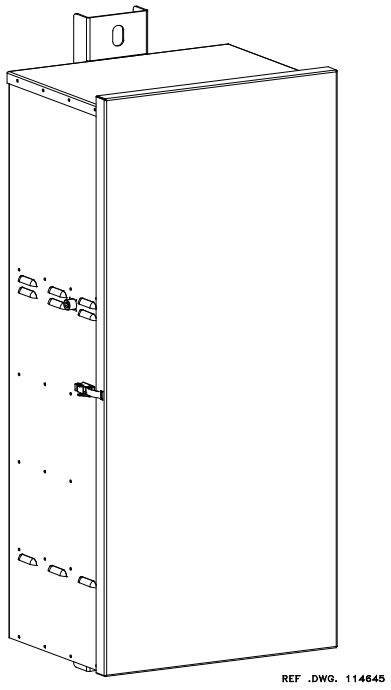
# INSTALLATION & USER'S GUIDE

## 875W & 1750W SINGLE PHASE

# LNFT Series Pole Mounted Emergency Lighting Central Inverter




Inverter Systems, Inc.
East Bridge Street
Morrisville, PA 19007
U.S.A.

Tel: 800-967-5540

114645E LNFT MANUAL

This unit contains LETHAL VOLTAGES. All repairs and service should be performed by AUTHORIZED SERVICE PERSONNEL ONLY! There are NO USER SERVICEABLE PARTS inside this unit.

# IMPORTANT SAFEGUARDS

**When using electrical equipment, you should always follow basic safety precautions, including the following:**

1. **READ AND FOLLOW ALL SAFETY INSTRUCTIONS.**
2. **Do not install near gas or electric heaters or in other high-temperature locations.**
3. **Use caution when servicing batteries. Depending on battery type, batteries contain either acid or alkali and can cause burns to skin and eyes. If battery fluid is spilled on skin or in the eyes, flush with fresh water and contact a physician immediately.**
4. **Equipment should be mounted in locations where unauthorized personnel will not readily subject it to tampering.**
5. **The use of accessory equipment not recommended by Manufacturer may cause an unsafe condition and void the warranty.**
6. **Do not use this equipment for other than its intended use.**
7. **Qualified service personnel must perform all servicing of this equipment.**

# SAVE THESE INSTRUCTIONS

**The installation and use of this product must comply with all national, federal, state, municipal, or local codes that apply. If you need help, please call Service. 610-868-5400**

**C A U T I O N**

**READ ENTIRE MANUAL AND REVIEW ALL DOCUMENTATION BEFORE ATTEMPTING SYSTEM INSTALLATION!**

FOR SERVICE OR INSTALLATION INFORMATION:

PHONE: 1-800-967-5540
WEBSITE: info@invertersystemsinc.com

**FOR YOUR PROTECTION....**
**PLEASE COMPLETE AND RETURN WARRANTY REGISTRATION CARD IMMEDIATELY.**

# TABLE OF CONTENTS

SECTION 1

# SAFETY WARNINGS

Read the following precautions before you install this emergency lighting system.

**IMPORTANT SAFETY INSTRUCTIONS**

SAVE THESE INSTRUCTIONS. This manual contains important instructions that you should follow during installation and maintenance of the system and batteries. Please read all instructions before operating the equipment and save this manual for future reference.

**DANGER**

This system contains **LETHAL VOLTAGES**. AUTHORIZED SERVICE PERSONNEL should perform all repairs and service **ONLY**. There is **NO USER SERVICEABLE PARTS** inside the Emergency lighting power supply.

**WARNING**

- Do not install near gas or electric heaters or in other high-temperature locations.
- Use caution when servicing batteries. Battery acid can cause burns to skin and eyes. If acid is spilled on skin or in the eyes, flush with fresh water and contact a physician immediately.
- Equipment should be mounted in locations where it is not readily subjected to tampering by unauthorized personnel.
- The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition.
- Do not use this equipment for other than intended use.
- Only qualified service personnel (such as a licensed electrician) should perform the system and battery installation and initial startup. Risk of electrical shock.

## BATTERY STORAGE

This shipment contains rechargeable, maintenance free batteries. They must be stored properly to assure proper operation upon installation. Therefore, please follow the following guidelines when storing batteries:

- Store in clean, dry and cool location. While it is safe to store batteries in environments of -18 to 40 degrees C (0 to 104 degrees F), it is recommended that you do not store at temperatures above 30 degrees C (86 degrees F). The warmer the ambient temperature, the higher the self discharge rate of the battery. This will require more frequent recharge of the individual batteries until they are placed in service.
- Avoid storing in direct sunlight or in front of or near heaters, heat duct or other sources of heat.
- Do not store directly on concrete structures. Always store on wooden pallets or metal shelves near floor level.
- Place the batteries in service within 180 days of receipt. If you cannot place the batteries in service within the 180 days, then the batteries must be recharged every 180 days, (more frequently if stored at elevated temperatures) while in storage. Failure to do so will void the warranty and may cause irreversible damage to the battery.

SECTION 2

# INTRODUCTION

**Keep this Guide in the folder mounted inside the unit.**

This unit is a microprocessor controlled PWM (Pulse Width Modulated) pure sine wave based DC to AC power inverter utilizing MOSFET technology. It integrates a fully automatic 3-rate battery charger, a solid-state transfer system, control circuitry, self testing and recording optional digital meter display, and maintenance free sealed lead calcium type batteries. The system components are carefully matched to make the unit a completely self-contained, fully automatic standby power source for operation on all types of lighting loads. The batteries are sized and tested per UL-924 and Life Safety Code ANSI / NFPA 101, providing emergency power for a minimum of 90 minutes.

If the duration of a power failure is greater than the batteries storage capability, the inverter will automatically shut down when the battery voltage reaches 87.5% of the nominal DC voltage. This feature protects the battery from being permanently damaged from a deep discharge that could cause cell reversal. This battery protection feature is called "Low Voltage Disconnect" or L.V.D.

When the AC power is restored after a full discharge, the system will be ready for another power failure within 24hrs. If another power failure occurs before the 24-hour recharge time, the run time will be decreased.

The optional keypad/display panel assembly incorporates an alphanumeric 4x20 vacuum fluorescent character display and a 4-button keypad. All user interface functions are available from the panel assembly.

Utilizing a small footprint, this unit is for use with any lighting load including quartz, HID, incandescent, and fluorescent and halogen.

## HOW TO USE THIS MANUAL

This manual tells you how to install, start, operate, and communicate with your unit and lets you know how to get more information for special situations.
Please record your unit's part number, serial number, and model number below. You can find these numbers on the label on the outside of the cabinet door.

Part Number _____

Serial Number _____

Model Number _____

## Record Keeping

An on-site permanent log of the inspection, testing, and maintenance of the emergency electrical power supply system shall be maintained in accordance with this manual. The log shall include:

The date on which the inspection, testing, and maintenance exercise was carried out.

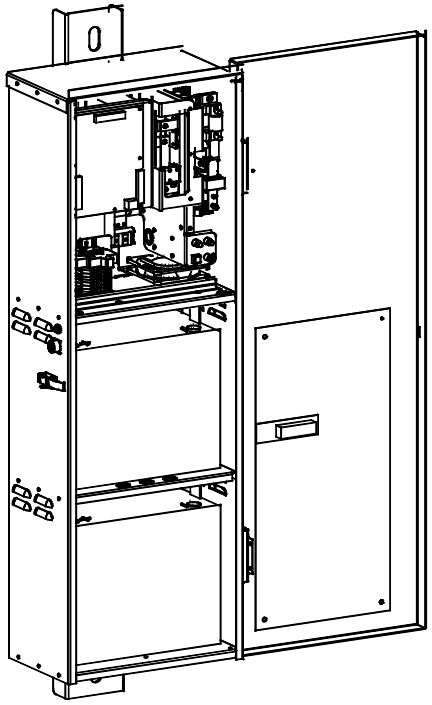
The name of the person(s) who performed the inspection, testing and maintenance.

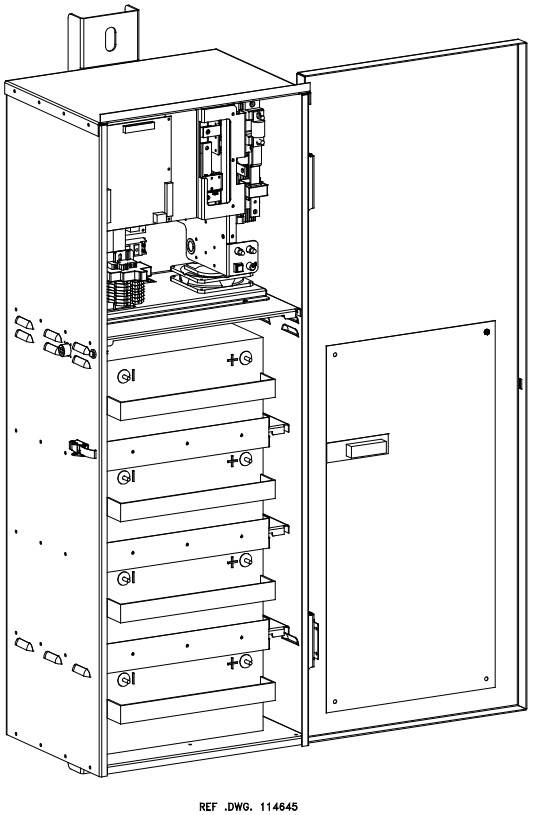
A note of any unsatisfactory condition observed or discovered, and the steps taken to correct the condition.

