

**EPS 3000**  
**12 to 36 kVA**  
**Uninterruptible Power System**  
**Installation and User's Guide**



**SQUARE D**

## IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS -This manual contains important instructions for all EPS 3000 UPS models that must be followed during operation and maintenance of the UPS and its auxiliary equipment. See page 4-1 for Battery Safety Instructions.

### WARNING

ENCLOSURE OPENINGS EXPOSE HAZARDOUS VOLTAGES. ALWAYS REFER SERVICE TO QUALIFIED PERSONNEL ONLY.

### NOTE

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.

### NOTE

This equipment generates and uses radio frequency energy, and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

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# EPS 3000 12 to 36 kVA Uninterruptible Power System Installation and User's guide

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## Revision history

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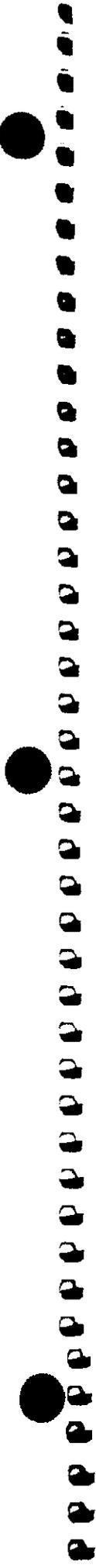
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**How To Use This Manual:**

This manual is designed for ease of use and easy location of information

To quickly find a specific topic, look in the Contents on page iii.

To quickly find the meaning of terms used within the text, look in the Glossary.

This manual uses Noteboxes to convey important information. Noteboxes come in four varieties:



**WARNING**

A **WARNING notebox** indicates information provided to protect the user and service personnel against safety hazards and/or possible equipment damage.



**CAUTION**

A **CAUTION notebox** indicates information provided to protect the user and service personnel against possible equipment damage.



**IMPORTANT**

An **IMPORTANT notebox** indicates information provided as an operating instruction, or as an operating tip.



**NOTE**

A **NOTE notebox** indicates information provided as an operating tip or an equipment feature.

# Introduction

## 1.0 Scope

This manual describes the EPS 3000 family of Uninterruptible Power Systems (UPS). The EPS 3000 UPS is shown in Figure I-1.

The manual is divided into four sections:

### Section I — Introduction

This section describes the EPS 3000 family of Uninterruptible Power Systems, including a general description of the system and its internal components, a description of available options, and system specifications.

### Section II — installation

This section describes the installation of the EPS 3000 UPS. It also includes receiving, handling, storage, and installation procedures.

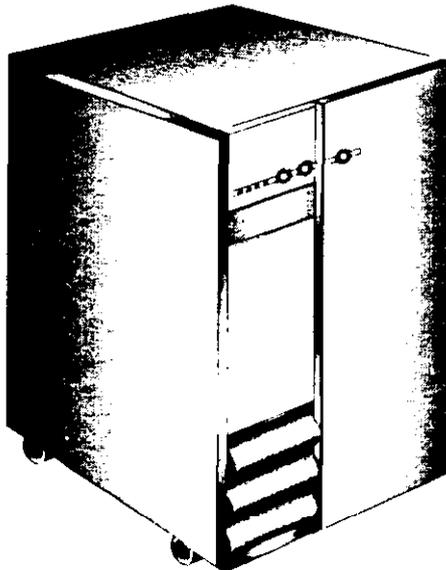
### Section III — Operation

This section presents operating information for EPS 3000 UPS systems, including an overview of system operation, controls and indications, and operating procedures.

### Section IV — Maintenance

This section describes the maintenance of the EPS 3000 UPS, including safety instructions, preventive maintenance, and information about replacement parts.

Figure I-1: EPS 3000 UPS



## 1.1 General Description

EPS 3000 family consists of compact, high-efficiency Uninterruptible Power Systems which are available in power ratings from 12 to 36 kVA, and are optimized for compatibility with nonlinear computer-type loads. Computer-aided UPS diagnostics and modular construction assure that any required service can be identified and completed rapidly. Remote system monitoring, remote annunciation of UPS performance signals, and communication capabilities allow total control of the UPS by its user.

The EPS 3000 UPS and its auxiliary equipment are designed for installation in a room where humidity and temperature can be controlled. The recommended and maximum environmental parameters are listed in the "Specifications" section of this document.

Major components of the EPS 3000 UPS include:

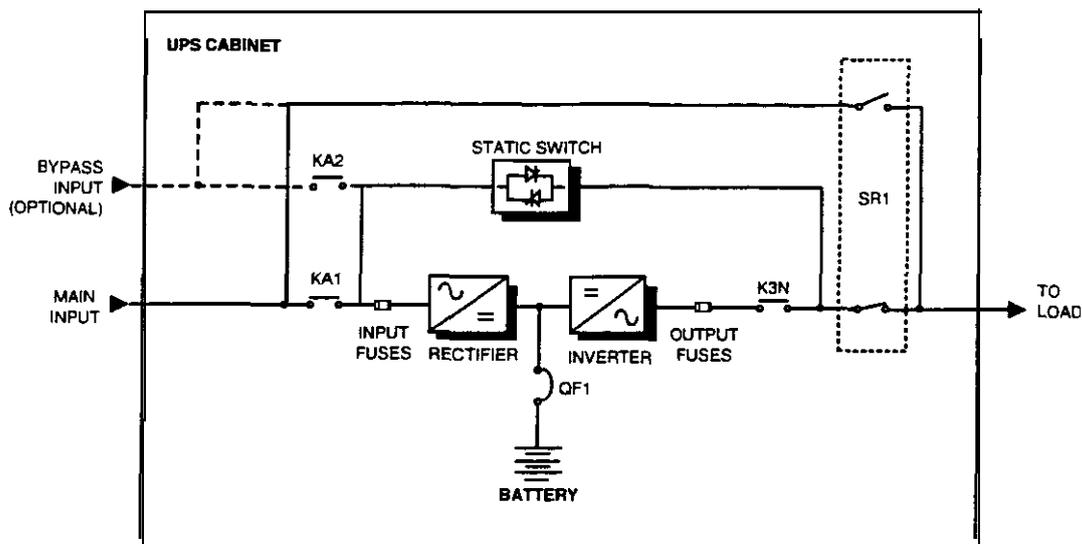
- Rectifier — Converts AC input voltage to DC voltage.
- Inverter — Pulse-width modulated (PWM) static inverter converts DC from the rectifier, or from the batteries when in battery operation mode, into AC output voltage to maintain attached load(s).
- Static switch — Automatically supplies the attached load from the bypass source when the inverter is off.
- Battery system — Stores energy for utilization by the inverter and attached load in the event that utility AC power is lost or of unacceptable quality.

Figure I-2 shows a single-line diagram of a typical UPS installation. During normal operation, utility power (Main Input) is supplied to the UPS rectifier. The inverter converts the DC voltage to three-phase regulated AC voltage, which in turn supplies the attached load. During power failure conditions, the inverter is supplied by the stored energy in the batteries, and the load is powered continuously with no disruption.

The EPS 3000 UPS is rated for 206 or 220VAC input and output. When different input and/or Output voltages are specified, external transformers provide step up/down functions as required. These transformers are housed in auxiliary cabinets, which may also house additional filtering, and an output distribution panel board. Additionally, an extended battery cabinet is available.

The EPS 3000 UPS and all auxiliary equipment is listed for safety by Underwriters Laboratories, Inc. (UL) under UL Standard 1776 - Uninterruptible Power Systems; and also listed as Underwriters Laboratories (CUL) under Canadian Standards Association (CSA) standard C22.107.

Figure 1-2: Single-line Diagram, EPS 3000 UPS



MODEL NUMBER	INPUT VOLTAGE (VAC)	OUTPUT VOLTAGE (VAC)	OUTPUT RATING (kVA/kW)	INPUT CURRENT (Amperes)	TOTAL WIDTH (mm/in)	NET WEIGHT (kg/lb)	HEAT LOSS (Btu/hr)
<b>EPS 3012</b>							
EPS-3012/22,66	208	208	12/8	26	521/20.5	268/590	3374
EPS-3012Z22.66	208	208	12/8	26	1041/41	386/850	3722
EPS-3012/MM,66	220	220	12/8	25	521/20.5	268,590	3374
EPS-3012fMM.66	220	220	12/8	25	1041/41	368,850	3722
EPS-3012/42,66	480	208	12/8	12	1041/41	386/850	3722
EPS-3012144.66	480	480	12/8	12	1562/61.5	482/1060	4079
EPS-3012/62,66	600	208	12/8	9	1041/41	386/850	3722
<b>EPS 3018</b>							
EPS-3018/22,66	208	208	18/12	39	521/20.5	290,640	4549
EPS-3018/22.66	208	208	18/12	39	1041/41	409/900	5060
EPS-30181MM.66	220	220	18/12	37	521/20.5	290/640	4549
EPS-3018/MM,66	220	220	18/12	37	1041/41	409/900	5060
EPS-3018142.66	480	208	18/12	17	1041/41	409/900	5060
EPS-3018/44,66	480	480	18/12	17	1562/61.5	505/1110	5583
EPS-3018/62,66	600	208	18/12	14	1041/41	409,900	5060

Table: 1-1: EPS 3000 Model Specifications

MODEL NUMBER	INPUT VOLTAGE (VAC)	OUTPUT VOLTAGE (VAC)	OUTPUT RATING (kVA/kW)	INPUT CURRENT (Ampere)	TOTAL WIDTH (mm/in)	NET WEIGHT (kg/lb)	HEAT LOSS (Btu/hr)
EPS 3024							
EPS-3024Q2.66	206	206	24/16	53	603/23.75	544/1200	6747
EPS-3024/22,66	206	206	24/16	53	1207/47.5	771/1697	7444
EPS-3024/MM,66	220	220	24/16	50	603/23.75	544/1200	6747
EPS-3024/MM,66	220	220	24/16	50	1207/47.5	771/1697	7444
EPS-3024/42,66	460	209	24/16	23	1207/47.5	771/1697	7444
EPS-3024/44,66	480	480	24/16	23	1810/71.25	970/2134	6157
EPS-3024162.66	600	206	24/16	16	1207/47.5	771/1697	7444
EPS 3036							
EPS-3036/22,66	206	206	36/24	78	603/23.75	612/1350	9099
EPS-3036/22,66	206	208	36/24	76	1207/47.5	840/1847	10121
EPS-3036/MM,66	220	220	36/24	74	603/23.75	612/1350	9099
EPS-3036/MM,66	220	220	36/24	74	1207/47.5	840/1847	10121
EPS-3036/42,66	480	208	36/24	34	1207/47.5	840/1847	10121
EPS-3036144.66	460	460	36/24	34	1810/71.25	1038/2284	11167
EPS-3036/62,66	600	208	36/24	27	1207/47.5	840/1847	10121

**Table: I-7: EPS 3000 Model Specifications**

- NOTES:
1. Total width, weight, and heat loss **are** for system line-up including auxiliary cabinets.
  2. Data does not include battery data; refer to the installation drawings supplied with your equipment.

