

# Services

## TRAINING COURSE CATALOG





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## INTRODUCTION

Companies today are relying on fewer people to do more work. At the same time, critical facility equipment is becoming more complex. That is why training is essential!

Creating and training a best-in-class team takes time and financial resources — two things that are typically limited in today's overtaxed workforce. Add the challenges of skilled labor attrition to the mix and you quickly understand the need for effective employee development.

After all, the performance of your workforce can have a significant impact on your overall operation and ultimately your bottom line.

Our training courses provide a cost-effective way to ensure your workforce is capable of performing tasks safely and at the highest level of efficiency. We also assist in ensuring compliance with the latest regulatory requirements, while optimizing process and equipment knowledge.

The end result is a safer environment, retention of top employees, and reduction of overall costs.

## POWER

### Albér CRT-300/400 Cellcorder and Hydrometer Training

**Course Code:** ALB001PXX0

**Course Objective:** This course provides the student with a brief lesson on the background of cell resistance measurement technology and compares the Albér method to other measurement technologies to illustrate the measurement accuracy and repeatability of the instrument.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 1 day

**Location:** On site (equipment dependent) or at Vertiv™ Learning Academy

### Agenda

#### Safety

#### Lead-Acid Battery Ohmic Resistance

#### Background

- Understanding cell resistance
- Measurement methods
- DC load test methods
- Detection of cell problems
- How resistance affects cell performance
- Evaluating problems
- Industry recommended practices

#### Battery Analysis Software

- Primary functions of the software
- Software overview – data storage and report files
- Downloading data from the cellcorder to a PC
- Saving the downloaded data
- Creating the folder tree on a PC

- Downloading data from the hydrometer
- Identifying the battery
- Navigating through the battery analysis software
- Viewing, trending, and comparing data
- Thresholds and alarms
- Generating and printing reports

#### Hardware

#### Product Overview and Description

- Instrument purpose
- Features and benefits
- Limitations

#### User Screens

- Setup
- Configuration
- Thresholds

#### Test Probes Description and Use

- Two-lead probe sets
- Three-lead probe sets

#### Loading Site Data to Smart Media or USB Memory Devices

- Via CRT-300
- Via configuration editor

#### Making Measurements

- Cell resistance
- Connection resistance
- Cell voltage
- Analyzing data on the cellcorder
- Minimum, maximum and average analysis function
- Downloading data
- Smart media card/USB memory stick use

## Albér BCT-2000 Capacity Testing Training

**Course Code:** BCT001PXX0

**Course Objective:** This course provides the student with the fundamentals of capacity testing based on the IEEE 1188 and IEEE 450 standards then educates students on proper use of the Albér BCT-2000 Capacity Tester.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 1 day

**Location:** On site (equipment dependent) or Vertiv™ Learning Academy

### Agenda

#### Safety

#### Fundamentals of Battery Capacity

#### Testing

- What is battery capacity testing?
- Defining battery capacity
- Expressing battery capacity
- Why it is necessary
- Capacity vs. life
- Recommendations on testing
- Frequency
- How testing is performed
- Determining voltage and test parameters

#### BCT-2000 System Hardware

- Personal computer interface
- Data logger
- Continuous load units
- Sense lead sets
- System overview
- Personal computer interface
- Load bank

#### BCT-2000 System Software

- Overview
- Selecting the com port
- Types of tests to perform
- Setting up and performing a test

- Generating a report
- Analyzing test results
- Saving a report
- Overview

#### Hands-On

- Hardware review
- Interconnection and test preparation
- Connecting the BCT to the battery
- Load bank connection
- Running a test
- Data review and analysis

## Stationary Battery Basics

**Course Code:** SBB001PXX0

**Course Objective:** This course provides the student with a fundamental understanding of stationary battery systems used for supporting mission critical systems.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and activity sessions for course delivery.

**Length:** 2 days

**Location:** On site or Vertiv™ Learning Academy

### Agenda

#### Chapter 1

- Battery applications
- Electrochemistry basics
- Types of plates and grid materials
- Battery selection criteria
- Battery construction
- Understanding battery life
- Voltage and current terminology
- Premature battery failure and causes
- Major failure modes
- Battery racks and stands

#### Chapter 2

- Safety and training note
- IEEE stationary battery committee
- Delivery inspection
- Storage considerations
- Spill containment
- Assembly and loading of racks
- Cell handling techniques
- Making cell-to-cell connections

#### Chapter 3

- Inter-aisle, inter-rack, and inter-tier cable groups
- Verifying connection integrity
- Commissioning
- Documentation
- Battery cleaning
- Acceptance testing

