE.

This too low a charge rate at the instant of turn-on can be due to a battery pack system voltage that is higher than specified on the charger, a charger malfunction resulting from electrical overload damage, or component failure. Test for the correct battery pack system voltage with a suitable voltmeter at the equipment battery connector and compare with the system voltage specified on the charger nameplate.

⚠ DANGER: TO REDUCE THE RISK OF ELECTRIC SHOCK, ALWAYS DISCONNECT BOTH THE POWER SUPPLY CORD AND THE OUTPUT CORD BEFORE ATTEMPTING ANY MAINTENANCE OR CLEANING.

The charger fuses are located behind the front panel. **DO NOT REMOVE THE FRONT PANEL FOR INSPECTION WITHOUT FIRST DISCONNECTING BOTH THE POWER SUPPLY CORD AND THE OUTPUT CHARGING CORD. RISK OF ELECTRIC SHOCK.**

Visually inspect and electrically test the fuses. A blown (OPEN) DC fuse indicates an electrical overload damage caused short circuit failure of a rectifier diode or reverse polarity connection of the charger to the batteries. Melted fuses or fuse links can result from weak fuseholders or fuseholder connections.

LOCATE AND CORRECT CAUSE OF TROUBLE BEFORE REPLACING A BLOWN FUSE.

DO NOT DISASSEMBLE THE CHARGER.

Take the charger to a qualified service agent to have the heatsink assembly with diodes and correct replacement fuse, fuseholder or fuse assembly installed. Incorrect reassembly may result in a risk of electric shock or fire.

During the charge, the battery voltage gradually increases which causes the charge rate to decrease. Batteries able to deliver their full rated capacity will still rise to 2.5 volts per cell, or higher, at 80°F, as they reach maximum charge. This will allow the charge current to decrease or taper to the charger's designed finish charge rate or lower at the end of charge. Refer to chart.

Charger Current Rating	Finish Current @ 2.5 Volts/Cell @ 80°F (27°C)	Normal Finish Charge Current Range
40 Amps	10 Amps	13 Amps or less

Since each battery cell accepts charge at a slightly different rate, charging with the ammeter reading in the normal finish charge range for the last few hours of charge is important to achieve equalization of all battery cells every time the batteries are charged.

As batteries wear out and lose capacity, the end of charge finish voltage continually decreases. As the end of charge finish voltage decreases to less than 2.5 volts per cell, this prevents the finish charge current from decreasing to the normal finish charge current range. The electronic timer still determines when the batteries have reached their now reduced maximum charge capacity and will turn the charger off.

The major factors affecting the required charge time are charger output current rating, battery size or capacity in amp-hours, and how heavily the battery is discharged. A larger, more heavily discharged battery requires more time to recharge to maximum charge with the same current rating charger than a smaller, less heavily discharged battery.

The electronic timer circuit board contains a section that stops supplying power to the control relay if the charger operates continuously for 18 hours and is unable to achieve maximum charge. The indicator light will blink if maximum time charge termination occurs. The indicator light will glow steady for normal charge termination in 18 hours or less.

If no power outage occurred and the charger operated continuously longer than 18 hours, either the control relay is stuck or the electronic timer circuit board is malfunctioning.

⚠ WARNING: DO NOT LEAVE THE CHARGER DC OUTPUT CONNECTOR CONNECTED TO THE BATTERY CONNECTOR WHILE UNATTENDED FOR TWO DAYS OR MORE IN A ROW. SEVERE OVERCHARGING AND POSSIBLE DAMAGE TO THE BATTERIES WILL RESULT IF THE CHARGER SHOULD FALL TO TURN OFF, OR TURN BACK ON.

APPROXIMATE RECHARGE TIMES		
Part No.	Battery Capacity Ampere Hours 6 Hr. Scale	Approximate Recharge Time (Hours)
957718	230	9
	440	18

Newer or colder batteries require greater energy return, are slower to respond, and consequently require extended charge time at a low finish charge current rate to return to maximum charge. As batteries wear out and lose capacity, their temperature rise both from use and on charge becomes significant as an indicator of the end of life and the battery cannot benefit from extended charge time. Even though they are properly charged, older batteries continually lose capacity, and should be replaced when they will no longer perform as desired. Very weak batteries are indicated when the charger turns off after only 8 hours and the indicator light is blinking.

- At the finish of charge, monitor the indicator light, read the ammeter, note the run time, and listen for transformer hum. Refer to the following chart.

Indicator Light	Ammeter Drop to Zero	Charging Run Time	Transformer Hum	
Steady Glow	Yes	18 Hours or less	No	MAXIMUM CHARGE ACHIEVED
Flashing	Yes	9 Hours	No	VDC less than 2.25 V/cell in 9 hours WEAK BATTERY SYSTEM
--- OR ---				
Flashing	Yes	18 Hours	No	Too large amp-hour capacity battery system or excessive discharge MAXIMUM CHARGE NOT ACHIEVED
Steady or Flashing	No		Yes	Malfunction; Relay Stuck or Electronic Timer Failure TURN OFF CHARGER BY DISCONNECTING CORD

After the charger has turned off, disconnect the charger DC output connector from the battery connector by grasping the plug body or handle and pulling the plug straight out of the receptacle.