## Service and Support

We are committed to outstanding customer service. A service technician is available **24** hours a day, **365** days a year. Service is also available **24** hours a day to give you access to technical notes and product information.

**NOTE:** Please have your unit's Serial and Part numbers available when you call; this number is located on the door.



SECTION 3

# BEFORE INSTALLING THE SYSTEM

## System Dimensions and Weights

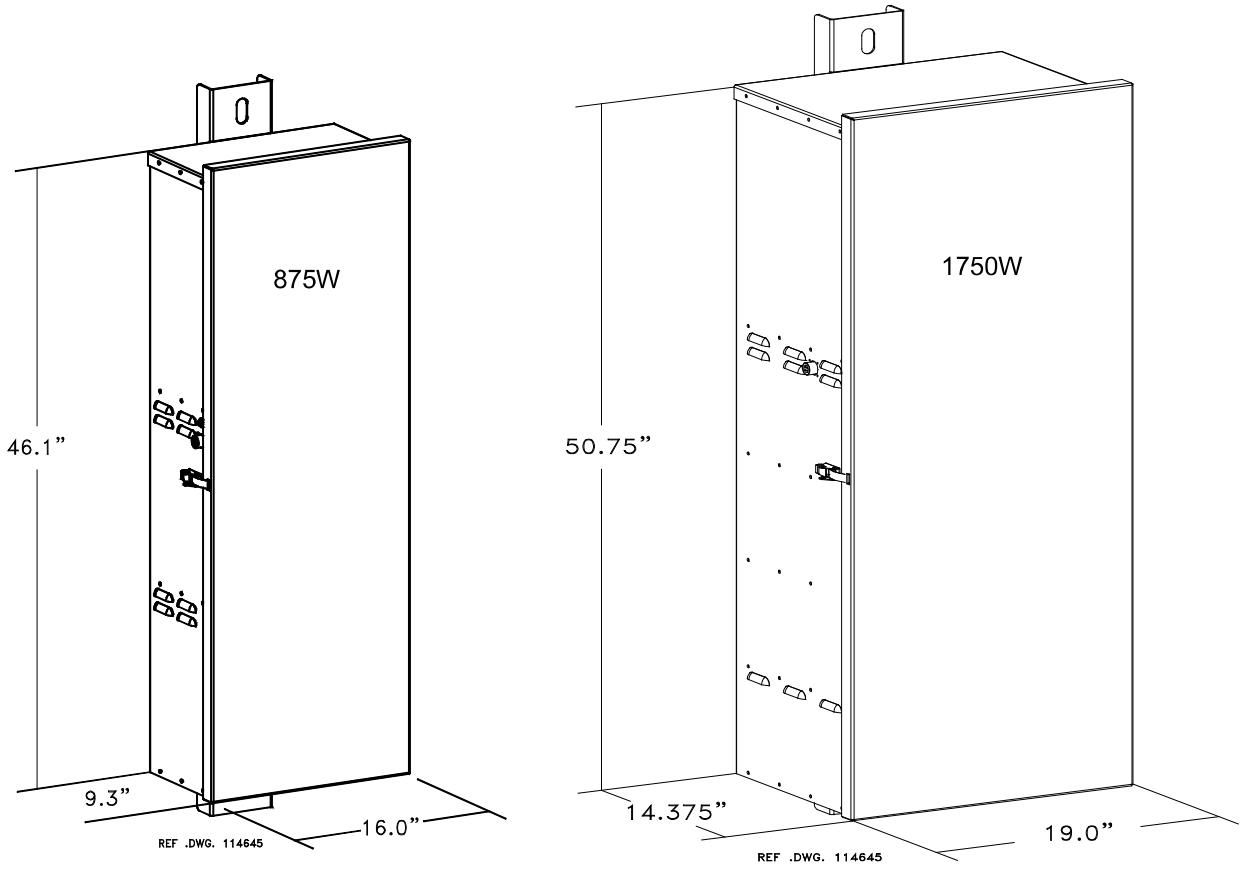



**Figure 3.1 System Dimensions**

**Table 3.1 System weight [in lbs. (kg)]**

| | 875W | 1750W |
|---|---|---|
| **Inverter Cabinet** | 232 (105) | 280 (127) |
| **Batteries** | 158 (72) | 316 (144) |
| **System Total** | 390 (177) | 596 (271) |

## Receiving and Moving the Unit and the Batteries

Systems weigh several hundred pounds, (see Table 3.1; ask your sales representative for additional information). Make sure you are prepared for these weights before you unload or move the unit or the batteries. Do not install any batteries until you have permanently installed the unit and connected all conduit and wiring.

### Ventilation

The air around the unit must be clean, dust-free, and free of corrosive chemicals or other contaminants. Do not place the system or batteries in a sealed room or container.

### Operating Temperature

System can operate from -20 to 50° (-4 to 122°F) and up to 95% relative humidity. The batteries' service life is longer if the operating temperature stays below 25°C (77°F).

### Batteries

The temperature should be near 25°C (77°F) for optimum battery performance. Batteries are less efficient at temperatures below 18°C (65°F), and high temperatures reduce battery life. Typically, at about 35°C (95°F), battery life is half of what it would be at a normal temperature of 25°C (77°F). At about 45°C (113°F), battery life is one-fourth of normal.

Do not allow tobacco smoking, sparks, or flames in the system location because hydrogen is concentrated under the vent cap of each cell of the battery. Hydrogen is highly explosive, and it is hard to detect because it is colorless, odorless, and lighter than air.

Every type of battery can produce hydrogen gas, even sealed maintenance-free batteries. The gas is vented through the vent caps and into the air, mainly when the unit is charging the batteries. The batteries produce the most hydrogen when maximum voltage is present in fully charged batteries. The amount of current that the charger supplies to the batteries (not the battery ampere-hour) determines how much hydrogen is produced.

### High Altitude Operation

The maximum operating ambient temperature drops 1°C per 300m (2°F per 1000 ft) above sea level. Maximum elevation is 3000m (10,000 ft).

# Installation Overview

Figure 3.2 and Figure 3.3 shows typical installations of system.