#### Chapter 4

- Goals of a maintenance program
- Specific recommendations
- IEEE standards
- What needs to be done
- Safety
- Battery disconnects
- Conditions affecting service life
- Failure modes
- Preventing system failures
- Flooded battery visual inspection criteria
- Internal resistance measurements case study
- Failures of monoblock batteries and resistance
- Water additions

- Benefits of proper maintenance
- Example battery readings in interpretation

#### Chapter 5

- Defining capacity tests
- Why testing is needed
- Who recommends testing
- Defining battery capacity
- Understanding the electrical ratings of a battery
- Types of tests
- Equipment requirements
- How the testing process works
- Calculation of battery capacity

#### Chapter 6

- Understanding ohmic measurements
- Schematic of a lead-acid cell
- Measurement methods
- Detection of cell problems
- Ohmic problems and cell performance
- Metallic vs. electrochemical problems
- Problem evaluation
- Measurement intervals

## Sitescan™ Web Operations

**Course Code:** MON301PXXO

**Course Objective:** This course prepares the student to perform proper navigation, alarm processing, alarm reporting, trend configuration, and report generation on the SiteScan system using appropriate documentation. Upon successful completion of this course, the student will have demonstrated proficiency defined by the following agenda topics.

**Student Requirements:** Non-Vertiv students must be a full-time employee of the company that owns the Liebert® equipment, have been trained in basic electronics, electricity, and electrical safety, and must sign a non-disclosure agreement with safety release form. Vertiv™ employees must bring Vertiv-issued working laptop computer, Vertiv ID badge, and proper field service attire.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions with site modules and protocol simulators for course delivery.

**Length:** 1 day.

**Location:** On site or Vertiv Learning Academy

### Agenda

#### Safety

#### Introductions

- Hardware and software

#### Navigation

- Navigation trees
- Areas
- Equipment
- Changing the view

#### Alarm Management

- Alarm lifecycle
- Alarm viewer
- Alarm testing
- Alarm categories and colors
- Enable/disable screen
- Alarm messages
- Field codes
- Alarm actions

#### Operators

- Privilege sets
- Operator screen
- Advanced passwords
- Manual commands

#### System Modification

- AC unit set point changes
- Moving equipment
- Modifying tree layout

#### Properties Menu Button

- Header
- AC unit control
- Other sections

#### Trends

- Trends bezel
- Trend sources
- Enabling point
- Saved graphs
- Trend button and viewer

- Trend display and print changes
- Trend usage report
- Custom trend report overview

#### Reports

- Different tabs
- Standard reports
- Custom reports
- System settings

#### Backups



## Liebert® APM™: First Responder

**Course Code:** UPS440PXX0

**Course Type:** Instructor-led training

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment and have been trained in basic electronics, electricity, and electrical safety.

**Course Objectives:** This course introduces the learner to the correct and safe operations of the APM product line and how to identify and report problems with the APM system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the APM using appropriate documentation.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of or authorized contractor for the equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 1 day

### Agenda

#### Safety

#### Introduction

- System description
- Bypass supplies
- Flexibility
- Higher availability

#### Modes of Operation

- Operator controls
- Operator control panel
- Operator control and display panel
- Types of LCD screens
- Pop-up windows
- Circuit breakers

#### Options

- Communication and other uses

#### Terminals

- LBS (Load Bus Synchronization) mode
- Parallel system
- Maintenance bypass cabinet
- Specifications

#### Theory of Operation

- System controls
- Rectifier/charger/inverter
- Static bypass switch
- Battery system

#### Operating Instructions

- Operating modes
- Energize (turn on) single module system
- Energize (turn on) multi-module system
- Totally de-energize single module system
- Totally de-energize multi-module system

- Partially de-energize (maintenance mode) single module system
- Partially de-energize (isolate one module) multi-module system
- Emergency shutdown with EPO
- Reset after shutdown for emergency
- Stop (EPO action) or other conditions
- Auto restart
- Battery protection

#### Support

- Vertiv Services
- Limited life components
- Detecting and reporting a problem
- Upstream feeder circuit breaker

#### Conclusion

## Liebert® EXL™: First Responder

**Course Code:** UPS560PXX0

**Course Type:** Instructor-led training

**Course Objective:** This course introduces the learner to the correct and safe operations of the EXL product line and how to identify and report problems with the EXL system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the EXL using appropriate documentation.