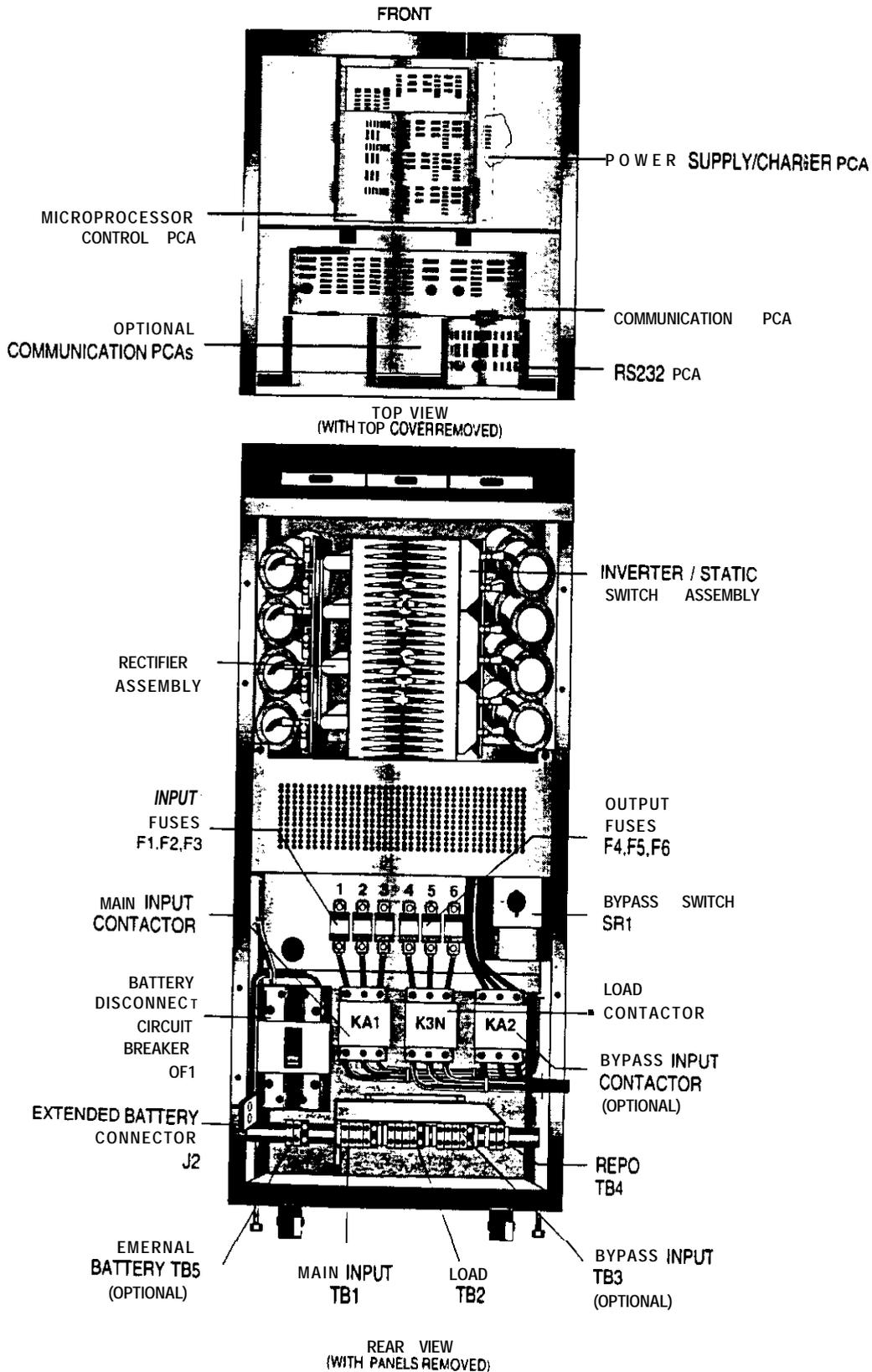
Consult the installation drawings provided with your equipment.

## 1.2 Description of Major internal Components

The following is a description of the EPS 3000 UPS major internal components. Refer to the single-line diagram provided in Figure 1-Z. and the internal component views provided in Figures 1-3 and I-4.



Figure 1-4: Rear and Top View of 24 & 36 kVA Unit



### 1.2.1 Rectifier

The rectifier converts the AC input voltage from the utility source into a DC voltage, supplying the inverter.

### 1.2.2 Inverter

The inverter converts the DC voltage supplied from either the rectifier or the battery system into a three-phase AC voltage. An AC output filter is used to achieve a computer-grade sinewave output voltage waveform, with a total harmonic distortion of less than 3% under linear-load conditions.

### 1.2.3 Static Switch

The static switch transfers the load between the inverter output and the bypass AC source without interrupting the supply of power to the load, allowing the load to continue operation in the event of a UPS fault. The static switch circuit assures that voltage from the UPS output cannot be fed back to the utility input lines.

### 1.2.4 Battery System

The battery system stores energy for use by the inverter. The stored energy is utilized in the event that the AC input power from the utility source fails, or falls outside of acceptable tolerance. The internal battery charger maintains the charge of the battery system. The DC output voltage of the charger is temperature regulated to ensure an optimal charge voltage.

The standard battery system is housed internally within the EPS 3000 UPS enclosure. For systems where additional back-up time is required, an optional extended battery system is available in an auxiliary cabinet.

An external battery system can also be supplied by the customer.

### 1.2.5 Communication Interface

The communication connectors positioned on the back for EPS 3000 supply the following information:

**UPS MANAGER  
Dry Contact Interface  
(DB15)**

- . Operation on inverter.
- . Operation on bypass.
- . Operation on battery.
- . Low battery shutdown warning.
- . UPS remote shutdown.

**SOFTUNOR  
(DB9)**

- . Diagnostics (for EPE Customer Support Services use only)

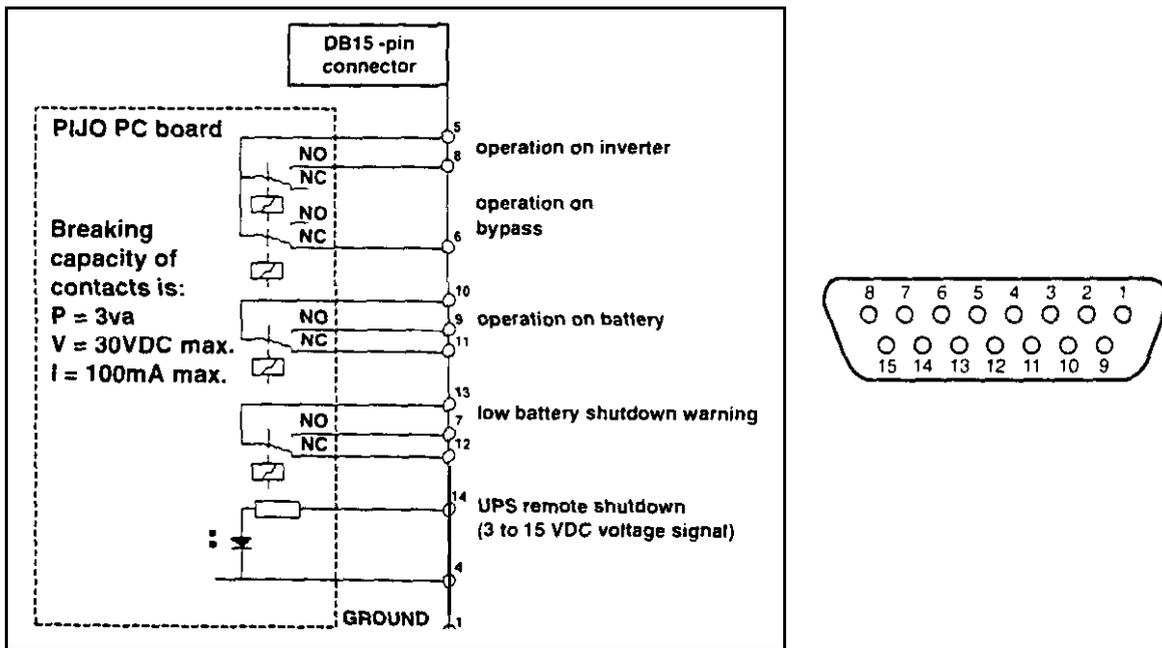
The UPS Manager connector enables communication with the most common Computer systems (AS400, NOVELL, etc.) or with the optional "UPS Manager UM1" software.

**NOTE:**

After the UPS remote shutdown signal is applied, the inverter stops and the load transfers to bypass after a predetermined time (typically 2 minutes).

Figure 1-5 indicates the pin-outs for the DB15-pin female connector (front view).

Figure 1-5: DB15-Pin Connector



## 1.3 Cabinet Options

This section describes options available for the EPS 3000 UPS. Most options must be specified at the time of equipment order; some options can be installed in the field. Contact your EPE dealer for further information.

