



Minuteman®

36 VOLT AUTOMATIC BATTERY CHARGER PART NO. 957740

Specifications

AC Input:	108-128 Volts AC, 15 Amp, 60 Hertz, single-phase
DC Output:	36 Volts DC, 36 Amp
Connections:	6- or 9-ft. AC input cord with NEMA 5-15 grounded plug 8½- or 10-ft. DC output cord with polarized connector

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.

Features

- Patented electronic timer monitors battery state of charge while charging and automatically turns charger off as battery reaches full charge
- Compensates automatically for AC input line voltage variation by high reliability ferroresonant transformer design. Supply voltage variation $\pm 10\%$ from nominal, $\pm 1\%$ maximum battery charger voltage variation, decreasing to $\pm \frac{1}{2}\%$ at finish rate with constant electrolyte temperature. No taps or rate controls to set.
- Automatic decrease of charge rate for superior battery life through good equalization of cells and low water use rate.
- Silicon diodes with inherent surge protection operated at a conservation percentage of their rating.
- Convection-cooled design for maximum reliability and minimum maintenance.

INTRODUCTION

This automatic 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 full charged and the charger turns off.

INITIAL INSTALLATION

The AC line to which the charger is to be connected must be capable of supply 15 amperes to this charger.

! CAUTION: USE ONLY ON CIRCUITS PROVIDED WITH A MAXIMUM OF 20 AMP (15 AMP IN CANADA) BRANCH CIRCUIT PROTECTION IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ANSI/NFPA 70 AND ALL LOCAL CODES AND ORDINANCES. IMPROPER CIRCUIT PROTECTION MAY RESULT IN A FIRE.

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. 14 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 subjected to damage or stress.

Do not operate this charge 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 or 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, OR OTHER FLAMMABLES.

! WARNING: TO REDUCE THE RISK OF AN ELECTRIC SHOCK, KEEP CHARGER DRY. DO NOT EXPOSE IT TO RAIN, POWER WASH DETERGENTS, OR SPRAY. FOR STORAGE, KEEP CHARGER IN A BUILDING.

! ATTENTION! Ne pas exposer a la pluie.

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.

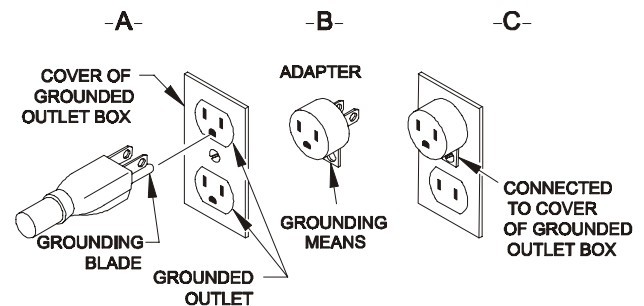
! WARNING: IMPROPER CONNECTION OF THE EQUIPMENT-GROUNDING CONDUCTOR CAN RESULT IN A RISK OF ELECTRIC SHOCK.

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 a live terminal. Refer to a qualified service agent.

Battery chargers equipped with a grounding plug, as illustrated in Figure A below, are for use on a nominal 120-volt circuit. A temporary adapter, as

illustrated in Figures B and C, may be used to connect this plug to a two-pole receptacle as shown in Figure C if a properly grounded outlet is not available. The temporary adapter should be used only until a properly grounded outlet can be installed by a qualified electrician. The green-colored rigid ear or lug extending from the adapter must be connected to a permanent ground such as a properly grounded outlet box. Make sure that the charger is connected to a receptacle having the same configuration as the plug.

GROUNDING METHODS



NOTE: The use of the adapter shown in Figures B and C is not permitted in Canada.

If a grounding type plug receptacle is not available, do not use this charger until the proper outlet is installed by a qualified electrician.

NORMAL OPERATION

The instructions printed on the charger are for daily reference.

Output Polarity:	WHITE, RED	"+"	POS.
	BLACK	"-"	NEG.