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment or a designated facilities management agent, and have been trained in basic electronics, electricity, and electrical safety.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner. Students must bring all personal protective equipment and proper field service attire.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 2 days

## Agenda

### Safety

#### Introduction

- System description
- Reliability
- Modes of operation
- Operator controls
- Options

#### Specifications

- Rating
- Environmental conditions
- Adjustments
- Battery operation
- Electrical

#### Theory of Operation

- UPS module
- Battery plant
- Controls - operator interface display

### System

- Rectifier/charger
- Battery charging circuit
- Inverter
- Static bypass
- Alarm messages
- Transfer and retransfer conditions

### Operation

- Display screens and operator controls
- Menu tree navigation
- Operator controls
- EXL operator control panel
- Status messages
- Modes of operation
- Manual procedures
- Startup procedure (SMS, 1+N, N+1)
- Load transfer procedures (SMS, 1+N, N+1)

- Shutdown procedures (SMS, 1+N, N+1)
- Local emergency modules off (LEMO)
- Remote emergency power off (REPO)
- Maintenance bypass load transfers
- Automatic operations
- Overloads (without transfer)
- Automatic retransfers to UPS
- Automatic restart (optional)
- Safety precautions
- Safety warnings

### Support

- Detecting a problem
- Reporting a problem
- Upstream feeder circuit breaker
- Vertiv™ Services
- Limited life components

### Conclusion

## Liebert® EXL™ S1: First Responder

**Course Code:** UPS570PXX0

**Course Type:** Instructor-led training

**Course Objective:** This course introduces the learner to the correct and safe operations of the EXL S1 product line and how to identify and report problems with the EXL S1 system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the EXL S1 using appropriate documentation.

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment or a designated facilities management agent, and have been trained in basic electronics, electricity, and electrical safety.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner. Students must bring all personal protective equipment and proper field service attire.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 2 days

### Agenda

#### Safety

#### Introduction

- System description
- Reliability
- Modes of operation
- Operator controls
- Options

#### Specifications

- Rating
- Environmental conditions
- Adjustments
- Battery operation
- Electrical

#### Theory of Operation

- UPS module
- Battery plant
- Controls - operator interface display

#### System

- Rectifier/charger
- Battery charging circuit
- Inverter
- Static bypass
- Alarm messages
- Transfer and retransfer conditions

#### Operation

- Display screens and operator controls
- Menu tree navigation
- Operator controls
- EXL S1 operator control panel
- Status messages
- Modes of operation
- Manual procedures
- Startup procedure
- Load transfer procedures
- Shutdown procedures

- Local emergency modules off (LEMO)
- Remote emergency power off (REPO)
- Maintenance bypass load transfers
- Automatic operations
- Overloads (without transfer)
- Automatic retransfers to UPS
- Automatic restart (optional)
- Safety precautions
- Safety warnings

#### Support

- Detecting a problem
- Reporting a problem
- Upstream feeder circuit breaker
- Vertiv Services
- Limited life components

#### Conclusion

## Liebert® EXM™: First Responder

**Course Code:** UPS445PXX0

**Course Type:** Instructor-led training

**Course Objectives:** This course introduces the learner to the correct and safe operations of the EXM product line and how to identify and report problems with the EXM system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the EXM using appropriate documentation.

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment and have been trained in basic electronics, electricity, and electrical safety.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of or authorized contractor for the equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 1 day

## Agenda

### Safety

### Introduction

### System Description

- Bypass supplies
- Flexibility
- Higher availability

### Modes of Operation

- Operator controls
- Operator control and display panel
- Types of LCD screens
- Pop-up windows
- Circuit breakers

### Options

- Communication and other user terminals
- LBS (Load Bus Synchronization) mode
- Parallel system

- Maintenance bypass cabinet
- Specifications

### Theory of Operation

- System controls
- Rectifier/charger/inverter
- Static bypass switch
- Battery system

### Operating Instructions

- Operating modes
- Energize (turn on) single module system
- Energize (turn on) multi-module system
- Totally de-energize single module system
- Totally de-energize multi-module system
- Partially de-energize (maintenance mode)
- Single module system

- Partially de-energize (isolate one module)
- Multi-module system
- Emergency shutdown with EPO
- Reset after shutdown for emergency stop
- Stop EPO action or other conditions
- Auto restart
- Battery protection

### Support

- Vertiv Services
- Limited life components
- Detecting and reporting a problem
- Upstream feeder circuit breaker

### Conclusion

## Liebert® NPower™: First Responder

**Course Code:** UPS420PXX0

**Course Type:** Instructor-led training

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment and have been trained in basic electronics, electricity, and electrical safety.

