



Content
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UPS Uninterruptible Power Supply 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 Training course begins with a discussion of the need for UPS systems. It then covers the relative comparisons between various UPS topologies and their modes of operation. The batteries used for UPS systems are also covered. How a battery works, their maintenance, safety and testing is thoroughly discussed.

A solid working knowledge of the typical electrical and electronic components found within a UPS system is explained, as well as how AC is converted to DC and then inverting DC back to AC. When all of the above elements of a UPS are understood, a theoretical rectifier and inverter feedback loop are thoroughly discussed. This will be followed by a testing and troubleshooting section. Students will be given failure scenarios where they will learn how to determine which circuit component has opened, shorted or significantly changed in value to produce the alarm condition described. The course finishes with a general discussion on UPS system testing and maintenance procedures.

Some working knowledge of basic electrical engineering principles is required, although this

will be revised at the beginning of the course. Real-life experience in working with batteries and UPS systems will enable the course to be placed in context.

After completion of the course the delegate will be able to:

- Understand the functionality of different UPS Type
- Size the UPS and battery bank for an application
- Recommend solution for a practical implementation
- Perform Maintenance and Parameter settings on a UPS
- Perform Battery maintenance and results interpretation
- Design a complete UPS System and recommend the proper grounding solution

LEARNING OBJECTIVES:

- Understand the functionality of different UPS Type
- Size the UPS and battery bank for an application
- Recommend solution for a practical implementation
- Perform Maintenance and Parameter settings on a UPS
- Perform Battery maintenance and results interpretation
- Design a complete UPS System and recommend the proper grounding solution

WHO SHOULD ATTEND

- Industrial, Commercial, Institutional Electrical Engineers
- Electrical Maintenance Tradespeople & Technicians
- Instrumentation and Control Engineers
- Power System Protection and Control Engineers
- Consulting Electrical 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/UPS Handbook - Value \$20
- 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 System Design, Application, Testing and Maintenance

Instructor

Peter Ho, Power Quality/UPS Consultant, Electricity Forum

DAY ONE

1. Review: Electrical and Electronic Fundamentals

- Electrical (resistance, inductance and capacitance)
- Electronic (diode, SCR, bi-polar transistor and IGBT)
- Understanding the linear and non-linear theory

- Power factor, displacement power factor, crest factor and k-rating term
- Electrical Disturbance (control and un-control)

2. Building Blocks of UPS Systems

- Kinetic (Motor Generator Sets)
- Flywheel
- Static and Components
- Rectifiers
- Choppers
- Batteries
- Inverters
- Internal bypass static switches
- Other components

3. Types of Static UPS

- Traditional UPS
- Static UPS
- Static UPS with Bypass

4. UPS Operation Overview

- 6. The Need for UPS System
- Power System Disturbances
- Basic Types of UPS Systems
- UPS Topologies
- Single Phase
- Three Phase

5. UPS I/O Sections

- Local control, displace, relay, SNMP, different communication bus and interface

6. UPS Specification

- In-depth study of rectifier and charger operation theory
- Input requirement and limitation (Voltage, current frequency and rate of change of X)
- DC bus upper and lower setting and alarm

7. Battery Requirements

- Types of batteries
- Theory of battery operation using ohm law
- Factors that affect battery performance and life cycle
- DC maximum and cut off voltage
- Monitoring systems

8. Lead Acid Batteries

- Chemistry
- Different types
- Capacity Factors
- S-Curves
- Battery Safety and Maintenance
- Float and Equalize Voltages
- Load Testing

9. Nickel Cadmium Batteries

- Chemistry
- Battery types
- Capacity Factors
- Battery Safety and Maintenance
- Float and Equalize Voltages
- Load Testing

10. Choppers and Inverters

- Chopper requirement
- Inverter theory (steps and PWM technology)
- SCR, transistor and IGBT (pro and con)
- Inverter duty cycle and operation frequency.
- Output requirement (voltage, current, frequency, rate of change, regulation
- Static and dynamic response, synchronization, overload capacity, protection,
- Forward, reverse and force transfers

11. Static Switches (internal and external)

- SS operational limitation
- Fully rated and partial rated

12. UPS Interface

- Standby generator with UPS
- Potential generator issues (sizing, harmonics, in-rush I, hunting, oscillation etc)
- Building communication interface (static contact and real time on line)
- Smoke, fire, heat , security, water, repo and others

13. UPS Grounding and Neutral Configuration

- Most common issue
- Principle and method

DAY TWO

14. UPS System Testing and Commissioning

- Factory and on-site testing
- Non-destructive and destructive testing
- Most items requires as per specification
- Load bank (linear or non-linear)
- Battery discharge testing
- Battery recharging test
- Performance testing

15. UPS Testing and Maintenance Procedures

- Charger and Rectifier Maintenance
- Input Filter
- Failure Detection and Maintenance
- DC Bus Capacitor Bank Filter Maintenance and Replacement
- Inverter Maintenance
- Forced Cooling System Malfunction
- Maintenance of Output Filter and Output Transformer
- Maintenance of Bypass Electronic Switch
- Maintenance of Power Electronic Board Control
- Main Control Board Replacement and Alarm System Troubleshooting
- Optimization of settings of the UPS Parameters

- Optimum Maintenance of the UPS Battery System
- Remote communications of UPS with Fire Systems and Building Automation
- Typical Installation Requirements of UPS systems
- Grounding requirements of UPS systems
- EMI Issues and UPS Control Systems
- Typical Protection Schemes for UPS Systems

16. Input and Output Power Quality Waveforms and Data

- Overload capacity (long and short)
- System efficiency calculation.
- Generator back-up testing under step loading
- (Leading and lagging power factor observation)

17. UPS System Applications

- Factors that affect the UPS application
- Initial cost, operational cost, footprint, weight, dimensions
- Nature of the load, environmental consideration

18. Cases Studies

- Static switch failure
- Generator governor destroyed due to UPS on bypass
- Non TVSS installation issue.
- N/G bonding issue

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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