Switchboard and Control Panel Design: LV and MV Assemblies, Busbars and MCCs

18 – 22 October 2027
London - Central London four-star



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Introduction:

Switchboard and control panel design errors surface late and cost dearly: undersized busbars that overheat, assemblies whose short-circuit rating does not match the fault level, separation forms that block safe maintenance, and control panels with no spare I/O or unreadable wiring. This Core Concept course trains design engineers and panel builders to specify and design main distribution boards, motor control centres and control panels as IEC 61439 assemblies, from ratings and busbar sizing to heat loss, device selectivity, control wiring and acceptance testing. Each participant produces a Distribution Board and Motor Control Panel Design Package.

Course Objectives:

- Specify main distribution boards, sub-distribution boards and motor control centres from load schedules, supply data and installation conditions
- Apply IEC 61439 design verification routes and assign rated currents, rated diversity factors and short-circuit withstand ratings to an assembly
- Size main and distribution busbars and their supports for continuous current, temperature rise and short-circuit forces
- Calculate enclosure power losses and select ventilation, cooling and derating measures that keep the assembly within temperature-rise limits
- Design control panels with control circuits, PLC I/O allocation, terminal arrangements, wiring identification and cable ducting that support commissioning and later change
- Prepare layout drawings, schedules and factory and site acceptance test procedures for a complete switchboard and control panel package

Target Audience:

- Electrical design engineers who prepare switchboard and control panel specifications for projects and plant upgrades
- Panel builders and assembly manufacturers who translate specifications into verified, buildable assemblies
- Consultant engineers who review switchboard and motor control centre submittals for compliance with the specification
- Control and automation engineers who define control panel I/O, wiring and interfaces to field devices
- Project and site electrical engineers who witness factory acceptance tests and accept assemblies on site

Course Outline:

Day 1: Switchboard Types, Assembly Roles and Specification Inputs

- Main Distribution Board, Sub-Distribution Board and Motor Control Centre Functions Compared
- Original Manufacturer and Assembly Manufacturer Responsibilities Under IEC 61439
- Specification Inputs: Supply Earthing System, Load Schedule and Installation Conditions
- Fixed, Plug-In and Withdrawable Functional Unit Construction Choices
- Switchboard Specification Gap Review Checklist

Day 2: IEC 61439 Design Verification, Ratings and Internal Separation

- IEC 61439 Design Verification by Testing, Comparison with a Reference Design and Assessment
- Rated Current of the Assembly and Circuits with Rated Diversity Factor
- Rated Short-Time Withstand Current and Rated Conditional Short-Circuit Current Selection
- Forms of Internal Separation from Form 1 to Form 4b and Their Maintenance Trade-Offs
- Protective Circuit Continuity, Earth Bar Sizing and Enclosure Bonding Within the Assembly

Day 3: Busbar Sizing, Thermal Design and Protective Device Selection

- Main and Distribution Busbar Cross-Section Sizing Worksheet
- Busbar Support Spacing Against Electrodynamic Short-Circuit Forces
- Temperature-Rise Verification with Enclosure Power Loss Calculation
- Natural Ventilation, Forced Cooling and Ambient Temperature Derating Factors
- Incomer, Feeder and Motor Starter Device Selection with Manufacturer Selectivity Tables

Day 4: Control Panel Design, Metering and MV Panel Interfaces

- Control Circuit Architecture: Control Voltage, Interposing Relays and Hardwired Interlocks
- PLC I/O Allocation, Marshalling Terminals and Spare Capacity Rules
- Internal Wiring Colour Codes, Ferrule Marking and Cable Ducting Fill Ratios
- Current Transformer Selection and Multifunction Metering Arrangements
- MV Switchgear Panel Overview: Metal-Clad Compartments and IEC 62271-200 Internal Arc Classification

Day 5: Distribution Board and Motor Control Panel Design Package

- Case Brief: Plant Sub-Distribution Board and Pump Motor Control Panel
- General Arrangement, Front Elevation and Mounting Plate Layout Drawing Set
- Busbar, Device, Cable Entry and Heat Dissipation Schedules for the Case Assembly
- Factory Acceptance Test and Site Acceptance Test Procedures with Routine Verification Checks
- Design Package Presentation and Peer Review

Skills You Will Gain:

- Assembly Specification Writing
- Design Verification Planning
- Busbar Sizing Calculation
- Enclosure Heat Loss Assessment
- Device Selectivity Checking
- PLC I/O Allocation
- Panel Layout Drafting
- Acceptance Test Procedure Writing

Why Attend This Course:

- Return with a Distribution Board and Motor Control Panel Design Package you can reuse as a template on the next project
- Catch rating, separation and heat-loss mismatches in switchboard submittals before the assembly is built
- Hand panel builders and commissioning teams drawings and schedules that leave less room for rework on site
- Compare assembly design practice with engineers from utilities, oil and gas, water, buildings and manufacturing

Conclusion:

A switchboard or control panel performs safely for decades when its ratings, busbars, thermal design, devices and wiring are decided together and verified before it leaves the workshop. The course moves from switchboard types and specification inputs, through IEC 61439 design verification, ratings, separation and earthing, to busbar sizing, heat loss and device selection, then to control circuits, PLC I/O, metering and MV panel interfaces. The final day applies every step to a case and produces a Distribution Board and Motor Control Panel Design Package.