**Course Objective:** This course introduces the learner to the correct and safe operations of the Npower system and how to identify and report problems with the Npower UPS system. The course covers system introduction, system specifications, theory of operations, system operations, and maintenance.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner. Students must bring all appropriate personal protective equipment and proper field service attire.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 2 days

### Agenda

#### Safety

#### Introduction

- System description
- Reliability
- Safety precautions
- Modes of operation
- Operator controls
- Options
- Specifications

#### Theory of Operation

- UPS module
- System controls
- Rectifier/charger
- Battery charging circuit
- Inverter
- Static bypass
- Transfer and retransfer conditions
- Battery system

#### Operation

- Operator controls and panel
- Rotary switch
- Fuse blocks
- Security access and passwords
- Display screens and procedures
- Menu tree
- MIMIC screen
- Auto startup
- Manual startup
- Shutdown
- Manual transfer
- Battery management
- Status reports
- System status monitoring
- Configuration screens
- Auto restart
- Faults, alarms, and status

#### Maintenance

- Routine maintenance
- Vertiv™ Services
- Limited life components
- Detecting and reporting a problem
- Upstream feeder circuit breaker

#### Conclusion

## Liebert® NX™ A/B: First Responder

**Course Code:** UPS430PXX0

**Course Type:** Instructor-led training

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment or a designated facilities management agent, and have been trained in basic electronics, electricity, and electrical safety.

**Course Objective:** This course introduces the learner to the correct and safe operations of the NX product line and how to identify and report problems with the NX system. This course covers system introduction, system specifications, theory of operation, system operations, and routine inspections of the NX using appropriate documentation.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 1 day

### Agenda

#### Safety

#### Introduction

- System description
- Bypass supplies
- Flexibility
- Higher availability
- Modes of operation

#### Operator Controls

- Operator control and display panel
- Types of LCD screens
- Pop-up windows
- Power switches

#### Options

- Communication and other uses

#### Terminals

- LBS (Load Bus Synchronization) mode
- Battery start (optional)
- Maintenance bypass cabinet

#### Specifications

#### Theory of Operation

- System controls
- Rectifier/charger
- Inverter
- Static bypass switch
- Battery system
- Operating instructions
- Operating modes
- Energize single- and multi-module system
- De-energize single- and multi-module system
- Partially de-energize (maintenance mode) single-module system
- Partially de-energize (isolate one unit) multi-module system
- Emergency shutdown with EPO
- Reset after shutdown for emergency
- Stop (EPO action) or other conditions

- Auto restart
- Battery protection

#### Maintenance Considerations

- Vertiv™ Services
- Limited life components
- Detecting and reporting a problem
- Upstream feeder circuit breaker

#### Conclusion

## Liebert® NX™ 225-600: First Responder

**Course Code:** UPS550PXX0

**Course Type:** Instructor-led training

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment or a designated facilities management agent, and have been trained in basic electronics, electricity, and electrical safety.

**Course Objective:** This course introduces the learner to the correct and safe operations of the NX 225-600 product line and how to identify and report problems with the system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the NX 225-600 using appropriate documentation.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner. Students must bring all personal protective equipment and proper field service attire.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 1 day

### Agenda

#### Safety

#### Introduction

- System description
- Reliability
- Modes of operation
- Operator controls
- Options

#### Specifications

- Rating
- Environmental conditions
- Adjustments
- Battery operation
- Theory of operation
- UPS module
- Controls - operator interface display

#### System

- Rectifier/charger
- Battery charging circuit
- Inverter
- Static bypass
- Alarm messages
- Transfer and retransfer conditions

#### Operation

- Display screens and operator controls
- Menu tree navigation
- Operator controls
- NX 225-600 operator control panel
- Status messages
- Modes of operation
- Manual procedures Startup procedure
- Load transfer procedures
- Shutdown procedures
- Local emergency modules off

- Remote emergency power off
- Maintenance bypass load transfers
- Overloads (without transfer)

#### Maintenance Considerations

- Safety precautions
- Safety warnings
- Vertiv™ Services
- Limited life components
- Detecting and reporting a problem
- Upstream feeder circuit breaker

#### Conclusion

## Liebert® NX™ 480: First Responder

**Course Code:** UPS435PXX0

**Course Type:** Instructor-led training

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment and have been trained in basic electronics, electricity, and electrical safety.