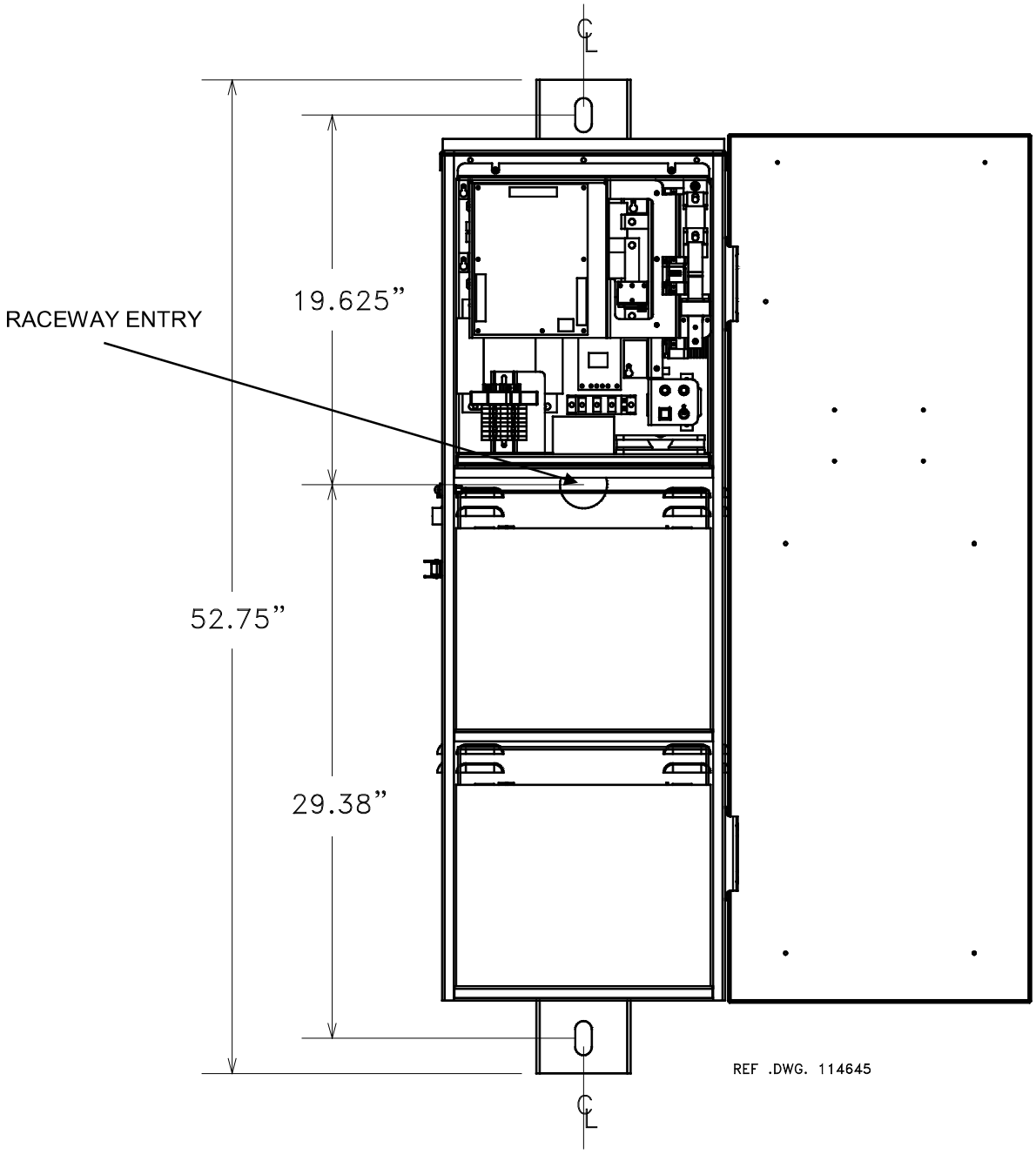



**Figure 3.2 Typical Hardwire Installation for 875W**

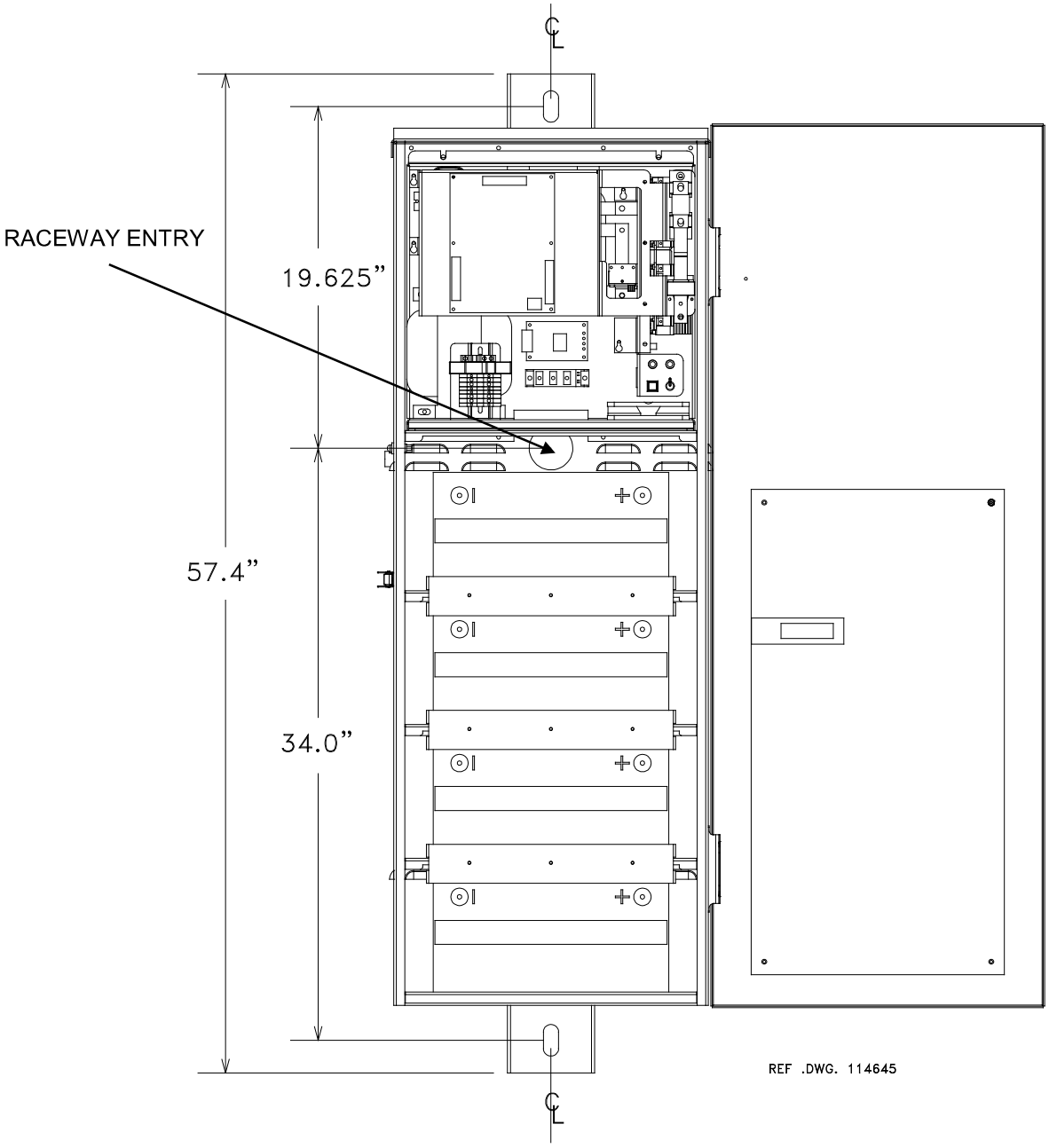



**Figure 3.3 Typical Hardwire Installation for 1750W**

SECTION 4

# AC INPUT & AC OUTPUT INSTALLATION

**WARNING**

Only qualified service personnel (such as a licensed electrician) should perform the AC installation. Risk of electrical shock.

Read the following cautions before you continue.

**CAUTION**

- Unit contains hazardous AC and DC voltages. Because of these voltages, a qualified electrician must install the system, AC line service, and batteries. The electrician must install the AC line service according to local and national codes and must be familiar with batteries and battery installation.
- Before you install, maintain, or service the unit, always remove or shut off all sources of AC and DC power and shut off the system. You must disconnect AC line input at the service panel and turn off the Installation Switch, open Main AC Input Fuse, and the Battery Fuse to make sure the unit does not supply output voltage.
- Whenever AC and/or DC voltage is applied, there is AC voltage inside the unit; this is because the unit can supply power from AC line or from its batteries. To avoid equipment damage or personal injury, always assume that there may be voltage inside the unit.
- Remove rings, watches, and other jewelry before installing the AC wiring. Always wear protective clothing and eye protection and use insulated tools when working near batteries. Whenever you are servicing an energized unit with the door open, electric shock is possible; follow all local safety codes. TEST BEFORE TOUCHING!

1. Open the unit's door. Make sure the installation switch is off, and the Main AC Input Fuse is removed and the Main DC Battery Fuse is removed inside the unit.
2. Look at the ID label on the inside of the door. Write down the following information:

   Input Voltage: _____
   Output Voltage: _____
3. Now, make sure the input and output voltages are what you need.
   - Does the input voltage available for the system at the AC service panel match the input voltage shown on the unit's ID label?

     Service Panel Voltage = _____ Input Voltage ___Yes /___No
   - Does the output voltage on the ID label match the voltage for your loads (protected equipment) ?

     Load Voltage = _____ Output Voltage ___Yes/___No

     If you answered NO to either of the preceding questions, call SERVICE.
4. Now, use the information you wrote down in Step 2 to find the correct circuit breaker for the service panel that is for your system.

**Table 4.1 Recommended Circuit Breaker for Maximum Input Current**

| System | Input Voltage (Vac) | Max. Current | Recommended Circuit Breaker |
|---|---|---|---|
| 875W | 120V | 10 amps | 15A, 1-Pole |
| 875W | 208V | 6 amps | 10A, 2-Pole |
| 875W | 240V | 5 amps | 10A, 2-Pole |
| 875W | 277V | 4 amps | 10A, 1-Pole |
| 875W | 347V | 4 amps | 10A, 1-Pole |
| 875W | 480V | 3 amps | 10A, 2-Pole |
| 1750W | 120V | 19 amps | 25A, 1-Pole |
| 1750W | 208V | 11 amps | 15A, 2-Pole |
| 1750W | 240V | 10 amps | 15A, 2-Pole |
| 1750W | 277V | 8 amps | 10A, 1-Pole |
| 1750W | 347V | 7 amps | 10A, 1-Pole |
| 1750W | 480V | 5 amps | 10A, 2-Pole |

** WARNING: THE EXTERNAL INPUT CIRCUIT BREAKER PROTECTING THE SYSTEM MUST BE A "MOTOR START", DELAYED TRIP TYPE. THIS IS DUE TO MAGNETIC INRUSH CURRENT DRAWN DURING APPLICATION OF AC POWER. PLEASE NOTE THAT THIS APPLIES TO ANY UNIT THAT HAS A DIFFERENCE BETWEEN THE INPUT AND THE OUTPUT VOLTAGES.

5. Write down the circuit breaker value that applies to your system from Table 4.1: _____
6. Now, refer to Table 4.2 and use the notes to find the proper gauge wire for the recommended circuit breaker recorded in step 5.

