Substation Battery and Charger Training Course: Duty Cycle, Sizing and Testing

6 – 10 December 2026
Kuala Lumpur

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Programme Summary

Substation battery and charger practice is the subject of this one-week training course for substation and plant electrical engineers, protection engineers and maintenance managers, taught at applied level and ending in a DC system record package for one substation. Protection and control depend on batteries and chargers that are often sized once and left untested. The programme moves from duty cycle to battery sizing, charger selection, distribution and redundancy, then monitoring and capacity tests, using prepared records from a substation and a power plant. Mars Training Centre UK delivers this programme on substation battery and charger practice to mixed-organisation cohorts.

The Business Case

Teams that size batteries from a recorded duty cycle and test them on a schedule keep protection, tripping and control supplied when alternating power fails. Where capacity is assumed and tests are skipped, ageing cells and undersized chargers stay hidden until a trip circuit fails to operate. The programme works on the measures below.

- Loss of Protection Supply Risk: Falls when duty cycle, sizing margins and redundancy are agreed and recorded.
- Unplanned Battery Replacement: Reduces when capacity tests and trends set replacement on evidence.
- DC Fault Response Time: Improves when earth fault detection and distribution are documented.

Principles and Evidence Base

- IEEE 485: The recommended practice for sizing lead-acid batteries for stationary applications, applied in Session 2 to size cells from a duty cycle.
- Duty Cycle Method: A load profile approach that lists loads against time, applied in Sessions 1 and 5 to define what the battery and charger must carry.

Intended Participants

- Substation electrical engineers who specify and maintain station batteries and chargers.
- Plant electrical engineers who answer for DC supply to switchgear.
- Protection engineers who depend on a reliable DC supply for tripping and relays.
- Maintenance managers who plan battery tests, spares and replacement.

Typical settings include transmission utilities and power generation.

Learning Outcomes

1. Participants will be able to construct a duty cycle profile from the connected DC loads of a substation.
2. Participants will be able to evaluate battery capacity and charger rating against the duty cycle and margins.
3. Participants will be able to diagnose earth faults and single points of failure in a DC distribution arrangement.
4. Participants will be able to prioritise battery and charger actions by effect on protection and control supply.
5. Participants will be able to justify a monitoring and capacity test routine with replacement criteria.

Programme Structure

Day 1: Substation Battery and Charger Principles and Duty Cycle

What must a DC supply carry, and for how long, when the alternating supply is lost?

- Substation DC Load Inventory
- Duty Cycle Profile Chart
- Continuous and Momentary Load Classification
- Battery Chemistry Comparison Table
- DC System Single-Line Diagram

Day 2: Battery Sizing and Charger Selection

How are cells, capacity margins and charger ratings chosen from the duty cycle?

- IEEE 485 Cell Sizing Method
- Temperature and Ageing Margin Table
- Charger Rating Calculation
- Float and Boost Setting Sheet
- Voltage Window Check for Connected Equipment

Day 3: DC Distribution, Earth Faults and Redundancy

How is DC power distributed, and how is one failure kept from losing protection?

- DC Distribution Board Schedule
- Fuse and Breaker Discrimination Table
- Earth Fault Detection Method
- Redundant Battery and Charger Arrangement
- Battery Integration and Changeover Plan

Day 4: Monitoring, Maintenance Testing and Capacity Tests

What tests and monitoring show that a battery will still carry its duty?

- Battery Monitoring Parameter List
- Capacity Test Procedure
- Cell Voltage and Impedance Trend Sheet
- Charger Alarm and Output Test
- Replacement Trigger Criteria

Day 5: DC System Record Package for One Substation

Do the earlier results join into a record package that maintenance and operations can rely on?

- Applying the Session 1 Duty Cycle
- Testing the Session 2 Sizing Result
- Checking the Session 3 Earth Fault Method
- Reviewing the Session 4 Capacity Test Record
- Completing the DC System Record Package

Methodology

The programme is a data workshop built on prepared records from a substation and a power plant: load lists, single-line diagrams, charger settings, test sheets and monitoring logs. Participants build duty cycles, size cells and chargers, read test trends and defend their conclusions to peers.

- Suggested activity: Building a duty cycle chart from a load list for a distribution substation.
- Suggested activity: Checking a charger rating against float, boost and load demand.
- Suggested activity: Reading a capacity test record to decide whether a battery stays in service.

Capstone Output

Each participant completes a DC system record package for one substation. It holds a load inventory, a duty cycle chart, a sizing note, a charger setting sheet, an earth fault method and a test schedule. At work it goes to the maintenance review team for approval and becomes the reference for later changes and tests.

Frequently Asked Questions

Is substation battery and charger training suitable for engineers new to DC systems?

Yes. Substation battery and charger practice is taught from prepared records and templates. You need basic knowledge of electrical circuits and substation equipment, but no earlier experience of battery sizing.

Which standards does substation battery and charger practice rest on in this training?

Substation battery and charger practice here rests on IEEE 485 for sizing lead-acid batteries for stationary applications, together with a duty cycle method that lists loads against time.

How is the record package from substation battery and charger training used at work?

You take the DC system record package to your maintenance review team for approval and use its test schedule and criteria for capacity tests and replacement.

How does substation battery and charger practice differ from UPS and AC supply design?

Substation battery and charger practice covers direct current supplies for protection, tripping and control, while UPS and AC supply design deals with alternating current loads.