### 1.3.1 Auxiliary Cabinet #1

Auxiliary Cabinet #1 may provide a combination of the following options: an input isolation or step down transformer, an input harmonic filter and an output distribution panel.

EPS 3000 UPS models configured for 208 VAC or 220 VAC operation can be equipped with an isolation transformer on the input. The transformer provides complete electrical isolation between the input AC source and the input of the UPS. The transformer may also provide voltage step-down capabilities for higher upstream AC input voltage operation.

An input harmonic filter reduces the level of current harmonics fed back to the input AC source.

An output distribution panel takes 208V AC output power for distribution to the computer and peripheral equipment.

### 1.3.2 Auxiliary Cabinet #2

Auxiliary Cabinet #2 provides an output auto transformer for output voltage step-up,

### 1.3.3 Extended Battery Cabinet

The Extended Battery Cabinet provides additional back-up time available during power outages

## 1.4 UPS Options

These options are internal to the EPS 3000 UPS,

### 1.4.1 Isolated Redundant System

This option is used to connect the static switch and maintenance bypass to a reserve UPS source for redundancy.

### 1.4.2 Frequency Converter

This option is used for different frequencies between the input and output of the UPS,

### 1.4.3 UPS Without Standard Battery Subsystem

This option allows for the connection of a customer-supplied battery system to the UPS.

## 1.5 Communication Options

Communication options may be used simultaneously on the EPS 3000, thus enabling communication with a wide number of computers and control devices.

### 1.5.1 Monitor Plus

Mini terminal for control and display of AC input power and system parameters. This option can be installed locally or remotely.

### 1.5.2 Contact 5

This option offers communication of five different signals via dry relay contacts:

- Load on UPS;
- Load on bypass;
- Operation on battery;
- Low battery shutdown warning;
- Summary alarm (major or minor faults).

### 1.5.3 U-Talk

This option manages an RS232 serial interface using an ASCII protocol.

### 1.5.4 **JBUS/RS485**

This option enables remote monitoring of the EPS 3000

1.5.5 Software Communication Packages

- **UM1 (UPS Manager 1)** - Automatic file shutdown during power outages or severe brownouts for stand-alone systems.
- **UM2 (UPS Manager 2)** - Automatic file shutdown for network servers plus additional monitoring and network communication functions.
- **UM3 (UPS Manager 3)** - Automatic file shutdown with user-friendly control panel and advanced decision-making functions for Windows. Including an easy to use load estimator.

1.5.6 TELESERVICE

TELESERVICE is a UPS monitoring and alarm reporting system for the EPS 3000 family. The subscribing site uses standard phone lines to communicate pertinent data to the EPE Central Station Site. The receptacle providing power for this option is located on the rear panel of the UPS.

1.6. Specifications

1.6.1 AC Input Ratings

Voltage:	208/220 VAC. + 10%. -15%				
Frequency:	47 to 63 Hz				
Phases:	3 $\emptyset$ (phase sequence must be A. B. C, clockwise)				
Wires:	3 wires plus neutral, plus ground				
Current:	12 kVA	18 kVA	24 kVA	36 kVA	
	@208 VAC	26 A	39 A	53 A	78 A
	@220 VAC	25 A	37 A	50 A	74 A
Power factor:	Up to 0.9 lagging; 0.95 with optional input harmonic filter				

1.6.2 AC Output Ratings

Voltage:	(inverter only)	208/220 $\pm$ 1% VAC (steady-state conditions)
		208/220 $\pm$ 6% VAC (transient conditions from 0% to 100% or 100% to 0%)

Frequency:	60/50 Hz $\pm$ 0.1% (free-running)				
Phases:	3 0 (phase sequence must be A, B, C, clockwise)				
Wires:	3 wires plus neutral. plus ground				
current:	12 kVA	16 kVA	24 kVA	36 kVA	
	@208 VAC	33 A	50 A	67 A	100 A
	@220 VAC	31 A	47 A	63 A	94 A
Power factor:	0.67 computer load 0.8 linear load				
Total harmonic distortion (THD):	< 2% (linear load) < 3.5% (for 100% non-linear load with a crest factor of up to 3.0)				
Dynamic regulation:	$\pm$ 1% for balanced load $\pm$ 2% for 100% unbalanced load				
Dynamic response:	$\pm$ 5% for 100% step load change				
Overload:	105 - 110% of rated current for 10 minutes 110 - 130% of rated current for 1 minute 130 - 150% of rated current for 10 seconds >150% of rated current for 0.15 seconds				

1.6.3 DC Ratings

		12 & 24 kVA	16 & 36 kVA	
Battery voltage:	float	218 Vdc	272 Vdc	
	nominal	192 Vdc	240 Vdc	
	minimum	158 Vdc	198 Vdc	
Maximum current at cut-off voltage:	12 kVA	18kVA	24kVA	36kVA
	56 ADC	67 ADC	111 ADC	134 ADC
Overcurrent protective device rating:	4.5 kA IC at 250/500 Vdc for 12 & 18 kVA UPS 10 kA IC at 250 Vdc for 24 & 36 kVA UPS			
	50A fuse per 12 & 18 kVA battery cabinet 100A fuse per 24 & 36 kVA battery cabinet			

1.6.4 Mechanical Ratings (UPS Cabinet only)	12 & 16 kVA	24 & 36 kVA
Height:	36 in/914 mm	54.5 in/1385 mm
Width:	20.5 in/521 mm	23.75 in/603 mm
Depth:	26.1 in/713 mm	32.6 in/827 mm
Weight:	266 kg/290 kg 590 lb/640 lb	544 kg/612 kg 1200 lb/1350 lb

1.6.5 Environmental Ratings

Temperature:	
Operating:	0° to 30° C (32° to 66°F) continuous <25°C (77°F) recommended 35°C (95°F) up to 24 hrs 40°C (104°F) up to 6 hrs
Non-operating and storage:	-20° C to 45° C (-4° to 113° F)
Humidity:	0 to 95% non-condensing
Altitude:	<3000 ft. (1000m) >3000 ft a derating coefficient must be applied to the rated output.

# Installation

## 2.0 Scope

This section describes the installation of the EPS 3000 UPS, including receiving, handling, storage, and installation procedures.

## 2.1 Receiving

Before accepting the shipment from the freight carrier, inspect the exterior surfaces of all shipping containers or packaging used, and the equipment, for damage that may have occurred during transit. If the shipping containers or equipment show evidence of damage, note the damage on the receiving document (bill of lading) prior to signing for receipt of equipment.

Damage claims should be filed directly with the carrier. Replacements for damaged components should be ordered through EPE Customer Support Services, @ 1-800-438-7373.

## 2.2 Handling

The equipment is shipped on a shipping pallet and is intended for handling by a pallet jack or a fork lift truck. Move the equipment to its intended location while still mounted on its pallet, and remove the equipment from the pallet when it is near its final location. Refer to Figure 2-1 for proper handling.

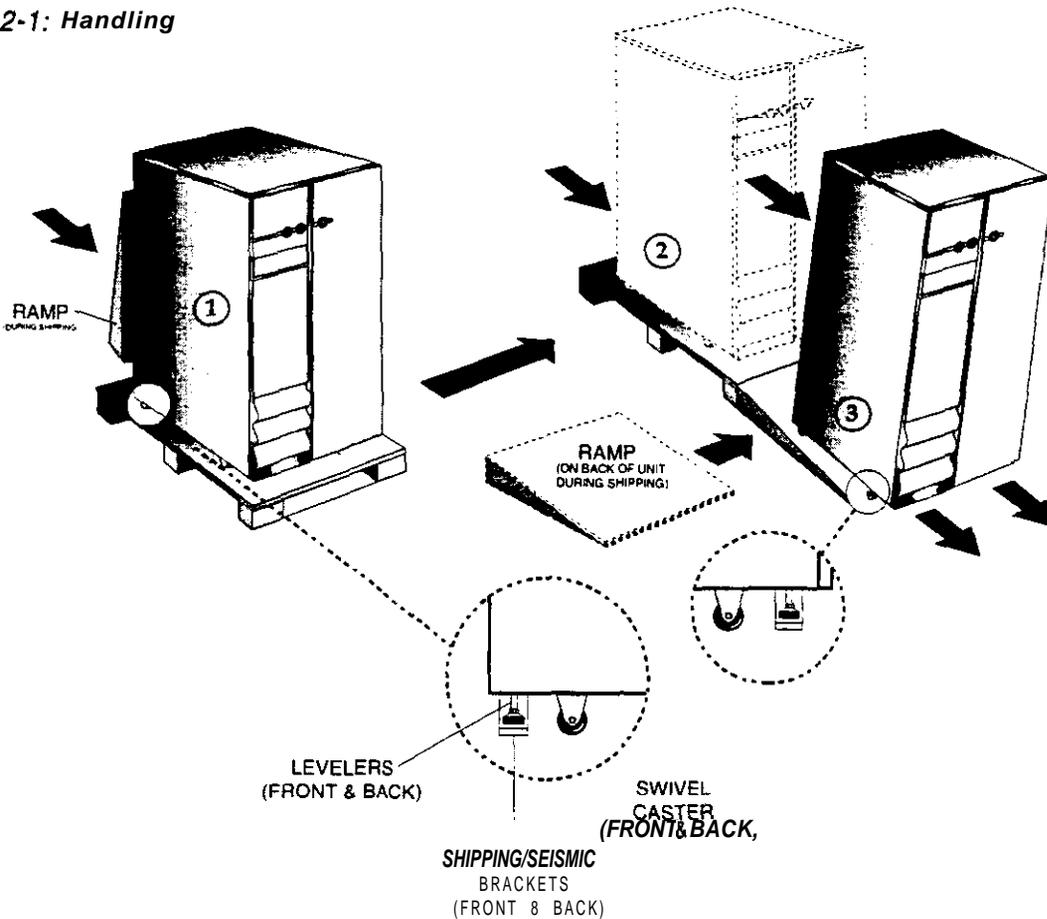
## 2.3 Storage

If the equipment is to be stored prior to installation, it should be stored in a cool, dry, well-ventilated location that is protected against rain, splashing water, chemical agents, etc. The equipment should be covered with a tarpaulin or plastic wrapper to protect it against dust, dirt, paint, or other foreign materials.