**Table 4.2 Recommended Minimum Wire Sizes**

| Read These Important Notes! | For this Input Circuit Breaker Size... | Use this Size 90°C Copper Wire | |
|---|---|---|---|
| | | AWG | $mm^2$ |
| This table lists the AWG and mm2 wire size for each circuit breaker size. The minimum recommended circuit breaker sizes for each model and voltage application are listed in Table 4.1. The temperature rating of conductor must not be less than 90° C wire.<br>Based on the ampacities given in Tables 310-16 of the National Electrical Code, ANSI/NFPA 70-1993 and NEC article 220. Circuit conductors, must be the same size (ampacity) wires and equipment-grounding conductors must meet Table 250-95 of the National Electrical Code. Code may require a larger wire size than shown in this table because of temperature, number of conductors in the conduit, or long service runs. Follow local code requirements. | 10, 15, 20 | 12 | 3.31 |
| | 25, 30 | 10 | 5.26 |

7. The input circuit breaker in the input service panel provides the means for disconnecting AC to the unit. Only authorized persons shall be able to disconnect AC to the unit [see NEC 700-20]. If you are using the input circuit breaker to disconnect AC, you must make sure that only authorized persons have control of the circuit breaker panel to meet the requirements of NEC 700-20.

**CAUTION**

To prevent electrical shock or damage to your equipment, the Installation Switch and the circuit breaker at the input service panel should be turned off. The Main DC Battery Fuse and the Main AC Input Fuse should be removed.

8. Install the conduit. You must run the AC input service conductors and AC output conductors through separate conduits. Emergency output conductors and non-emergency output conductors must also be run through separate conduits. Emergency output circuits shall be installed in dedicated conduit systems and not shared with other electrical circuits as described in NEC 700-9(b).

The next step explains where to make the AC connections to the system.

**INSTALLING AC INPUT WIRES:**

Connect AC utility from the service panel to the system's terminal block labeled **"IN"**. **For 2-wire input:** connect hot wire to the black terminal block marked **"IN"**, connect the common wire to the white terminal block marked **"IN"** and connect the ground wire to the green/yellow terminal block next to the input terminal blocks. **For 3-wire input:** connect each hot wire to each of the black terminal block positions marked **"IN"**, connect ground wire to the green/yellow terminal block next to the input terminal blocks. (See Figure 4.1)

**INSTALLING AC OUTPUT WIRES:**

Connecting load wires to system's terminal block labeled **"OUT"**. Connect hot wire to the black terminal block marked **"OUT"**, the common wire to the white terminal block marked **"NEU"** and the ground wire to the green/yellow terminal block next to the output terminal blocks. (See Figure 4.1)

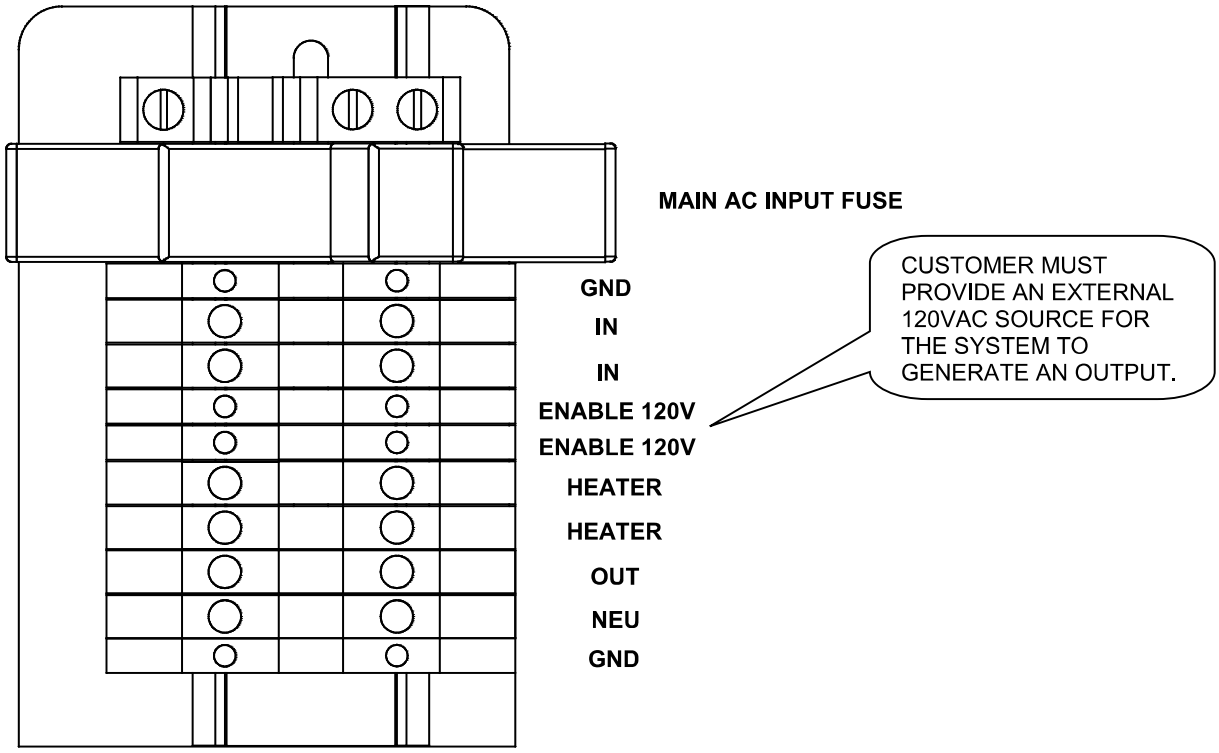



**Figure 4.1 AC Input and Output connections**

SECTION 5

# INSTALLING BATTERIES AND DC WIRING

**WARNING**

Only qualified service personnel (such as a licensed electrician) should perform the battery and DC wiring installation. Risk of electrical shock.

This section explains how to install system batteries and cables. An electrician who is familiar with battery installations and applicable building and electrical codes should install the batteries.

**WARNING**

The batteries that will need to be installed in this system could cause you harm or severely damage the electronics if proper precautions are not followed. Batteries connected in series parallel configuration could produce lethal voltages with extreme currents. All batteries should be inspected for damage prior to installation. Never install a battery that is leaking electrolyte. Battery terminals should be cleaned with a wire brush to remove any oxidation. All tools should be insulated. Rubber gloves and safety glasses are recommended. With the Main battery fuse removed, make connections to battery positive first, each string's positive and inverter positive. Then make connections to battery negative, each string's negative and inverter negative. Finally, connect each string's positive to negative.

## Safety Instructions

**IMPORTANT SAFETY INSTRUCTIONS**

SAVE THESE INSTRUCTIONS

This section contains important instructions that a qualified service person should follow during installation and maintenance of the system and batteries. ONLY a qualified service person should work with the batteries.

**CAUTION**

Full voltage and current are always present at the battery terminals. The batteries used in this system can produce dangerous voltages, extremely high currents, and a risk of electric shock. They may cause severe injury if the terminals are shorted together. You must be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals during battery installation. Do not touch un-insulated battery terminals.

A qualified electrician familiar with battery systems and required precautions must install and service the batteries. Any battery used with this unit shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924. Cabinets are design to be used with, and batteries must be replaced with, manufacturer battery number or a manufacturer approved equivalent (see the battery wiring diagram that came with the system). If you substitute batteries not supplied by manufacturer, the unit's UL listing is void and the equipment may fail. Installation must conform to national and local codes as well. Keep unauthorized personnel away from batteries.

The electrician must take these precautions:
Wear protective clothing and eyewear. Batteries contain corrosive acids or caustic alkalis and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Don't carry metal objects in your pockets where the objects can fall onto the batteries or into the cabinet.

Tools must have insulated handles and must be insulated so that they do not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the batteries, and do not lay them where they could fall onto the batteries or into the cabinet.

Install the batteries as shown on the battery-wiring diagram provided with the system. When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet.

Align the cables on the battery terminals so that the cable lug does not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.

**CAUTION**

If you are replacing batteries or repairing battery connections, follow the procedure in the section 7 to shut down your system and remove both AC and DC input power.

# Before Installing the Batteries

## Tools

**CAUTION**

Always use insulated tools when you work with batteries. Always torque connections to the manufacturer's recommendations.

When you work with system batteries, you need the following tools. The tools must be insulated so they do not short battery terminals to the cabinet. Wear the safety equipment required by local code whenever the door is open and whenever you are working on batteries. Other tools may be necessary for batteries.

- Digital volt-ohm meter
- 7/16" open end wrench
- 3" extension socket
- Ratchet
- Wire brush
- Electrical tape
- Conductive grease or petroleum jelly
- Brush (to apply grease or petroleum jelly to terminals)
- Safety equipment required by local codes
- Torque wrench calibrated in inch-pounds or Newton-meters
- 7/16" socket wrench
- Safety glasses with side shields

## Battery Voltage (vdc)

| Models | 875W | 1750W |
|---|---|---|
| Battery Volts | 24VDC | 24VDC |

### Battery Cable Sizing
The battery cable or wire used is No. 4 AWG for all applications:

### DC Disconnect
Systems have a Main Battery Fuse inside the cabinet; this fuse lets you remove DC power from the batteries. Make sure this fuse is removed before installing the batteries.