! CAUTION: USE CHARGER ONLY FOR CHARGING 36-VOLT, 18-CELL SERIES CONNECTED WET LEAD-ACID SYSTEM WITH A CAPACITY OF 240 TO 370 AMPERE-HOURS (20 HR. RATE). OTHER TYPES OF BATTERIES MAY BURST, CAUSING PERSONAL INJURY AND DAMAGE.

! ATTENTION! Utiliser pour charger uniquement les accumulateurs au plomb à électrolyte liquide. D'autres types d'accumulateurs pourraient éclater et causer des blessures ou dommages.

! DANGER: RISK OF ELECTRIC SHOCK! DO NOT TOUCH UNINSULATED PORTIONS OF THE OUTPUT CONNECTOR OR UNINSULATED BATTERY TERMINALS.

! DANGER: Risque de chocs électriques. Ne pas toucher les parties non isolées du connecteur de sorti ou les bornes non isolées de l'accumulateur.

1. With the charger DC output cord disconnected from the batteries, connect the input plug to a properly grounded 120 volt, 60 Hertz outlet with the same number and size pins as the plug.

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

2. Connect the DC output plug to the battery receptacle by grasping the plug body or handle and pushing the plug straight into the receptacle. The charger will turn on with an audible "click" after a short delay if all circuits and a battery voltage test good. The transformer will "hum" and ammeter indicate initial charge rate.

!WARNING: DO NOT DISCONNECT THE DC OUTPUT CORD FROM THE BATTERY RECEPTACLE WHEN THE CHARGER IS ON. THE RESULTING ARCING AND BURNING WILL DAMAGE THE CONTACTS AND COULD CAUSE THE BATTERIES TO EXPLODE. DISCONNECT THE AC POWER SUPPLY CORD TO TURN THE CHARGER "OFF" BEFORE DISCONNECTING THE OUTPUT PLUG.

3. Monitor the ammeter for the initial charge rate. The initial charge rate will vary from 32 to 40 amperes, depending upon the condition of the batteries and how much the batteries have been discharged. Slight variations in the initial charge rate may also result from AC input line voltages which are higher or lower than nominal. Higher line voltages increase the initial charge rate while lower line voltages reduce the charge rate. If the batteries are heavily discharged and the AC input line voltage is higher than nominal, the initial charge rate may exceed 40 amperes. Under normal conditions, the charger rate will taper to less than 40 amperes within 90 minutes. If the ammeter still reads more than 40 amperes after 90 minutes, turn the charger off by disconnecting the power supply cord from its outlet.

!CAUTION: TO PREVENT BATTERY DAMAGE, CHARGER OVERHEATING, AND TRANSFORMER BURNOUT, DO NOT ALLOW THE CHARGER TO OPERATE FOR MORE THAN 90 MINUTES WITH THE AMMETER READING IN EXCESS OF 40 AMPS. THIS IS MISUSE AND WILL CAUSE OVERHEATING AND TRANSFORMER WILL BURN OUT.

4. The charge rate will decrease to 6 to 10 amperes for the last few hours of charge if all battery cells test good.

During charge, the battery voltage increases gradually causing the charge rate to decrease. Good battery cells should each rise to approximately 2.5 volts DC causing the charge rate to reduce to less than 10 amps. Each cell accepts charge differently; normal charging with the ammeter reading in the 6 to 10 amps area for the last few hours of charge is important to achieve equalization of all battery cells every time the batteries are charged.

As batteries age, individual cells weaken resulting in lower than normal finish charge voltage. As the finish charge voltage decreases, the finish charge rate increases and no longer reduces into the 5 to 10 amps range on the ammeter. The electronic timer still determines when the batteries have reached their maximum state of charge and turns the charger off. Even though they are properly charged, older batteries will gradually lose capacity, and should be replaced when they will no longer perform as required.