### IMPORTANT

 Batteries should be stored no longer than three (3) months at 25° C (77° F.) or lower prior to recharging. Exceeding the recommended ambient storage temperature Will reduce battery back-up time and may adversely affect battery life.

Figure 2-1: Handling



If the equipment is to be stored for more than three months before installation, it should be unpacked and connected to an AC input source to allow the batteries to be recharged. Refer to the installation Instructions that follow.

## 2.4 Prerequisites to Installation

An efficient EPS 3000 UPS installation depends on careful planning and site preparation. Installation of UPS equipment must be handled by skilled technicians and electricians familiar with the special requirements of high-energy electrical equipment. The installation must comply with the requirements of the National Electrical Code (NEC, ANSI/NFPA 70, latest issue) and with local codes and requirements as applicable.

We strongly recommend contracting EPE Customer Support Services @ 1-800-438-7373 for system start-up. Do not allow unqualified personnel to handle, install, or operate the EPS 3000 UPS.

2.4.1 Environmental

The EPS 3000 UPS is intended for use in an environment where control of temperature and humidity is provided. The maximum operating and recommended environmental parameters are provided in the 'Specifications' section of this document.

The EPS 3000 UPS generates heat and exhausts air through the top rear portion of its enclosure. Heat loss data is provided in Table 1.1.

2.4.2 Mechanical

The EPS 3000 UPS can be mounted on a raised computer room floor, or flush-mounted on a concrete floor. All floors must be level. On a raised floor, conduits can be run below the floor, with cut-outs made in the floor tiles as shown on the installation drawings.

The EPS 3000 UPS may be placed beneath a table or work surface. Allow at least two feet clearance in front of the UPS for normal operation (access to the UPS controls). Once installed, right side clearance of 24 inches for the 24 & 36 kVA UPS is recommended for battery maintenance. The EPS 3000 requires at least 36 inches rear clearance for ventilation.

2.4.3 Electrical

Electrical service for the EPS 3000 UPS should be supplied on its own dedicated branch circuit. Main input cables and upstream protective devices must be provided and sized per the National Electrical Code (NEC, ANSI/NFPA 70, latest issue), per local codes as applicable, and as appropriate for your load and distribution requirements. Cable sizing data is provided on the installation drawings supplied with the equipment. The EPS 3000 UPS is not a separately-derived source.

**CAUTION**

The customer-supplied upstream protective device shall open in one cycle when 10 times the output rated current is applied or in the event of an output short circuit when the unit is working on "static switch".

Square D circuit breakers recommended or equivalent.

EPS3000 s" (kVA)	12	18	24	36
Square D circuit breakers	KAL 36070 Set at #2 position	KAL 36070 Set at #2 position	KAL 36125 Set at #2 position	KAL 36125 Set at #2 position
CB rating	70A	70A	125A	125A

## 2.5 installation Procedures

The steps to be followed are:

- Placement of the UPS and associated equipment
- Connection of input power, output power, and control cables

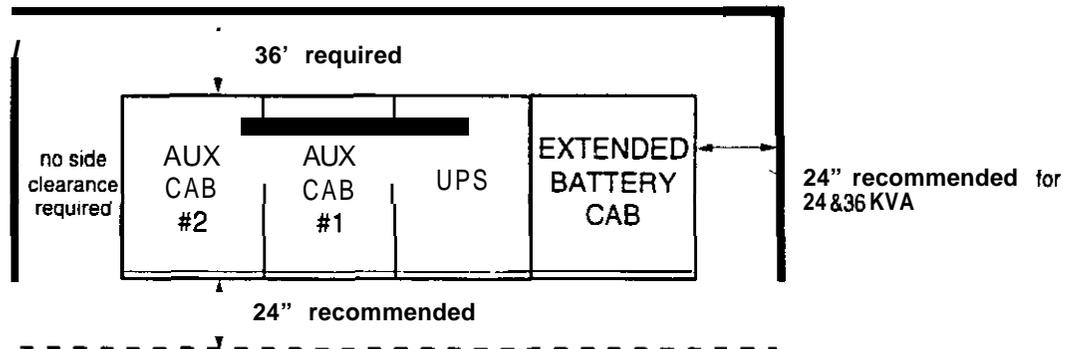
Installation of UPS equipment must be handled by skilled technicians and electricians familiar with the special requirements of high-energy electrical equipment. We strongly recommend contracting EPE Customer Support Services for start-up of the installed EPS 3000 UPS system. Do not allow unqualified personnel to handle or operate the EPS 3000 UPS.

Refer to the installation drawings for proper placement and auxiliary cabinet connections.

### 2.5.1 Placement

Move the EPS 3000 UPS, battery cabinets (if any), and auxiliary cabinets(s) (if any), to their final location (see Figure Z-2). For cabinets installed adjacent to each other, alignment is critical to properly install the mechanical and cable interconnections.

Figure 2-2: Placement



### 2.5.2 Customer Connections

Electrical connections and cabinet interconnections will Vary depending upon the configuration of your EPS 3000 UPS system. Refer to Figure 2-3 and to the installation drawings supplied with your equipment.

#### CAUTION

Before making any electrical connections, verify that the battery disconnect circuit breaker OF1 is in the "off" position (if there is more than one, all should be in the OFF position). Customer-supplied upstream protective device and distribution circuits should be OFF.

### 2.5.2.1 Main AC Input Connections

The connections to be made are the three phases, neutral, and ground cables from the utility AC power source to the UPS. The main AC input cables are terminated at the "main input" terminal blocks. Complete wiring instructions for your installation are provided on the installation drawings supplied with the equipment.

### 2.5.2.2 Bypass AC Input Connections (Optional)

The connections to be made are the three phases, neutral, and ground cables from the bypass AC input power source to the UPS. The bypass AC input cables are terminated at the "bypass input" terminal blocks. This option provides a separate AC input source for bypass operation.

### 2.5.2.3 REPO Connections

The control connections are available for "Remote Emergency Power Off" (REPO) through a customer-supplied normally closed pushbutton. With REPO connected, the metal jumper on the "REPO" terminal blocks must be removed.

### 2.5.2.4 AC Output Connections

The connections to be made are the three phases, neutral, and ground cables from the load source to the UPS. The output cables are terminated at the "load" terminal blocks.

Load cables must be run separately from all other cables (power supply or computer-system interconnection cables). They should not pass near interference-emitting equipment or sensitive loads.

### 2.5.2.5 Battery Connections

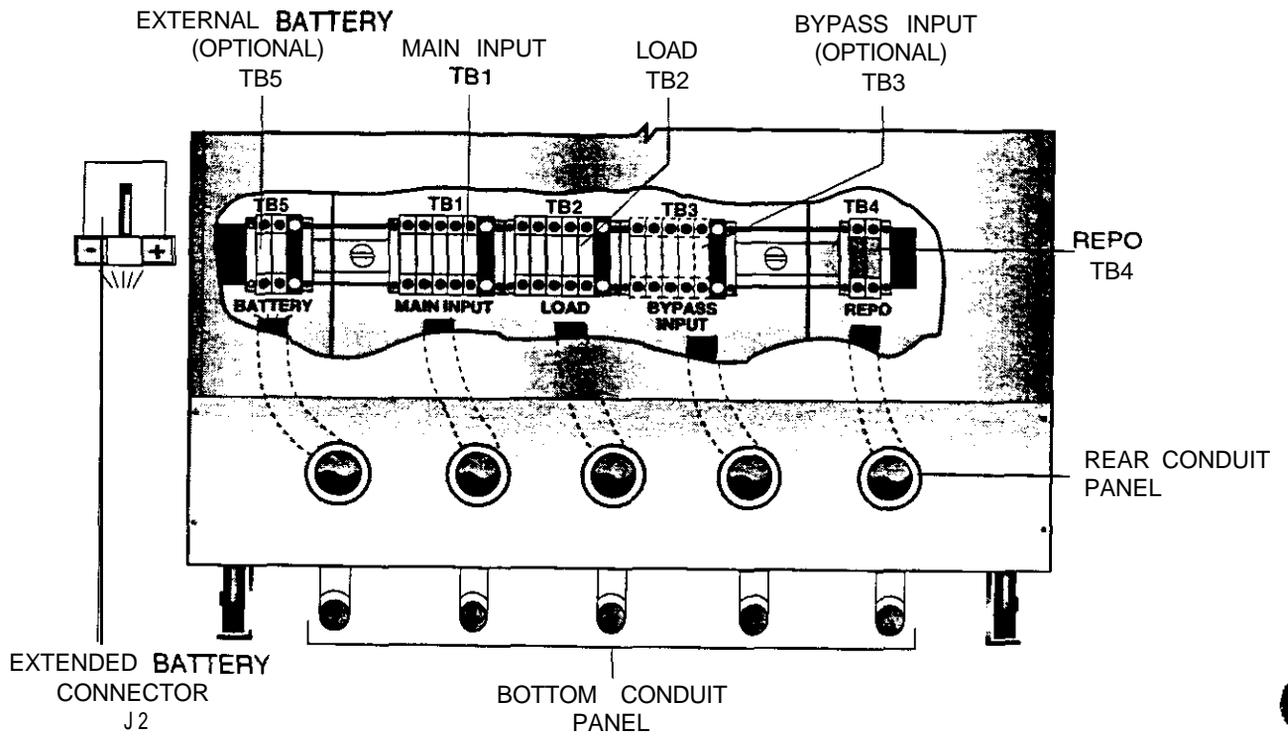
No battery connections are needed with a battery system internal to the UPS. For an optional extended battery cabinet, an internal battery connector (J2) is supplied.

For a customer-supplied battery cabinet, an optional "external battery" terminal block is available.

## 2.5.3 Finishing the Installation

Once all connections have been completed, install the bottom and rear conduit panel(s) of the enclosure.