## Installing and Connecting the Batteries

### Battery Wiring Diagram
Refer to the "Battery Interconnect" diagram (drawing # 303518 for one-battery string or # 303498 for two-battery strings, located in the print package behind the system door). This battery-wiring diagram shows how you should install the batteries, make terminal, and fuse connections. Use the diagram as you follow the steps below.

### Location
The system batteries are housed inside the unit. Before you start installing the batteries, you must install the system in its permanent location. If you have not already done this, see Section 3.

**CAUTION**

To prevent damage to your equipment, do not move the system after the batteries are installed.

To make sure a location is acceptable for the system, review the requirements in Section 3.

### Main Battery Terminal Connections
Positive and Negative cables from inverter are factory installed. Insulate (cover) expose lugs until connections are required.

### Fuse
All units come with a fuse to protect the system. The battery-wiring diagram (drawing # 303518 for one-battery string or # 303498 for two-battery strings) shows the fuse location; a label next to the fuse shows the fuse size.

**Verify that the Main DC Battery fuse in the cabinet is removed before connecting the batteries.**

### Arranging the Batteries

***NOTE*** *As you arrange the batteries, you must be wearing the required safety equipment.*

Arrange the batteries in the system only as shown in the battery-wiring diagram. This arrangement is designed to maximize airflow around the batteries. The cabinets are designed so that battery cases should never touch. Air should be free to circulate. Clean the entire surface of all battery terminals with the wire brush before you install the batteries to create good contact points.

Load the batteries into the system. Starting with the bottom shelf, load one shelf at a time.

**CAUTION**

Never install the batteries in an airtight enclosure.

## Connecting the Cables to Batteries

When you make battery terminal connections, use the torque wrench to tighten the battery terminal connections securely. For most batteries, you can find out what torque value to use by finding the battery number on the front of the battery. Then, use Table 5.1 to find the torque value for that battery.

Now, follow these steps to connect the cables:

**Table 5.1 Battery Torque**

| Battery Type | Torque |
|---|---|
| MCG-120 | Torque to 70 in lbs. (7.9 Nm) |
| BBG-205RT | Torque to 70 in lbs. (7.9 Nm) |

1. Using the battery-wiring diagram, determine which batteries belong to each battery string.

   ***NOTE:*** *For standard 90-minute runtimes, 875W model has one-battery string and 1750W model has two-battery strings.*

2. Clean the cable connectors with the wire brush before you make the battery connections.

   ***NOTE*** *As you carry out the following step, use these guidelines:*
   *If you are using conductive grease, apply a thin coating of high-temperature conductive grease on each post and every cable connector before you assemble and torque the connection to slow corrosion.*
   *If you use nonconductive grease like petroleum jelly, do not apply any grease before you make the connections and torque them. Instead, make the connection first; then, torque it to the value shown in Table 5.1. After you make the connection, apply a coating of the nonconductive grease to the hardware at the battery terminals.*

3. Connect the red positive (+) wire(s) as shown on the battery-wiring diagram.

   **(One-battery string)** Connect the inverter red positive (+) wire as shown on the battery-wiring diagram.

   **(One-battery string)** At this time remove the insulation cover from the red wire from inverter positive (+) and connect to battery #2 positive (+).

   **(Two-battery strings)** Connect the red battery cable that parallels the strings together and the inverter red positive (+) wire as shown on the battery-wiring diagram.

   **(Two-battery strings)** Red jumper wire from battery #2 positive (+) to battery #4 positive (+); at this time remove the insulation cover from the red wire from inverter positive (+) and connect to battery #4 positive (+).

4. Connect the black negative (-) wire(s) as shown on the battery-wiring diagram.

   **(One-battery string)** Connect the inverter black negative (-) wire as shown on the battery-wiring diagram.

   **(One-battery string)** At this time remove insulation cover from the black wire from inverter negative (-) along with the Temperature Probe Lug and connect to battery #1 negative (-).

   **(Two-battery strings)** Connect the black battery cable that parallels the strings together and the inverter black negative (-) wire as shown on the battery-wiring diagram.

   **(Two-battery strings)** Connect the Temperature Probe Lug along with one end of the black jumper wire to battery #3 negative (-). Connect the other end of the black jumper wire to battery #1 negative (-); at this time remove insulation cover from the black wire from inverter negative (-) and connect to battery #1 negative (-).

5. In each battery string, connect the battery cables between the batteries as shown in the battery-wiring diagram (positive terminal to negative terminal).

   **(One-battery string and Two-battery strings)** Black jumper wire from battery #1 positive (+) to battery #2 negative (-).

   **(Two-battery strings only)** Black jumper wire from battery #3 positive (+) to battery #4 negative (-).

   Torque the all connections to the value shown for your battery in Table 5.1.

**CAUTION**

Hazardous voltage is present! System batteries are high current sources. These batteries can produce dangerous voltages, extremely high currents, and a risk of electric shock.

6. Using a voltmeter, check the DC voltage between the negative (-) and the position (+) on the inverter terminals. This voltage should be approximately the battery voltage record on the unit ID label. If it is greater than + or – 5% Vdc, review the battery wiring diagram. Correct any wiring errors and recheck the DC voltage; do not go on until your measurement is within + or – 5% Vdc. If the measurement is too high and you cannot find the cause of the problem, call SERVICE.

**CAUTION**

If you do not verify that voltage and current direction are correct, the equipment may fail.

## Replacing the Batteries

**CAUTION**

A battery can present a risk of electrical shock and high short circuit current. A qualified electrician familiar with battery systems should service the batteries.

Review all the safety instructions at the beginning of this chapter before you replace any batteries.

### Use the Same Quantity and Type of Battery

**CAUTION**

You must use the same quantity and type of battery. Substituting batteries not supplied by manufacturer voids the UL listing and may cause equipment damage.

To ensure continued superior performance of your system and to maintain proper charger operation, you must replace the batteries in the system with the same number of batteries. These batteries must be the same types as the original batteries. The replacement batteries should have the same voltage and ampere-hour rating as the original batteries.

### Handle Used Batteries with Care!

Assume that old batteries are fully charged. Use the same precautions you would use when handling a new battery. Do not short battery terminals or the battery string with a cable or tool when you disconnect the batteries! Batteries contain lead. Please dispose of old batteries properly.

**CAUTION**

Do not dispose of batteries in a fire because the batteries could explode. Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

### Dispose of Batteries Properly

**CAUTION**

Batteries contain lead. Many states and local governments have regulations about used battery disposal. Please dispose of the batteries properly.