The charger turns off automatically when the batteries reach full charge. The necessary charge time is affected by numerous factors. The major factors affecting the required charge time are better amp-hour capacity, depth of discharge, battery temperature, and if the battery is new or broken in. The required charge time varies with battery size and depth of discharge. Allow sufficient time, as listed in the following charge, for normal charging.

Battery Capacity (Amp-hours, 20 hr. rate)	Normal Charge Time (Hours)
240	9-12
305	12-14
370	14-16

The normal charge times listed are for batteries which have been discharged to 80% of their rated capacity. As much as 4 ADDITIONAL HOURS may be required to properly charge batteries under the following conditions:

- a. Heavily discharged batteries (more than 80% discharged).
- b. Charging new batteries (batteries with less than 50 discharge/charge cycles).
- c. Charging cold batteries (ambient temperatures below 65°F). When charging new or cold batteries, a higher than normal finishing charge voltage can be expected. This results in a low finish charge rate (2-5 amps), and additional time is required to achieve equalization of all battery cells. Refer to a qualified service agent if the

charger does not turn off within the specified time.

As batteries age, the charge rate may no longer decrease to the 6 to 10 amp finish rate. This is normal; as battery cells wear out, they weaken resulting in a lower than normal finish voltage. However, the charger will still determine when the battery is as charged as it can be and then turn off. Even though they are properly charged, older batteries will gradually lose capacity, and should be replaced when they will no longer perform as required.

⚠️ WARNING: DO NOT LEAVE THE CHARGER OUTPUT CONNECTOR CONNECTED WHILE UNATTENDED FOR TWO (2) OR MORE DAYS IN A ROW. SEVERE OVERCHARGING AND POSSIBLE DAMAGE TO THE BATTERIES WILL RESULT IF THE CHARGER ELECTRONIC TIMER KIT SHOULD FAIL AND NOT TURN OFF, OR TURN BACK ON.

5. After the charger has been turned off, disconnect the input plug from the receptacle by grasping the plug body and pulling the plug straight out of the receptacle.

⚠️ WARNING: TO AVOID DAMAGE TO THE INPUT PLUG AND CORD, DO NOT PULL ON THE CORD.

BATTERY STORAGE MAINTENANCE

When the machine is not in use, charge the batteries once a week; disconnect the plug at the end of the charge.

PROPER CARE OF DEEP-CYCLE 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 CLOTHING AND EYE SHIELDS 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 hook up the batteries improperly 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 20 cycles. New batteries and older batteries that have been in storage 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. Heavily discharging (over 60%) new batteries before they have been broken in (approximately 20 cycles) can cause permanent cell damage, resulting in reduced energy capacity and shortened life.
5. Maintain the proper electrolyte by adding water when necessary. Distilled or deionized water is free of contaminants and preferred for this use. Never allow the electrolyte level to fall below the top of the battery plates. Electrolyte levels lower 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. Hard crystalline sulfates form when batteries in storage are not maintained in a charge active state. Internal self-discharge can bring about the start of this condition in as little as three days in warm temperatures. Batteries allowed to sit unmaintained in storage will self-discharge, sulfate to various degrees, and lose capacity. Repeated charging without using the batteries between charges may recover some of the lost power, range, and life, but some permanent loss should be expected.
7. When the temperature falls below 65°F, the batteries should be placed on charge as soon after use as possible. Cold batteries require more time to fully recharge.
8. 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 framer. Electrolyte spilled on the batteries never dries or evaporates and must be cleaned off.
9. All connections to batteries that are bolted must be maintained clean and tight. Due to heating and discharge rates, bolted connections loosen over time. Re-tighten the connections twice yearly to the manufacturer's specified torque.

10. Follow all operating instructions, cautions, and warnings as specified in this manual, on the charger, and in your equipment owner manual.

TROUBLESHOOTING GUIDE

To be able to troubleshoot safely and effectively, it is important to read this guide completely before beginning any tests.

⚠ CAUTION: DO NOT DISASSEMBLE THE 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. THE FOLLOWING PROCEDURES ARE INTENDED ONLY TO DETERMINE IF A MALFUNCTION MAY EXIST IN THE CHARGER.