**Course Objective:** This course introduces the learner to the correct and safe operations of the NX 480 product line and how to identify and report problems with the NX 480 system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the NX480 using appropriate documentation.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery if units available for training. Students must bring all personal protective equipment and proper field service attire.

**Length:** 1 day

### Agenda

#### Safety

#### Introduction

- System description
- Bypass supplies
- Flexibility
- Higher availability

#### Modes of Operation

- Operator controls
- Operator control and display panel
- Types of LCD screens
- Pop-up windows
- Circuit breakers

#### Options

- Communication and other uses

#### Terminals

- LBS mode
- Parallel system
- Maintenance bypass cabinet
- Specifications

#### Theory of Operation

- System controls
- Rectifier/charger
- Inverter
- Static bypass switch
- Battery system

#### Operating Instructions

- Operating modes
- Energize system
- De-energize system

- Partially de-energize (maintenance mode) single-module system
- Partially de-energize (isolate one module) multi-module system
- Emergency shutdown with EPO
- Reset after shutdown for emergency
- Stop (EPO action) or other conditions
- Auto restart
- Battery protection

#### Conclusion



## Liebert® NXL™: First Responder

**Course Code:** UPS540PXX0

**Course Type:** Instructor-led training

**Course Objective:** This course introduces the learner to the correct and safe operations of the NXL product line and how to identify and report problems with the NXL system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the NXL using appropriate documentation.

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment or a designated facilities management agent, and have been trained in basic electronics, electricity, and electrical safety.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 2 days

### Agenda

#### Safety

#### Introduction

- System description
- NXL single-line diagram
- Flexibility
- Applications
- Modes of operation

#### Operator Controls

- Display touchscreen
- Mimic display
- Touchscreen navigation
- Configurations menu
- Status reports
- Startup, shutdown and transfer menus
- Battery management menu
- Circuit breakers
- Options
- Maintenance bypass cabinet

### Specifications

#### Theory of Operation

- System controls
- Rectifier/charger
- Inverter
- Static bypass switch
- Battery system

#### Operations

- Modes of operation
- Manual procedures
- UPS startup procedure
- Load transfer procedures
- Maintenance bypass load transfers
- UPS shutdown procedures
- Automatic operations

### Maintenance

- Routine maintenance
- Vertiv Services
- Limited life components
- Detecting and reporting a problem
- Upstream feeder circuit breaker

### Conclusion

## Liebert® Series 600/610: First Responder

**Course Code:** UPS515PXX0

**Course Type:** Instructor-led training

**Prerequisites:** Must be a full-time employee of the company that owns the Liebert equipment and have been trained in basic electronics, electricity, and electrical safety.

**Course Objective:** This course introduces the learner to the correct and safe operations of the Series 600 product line and how to identify and report problems with the Series 600 system. This course covers system introduction, system specifications, theory of operations, system operations, and routine inspections of the Series 600 using appropriate documentation.

**Student Requirements:** Non-disclosure agreement, safety release form, and employee of equipment owner.

**Media:** The instructor uses electronic documentation, presentations, and hands-on lab sessions for course delivery.

**Length:** 2 days

### Agenda

#### Safety

#### Introduction

- System description
- Reliability
- Modes of operation
- Operator controls
- Options

#### Specifications

- Rating
- Environmental conditions
- Adjustments
- Battery operation
- Electrical

#### Theory of Operation

- UPS module
- Battery plant
- Controls - operator interface display

#### System

- Rectifier/charger
- Battery charging circuit
- Inverter
- Static bypass
- Alarm messages
- Transfer and retransfer conditions

#### Operation

- Display screens and operator controls
- Menu tree navigation
- Operator controls
- Series 610 operator control panel
- Status messages
- Modes of operation
- Manual procedures
- SCC Startup procedure
- Load transfer procedures
- Shutdown procedures

- Local emergency modules off (LEMO)
- Remote emergency power off (REPO)
- Maintenance bypass load transfers
- Automatic operations
- Overloads (without transfer)
- Automatic retransfers to UPS
- Automatic restart (optional)
- Detecting a problem
- Reporting a problem
- Upstream feeder circuit breaker
- Maintenance review
- Maintenance

#### Conclusion

## ELECTRICAL

### OSHA 1910/NFPA 70E Electrical Safety

**Course Code:** ES101

**Course Type:** Instructor-led training

**Course Objective:** This electrical safety course will provide the student with the information needed to comply with the latest OSHA regulations and requirements regarding electrical safety training for “qualified electrical workers.” The students will understand the hazards associated with working on or around electricity and to identify the most effective ways to minimize the risks associated with the hazards. Anyone who works on or near electrical equipment as well as supervisors, managers, and safety personnel should attend this course.