## Battery Diagram for 875W

**24VDC (One String)**

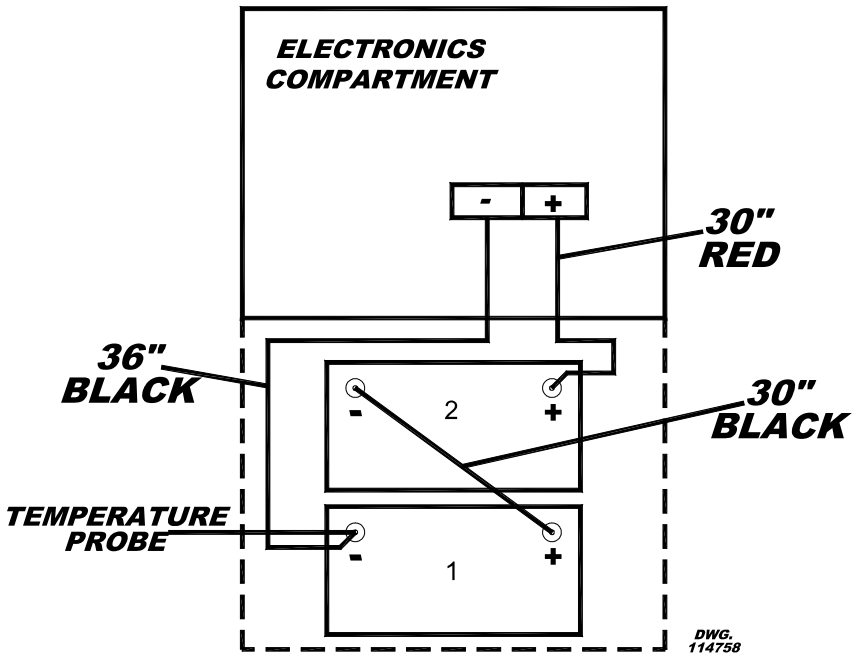



**Figure 5.1 One-String Battery Interconnect Diagram**

## Battery Diagram for 1750W

**24VDC (Two Strings)**

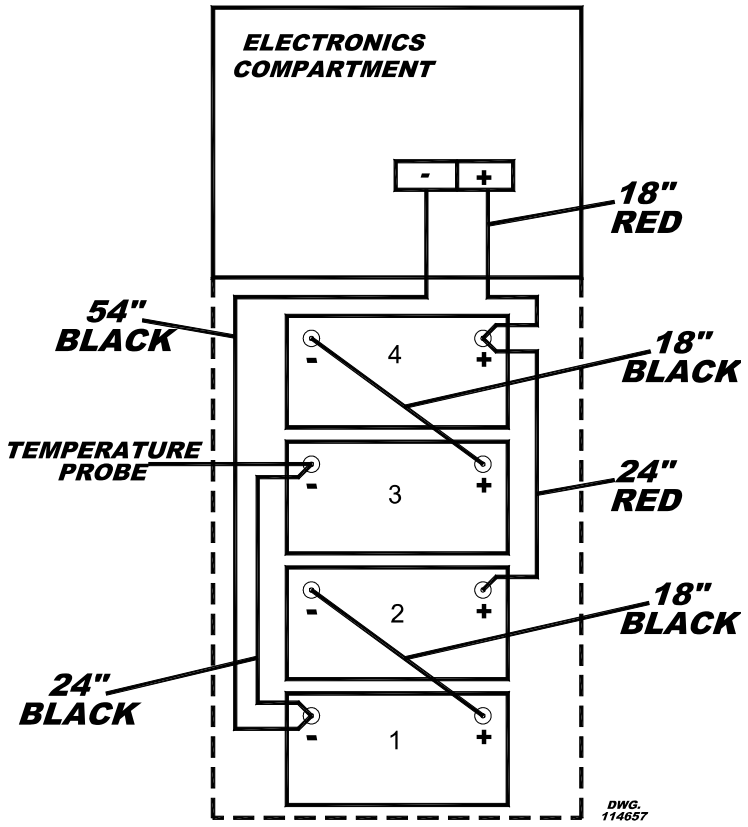



**Figure 5.2 Two-String Battery Interconnect Diagram**

SECTION 6

# OPERATION

## Enable Input Circuit

The Enable terminal blocks are located between the input and output terminal blocks (see Figure 4.1). An external 120V sinusoidal input must be connected to these two terminal blocks. When the system is in a normal mode or on battery back up and the external source is present, the system generates an output.

If utility mains fail and the enable circuit voltage is not present the system will transfer to emergency mode with no output. This stand-by mode will last 24-hours (system will automatically shutdown until utility is restored) or until the utility mains is present.

## System Status Light

The following is a description of the system status light located on the outside of the cabinet. When the Red light is on solid, this indicates a normal condition. When the Red light flashes at a 1/second interval, this indicates that the system is running normally on battery power (during monthly and yearly self-test), and when the Red light flashes at a 4/second interval, this indicates a fault condition (including the system running on battery power with utility mains failure).

Fault conditions are: High/Low AC input Volts, High/Low Battery Charger, Near Low Battery, Low Battery, Inverter Fault, Output Fault, Output Overload, Load Reduction Fault and High Ambient Temperature.

SECTION 7

# STARTUP AND SHUTDOWN PROCEDURE

## STARTUP PROCEDURE

For the initial startup of the system, follow these instructions. Failure to do so will void warranty.

**CAUTION: HAZARDOUS VOLTAGES – ONLY QUALFIED SERVICE PERSONNEL SHOULD PERFORM PROCEDURE.**

1. Verify that the installation switch located on the inverter chassis is in the OFF position and the Main AC Input Fuse is removed.
2. Turn on AC input at the building service center.
3. Locate the DC Pre-charge Switch, see figure 7.1; press it for five seconds; then, install the Main DC battery fuse. If a large flash occurs, the batteries are not connected properly. Call service immediately.
4. Install Main AC Input Fuse. (See figure 4.1)
5. Turn the installation switch to the ON position. System will run on batteries, then transfer to normal mode. Red Status light located on the left outside of the cabinet is on solid.

## SHUTDOWN PROCEDURE

1. Turn the installation switch located on the inverter chassis to the OFF position.
2. Interrupt the AC Mains to the machine by the Distribution Panel Breaker.
3. Remove the main DC battery fuse located on the inverter chassis.
4. Locate the DC Discharge Switch; see figure 7.1; press it for 10 seconds.
5. Remove the Main AC input Fuse. (See Figure 4.1)

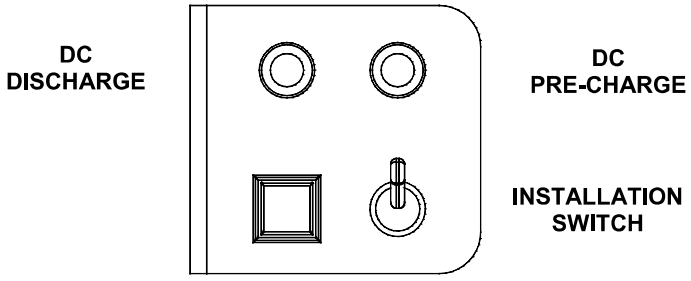



**Figure 7.1 DC Pre-charge Switch, DC Discharge Switch & Installation Switch**

**CAUTION:**

**HAZARDOUS VOLTAGES STILL EXIST AT THE BATTERY TERMINAL CONNECTIONS AND WITHIN THE SYSTEM. AUTHORIZED SERVICE TECHNICIANS MUST DISCHARGE DC CAPACITORS AND TURN OFF UTILITY POWER BEFORE SERVICING EQUIPMENT.**

**DO NOT LEAVE THE SYSTEM SHUTDOWN FOR A PROLONGED LENGTH OF TIME. LEAD BASED BATTERIES WILL EXPERIENCE PERMANENT DAMAGE FROM LACK OF CHARGING AFTER A FEW MONTHS.**

SECTION 8

# OPTIONAL KEYPAD/DISPLAY PANEL

The optional Keypad/Display Panel assembly consists of a 4 x 20 vacuum fluorescent display and a 4-button keypad. The 4 buttons can navigate through all the menus by using the left and right arrow keys, the ENTER and the ESCAPE.

The default menu will scroll between the status screen and the Identification/Date-Time screen. To view the other menu options from the default screen, press the ENTER key, and then press the left or the right arrow key to go to the desired menu.

The Menu's available are Meter, Test Log, Event Log, Alarm Log, User Setup, Factory Setup, Status, System Information, and Test Mode.

Once the desired menu has been reached, press the ENTER key to gain access to this menu. Once into the menu, use the left or right arrow key to scroll to different functions within the menu. Press the ENTER key again to gain access to the desire function. To exit, press the ESCAPE key until the desired level has been reached. (See figure 8.1)

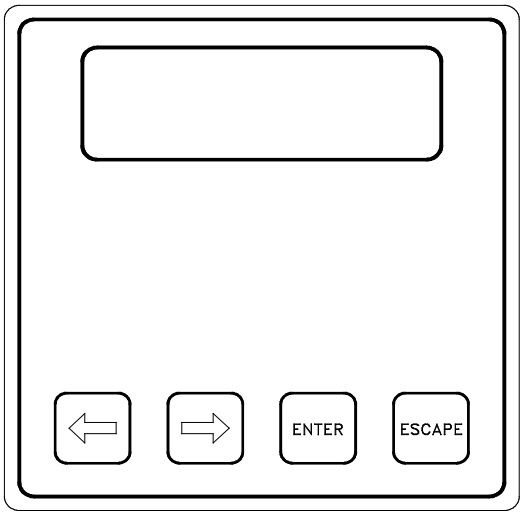



**Figure 8.1 Keypad / Display**

## Keypads Controls

**Table 8.1 Keypad Functions**

| Key Name | Description |
|---|---|
| Enter (Blue) | Pressing this key will view menus. |
| Escape (Black) | Pressing this key will exit out of menus and return to the Identification/Date-Time screen. |
| [ ◄ ] (Red) | This key functions as Left scroll key. |
| [ ► ] (Red) | This key functions as Right scroll key. |

## Meter Functions

To get to the meter functions from the default screen, press the **ENTER** key, scroll to the METER menu using the left or the right arrow key, then press the **ENTER** key again. Use left or the right arrow key to view the meter function desired.

**Table 8.2 Meter Functions**

| Function | Description |
|---|---|
| Voltage Input | Measures the AC Input Voltage to the Inverter. |
| Voltage Output | Measures the AC Output Voltage from the Inverter. |
| Current Output | Measures the AC Output Current from the Inverter. |
| Battery Voltage | Measures DC Battery Voltage. |
| Battery Current | Measures the DC Battery Current. When in charge mode, the current will be positive. When in Inverter mode, the current will be negative. |
| Battery Temperature | Optional feature – measures temperature at the battery. |
| Internal Temperature | Measures the ambient temperature inside the system. |
| Inverter Minutes | Indicates the total minutes the system has run on inverter. |
| System Days | Indicates the total days the system has been on-line. |
| VA Output | Indicates the AC Volts-Amps of the Inverter output. |
| Inverter Watts | Indicates the DC Watts (Battery Power) the Inverter is processing. |

## Test Log

To get to the Test log menu from the default screen, press the **ENTER** key, scroll to the Test log menu using the left or right arrow key, then press the **ENTER** key again. Use the left or right arrow key to view the test desired, and the press the **ENTER** key for more information.