⚠ 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; TURNING THE CHARGER OFF DOES NOT REDUCE THE RISK.

⚠ WARNING: DO NOT OPERATE THE CHARGER IF IT IS MALFUNCTIONING. PERSONAL INJURY OR PROPERTY DAMAGE COULD RESULT.

To determine if a charger malfunction exists, identify the problem from the following list and refer to the appropriate section for detailed instructions.

1. CHARGER DOES NOT TURN ON
2. CHARGER FUSE BLOWS
3. THE AMMETER NEEDLE REMAINS AT MORE THAN 40 AMPS FOR MORE THAN 90 MINUTES
4. CHARGER DOES NOT TURN OFF
5. THE BUILDING AC LINE CIRCUIT BREAKER OR FUSE BLOWS

If the problem is other than listed above, refer to a qualified service agent for additional troubleshooting procedures.

1. CHARGER DOES NOT TURN ON
The AC plug must be disconnected and reconnected to start the charger after turn off.
Test for a live outlet by connecting a light or appliance to the same outlet.
2. CHARGER FUSE(S) BLOW
The charger fuse assembly consists of a U-shaped wire visible through a transparent cover, and is mounted on the front panel. Electrical connections to the fuse wire are soldered to the middle and each end. Each half of the fuse wire serves as an individual fuse link which protects the charger in the event one or both rectifier

diodes fail, or a reverse polarity connection is made to the batteries.

Check the fuse assembly visually for an open or blown fuse link. If both half links of the fuse assembly blow as soon as the DC output plug is connected to the battery connector, the polarity of the batteries may be reversed. If no battery or connector maintenance has been performed prior to the fuse blowing, the charger is malfunctioning. If only one half link blows, the charge rate will be low and the charger is malfunctioning.

⚠ 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.

