CONCEPT

UPS Systems, Battery Chargers and DC Systems: Maintenance, Testing and Troubleshooting



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Introduction:

UPS systems, battery chargers and DC systems protect relays, breaker tripping, control systems and emergency lighting, yet they often fail silently: a string with one high-resistance cell, a charger floating at the wrong voltage or a static bypass nobody has tested. This Core Concept course gives maintenance engineers and technicians a practical method to inspect, test and troubleshoot the whole critical-power chain, from rectifier and charger through the battery to the inverter, static switch and load. Participants produce a UPS and DC System Condition Assessment and Maintenance Plan for one installation at their own site.

Course Objectives:

- Trace the critical-power chain of an installed UPS or DC system from input rectifier and charger through the battery and inverter to the static switch, bypass and load
- Classify UPS topologies and parallel redundant configurations and explain how each behaves on mains failure, overload and module fault
- Set and verify charger float, boost and equalise modes and DC earth fault monitoring for the battery technology installed
- Carry out battery inspections, ohmic measurements and capacity discharge tests and interpret the results against manufacturer data
- Diagnose common UPS, charger and battery faults using alarm logs, waveforms and a structured fault-finding sequence
- Build a maintenance, monitoring and battery replacement plan that keeps backup autonomy at its design value

Target Audience:

- Electrical maintenance engineers responsible for UPS, charger and battery assets in power plants, substations and process facilities
- Electrical technicians responsible for routine inspection, testing and first-line fault finding on battery banks and DC boards
- Maintenance supervisors responsible for scheduling battery tests, managing spares and approving replacement work
- Instrument and control technicians responsible for DC-fed control panels, relays and telecom loads
- Facility and data centre technical staff responsible for critical-load UPS availability

Course Outline:

Day 1: Critical-Power Chain, Load Profiles and Site Survey

- Critical Load Register: Protection Relays, Breaker Trip Coils, DCS and Emergency Lighting
- AC UPS Versus DC Battery Charger Systems: Selection by Load Type
- Single-Line Diagram of Rectifier, Battery, Inverter, Static Switch and Maintenance Bypass
- Load Duty Cycle Profile: Continuous, Momentary and Inrush Loads
- Existing Installation Survey Checklist: Nameplates, Settings and Alarm History

Day 2: UPS Topologies, Static Switch and Parallel Redundancy

- Offline, Line-Interactive and Online Double Conversion Topologies Compared
- IEC 62040-3 Performance Classification and Output Waveform Characteristics
- Static Transfer Switch Logic, Synchronisation Window and Maintenance Bypass Sequence
- N+1 Parallel Redundant Modules, Load Sharing and Selective Module Tripping
- Industrial Rectifier Chargers: Thyristor and Switch-Mode Designs, Float and Boost Modes

Day 3: Battery Technologies, Sizing Checks and Battery Room Safety

- VRLA AGM and Gel, Flooded Lead-Acid, Vented NiCd and Lithium-Ion Characteristics Compared
- Battery Autonomy Check: Ampere-Hour Capacity, End Voltage and Temperature Correction
- Charger Settings by Chemistry: Float Voltage, Equalise Charge and Temperature Compensation
- Battery Room Ventilation, Hydrogen Gassing and Lower Explosive Limit Control
- Electrolyte Handling, Eyewash Stations, Insulated Tools and Personal Protective Equipment

Day 4: Battery Testing, Monitoring and Fault Diagnosis

- Cell Voltage, Specific Gravity and Connection Resistance Inspection Records
- Ohmic Measurements: Internal Resistance, Impedance and Conductance Trending
- Capacity Discharge Test Procedure, Load Bank Set-Up and Acceptance Criteria
- DC Earth Fault Location, Charger Ripple and Thermal Runaway Warning Signs
- UPS Fault Finding: Inverter Trips, Rectifier Failures, Fan and Capacitor Ageing

Day 5: Site Inspection Walkthrough and Maintenance Plan

- Guided Inspection Walkthrough of a Case UPS Room and Substation Battery Room
- Test Data Review: Discharge Curves, Ohmic Trends and Alarm Logs from the Case
- Remote Battery Monitoring and Replacement Criteria Decision Table
- Preventive Maintenance Schedule and Spares List for UPS and DC Systems
- UPS and DC System Condition Assessment and Maintenance Plan Presentation

Skills You Will Gain:

- Critical-Power Chain Mapping
- UPS Topology Assessment
- Static Bypass Verification
- Charger Mode Configuration
- Battery Ohmic Testing
- Capacity Discharge Testing
- DC Earth Fault Location
- Battery Replacement Planning

Why Attend This Course:

- Return with a UPS and DC System Condition Assessment and Maintenance Plan for one installation at your own site
- Spot weak cells, wrong charger settings and untested bypass paths before a mains failure exposes them
- Run discharge and ohmic tests with confidence and read the results against manufacturer data
- Compare battery and UPS maintenance practice with peers from power generation, utilities, oil and gas and process plants

Conclusion:

Backup power is only as dependable as its weakest cell, its charger settings and its bypass path. The one week move from mapping the critical-power chain and its loads, through UPS topologies, static switching and parallel redundancy, to battery technologies, charger settings and battery room safety. Testing, monitoring and structured fault finding follow, and the final day applies everything in an inspection walkthrough that produces a UPS and DC System Condition Assessment and Maintenance Plan ready for the participant's next maintenance review.