The Test log indicates the Date, Time and Duration of the test. It also indicates if it was a monthly or yearly test, and it records the output voltage, the output current, the ambient temperature, and if there were any alarm conditions.

The numbers of tests that can be captured in the test log are 75. The format is first in is first out so; test number one is the most recent test.

## Event Log

To get to the Event log menu from the default screen, press the ENTER key, scroll to the Event log menu using the left or right arrow key, then press the ENTER key again. Use the left or right arrow key to view the event desired, and then press the ENTER key for more information.

The Event log is identical to the test log in parameters it stores. The Event log captures data every time there is a transfer from utility power to battery power. The numbers of events that can be captured in the event log are 75. The format is first in is first out so; event number one is the most recent event.

## Alarm Log

To get the Alarm log menu from the default screen, press the **ENTER** key, scroll to the alarm log menu using the left or right arrow key, then press the **ENTER** key again. Use the left or right arrow key to view the alarm desired, and then press the **ENTER** key for more information.

Any alarm that has occurred is captured in the Alarm log. The numbers of alarms that can be captured in the alarm log are 75. The format is first in is first out so; alarm number one is the most recent alarm.

## Alarms

To get to the Alarm menu from the default screen, press the **ENTER** key, scroll the Alarm menu using the left or right arrow key, then press the **ENTER** key again.

The alarm menu displays all present alarms. If there are no alarms, the display screen will indicate no alarms.

## User Setup

To get to the User Setup menu from the default screen, press the ENTER key, scroll to the User Setup menu using the left or right arrow key, then press the ENTER key again. The display will prompt for a password.
****** The password is left arrow, right arrow, left arrow, and right arrow. ******

Once the password is entered, the user has access to change the following functions:
Date, Time, Month Test, Year Test, Low VAC, High VAC, Near Low Battery, Low Battery, High Temp, Load Reduction Current.

## Date

The parameters are Day of Week, Month, Day, and Year.
To change any of the parameters, use the left or right arrow key depending if you want to increase or decrease. Once the parameter is correct, press the ENTER key and the next parameter can be changed.

## Time

The parameters are Hour and Minute. The 24-hour standard is used so 2:00 PM would be 14 hours. Use the left or right arrow key to change the parameters and the ENTER key to scroll between parameters.

## Month Test, Year Test

The parameters are Date, Time (Hours and Minutes) use the left or right arrow key to change the parameters and the ENTER key to scroll between parameters.

**Low VAC, High VAC, Near Low Battery, Low Battery, High Temperature**
Parameters are set in Volts AC, Volts DC, and Degrees Centigrade respectively.
Use the left or right arrow key to turn on or off this alarm. When the alarm is turned on, a number will appear. To change the number, press the **ENTER** key and then use the left or right arrow key. Once the desired number is reached, press the **ENTER** key and this will return to the top-level menu.

**Table 8.3 Near Low Battery Fault Chart**

| DC Voltage | Near Low Battery |
|---|---|
| 24VDC | 21.5VDC |

**Load Reduction Current**
Parameters are set in Amps AC.
Use the same technique as the above alarms for modification.
Load Reduction Current is a useful diagnostic tool that will automatically generate a fault when the output current is 10 percent higher or lower than the set-point number.

## Status
Indicates the Status of the machine – Line Present, Battery Charging, Ready, Battery Power, and if any faults are present.

## System Information
Indicates Model Number, Serial Number and Current Software Revision Level of the system.

## Test Mode
To initiate a Test and cause the inverter to run on battery power.

The following is a description of the system status located on the panel of the Vacuum Fluorescent Display.

## AC Present

When the AC Mains is present, the words “LINE PRESENT” will illuminate. If a power failure was long in duration or the AC mains was disconnected by some other means (Circuit breaker open) the “LINE PRESENT” would not be illuminated. When the control circuit senses that the line has dropped below an acceptable level (Black Out, Brown Out, or Transient), the inverter will energize for at least one minute. So, if the power failure was a momentary glitch, the “LINE PRESENT” would be illuminated but the inverter would be running.

## System Ready

When the system has adequate battery voltage to transfer, the words “SYSTEM READY” will illuminate.
This feature prevents damage from multiple deep discharges of the battery.

## Battery Charging

When the AC Mains is connected to the line and the battery is charging under normal conditions, the words “BATTERY CHARGING” will illuminate.

## Battery Power

When the inverter is producing output power (battery is being discharged), the words “BATTERY POWER” will be illuminated.

## Fault

This is a summary Fault indication. When there is a fault condition present, the word “FAULT” will illuminate. To view which fault is present, use the keypad and vacuum fluorescent display feature.

The panel display will provide the user with a variety of information. It has a full compliment of Meter functions, Control functions and Program functions.

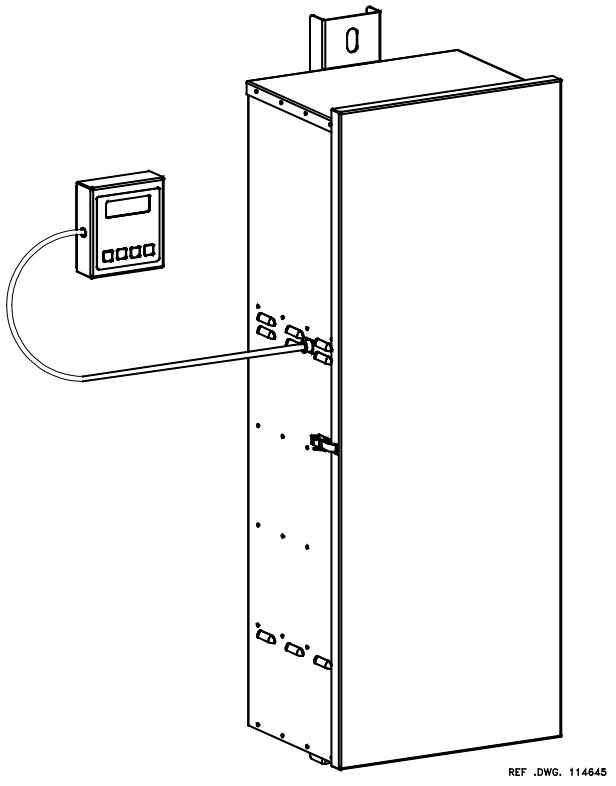



**Figure 8.2 Keypad / Display Connected to System**

SECTION 9

# SPECIFICATIONS

General Specifications

| | | |
|---|---|---|
| **Input** | Voltage | 120 or 208 or 240 or 277 or 347 or 480Vac 1-phase 2-wire +10% -15%. |
| | Input Power Walk-in | Walk-in limiting inrush current to less than 125%, 10 times for 1 line cycle |
| | Input Frequency | 60Hz, +/- 3% |
| | Synchronizing Slew Rate | 1Hz per second nominal |
| | Protection | Input Circuit Fuse |
| | Harmonic Distortion | < 10% |
| | Power Factor | .5 lag/lead |
| **Output** | Voltage | 277Vac 1-phase 2-wire. |
| | Static Voltage | Load current change +/-2%, battery discharge +/-12.5% |
| | Dynamic Voltage | +/- 2% for +/-25% load step change, +/-3% for a 50% load step change, recovery within 3 cycles |
| | Harmonic Distortion | < 3% THD for linear load |
| | Output Frequency | 60Hz +/- .05Hz during emergency mode |
| | Load Power Factor | .5 lag to .5 lead |
| | Inverter Overload | 115% for 10 minutes, 125% for 12 line cycles |
| **Battery** | Type | Valve-regulated sealed lead-calcium. |
| | Charger | Microprocessor controlled for various battery types and temperature compensating (recharge per UL924 spec) |
| | Protection | Automatic low-battery disconnect; automatic restart upon utility return. |
| | Disconnect | Fuse |
| | Runtime | 90-Minute runtime minimum @ -4 degrees F (-20 degrees C) with Heater Option |
| **Environmental** | Altitude | < 10,000 feet (above sea level) without derating |
| | Operating Temperature | 32 to 122 degrees F (0 to 50 degrees C), Optional: -4 degrees F (-20 degrees C) |
| | Storage Temperature | -4 to 158 degrees Fahrenheit (-20 to 70 degrees Celsius) (electronics only) |
| | Relative Humidity | < 95% (non-condensing) |
| **General** | Design | Line interactive PWM inverter type utilizing MOSFET technology with 2mS transfer time. |
| | Generator Input | Compatible with generators. |
| | Optional Panel | Microprocessor controlled 4 x 20-charactor vacuum fluorescent display with touch pad controls/functions & scrolling system status. |
| | Optional Metering | Input & Output Voltage, Battery Voltage, Battery & Output Current, Output VA, Temperature, Inverter Wattage. |
| | Alarms | High/Low Battery Charger Fault, Near Low Battery, Low Battery, Load Reduction Fault, Output Overload, High/Low AC Input Volts, High Ambient Temperature, Inverter Fault, Output Fault |
| | Status Light | Normal, Battery Backup, Fault |
| | Warranty | 1 year standard warranty includes all parts, labor, & travel expenses within 48 contiguous states. Up to 10 years prorated warranty on batteries. Extended warranties, preventative maintenance and customized service plans are available. |
| | Factory Start-up | Purchase factory start-up & receive 1 additional year of warranty. |
| | 5 Year Service Plan | Purchase 5 year service plan & receive free factory start-up. |
| **Physical** | Cabinet | NEMA 3R, Single-door, Powder Coat Paint, CRS. |
| | Cooling | Forced Air. Temperature controlled Fan. |
| | Cable Entry | Back |
| | Access | Front Only |

SECTION 10

# MAINTENANCE AND SERVICE

The Self-testing feature of the inverter ensures that the system is tested at least once per month for 5 minutes and once per year for 90 minutes. If there are any problems with the self-tests, the fault log shall indicate which faults occurred. Please see the fault descriptions and troubleshooting guide.