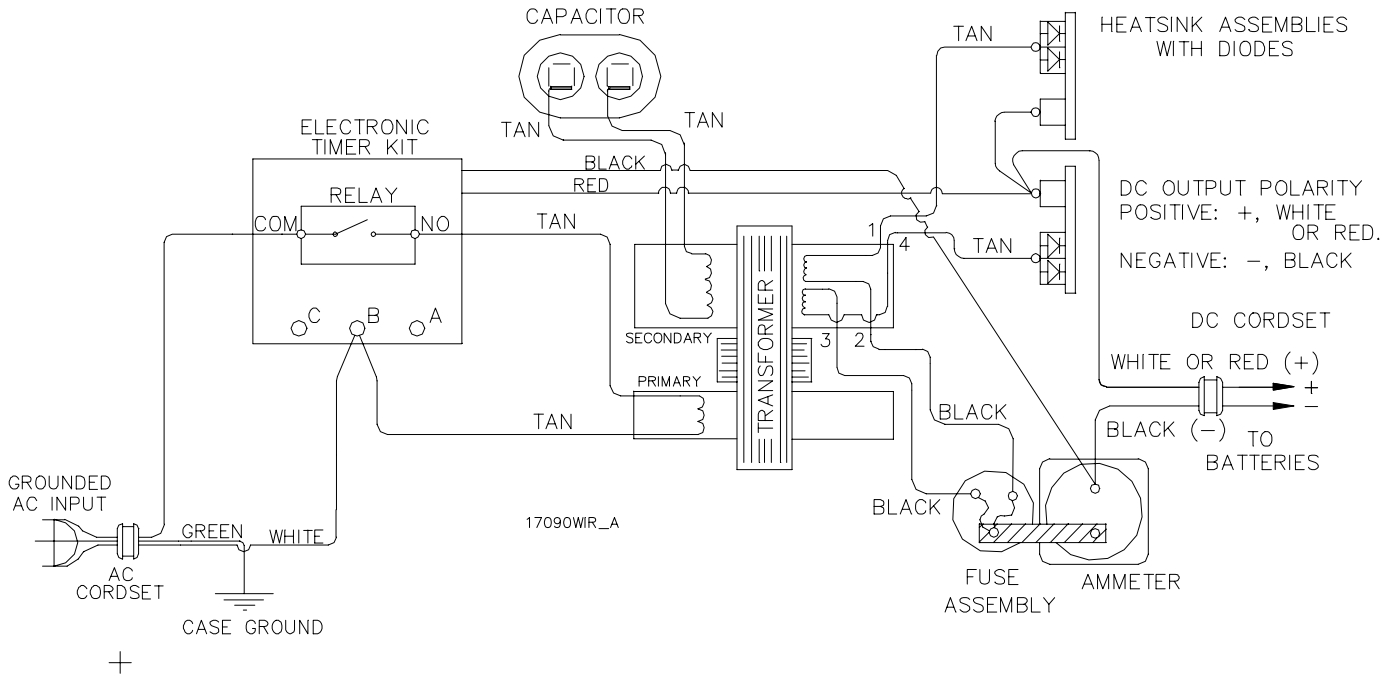
3. AMMETER NEEDLE REMAINS AT MORE THAN 40 AMPS FOR MORE THAN 90 MINUTES

This high charge rate is caused by misuse. 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 connected to a battery system of less than 36 volts, the charge rate will not taper and decrease to 40 amps or less within 90 minutes. This is caused when one or more of the batteries in the system is connected reverse polarity.

4. THE CHARGER DOES NOT TURN OFF
New batteries or batteries charged in cold temperatures may require an extended charge time to achieve full charge. However, if the charger runs for longer than the maximum listed without shutting off, the charger is malfunctioning. Turn the charger off by disconnecting the input plug before disconnecting the charging plug.
5. THE BUILDING AC LINE CIRCUIT BREAKER OR FUSE BLOWS

This condition can be caused by a charger problem, a "weak" fuse or circuit breaker protecting the circuit, or an overloaded circuit. If the building AC power fuse or circuit breaker blows, connect the charger to other outlets (on different circuits) in the building. If the charger operates properly on other circuits, have a qualified electrician inspect and test the original circuit. If the charger causes other fuses or circuit breakers (in the building) to blow, the charger should be tested for a problem.

WIRING DIAGRAM



PARTS LIST FOR 36 VOLT AUTOMATIC BATTERY CHARGER PART NO. 957740 120 VAC / 60 HZ

PART NO.	QTY.	DESCRIPTION
31236S	1	CASE ASSEMBLY
17095S	1	TRANSFORMER ASSEMBLY
02390S	1	CAPACITOR, 6 MFD, 660 VAC
16946S	2	HEATSINK ASSEMBLY W/ 2 DIODES IN PARALLEL
08774S	1	FUSE ASSEMBLY
16823S	1	AMMETER, 50 AMP, W/ CORNER MOUNTING STUDS
24840S	1	TIMER KIT, 36 VDC, 120 VAC
* 04484S	1	RELAY, FOR ELECTRONIC TIMER
** 23385S	1	RELAY, FOR ELECTRONIC TIMER
04484S	1	TIMER KIT RELAY, 36 VDC, SPSTNO, 120 VAC
02028S	1	CORDSET BUSHING, 7W-2, FOR 14/3 INPUT CORDSET
02008S	1	CORDSET BUSHING, 8P-2, FOR 10/2 OUTPUT CORDSET
02506S	1	AC CORDSET, 14/3, 72" W/ 125V/15A PLUG
08329S	1	DC CORDSET, 10/2, 108", W/ SB175 GRAY PLUG

* FOR USE WITH CHARGERS BUILT BEFORE 04/04
 ** FOR USE WITH CHARGERS BUILT AFTER 04/04

LIMITED WARRANTY

Minuteman warrants each new Battery Charger for defects in material and workmanship for a period of one (1) year from the date of manufacture 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 with 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 two years from date of manufacture 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.