⚠ WARNING: TO AVOID DAMAGE TO THE CHARGER CORD CONNECTOR PLUG, AND BATTERY CONNECTOR RECEPTACLE, DO NOT PULL ON THE CHARGER CORD. DO NOT TWIST, ROCK, OR PULL THE CONNECTOR PLUG SIDEWAYS.

ON-DEMAND CHARGING

Battery cycle life is directly determined by severity of use. A battery that has 100% of its available energy discharged every time it is used will wear out twice as fast as a battery that has 70% of its available energy discharged every time it is used. In severe use situations, some additional battery life can be realized by instituting short charge periods during work breaks. This reduces the incidence of full 100% battery depletion before charging.

Follow "Normal Operation" procedures to begin a short charge period. At the end of any short charge period where the charger has not turned off, turn the charger off by depressing the STOP button until the ammeter decreases to zero or disconnect the AC plug from its receptacle.

BATTERY STORAGE MAINTENANCE

When the equipment is not in use, charge the batteries once each week. Remove the DC output connector at the end of charge.

STORAGE

When the machine is not in use, charge the batteries once each week.

PROPER CARE OF MOTIVE POWER BATTERIES

Motive power batteries are subjected to severe deep cycle duty on a daily basis. Although these batteries are designed to withstand such duty, the following precautions must be observed to obtain good performance and maximum cycle life.

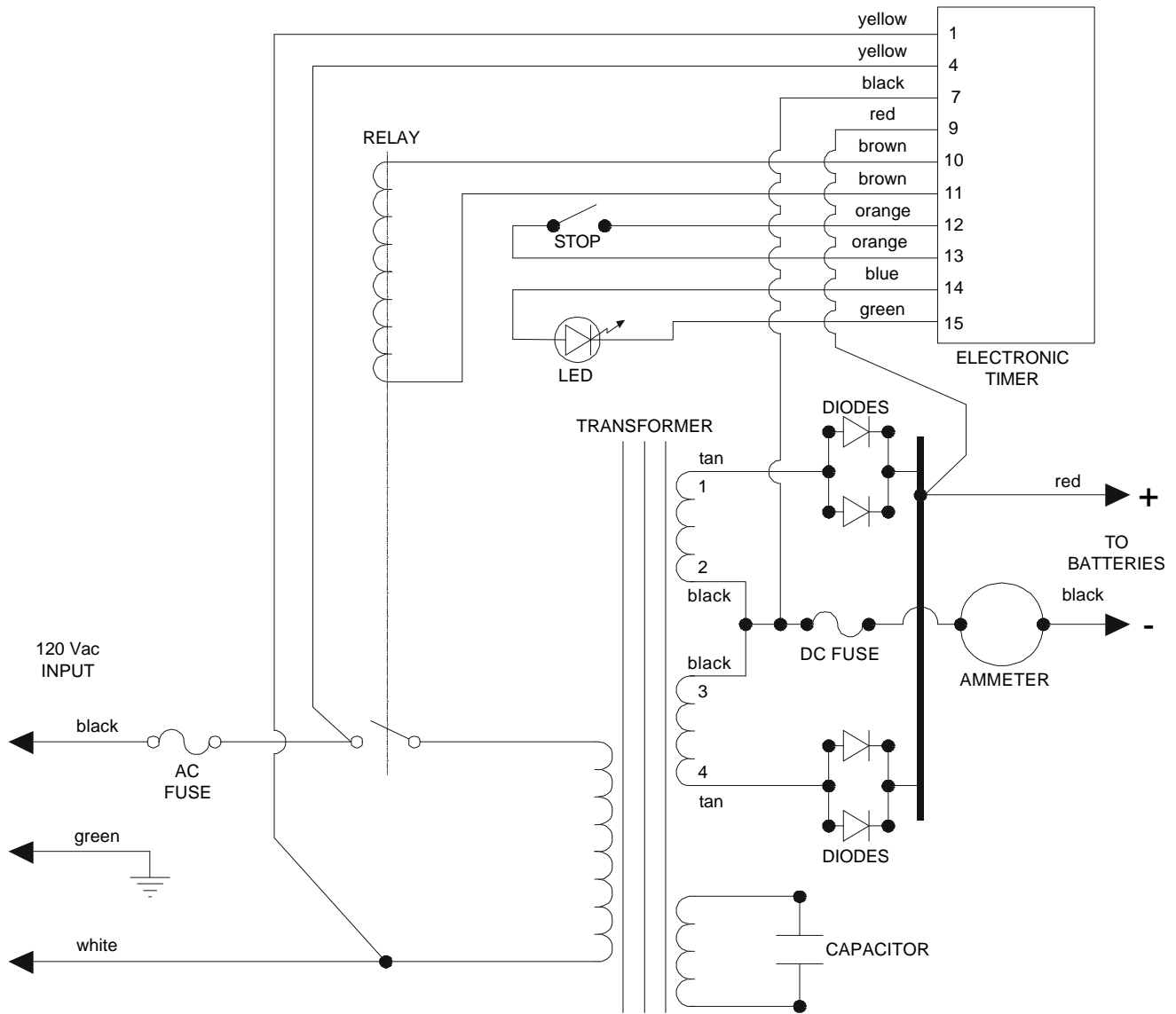
⚠ CAUTION: ALWAYS WEAR PROTECTIVE EYE SHIELDS AND CLOTHING WHEN WORKING WITH BATTERIES. BATTERIES CONTAIN ACIDS WHICH CAN CAUSE BODILY HARM. DO NOT PUT WRENCHES OR OTHER METAL OBJECTS ACROSS THE BATTERY TERMINAL OR BATTERY TOP. ARCING OR EXPLOSION OF THE BATTERY CAN RESULT.