**Student Requirements:** Safety release form and hands-on equipment to be provided by customer if required.

**Length:** 1 day

### Agenda

#### Introduction

- Course objectives
- Required worker safety training

#### Codes and Standards

- Federal safety regulations (OSHA)
- Enforcement agencies
- Other standards and guidelines

#### Safety Fundamentals

- Safety engineering
- Safety program essentials
- Elements of safety programs

#### Electric Shock

- Nature of electric shock
- Shock severity factors
- Response to shock
- Quantifying the shock hazard
- Mitigation of shock hazard

- Protective equipment
- Rescuing a shock victim

#### Arc Flash and Blast

- Nature of arc flash and blast
- Quantifying arc flash hazard
- Prevention of hazards from the arc flash/blast
- Personal protective equipment

#### Safe Work Practices

- Employer responsibilities
- Employee responsibilities
- Contractor responsibilities
- Equipment working clearances
- Preliminary planning
- Selection and use of safe work practices
- Exposed live part
- Safe switching procedures
- Lockout and tagout procedures

- Performance of lockout and tagout procedures
- Application of personal protective grounding cables
- Release from lockout/tagout and re-energization
- Working on or near energized equipment
- Safe use of test equipment
- Interlocks

#### Special Situations

- Battery rooms
- Raised floor

## OSHA 1910/NFPA 70E Electrical Safety with Hands-on Experience Available

**Course Code:** ES102

**Course Type:** Instructor-led training

**Student Requirements:** Safety release form, and hands on equipment to be provided by customer if required.

**Length:** 2 days

**Course Objective:** This course is designed to provide those personnel involved with the operation and maintenance of a power distribution system the knowledge, skills, and abilities to meet the NFPA 70E training requirements to be considered a “qualified electrical worker” in accordance with Chapter 1, and to meet the NFPA 70E Chapter 2 maintenance requirements:

“Article 205.1 Qualified Persons. Employees who perform maintenance on electrical equipment and installations shall be qualified persons as required in Chapter 1 and shall be trained in, and familiar with, the specific maintenance procedures and tests required.”

The presentation is designed to be adapted to the company’s facility, campus, or site. The proper operation and maintenance of the major components will be presented using specific equipment manufacturer’s instructions whenever possible. In absence of manufacturer’s instructions, the applicable maintenance and testing recommended by the InterNational Electrical Testing Association (ANSI/NETA MTS) or NFPA 70B Recommended Practice for Electrical Equipment Maintenance will be utilized. Site and equipment specific safety hazards and mitigation techniques will be covered.

**Media:** This two-day seminar will utilize both lecture and hands-on demonstrations to provide the greatest possible exposure to power distribution system safety, operations, and maintenance requirements.

### Agenda

#### NFPA 70E Chapter 1: Electrical Safety

- Premise – electric shock, arc and blast
- Application of safety-related work practices
- General requirements for safety-related work practices
- Establishing an electrically safe work condition
- Work involving electrical hazards
- Portable tools and equipment
- Personal safety and protective equipment

#### NFPA 70E Chapter 2: Safety-Related Maintenance Requirements

- Single-line diagrams
- Switchboards
- Switchgear assemblies
- Panelboards
- Motor control centers
- Disconnect switches
- Bus, cable and wiring
- Fuses
- Circuit breakers
- Rotating equipment
- [Automatic transfer switches]
- [Uninterruptible power supplies]
- [Hazardous locations]
- [Batteries and battery rooms]

## Low-Voltage Circuit Breaker Operations and Maintenance

**Course Code:** EM101

**Course Type:** Instructor-led training

**Student Requirements:** Safety release form, and hands-on equipment to be provided by customer if required.

**Length:** 1 day

**Course Objective:** Power circuit breakers represent the workhorses of industrial systems. It's important to understand the installation criteria, operational parameters, operating limitations, inspection, and maintenance requirements because these devices can present hazards to personnel, equipment, and operations. They are fundamental to the operation of your power system. They provide a means of switching electrical equipment into service or out of service. Additionally, they are essential for the safe isolation of equipment when work is being performed.

This course introduces the student to different types of breaker construction, important breaker data plate information such as AIC at operating voltage, HACR ratings, and how the various types of circuit conditions (faults and overloads) should affect the protective functions of the circuit breaker. The proper operation of power circuit breakers, including racking interlocks of draw-out style equipment, will be explored in detail. The course covers various causes of breaker failure, safety issues, and steps for getting back online as soon as possible.