A few simple maintenance operations performed periodically will help ensure many years of trouble free operation. Battery terminals should be checked for tightness and corrosion. If severe corrosion is evident, maintenance is required to correct this situation.

Since the unit depends on unrestricted airflow for cooling of power handling components, it is important to keep the air vents free of any obstruction. If the environment tends to be extremely dusty, occasionally blow away any accumulation of dust on components. Please follow the shutdown procedure before cleaning.

**CAUTION:** Follow the shutdown procedure (See Section 7) before cleaning. An authorized technician only should perform Service!

**Table 10.1 Preventive Maintenance Schedule**

| SERVICE TO PERFORM: | PERFORM SERVICE EVERY: | | |
|---|---|---|---|
| | 3 MONTHS | 6 MONTHS | 12 MONTHS |
| **1. TEST UNIT:**<br><br>**NOTE:** Perform manual test only when critical load is connected but not required.<br>----- Output voltage should be present.<br>----- Confirm operations of Red Status Indicator. | X | | |
| 2. INSPECT BATTERIES:<br><br>----- All connections are tight.<br>----- Connections have no corrosion. (Clean if necessary). | | X | |
| **CLEAN UNIT:** NOTE: Unit must be shut down during this service.<br>----- Inspect air vents and clean if necessary.<br>----- Clean excessive dust from inside cabinet.<br>----- Clean excessive dust from fan. | | | X |

"X" Indicates when to perform service. Lines below the "X" are for the date of service.

# TROUBLE SHOOTING CHART

| THE NUMBER IN THE CHART INDICATES ORDER IN WHICH PROBLEMS SHOULD BE CHECKED | SYMPTOMS | Inverter will not run during a power failure | System draws excessive AC input current | System noisy, excessive transformer hum during normal run conditions | AC output voltage low during a utility power failure | System overheats, smells, smokes, etc. | System noisy, transformer hum during a power failure | Inverter jitters or staggers during a power failure | System blows battery fuse (& fuses in battery cabinet if applicable) | Charger not charging properly, batteries low or dead | Charger stays in HI charge | Batteries require continuous addition of water to keep proper level (optional w/ wet cells) | Battery acid leaking in cabinet or around tops of batteries | Battery voltage does not read properly after Installation of fresh cells | Battery Voltage low or non existent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PROBLEMS** | | | | | | | | | | | | | | | |
| Installation switch on inverter in off position | | 1 | | | | | | | | | | | | | |
| Shorted MOSFET module(s) | | 3 | | | 3 | 3 | | 1 | 3 | | | | | | |
| No AC input voltage | | | | | | | | | | 2 | | | | | |
| Defective inverter | | 4 | | | 2 | 2 | 1 | 3 | 5 | | | | | | |
| Output volt-ampere rating of unit being exceeded | | 6 | 1 | | 1 | 1 | 2 | 2 | 6 | | | | | | |
| Ambient temperature too high, vents blocked | | | | | | | | | | | | 3 | 1 | | |
| Shorted load | | | 2 | | 4 | | 3 | | | | | | | | |
| Reverse battery diodes shorted | | | | | | | | | 2 | | | | | | |
| Open battery fuse | | 2 | | | | | | | | | | | | | 1 |
| Battery polarity wrong | | | | | | | | | 1 | | | | | | |
| Defective charger | | 11 | | 1 | | 4 | | | | 6 | 1 | 1 | 2 | 4 | 2 |
| Battery capacity low | | 7 | | | | | | | | | | | | 3 | 3 |
| Low water in battery (Optional w/ wet cells) | | 10 | | | | | | | | 3 | | | | | 4 |
| Wrong amount of battery cells in series | | 9 | | 2 | | 6 | | | 4 | 4 | 2 | 2 | 4 | 1 | 5 |
| Batteries dead, low or defective | | 8 | | | | | | | | 5 | 3 | 4 | 3 | 2 | |
| Transfer module and/or control circuit malfunction | | 5 | | | | | | | | | | | | | |
| Transformer not connected for proper voltage | | | 3 | 3 | | 5 | | | | 1 | | | | | |

SECTION 11

# OPTIONAL HEATER

The Heater option contains all the required components to maintain the batteries at a constant temperature of 25 deg. C or 77 deg. F. It comes pre-wired and programmed and should require no operator interface.

The Heater Option consists of a Temperature Controller, Solid State Switch, Temperature Sensor, and Heating Element.

The Temperature Controller is preset at the factory. The programmed temperature is factory set to 25 deg. C or 77 deg. F.

The Temperature Sensor is an RTD type and is located in the cable bundle on the left side of the third battery shelf.

There is a heating element on the inside of the door. Each battery shelf has insulated foam foil and provides an even distribution of heat over the entire surface of the shelf. This even distribution eliminates hot spots and uneven heat distribution between the batteries.

The Temperature Controller is factory programmed and should only be changed by authorized factory personnel.

SECTION 12

# WARRANTY

## RETURN MATERIAL AUTHORIZATION (RMA) POLICY

No return material is accepted without written "Return Material Authorization"(RMA). An RMA number is obtainable by contacting the Field Service Department.

Every effort will be made to correct problems over the phone before a RMA is granted or a service trip made. Cooperation will save both time and expense for customer and manufacturer.

If it is deemed necessary to return material, the RMA number must appear on shipping labels, packing slips, and bills of lading.

## OUT OF WARRANTY REPAIR CHARGES AND LABOR

Contact Field service for current parts and labor rates. A minimum rate will be assessed. The manufacturer will not proceed with repairs of an out of warranty unit until authorization in the form of a purchase order is received from the customer. The unit for repair must be returned prepaid with an RMA number on the carton. For travel to the job site, a quote "Not to Exceed" estimate will be given. A purchase order to cover that amount is required before a trip to the job site is made.

## LIMITED WARRANTY

The parts and on-site labor for the electronics portion of this equipment are warranted against defects in workmanship and material for a period of one year from time of shipment, but in no case will this warranty be valid if installation of equipment is not accomplished within 180 days from date of shipment. Batteries cannot be disconnected from the unit for long periods (180 days) or they will not be able to charge, creating malfunction of both batteries and/or electronics and thereby voiding the warranty. Systems ordered with "Heavy Lead" batteries over 25 Ah have a one year unconditional battery warranty with an additional prorated warranty contingent upon timely return of warranty registration card and the terms called out in the particular battery warranty sheet. See individual battery warranty policy.

The warranty does not cover damage caused by abuse, improper environmental conditions, shipping damage, improper electronics and/or battery installation, unauthorized modifications, service by unauthorized personnel, transportation of damaged equipment, or acts of war. Damage due to lack of maintenance (where applicable) or damage resulting from installation in areas with other than normal temperatures are not covered. See the battery warranty policy for details, as adverse environmental conditions reduce battery life and void the warranty. Replacement of fuses, pilot lamps, and/or contractor labor is not included in warranty. Damage do to acts of nature, such as, but not limited to, lightning, flooding, explosions and earthquakes, are not covered.

The warranty is limited to the repair and/or replacement of parts and/or units that upon examination at our factory and/or job site are determined to be defective and in our judgment are subject to repair or replacement.
All such repair shall be manufacturer's exclusive remedy. A date code, part number and serial number identify all such units.

**TO THE EXTENT ALLOWED BY LAW, MANUFACTURER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, AND LEED WARRANTIES OR MERCHANT ABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ANY IMPLIED WARRANTY OF MERCHANT ABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY. TO THE EXTENT ALLOWED BY LAW, THE MANUFACTURER SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, INJURIES TO PROPERTY, LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT.**

Special on site extended warranties are also available upon request. The warranty period may be adjusted because of special circumstances, but only by arrangement with the manufacturer at the time of purchase.

All in or out of warranty repaired material or replacement units/parts carry a 90-day new part guarantee. Return of your original repaired component or unit is not guaranteed.

This limited warranty is for the 48 contiguous states.

For international warranty information, call the Field Service Department. See telephone number in front of manual. The standard warranty can be extended and renewed for a nominal fee. Please contact the factory for pricing information.