Figure 2-3: UPS Terminal Blocks (No Auxiliary Cabinet)



# Operation

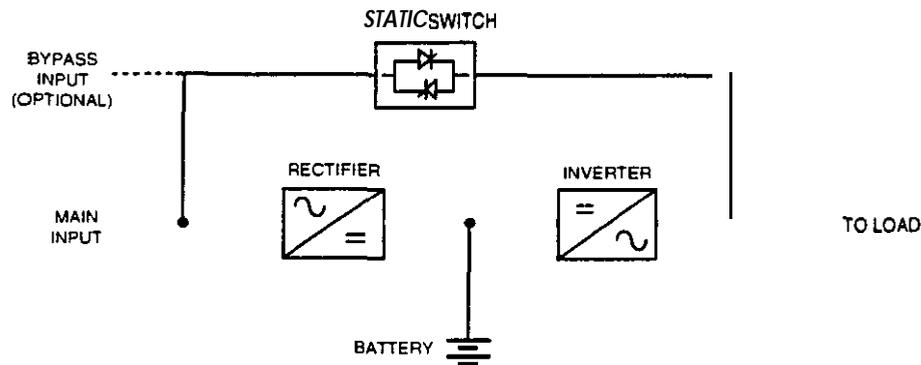
## 3.0 Scope

This section presents operating information for EPS 3000 UPS systems, including an overview of system operation, controls and indicators, start-up, operating procedures and alarms.

## 3.1 Overview

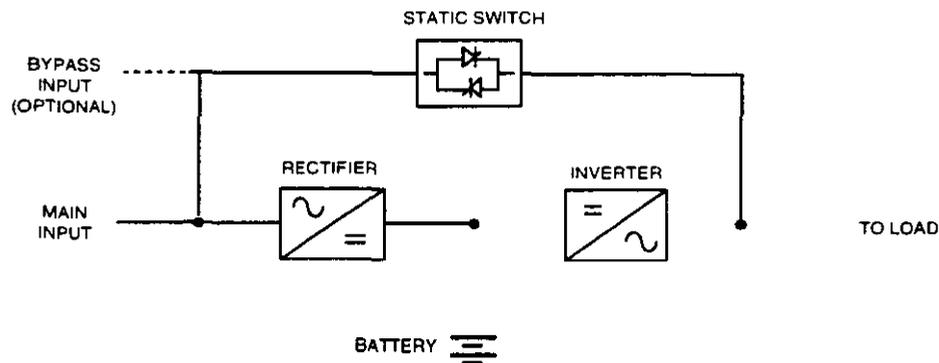
During normal operation the AC input source supplies the rectifier, which converts the incoming AC to DC power. The rectifier in turn supplies the inverter, which regenerates AC power to supply the attached load (see Figure 3-1).

Figure 3-1: Power Now, Normal Operation



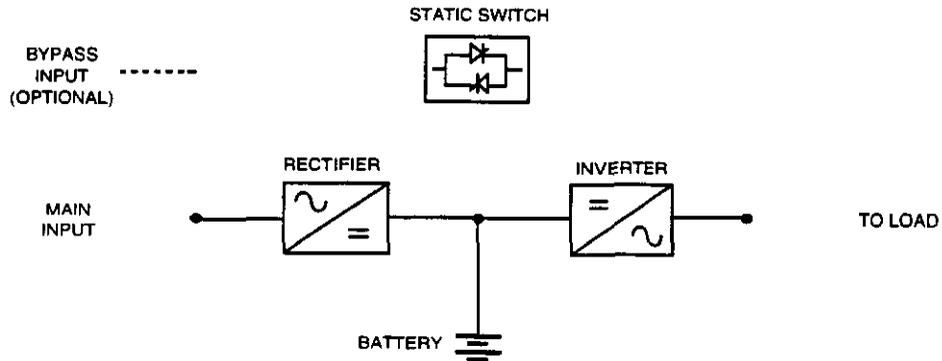
When AC input power fails, the UPS goes to on-battery operation. DC power is supplied from the UPS battery system to the inverter, which regenerates power to supply the attached load (see Figure 3-2).

Figure 3-2: Power Now, On-Battery Operation



Should there be an internal fault in the UPS, the load will automatically be transferred to the “static switch” (if bypass AC input is within tolerance). The load is supplied without interruption while the UPS is bypassed (see Figure 3-3).

Figure 3-3: Power Now, Bypass Operation



### 3.2 Controls and Indicators

Controls and indicators are located on the front panel of the EPS 3000 UPS.

EPS 3000 operating controls are made up of (see Figure 3-4):

- Basic controls and indications concerning the overall operating status of the UPS:
- A diagnostics panel with special control keys and a two digit display of faults for trouble-shooting purposes.

#### 3.2.1 Basic Controls and Indications

Positioned in the upper left-hand corner of the front panel, this panel provides information on the operating status of the system (see figure 3-5). Interpretation of signals is very easy and requires no special training.

They indicate:

- Normal operation (load protected);
- Battery power is not available (load not protected);
- Downgraded operation (fault);
- Danger of a break in the supply of power to the load (load not protected);

- Operation on battery power

figure 3-4: Controls and Indicators

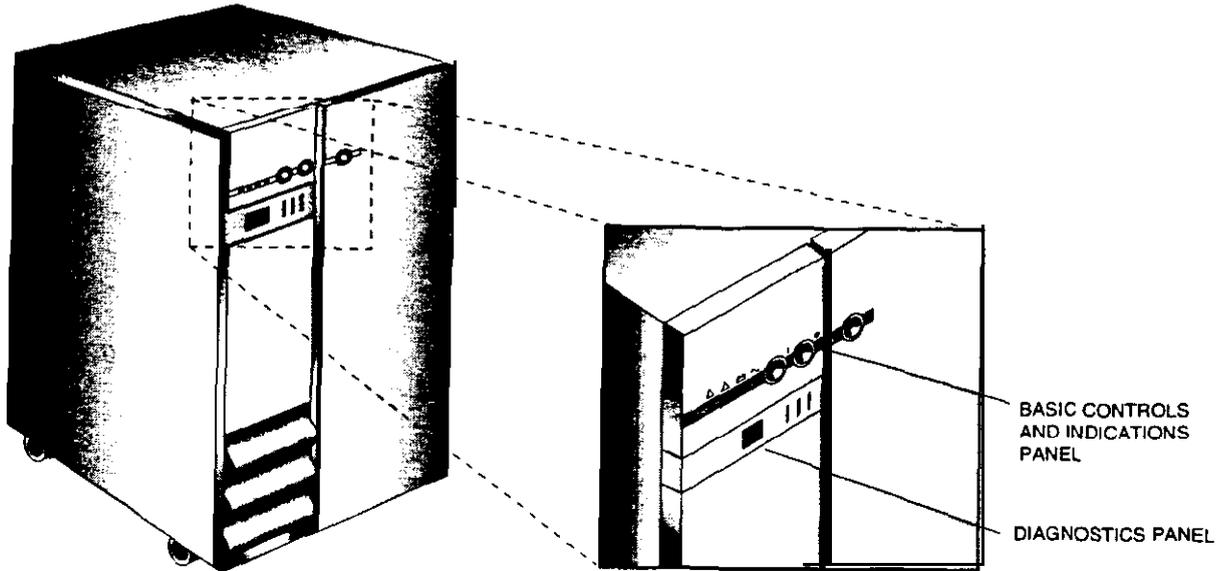
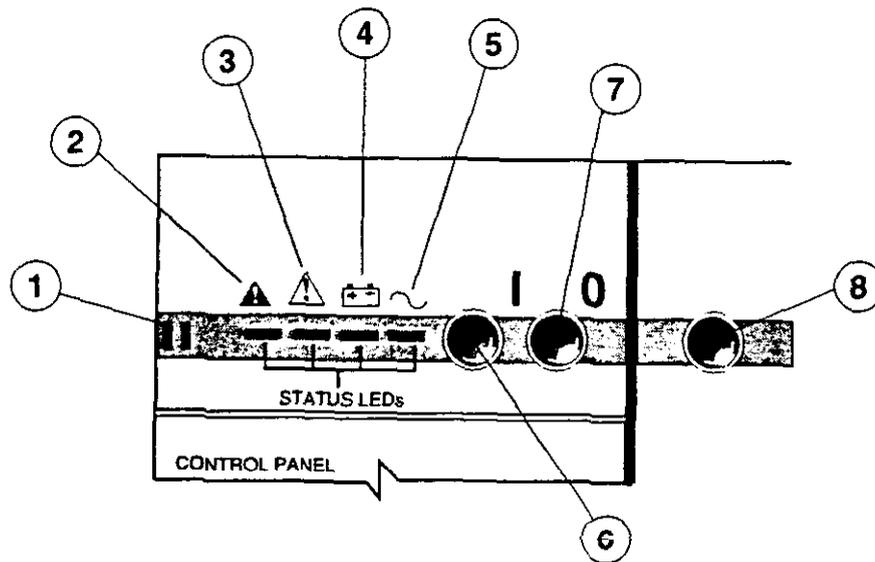


Figure 3-5: EPS 3000 UPS Front Panel



Key to Figure 3-5:

- 1 Buzzer
- 2 "Load not protected" light
- 3 "Fault" light
- 4 "battery Status or operation on battery power" light
- 5 "load protected" light
- 6 "inverter on" button
- 7 "inverter off" button
- 8 "EPO" button

### 3.2.1.1 Buzzer: ITEM 1

The buzzer is activated in the following situations:

- The load is supplied directly by AC input power via the "static switch";
- The inverter is operating on battery power;
- Operating faults.

It beeps softly and slowly for minor faults and during inverter operation on battery power. When the low battery shutdown warning level has been reached, the level and the frequency of the beeps increase.

In the event of an inverter shutdown, a continuous load alarm is emitted. A buzzer reset button is provided on the diagnostics panel. Detection of a new fault will set the buzzer on again.