1. When installing new batteries, be sure the polarity of each battery and overall battery pack is correct. Due to the electrical characteristics of this charger, it is possible to improperly hook up the batteries and not blow the fuse when charging. Battery and/or charger damage can result.
2. New batteries should be given a full charge before their first use because it is difficult to know how long the batteries have been stored.
3. Limit the use of new batteries for the first five cycles. New batteries are not capable of their rated output until they have been discharged and charged a number of times.
4. Do not excessively discharge the batteries. Excessive discharge can cause polarity reversal of individual cells resulting in complete failure shortly thereafter. Limited use of new batteries will minimize the risk of cell reversals.
5. Maintain the proper electrolyte level by adding water when necessary. Never allow the electrolyte level to fall below the top of the battery plates. Electrolyte levels fall during discharge and rise during charge. Therefore, to

prevent the overflow of electrolyte when charging, it is mandatory that water be added to cells AFTER they have been fully charged; do not overfill. Old batteries require more frequent additions of water than do new batteries.

6. When the temperature falls below 65°F, the batteries should be placed on charge as soon after use as possible.
7. The tops of the batteries and battery hold-downs must be kept clean and dry at all times to prevent excessive self-discharge and flow of current between the battery posts and frame.
8. Follow all operating instructions, cautions, and warnings as specified in this manual and on the charger case.

WIRING DIAGRAM



L2120S06

REPLACEMENT PARTS LIST

AMMETER
 TRANSFORMER
 TIMER, ELECTRONIC
 HEATSINK ASSEMBLY
 RELAY
 FUSE, AC
 FUSE, DC
 CONTROL CABLE
 FUSEHOLDER
 CORDSET, AC
 CORDSET, DC, SB-175 RED PLUG
 BASE ASSEMBLY

FRONT BOTTOM PANEL
 CASE ASSEMBLY, COMPLETE
 SWITCH, PUSHBUTTON
 LED HOLDER
 CAPACITOR, 6 MFD, 660 VAC
 COVER
 BACK PANEL
 LEFT SIDE PANEL
 RIGHT SIDE PANEL
 INNER MOUNTING PANEL
 FUSE PANEL
 FRONT TOP PANEL

LIMITED WARRANTY

Minuteman warrants each new Minuteman Battery Charger for defects in material and workmanship for a period of one year from the date of original purchase of the complete unit. Repairs can be made at the Minuteman factory. To do so send the defective unit with transportation charges prepaid to:

Minuteman, Inc.
111 South Rohlwing Road
Addison, Illinois 60101
Attention: Service Department

For repairs made at other than the Minuteman factory, Minuteman will provide only the replacement parts. Defective parts should be sent with transportation charges prepaid to the Minuteman factory at the previously mentioned address.

If the unit or parts are found in the reasonable judgment of Minuteman to be defective in material or workmanship, repair, or replacement will be made by Minuteman without charge for parts or labor. Repair or replacement will be at the discretion of Minuteman, with replacements being made using current models or parts performing the equivalent function. Labor charges other than those incurred at the Minuteman factory are not covered under this warranty. All expenses associated with delivering defective items to the Minuteman factory and the expense of returning repaired or replaced items from the Minuteman factory to the owner will be paid for by the owner. All warranty work accomplished at the Minuteman factory will be completed within a reasonable time after receipt of defective items.

This warranty does not cover any semiconductor parts, such as diodes, which are vulnerable to electrical overloads beyond the control of Minuteman.

This warranty does not cover any charger that has been subject to misuse, neglect, negligence, or accident, or operated in any way contrary to instructions specified on the charger case and in the owner's manual. No claim of breach of warranty shall be cause for cancellation of the contract of sale of any Minuteman charger. Minuteman assumes no responsibility for loss of time, inconvenience, or other damage, consequential or otherwise, resulting from a defective charger. All implied warranties (including merchantability) are limited in duration to the one year warranty period.

Some states do not allow the exclusion or limitation of incidental or consequential damages; or limitations on how long an implied warranty lasts, so the above limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Minuteman's obligation under this warranty is strictly and exclusively limited to the repair or replacement of defective items. Minuteman issues this warranty in good faith and with full confidence in the workmanship and quality of Minuteman products.