### Agenda

#### Definitions

#### Introduction and Theory

- Functions
- Comparisons
- Interruption theory

#### Control and Indication

- Voltage transformers
- Current transformers
- Unit programmers – LSIG and I2T settings

#### Types of Protection

- Overloads
- Short circuits
- Ground fault
- Under voltage
- Shunt trip

#### Circuit Breaker Troubleshooting Considerations

- Breaker fails to close
- Breaker fails to trip
- Breaker trips free
- Interlock failures
- Sensing failures

#### Inspection and Test Procedures

- Safety during maintenance
- NETA testing standards
- Interpreting results

#### Conclusion

- Review
- Questions/comments
- Exam

## Low-Voltage Circuit Breaker Operations and Maintenance with Hands-on Experience Available

**Course Code:** EM103

**Course Type:** Instructor-led training

**Student Requirements:** Safety release form, and hands on equipment to be provided by customer if required.

**Length:** 2 days

**Course Objective:** Power circuit breakers represent the workhorses of industrial systems. It's important to understand the installation criteria, operational parameters, operating limitations, inspection, and maintenance requirements because these devices can present hazards to personnel, equipment, and operations. They are fundamental to the operation of your power system. They provide a means of switching electrical equipment into service or out of service. Additionally, they are essential for the safe isolation of equipment when work is being performed.

This course introduces the student to different types of breaker construction, important breaker data plate information such as AIC at operating voltage, HACR ratings, and how the various types of circuit conditions (faults and overloads) should affect the protective functions of the circuit breaker. The proper operation of power circuit breakers, including racking interlocks of draw out style equipment, will be explored in detail. The course covers various causes of breaker failure, safety issues and steps for getting back on line as soon as possible.

**Media:** This two-day seminar will utilize both lecture and hands-on demonstrations to provide the greatest possible exposure to power distribution system safety, operations, and maintenance requirements.

### Agenda

#### Definitions

#### Introduction and Theory

- Functions
- Comparisons
- Interruption theory

#### Control and Indication

- Voltage transformers
- Current transformers
- Unit programmers – LSIG and I2T settings

#### Types of Protection

- Overloads
- Short circuits
- Ground fault
- Under voltage
- Shunt trip

#### Circuit Breaker Troubleshooting Considerations

- Breaker fails to close
- Breaker fails to trip
- Breaker trips free
- Interlock failures
- Sensing failures

#### Inspection and Test Procedures

- Safety during maintenance
- NETA testing standards
- Interpreting results

#### Conclusion

- Review
- Questions/comments
- Exam

## Automatic Transfer Switch and Generator Operations and Maintenance

**Course Code:** EM102

**Course Type:** Instructor-led training

**Student Requirements:** Safety release form, and hands-on equipment to be provided by customer if required.

**Length:** 1 day

**Course Objective:** This one-day course provides a comprehensive overview of the components that make up emergency standby power systems. Emphasis is given to codes and standards used as guidelines for inspection, testing and maintenance. We will also present typical problems encountered by technicians and discuss recommended solutions.

This course is highly recommended to anyone responsible for a facility with an emergency system, facility operators, and maintenance technicians, including hospital facility managers and technicians.

### Agenda

#### Codes and Standards

- Introduction and general code requirements
- Hospital codes and standards
- Routine maintenance and operational testing
- National electrical codes for ground fault systems

#### Function Design

##### Engine Controls

- Speed control
- Relay logic
- Advances and retrofit
- Voltage regulation

##### UPS and Generator Comparison

- Advantages/disadvantages
- Selection criteria

#### Installation Considerations

- Moisture
- Temperature
- Noise
- Intake

#### Ground Fault Protection

- Multi zone
- Double-ended substations
- Emergency generating maintenance

#### Engine Control Problem

- Slow Start
- Hunting
- Load response

#### Generator Control Problems

- Regulation

#### Industry Standard for Testing

- NETA

#### System Documentation

- OEM manuals

#### Determining Spare Parts

- History
- Manufacturer's recommendations
- Trouble log

#### ATS

- The key to system
- Problems
- Start-load test function
- Solid suit

#### UPS

- Function
- Design
- Batteries

#### Case Studies

- Review of participant's problems
- Review of previous jobs

## Switching Operations and Safety

**Course Code:** WP101

**Course Type:** Instructor-led training

**Student Requirements:** Safety release form, and hands on equipment to be provided by customer if required.

**Length:** 1 day

**Course Objective:** This class covers the practical application of PPE, safety grounds, switching, LOTO, and verification that circuits are de-energized. This class is a hands-on review and practice of skills taught in electrical safety for OSHA 1910. Anyone responsible for the operation or performing maintenance should attend. Anyone considering the purchase of a substation should attend to gain a working knowledge of the condition indicators used by those performing testing and maintenance on substations. Those needing to ensure a proper response to a substation emergency should also attend.