### 3.2.1.2 "Load Not Protected" Light: ITEM 2

This red light indicates:

- Direct supply of power to the load by AC input power via the 'static switch' due to inverter shutdown (voluntary or following an overload or an internal fault);
- Battery power is not available. Battery circuit breaker is in the "off" position or battery not connected.

### 3.2.1.3 "Fault" Light: ITEM 3

This yellow light indicates an operating fault or an environment fault. However, the load continues to be supplied by the inverter.

### 3.2.1.4 "Battery Status" Light: ITEM 4

This yellow light indicates:

- Inverter operation on battery power following an AC input failure or detection of an AC input voltage outside tolerances:
- It flashes to indicate that the low battery shutdown warning level has been reached.
- If the light flashes when the system is not on battery power. battery conditions should be checked.

### 3.2.1.5 "Load Protected" Light: ITEM 5

This green light indicates that the EPS 3000 is operating normally. The load is protected and supplied via the inverter output.

### 3.2.1.6 "Inverter On" Button: ITEM 6

This green button is used to start the inverter.

### 3.2.1.7 "Inverter Off" Button: ITEM 7

This grey button is used to stop the inverter.

### 3.2.1.8 "EPO" Button: ITEM 8

This red button is used to stop the unit during an emergency situation only. All power is removed from the load.

## 3.2.2 Diagnostics Panel

This panel provides a display of faults and controls (see Figure 3-6):

- Environment faults;
- Internal faults in the EPS 3000;
- Special control keys.

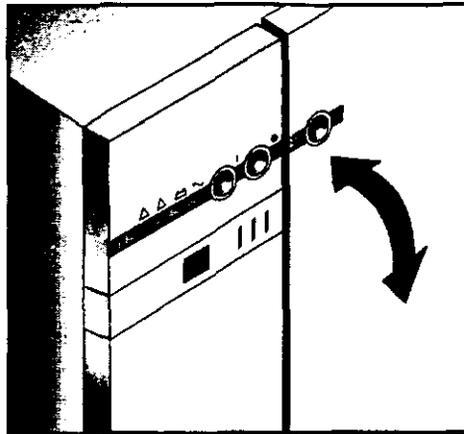
### 3.2.2.1 Buzzer Reset

This button enables the user to stop buzzer operation. Detection of a new alarm will set the buzzer on again.

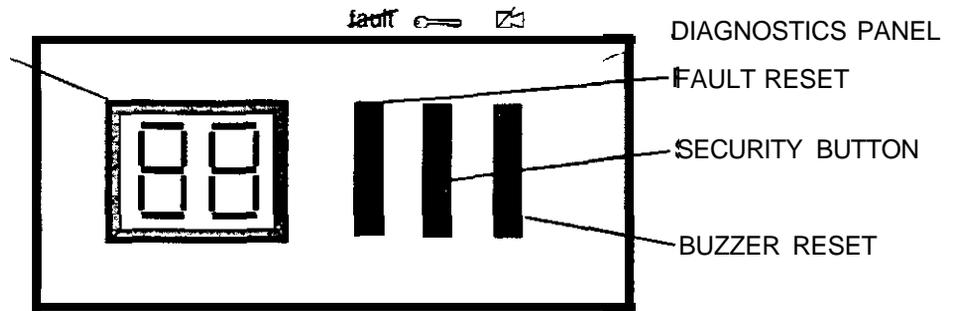
### 3.2.2.2 Fault Reset

This button clears the faults stored in memory. Clearing of alarms in memory is accepted only once the alarm conditions themselves have been cleared.

Figure 3-6: Display Panel



DIAGNOSTICS DISPLAY



### 3.2.2.3 Security Button

This button enables forced operation. The security pushbutton **must** be held down while the desired function is executed. Refer to the "Forced Transfers" section of this document.

### 3.2.2.4 Diagnostics Display

Alarm, fault and status information is provided on the display in the form of a two digit number.

In the event of a fault, refer to the "Alarms" section of this document.

Faults are only displayed at the users requested by pressing once on the Control key.

## 3.3 Start-up Procedure

### 3.3.1 Preliminary Checks

- Check the settings of the protection devices;
- Verify that the battery circuit breaker is in the "off" position;

- Verify that the manual bypass switch SR1 is set to "NORMAL" position;
- Check that nothing can block the ventilation system (air entry through the bottom and exhaust through the top rear);
- Check that there is a minimum 36 inches clearance at the back for ventilation;
- Check that the EPS 3000 no Longer rests on its 4 wheels (lifting levelers in place);
- Check that the load-circuit breakers (where applicable) are in the "off" position.

### 3.3.2 Powering Up the EPS 3000

#### CAUTION

**As soon as AC input** power is supplied to the EPS 3000 (customer supplied upstream circuit breaker is in the "on" position), the load is initially supplied via the "static switch". No indications are given on the control panel.

- Apply AC input power to the unit by closing the upstream circuit breaker:
- Put the battery circuit breaker in the "on" position:
- The buzzer sounds:
- The status LED lights go on;
- The rectifier starts up;
- The inverter automatically starts up. except if the system is in "manual start-up" mode (optional);
- If the transfer conditions (AC input power within tolerances) are correct, the inverter comes on line and supplies the load. The green "load protected" light goes on.

In the event of a fault. refer to the "Alarms" section of this document

### 3.3.3 Inverter Manual Start-Up Mode

Typically, the inverter is configured for automatic start-up mode. For manual start-up mode, contact EPE Customer Support Services.

For manual start up:

- Press the green "inverter on" pushbutton:
- The green "load protected" light flashes;

- The inverter starts and if the transfer conditions are correct, the load is transferred to the inverter:
- The red "load not protected" light goes off:
- The green "load protected" light goes on.

#### 3.3.4 **Inverter** Shutdown

- Press and hold the grey "inverter off" pushbutton for 3 seconds;
- The green "load protected" light goes off;
- The red "load not protected" light goes on;
- The buzzer sounds:
- The inverter stops if the transfer conditions are correct:
- The load is transferred and supplied via the "static switch".

In the event of a fault, refer to the "Alarms" section of this document.

#### 3.3.5 Powerina Down

It is recommended not to power down the EPS 3000 for long periods because the battery should remain charged. However, to carry out a power down, proceed as follows:

- Shutdown the inverter;
- Put the battery circuit breaker in the "off" position;
- Put the upstream main circuit breaker in the "off" position;
- All the indicating lights on the control panel go off.

## 3.4 Operating Procedures

### 3.4.1 Normal Operation

The AC input power is present.

The green "load protected" light is on.

The power drawn by the load is supplied by AC input power via the rectifier and inverter modules. The battery charger float charges or recharges the battery.

### 3.4.2 Operation on Battery Power

When AC input power fails or exceeds tolerances, the rectifier shuts down and the battery supplies the power required by the inverter to supply the load. The battery discharges.

The green "load protected" light is on.

The user is warned of operation on battery power by the buzzer and by the yellow "battery status" light. This information is also available via the standard UPS MANAGER DB15 connector

#### 3.4.2.1 Battery Duration

During an AC input power failure, the duration of inverter operation on battery power depends on:

- The rated capacity of the battery;
- The power draw" by the load;
- The battery temperature;
- The age of the battery.

The rated backup time corresponds to a minimum for a new battery and with the inverter operating at the rated load.

The real backup time, which depends on the power drawn, may be greater if the inverter operates at less than full rated load. It is possible, during operation on battery power, to increase *the* battery backup time by reducing the power drawn by the load (shedding of non-priority circuits).

A low battery shutdown warning signal is available via the standard UPS MANAGER DB15 connector for remote indications. It warns the user of upcoming battery shutdown at a user-determined level of remaining power.

On the UPS itself, the buzzer beeps louder and more rapidly, and the yellow "battery status" light flashes rapidly.

The end of battery power occurs when the battery reaches shutdown level. At this point, the inverter shuts down and the UPS goes in 'Stand-by' mode. Load is no longer supported. If the input AC power does not return to within tolerance, typically within 2 hours, the unit will shutdown.

To restore rated backup power, battery recharge cycle takes approximately 10 hours for a backup time of 8 minutes.

#### 3.4.2.2 Return of AC Power

When the AC input power failure ends or power returns to within tolerances:

- If the end of battery backup power was not reached, the EPS 3000 returns to the normal operating mode described above:
- If the end of battery backup power was reached and unit is in "Stand-by" mode, the rectifier and the inverter automatically start up (the inverter must be manually started if the system is in manual start-up mode):
- If the end of "Stand-by" mode was reached, follow the Start-up procedure.

#### 3.4.3 Overload

When an inverter temporary overload occurs:

The load is transferred to the "static switch", Return to the inverter is automatic, following elimination of the overload.

The inverter can handle an overload for a given duration depending on the size of the Output current overload (see Figure 3-7) or the output power overload (see Figure 3-S).

When an overload occurs:

- The buzzer sounds:
- The yellow "fault" light goes on;
- The inverter shuts down at the end of its corresponding overload time:
- The load is supplied by AC input power via the "static switch";
- The green "load protected" light goes off;
- The red "load not protected" light goes on

If the overload continues during operation via the "static switch", the supply of power to the load is interrupted after a specified time.

When the EPS 3000 shuts down due to an overload, the "fault reset" button must be pressed prior to return to normal operation.

