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## UPS Battery Maintenance Training

Contact us Today for a FREE quotation to deliver this course at your company's location.

<https://www.electricityforum.com/onsite-training-rfq>

This UPS Battery Maintenance Training course provides an understanding of battery backup failures such as: excessive or micro cycling, improper charging, poor temperature control, installation errors, manufacturing deficiencies and operational errors.

Battery and battery room safety requirements and inspection methods are also detailed along with personal protective equipment (PPE). Manufacturer installation and maintenance requirements are major components of this training.

A fully-functioning Uninterruptible Power Supply (UPS) system depends greatly on the batteries that are called on to serve emergency power during unexpected outages? Do you know all the steps necessary to properly test and maintain your batteries? This 2-Day UPS Battery Systems training course is perfect for anyone who works in a facility when a power outage occurs - the plant electrician, maintenance technician or a supervising engineer. Backup emergency batteries are essential, but only reliable if you have staff trained to properly test and maintain batteries so they perform in emergency situations.

## LEARNING OBJECTIVES

- Identify types of batteries and their operating principles
- Understand battery maintenance and testing techniques
- Identify and correctly use various types of test equipment and hand tools
- Use of NFPA 70E, IEEE 450, Megger® Battery Testing Guide and battery installation and operating instructions to develop a battery/cell inspection form
- Perform correct maintenance of vented lead-acid batteries using the IEEE Standard 450, IEEE “Recommended Practice for Maintenance, Testing and Replacement of Vented Lead
- Acid batteries for Stationary Applications”
- Identify battery and battery room installation requirements per IEEE guidelines

## WHO SHOULD ATTEND

- Electrical Engineers
- Electrical Maintenance Trades people & Technicians
- Instrumentation and Control Engineers
- Power System Protection and Control Engineers
- Building Service Designers
- Data Systems Planners and Managers
- Other electrical personnel involved in the maintenance industrial, commercial and institutional power systems

## STUDENTS RECEIVE

- 100-Page Digital Power Quality Handbook - Value \$20 (details below)
- 1.4 Continuing Education Unit (CEU) Credits
- A **FREE** Magazine Subscription (Value \$50)
- **\$100** Coupon toward any future Electricity Forum event (restrictions apply)

- Course Materials in Paper Format

## **COURSE OUTLINE**

### **UPS Battery Testing and Maintenance**

**Instructor:**

*Peter Ho, UPS Battery Consultant, The Electricity Forum*

#### **DAY ONE**

##### **BATTERY BASICS**

- Introduction to various battery technologies
- The objective of battery design
- Universal law of Conservation of Energy

##### **TYPES OF BATTERIES**

- Primary, secondary and reserve types
- Dry and wet cell batteries
- Lead calcium, Lead antimony, valve regulate lead acid, absorbed glass mat batteries
- Gel cell, automotive and deep cycle batteries

## **BATTERY BASIC CONSTRUCTION**

- Terminals, + and – plates, electrolyte, relief valve, separators and container

## **FACTORS TO DETERMINE BATTERY ELECTRICAL CHARACTERISTICS**

- Selection of active materials and weight of the active materials
- Theoretical and practical parameters (voltage and amp per hour)

## **BATTERY OPERATIONAL THEORY**

- Chemical reactions within the battery
- Charging and discharging processes

## **MSDS (Material Safety Data Sheet)**

- Sealed lead acid battery and wet lead acid batteries

## **OSHA AND NFPA REVIEW**

- Occupational safety and health standards
- National fire prevention standards
- Electrical safety and hazard (shock, arc flash and fire)
- Effects of electric shock on humans
- Human body surface and internal resistance
- Definition of battery electrical arc flash (bolt and air)
- DC arc flash calculations
- Establish electrical arc flash boundaries (limited, restricted and prohibited)
- PPE requirement and selection

- Category 1, 2,3 and 4 (cal/cm<sup>2</sup>)
- Labeling and personal responsibility

### **BATTERY SIZING DETERMINATION**

- KW and KVA of electrical equipment
- Efficiency of electrical equipment
- Battery watt per cell calculation
- Selection of battery, number of cells, number of battery units and number of cells per battery block
- Single or shared battery configuration considerations

### **BATTERY SHIPMENT AND RECIEVING**

- Visual inspection (external and internal)
- Concealed damage, housing damage and cracking
- Battery storage location, tie restriction and handing

### **BATTERY INSTALLATION**

- Important factors
- Space, environment, temperature/humidity, ventilation, flooring weight
- Anchoring, configuration, cabling, eye water station, grounded and ungrounded systems

### **BATTERY CHARGING**

- Charger selection
- Switching mode, linear, shunt, chopper, pulsed, USB and inductive types

## **CHARGING METHODS**

- Constant voltage, constant current, pulsed trickle, slow and fast

## **NATURE OF CHARGING**

- Initial (equalization) normal float, termination time and temperature relationship

## **CHARGER PERFORMANCE**

- Voltage and current regulation, AC ripple, efficiency, inrush current, power factor, 2nd current limitation

## **WET CELL BATTERY INSTALLATION CERTIFICATION**

- Third party battery inspection
- Initial and final open battery voltage and battery specific gravity measurement

## **FACTORS AFFECTING BATTERY PERFORMANCE**

- Battery voltage, nature of discharging, Charger voltage regulation, AC ripple,
- Impurity of battery active material, internal battery temperature, charging
- Methods, number of deep and normal discharging and battery aging

## **VRLA BATTERY THERMAL RUNAWAY**

- Battery internal impedance and temperature relationship
- Causes and prevention

### **BATTERY SAFETY**

- Electrocutation, fault, explosion, acid, gases, weight, equipment and clothing

### **BATTERY MAINTENANCE**

- Monthly, quarterly and annual check lists
- System voltage, charger AC ripple, internal battery temperature
- electrolyte Level, specific gravity, individual cell voltage, internal ohm
- inter-cell resistance Housing, terminals corrosion, pole discolor and leaking

### **BATTERY CLEANING**

- Battery individual cell posts and connectors, safety precautions and cleaning materials

### **SIGNS OF BATTERY FAILURE**

- Electrolyte levels, plates deformation, sediment, sinking poles and abnormal heat

### **IEEE 450-2010 STANDARD**

- Review key points with the IEEE 450
- Protective equipment, Duration of BM, State of charging determination
- Capacity testing method, Time adjustment, temperature factor method and Rated battery adjustment method

## **BATTERY TESTING**

- R and Z relationship with heat
- Internal self-discharging
- Battery impedance and resistor type testers, ground fault condition and Detection
- Battery replacement guidelines

## **COURSE TIMETABLE**

Start: 8:00 a.m.

Coffee Break: 10:00 a.m.

Lunch: 12:00 noon (included with course)

Restart: 1:15 p.m.

Finish: 4:30 p.m.

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