**Media:** This material is presented through lecture, demonstration, and hands-on exercises.

**Location:** This course is presented on site.

### Agenda

#### Personal Protective Equipment

- Inner wear
- Blast suits
- Insulated gloves
- Insulated tools (hot sticks)

#### Switching

- Pre-switching planning
- Opening circuits under load
- PPE application

#### Grounding Inspection

- Interlocks
- Switch operation

#### Emergency Response

- Switching operation review

#### Lockout/Tagout Procedures

#### Device Requirements

#### Procedural Requirements

- Coordination
- Isolation
- Locking/blocking
- Re-energizing attempt
- Live dead live checks
- Application of grounds

#### Verification of De-energization

- Noncurrent-carrying metal parts
- Equipment rating
- High-voltage testers
- Insulated test equipment

#### Voltage Detection and Phasing Sticks

#### Application of Grounds

#### Grounding Methods

- Equipotential zone
- Single-source or site grounding
- Double grounding

#### Protective Grounding Equipment

#### Determining Current Ratings

- Withstand
- Clearing time

#### Inspection

- Cable
- Clamp
- Ferrule
- Cluster

#### Personal Protective Ground Removal

- Re-energization

#### Working Near Energized Equipment



## Switching Operations and Safety with Hands-on Experience Available

**Course Code:** WP102

**Course Type:** Instructor-led training

**Student Requirements:** Safety release form, and hands-on equipment to be provided by customer if required.

**Length:** 2 days

**Course Objective:** This class covers the practical application of PPE, safety grounds, switching, LOTO, and verification that circuits are de-energized. This class is a hands-on review and practice of skills taught in electrical safety for OSHA 1910. Anyone responsible for operations or performing maintenance should attend. Anyone considering the purchase of a substation should attend to gain a working knowledge of the condition indicators used by those performing testing and maintenance on substations. Those needing to ensure a proper response to a substation emergency should also attend.

**Media:** This two-day seminar will utilize lecture, demonstration, and hands-on exercises.

**Location:** This course is presented on site.

### Agenda

#### Personal Protective Equipment

- Inner wear
- Blast suits
- Insulated gloves
- Insulated tools (hot sticks)

#### Switching

- Pre-switching planning
- Opening circuits under load
- PPE application

#### Grounding Inspection

- Interlocks
- Switch operation

#### Emergency Response

- Switching operation review

#### Lockout/Tagout Procedures

#### Device Requirements

#### Procedural Requirements

- Coordination
- Isolation
- Locking/blocking
- Re-energizing attempt
- Live dead live checks
- Application of grounds

#### Verification of De-energization

- Noncurrent-carrying metal parts
- Equipment rating
- High-voltage testers
- Insulated test equipment

#### Voltage Detection and Phasing Sticks

#### Application of Grounds

#### Grounding Methods

- Equipotential zone
- Single-source or site grounding
- Double grounding

#### Protective Grounding Equipment

#### Determining Current Ratings

- Withstand
- Clearing time

#### Inspection

- Cable
- Clamp
- Ferrule
- Cluster

#### Personal Protective Ground Removal

- Re-energization

#### Working Near Energized Equipment

## THERMAL

### HVAC Operations

**Course Code:** PCT203

**Course Type:** Instructor-led training

**Student Requirements:** This course is designed for the experienced HVAC technician.

**Length:** 2 days

**Course Objective:** This class covers the operations, programming, and installation basics of Liebert® equipment including the DS-VS™, CW™, PDX™, PCW™, Challenger, SmartRow™ DCR with PDX™ units featuring iCOM™ control, the new MC™ condenser, and other heat rejection devices.

**Media:** Students learn through a combination of presentations and hands-on training using a factory-built simulator. The simulator is constructed with an actual main control board, iCOM control, fuse board and temperature/humidity sensor.

### Agenda

#### Large Thermal Management

- Identifying products
- Model variation

#### Liebert iCOM Controls

- Navigation
- Implementing temperature-humidity programs
- Programming menus, screens and icons

#### Program, Diagnose and Troubleshoot

- Displays and touch screens

#### Networking

- Unit to unit
- Multi-unit



**For more information on Vertiv training courses, contact your local sales representative.**