Figure 3-7: Output Current Overload Curve

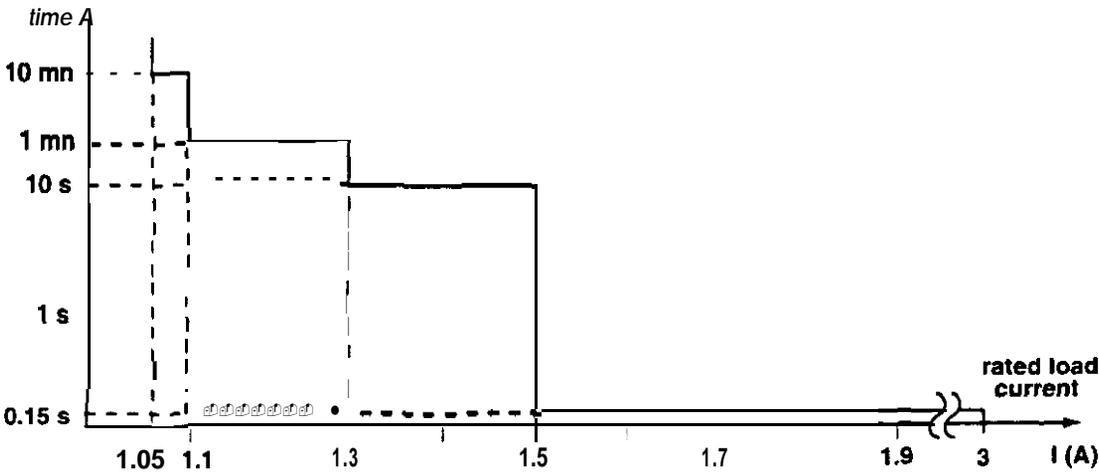
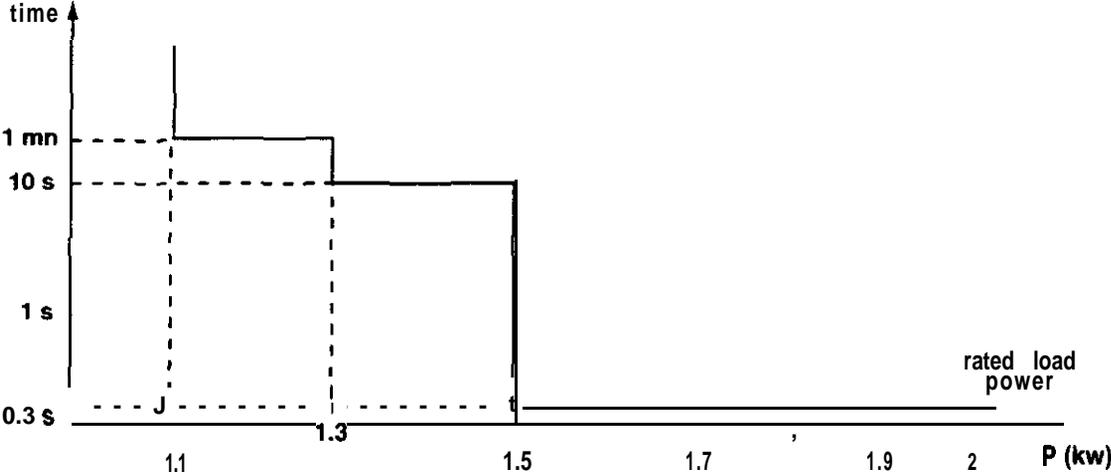


Figure 3-8: Output Power Overload Curve



3.4.4 Emergency Shutdown Using EPO

**CAUTION**

**!** Pressing the “Emergency Power Off” (EPO) pushbutton disconnects the attached load. The EPO is to be used during emergency situations only, where a hazard to personnel or equipment exists, such as during a fire. **DO NOT USE THE EPO TO TURN THE UPS ON OR OFF;** follow the procedures listed in this section for turning the inverter on and off.

During an emergency situation, such as a fire in the computer or electrical room, the UPS and all downstream devices can be instantly shutdown by pressing the EPO pushbutton on the front panel of the UPS cabinet, or by pressing the “Remote Emergency Power Off” (AEPO) optional pushbutton.

The EPO or REPO pushbuttons should not be used for normal shutdown of the equipment.

If the EPO pushbutton has been pressed, it must be reset by pressing it again and by pressing the “fault reset” button in the diagnostics panel to allow the UPS to restart.

### 3.4.5 Forced Transfers

#### CAUTION

Using the forced transfer functions will cause the **load** to experience a power interruption for a minimum of 500 milliseconds. **Be certain that** the load can **tolerate** this interruption.

Forced transfer is required if bypass input is out of tolerance. The load can be transferred from the inverter output to the bypass input source, or back, with a power interruption of 500 milliseconds.

#### Transferring the Load to Bypass Input From Inverter

On the diagnostics panel, press the “security” button and hold it while pressing the grey “inverter off” pushbutton for 3 seconds.

#### Transferring the Load to Inverter From Bypass Input

On the diagnostics panel, press the “security” button and hold it while pressing the green “inverter on” pushbutton for 3 seconds.

### 3.4.6 Maintenance Bypass

This procedure assumes that the UPS is operating normally, with the attached load supplied via the UPS inverter:

From Normal to Maintenance Bypass mode.

1. Stop the inverter by pressing the gray “inverter off” pushbutton for approximately three (3) seconds on the UPS front panel. The audible alarm will sound: silence the alarm by pressing the “buzzer reset” pushbutton. If the transfer conditions are not satisfied (bypass out of tolerance or other reason), a forced transfer will be required. Refer to the “Forced Transfers” section for more information.
2. Switch the battery circuit breaker QF1 to the “off” position

#### NOTE

The battery circuit breaker **QF1** will **automatically** trip open if it is left in the “ON” position when the UPS is placed in the Maintenance Bypass mode.

3. Turn the manual bypass switch to the “transfer” position, then to the “bypass” position.

4. All indicating lights go off

CAUTION

In this mode of operation, the UPS is ready for maintenance, but voltage is **Still** present on terminal blocks and various internal components. Switching unit to Maintenance Bypass mode removes all **alarms from** unit memory.

Now the UPS is ready for maintenance.

To restart the UPS after maintenance:

From Maintenance Bypass to Normal mode.

1. Turn the manual bypass switch to the "transfer" position.
2. Wait for an alarm and diagnostics display to go on.

WARNING

Failure to follow the proper Start-up sequence will result in **a load** loss. After **SR1** is set to "TRANSFER", it takes the UPS five (5) to six (6) seconds to test the input power before turning on the "static switch". During this time, the load is still supplied by the Maintenance Bypass **line**, and moving **SR1** to "NORMAL" will result in interruption of power to the load.

3. Turn the inverter off by pressing the grey "inverter off" pushbutton on the front panel. If your EPS 3000 has been programmed to automatically restart.

NOTE

ALWAYS turn the inverter off before rotating the **SR1** Rotary Switch.

4. Close the battery disconnect circuit breaker QF1.
5. Turn the manual bypass switch to the "normal" position.
6. Turn the inverter on by pressing the green "inverter on" pushbutton on the front panel. If the transfer conditions are not satisfied (bypass out of tolerance or other reason), a forced transfer will be required. Refer to the "Forced Transfers" section for more information.

Now the UPS is in normal operating mode. The green "load protected" light is illuminated on the indication panel.

### 3.5 Alarms

#### 3.5.1 Alarm Indications Table

Figure 3-9: Alarm Indications

					status or action producing the indication
					<ul style="list-style-type: none"> <li>■ inverter start-up phase prior to load transfer. The "inverter on" button has been pressed.</li> </ul>
					<ul style="list-style-type: none"> <li>■ normal operation;</li> <li>■ load supplied by <b>EPS 3000</b> (SR1 in normal position)</li> </ul>
					<ul style="list-style-type: none"> <li>■ inverter shutdown following pressing of the "inverter off" button or a major fault;</li> <li>■ load supplied via the "static switch"</li> </ul>
					<ul style="list-style-type: none"> <li>■ operation on battery power;</li> <li>■ load supplied by <b>EPS 3000</b></li> </ul>
					<ul style="list-style-type: none"> <li>■ end of battery power or battery should be checked</li> </ul>
					<ul style="list-style-type: none"> <li>■ minor fault; (load continues to be supplied via inverter)</li> </ul>
					<ul style="list-style-type: none"> <li>■ UPS shutdown;</li> <li>■ load supplied via maintenance bypass</li> </ul>

Legend of alarm indications table:

-  buzzer off,
-  light off,
-  buzzer on,
-  light on,
-  light flashing

### 3.5.2 Numerical Fault List

Any state other than normal operation (green "load protected" light on) is considered a fault by the diagnostics system.

Before undertaking any servicing or other action, note the status of the different lights and the two-digit number displayed on the diagnostics panel. If the 'Monitor Plus' option is installed, note as well the list of messages on the screen.

If the load still functions, it is supplied via the "static switch", i.e. it is not protected.

The following is a list of possible fault numbers displayed on the diagnostics panel.

- "11" - battery circuit fault:

Indicates that the battery circuit is open (battery circuit breaker is in the 'off' position). The load is no longer protected because battery power is no longer available in the event of an AC input power failure;

- "12" - check battery:

Indicates that the battery should be checked;

- "13" - end of battery backup (pre-alarm):

Indicates that battery power will end after a pre-set time period. The user must take the required measures to secure the load (load shedding, file saving and system shutdown. etc.):

- "14" - end of battery backup:

- "15" - battery fault:

- "16" - battery temperature alarm:

- "17" - automatic battery test running:

- "18" - manual battery test running:

- "21" - K3N response fault, or phase A, B, C inverter voltage fault, or DC short-circuit:

- "22" - Inverter or static switch over temperature:

- "23" - Inverter fuse blown:

- "25" - Inverter thermal Overload. Or output short-circuit, or inverter current limitation:

- "31" - Bypass voltage out of tolerance:

- "32" - Bypass/inverter phasing out of tolerance:

Indicates bypass input and inverter output phasing out of tolerance.

- “33” - phase rotation fault:  
  
Informs the user that the phase sequence of the three-phase incoming power source is incorrect:
- “34” - Bypass frequency out of tolerance:
- “35” - Bypass thermal overload:  
  
Indicates a load current overload;
- “36” - KA1 and/or KA2 response fault:
- “37” - Input voltage out of tolerance:
- “38” - Emergency Power Off (EPO or REPO):
- “39” - Bypass configuration fault:
- “41” - Static switch on:  
  
Indicates load supplied via “static switch”.
- “51” - Charger min. voltage, or charger current, or charger max. voltage fault:
- “61” - Chopper max. voltage, or chopper min. voltage fault, or chopper DC unbalance, or input fuse fault, or input SCR fault:
- “62” - Chopper or rectifier over temperature:
- “63” - Input fuse blown:  
  
“65” - Chopper thermal overload, or chopper overload:  
  
Indicates that the active power (kW) drawn is excessive. Reduce the load.
- “71” - Core - com. communication fault:  
  
Indicates communication fault between microprocessor and communication PCAs.
- “72” - Communication autotest fault:
- “73” - Core autotest fault:

Note the fault numbers are also located on the “UPS Event” label located on the rear panel of the EPS 3000.

Contact EPE Customer Support Services for assistance at 1-800-438-7373.

# Maintenance

## 4.0 Scope

This section describes the maintenance of the EPS 3000 UPS, including safety instructions, preventive maintenance, and a description of replacement parts.

## 4.1 Battery Safety

### IMPORTANT SAFETY INSTRUCTIONS FOR SERVICING BATTERIES

- A. Servicing of batteries should be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.
- B. When replacing batteries, use the same model and manufacturer of batteries.
- C. CAUTION — Do not dispose of battery or batteries in a fire. The battery may explode.
- D. CAUTION — Do not open or mutilate the battery or batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.
- E. CAUTION — A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working with batteries:
  - 1. Remove watches, rings, or other metal objects.
  - 2. Use tools with insulated handles.
  - 3. Wear rubber gloves and boots.
  - 4. Do not lay tools or metal parts on top of batteries.
  - 5. Disconnect charging source prior to connecting or disconnecting battery terminals.
  - 6. Determine if the battery is inadvertently grounded. If inadvertently grounded, remove the source of ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.

## 4.2 Preventive Maintenance

The following preventive maintenance routines should be considered the minimum requirements: your installation and site may require additional preventive maintenance to assure optimal perfor-

mance from your installed EPS 3000 UPS and associated equipment. These routines should be performed twice a year (more often if required). We strongly recommend contracting EPE Customer Support Services for preventive and remedial maintenance at 1-800-438-7373.

The technician or electrician performing preventive maintenance on the UPS must be familiar with the indicators, controls, and operation of the UPS.

- a. Isolate and de-energize all EPS 3000 UPS equipment for all maintenance operations. Lock and tag all upstream circuit breakers during maintenance.
- b. Ensure that all equipment is clean and free of dust, dirt, and debris. The exterior of the UPS enclosure may be cleaned with a mild solution of soap and water, lightly applied with a lint-free cloth.
- c. Clean the air intake, exhaust plates, and the enclosure interior with a vacuum cleaner.
- d. Initiate the start-up procedure, as described in section III
- e. Test the main operating sequences as applicable to your installation (see section III ).

### 4.3 Replacement Parts

There are no user serviceable parts inside the EPS 3000 UPS

Three levels of replacement parts are available for the EPS 3000. The three levels are designated A, B, and C. The level that you should keep on hand for your installation will vary depending on the type of maintenance planned on site, and the configuration of your UPS system.

Having the replacement parts on hand will prevent any unacceptable delays (due to time involved obtaining spares) during critical periods, such as system start-up. Any items used during start-up will be replaced by EPE at no charge. Contact EPE Customer Support Services at 1-800-438-7373 for specific recommendations. A description of each level is provided below:

<b>Level</b>	Description
A	This level of replacement parts consists of consumable items, specifically power and control fuses. It is recommended to have these items on hand during installation of the UPS systems, including initial start-up.
B	This level of replacement parts is recommended when the user can tolerate short-duration UPS down-time to obtain replacement parts in the event of a major UPS failure. This level of replacement parts consists of consumable items, specifically power and control fuses, fans, and the most critical circuit board assemblies.
C	This level of replacement parts is recommended when the user can tolerate only a minimum of down-time in the event of a major UPS failure. This level of replacement parts consists of consumable items, specifically power and control fuses, fans, and a significant set of circuit board assemblies.

## Glossary

## Symbols

I	Used to represent 'and/or.'
%	Percent; of each hundred.
° F.	Degrees Fahrenheit.
° C	Degrees Celsius.
@	At.
±	Plus or minus.
#	Number.
0	Phase.
Ω	Ohms.
2nd	Second.
<b>A, B, C</b>	Normal sequence of phases (clockwise) in three-phase power.
<b>AC or ac</b>	Alternating current.
<b>Diagnostics panel</b>	The display panel behind a hinged cover on the UPS.
<b>Ambient air temperature</b>	The temperature of the surrounding air.
<b>Ambient noise</b>	The noise level of the environment.
<b>attached load</b>	The load attached to the UPS output. such as a computer system or manufacturing system.
<b>audible alarm</b>	Sounds when alarm condition occurs. or when pressing the control pushbuttons.
<b>AWG</b>	American Wire Gage, formerly Brown & Sharp gage.
<b>SAT. or BATT.</b>	Battery.
<b>Breaker</b>	Circuit breaker.
<b>British Thermal Unit</b>	A unit of heat equal to 252 calories (see BTU).

BTU or <b>Btu</b>	British thermal unit. Defined as the amount Of energy required to raise the temperature of 1 pound of water by 1° F.
<b>Buzzer reset</b>	A pushbutton located behind the diagnostics panel on the UPS allowing silencing of the audible alarm.
BYP	Bypass.
BYPASS	Maintenance bypass; wrap-around manual maintenance bypass using the bypass switch SR1.
Bypass <b>ac</b> input	Mains 2.
CAB	Cabinet.
<b>Calorie</b>	A unit of heat. One calorie is the amount of energy required to raise the temperature of one gram of water by one degree Celsius.
Carrier	The company or individual responsible for delivering goods from one area to another.
CB	Circuit breaker.
Conduit	A flexible or rigid tube surrounding electrical conductors.
<b>C.S.S.</b>	Customer Support Services.
CT	Current transformer.
<b>Curr.</b>	Current.
Current rating	The maximum current that a piece of electrical equipment is designed to carry.
DC or dc	Direct current.
Earth ground	A ground circuit that has contact with the earth.
Electrician	Refers to an installation electrician qualified to install heavy-duty electrical components in accordance with local codes and regulations. Not necessarily qualified to maintain or repair electrical or electronic equipment. Compare to technician.
EPE	EPE Technologies, Inc.
EPO	Emergency Power Off.
Free running	Indicates that the inverter frequency is stable and independent of the bypass AC input (mains 2) frequency.
<b>FREQ</b>	Frequency.

<b>Fusible</b>	Capable of being melted with heat.
<b>GND</b>	Ground
<b>Hz</b>	Hertz. a measure of frequency: one cycle per second equals one Hertz.
<b>I</b>	Current.
<b>In</b>	Nominal current.
<b>Input branch circuit</b>	The input circuit from the building power panel to the equipment.
<b>Inverter</b>	An electrical circuit that generates an AC sinewave output from a DC input.
<b>kVA</b>	Kilovolt-Ampere: a measure of apparent power.
<b>kW</b>	Kilowatt; a measure of real power.
<b>LED</b>	Light-emitting diode.
<b>Load protected</b>	The attached load is being supplied by the UPS inverter output, and the battery is available in the event that incoming (utility) power is lost.
<b>Load not protected</b>	The attached load is being supplied. but the battery system is unavailable.
<b>Low battery shutdown</b>	The battery has reached the lowest permitted operating voltage, and the inverter has shutdown (disconnecting the load) to protect the battery from damage due to further discharge.
<b>Mains or mains 1</b>	Main AC input source.
<b>Mains 2</b>	Bypass AC input source.
<b>MAX</b>	Maximum.
<b>MCM</b>	Thousand circular mil; standard wire sizes for multiple stranded conductors over 4/0 AWG in diameter. M is from the Roman numeral system: it is the symbol for 1,000.
<b>MOV</b>	Metal-Oxide Varistor.
<b>NEC</b>	National Electric Code.
<b>NFPA</b>	National Fire Protection Association.
<b>NO. or No.</b>	Part number.
<b>OSHA</b>	Occupational Safety and Health Agency.
<b>OF</b>	Over-frequency.

On-battery operation	The attached load is being supplied by the stored energy in the battery system.
o v	Over-voltage.
Packing list	The list of articles included in a given shipment.
P.F.	Power factor
<b>KA1</b>	UPS main AC input (mains 1) contactor.
<b>KA2</b>	Bypass AC input separate source contactor (optional).
<b>K3N</b>	UPS load AC output contactor.
<b>QF1</b>	Battery disconnect circuit breaker
Remote Emergency Power Off ( <b>REPO</b> )	A switch used for shutting down electrical equipment from a location away from the equipment.
<b>REPO</b>	Remote Emergency Power Off.
SCR	Silicon-controlled rectifier.
Security button	A pushbutton located behind the diagnostics panel on the UPS allowing forced transfers and other commands to be issued. The security pushbutton must be held down while the desired function is executed.
<b>SEQ</b>	Sequence.
Shipping damage	Any damage done to an article while it is in transit
Shipping pallet	A platform on which articles are fixed for shipping
Specific gravity	The ratio of the weight of a given volume of substance (such as electrolyte) to that of an equal volume of another substance (such as water) used as a reference.
<b>SR1</b>	UPS maintenance bypass switch.
Sync or synch	Synchronization.
Technician	Refers to an electronic technician qualified to maintain and repair electronic equipment. Not necessarily qualified to install electrical wiring. Compare with electrician.
<b>U</b>	Voltage.
UF	Under Frequency,
UL	Underwriters Laboratories, Inc.

<b>UPS</b>	<b>Uninterruptible Power Supply</b>
<b>u v</b>	<b>Under Voltage.</b>
<b>VAC</b>	<b>Volts of alternating current.</b>
<b>Vb</b>	<b>Battery voltage (in Volts DC)</b>
<b>VDC</b>	<b>Volts of direct current.</b>
<b>Via</b>	<b>By way Of.</b>
<b>VPC</b>	<b>Volts per cell, the measure of the electrical potential of a storage cell, such as a battery.</b>
<b>XFMR</b>	<b>Transformer,</b>



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