JUPITER PRIME
Consulting • Training • Advisory
جوبيتر برايم للاستشارات والتدريب

COURSE BROCHURE

# High Voltage Insulation Coordination and Overvoltage Behaviour Training Course

17 – 21 October 2027
Muscat

# High Voltage Insulation Coordination and Overvoltage Behaviour Training Course

**Ref:** 3158_119979 **Date:** 17 – 21 October 2027 **Location:** Muscat **Fees:** 6500 GBP

High Voltage Insulation Coordination and Overvoltage Behaviour is a 1-week training course for electrical engineers and senior technicians who look after high voltage networks, and it ends with each participant completing an insulation coordination study sheet for one item of plant. Ageing assets, denser networks and more frequent switching are putting insulation under stress it was never sized for. Jupiter Prime Training delivers this course, linking insulation strength to safe operation.

## Why High Voltage Insulation Coordination Matters Now

Three forces shape high voltage insulation coordination today. Networks gain new cable sections and compact substations, so overvoltage paths change faster than design records. Owners run transformers, bushings and joints beyond their planned lives, narrowing withstand margins. Field crews also switch more often and restore supply under time pressure, creating transients that older plant was never tested against. Coordinating insulation well avoids flashovers and long outages; neglecting it exposes gaps during a lightning storm. The course rests on internationally recognised insulation coordination practice, described here in general terms.

## Who Gains Most from High Voltage Insulation Coordination

- Engineers specifying insulation levels, clearances and arresters for substations
- Senior technicians operating switchgear who must recognise transient-producing conditions
- Asset engineers deciding whether aged transformers, bushings and cable terminations can stay in service
- Commissioning engineers who plan withstand tests and verify that installed plant matches its rated insulation
- Maintenance planners scheduling insulator cleaning and arrester checks

A substation or network operations group gains most when its design, operations and maintenance members attend together and agree one shared view of where their insulation margins are thin.

## High Voltage Insulation Coordination Capabilities

These outcomes link dielectric stress to control room, specification and maintenance choices.

- Classify temporary, switching and lightning overvoltages by shape, duration and origin — the protection choice for each bay
- Calculate the protective margin between an arrester's residual voltage and equipment withstand level — arrester selection and placement
- Assess clearances, creepage distances and pollution severity for outdoor insulation — insulator specification and cleaning intervals
- Weigh switching sequences, cable lengths and capacitor banks against the transients they create — operating instructions for control engineers
- Specify earthing arrangements that keep step and touch voltages within safe limits — site safety and layout approval
- Build an insulation coordination study sheet for one plant item — asset owners and network planners

## Key High Voltage Insulation Coordination Terms

- Insulation coordination — matching equipment dielectric strength to expected overvoltages and protective devices.
- Basic lightning impulse level — the peak of a steep test impulse that insulation must withstand without breakdown.
- Switching impulse withstand — the slower-fronted impulse level, typical of breaker operation, that insulation must survive.
- Protective margin — the ratio between equipment withstand voltage and arrester let-through voltage.
- Creepage distance — the shortest surface path along an insulator between energised and earthed parts.
- Temporary overvoltage — a power-frequency rise lasting cycles to seconds, often from earth faults or load rejection.

## High Voltage Insulation Coordination Day by Day

### Day 1: Plant, Stress and System Context

- High Voltage Plant Inventory — Which Items Carry the Highest Dielectric Risk
- Electric Field Distribution in Gas, Oil and Solid Insulation — Material Choice
- Neutral Earthing Methods and Fault Voltage Rise — System Grounding Decisions
- Network Topology Changes and Cable Additions — Shifting Overvoltage Exposure
- Failure Records and Outage Reports — Where Insulation Margins Already Fail

### Day 2: Overvoltage Sources and Shapes

- Temporary Overvoltage From Earth Faults and Load Rejection — Arrester Rating
- Switching Transients From Breakers, Reactors and Capacitor Banks — Operating Limits
- Direct and Induced Lightning Strokes on Lines — Shielding Wire Layout
- Travelling Wave Reflection at Cable and Line Junctions — Arrester Location
- Ferroresonance in Voltage Transformers — Switching Sequence Restrictions

## Day 3: Withstand Levels and Protective Devices

- Rated Withstand Levels and Standard Test Impulses — Equipment Insulation Class
- Surge Arrester Energy and Residual Voltage Data — Device Selection
- Protective Margin Calculation Worksheets — Acceptable Risk of Flashover
- Rod Gaps and Spark Gaps as Backup Protection — Low-Cost Coverage Choices
- Altitude, Temperature and Humidity Correction Factors — Site-Specific Clearances

## Day 4: Outdoor Insulation, Earthing and Safe Operation

- Pollution Severity Mapping and Creepage Selection — Insulator Type and Washing Cycle
- Substation Earth Grid Resistance Measurement — Step and Touch Voltage Safety
- Switching Instructions That Limit Transients — Control Room Procedure Updates
- Insulation Resistance and Dielectric Loss Tests — Return to Service Decisions
- Partial Discharge Indications on Aged Plant — Replacement Priority Lists

## Day 5: Practising the Insulation Coordination Study Sheet

- Overvoltage Source Table for a Chosen Substation Bay — Applying Day 2 Analysis
- Arrester Selection and Margin Check — Applying Day 3 Worksheets
- Clearance and Creepage Verification — Applying Day 4 Pollution Mapping
- Peer Challenge of Assumptions and Weak Points — Shared Margin Judgement
- Completed Insulation Coordination Study Sheet — Recommendation to the Asset Owner

## Applying High Voltage Insulation Coordination After the Course

- Lead a protective margin check on one bay's arresters against the transformer withstand rating.
- Revise a capacitor bank switching instruction to reduce energisation transients.

## High Voltage Insulation Coordination Questions FAQ

### What is high voltage insulation coordination and why does it matter now?

High voltage insulation coordination is the matching of equipment insulation strength to the overvoltages a network produces. It matters now because extended networks and aged plant are shrinking the margin between stress and withstand.

### Which roles gain most from high voltage insulation coordination training?

Substation design engineers, asset engineers and senior operating technicians gain most. Commissioning engineers and maintenance planners also benefit, since their choices change insulation margins.

## How does high voltage insulation coordination differ from a high voltage switching and isolation course?

High voltage insulation coordination studies how insulation withstands voltage stress and how devices limit it. A switching and isolation course covers procedures for making equipment safe for work instead.

## What do you bring back from high voltage insulation coordination training?

You bring back an insulation coordination study sheet for one real plant item. It lists overvoltage sources, arrester data, margins, clearance checks and a recommendation for the asset owner.

## High Voltage Insulation Coordination: The Way Forward

The insulation coordination study sheet first informs whether the arresters on a chosen bay give enough protective margin for the equipment behind them. Asset engineers and network planners use it to justify replacements, extra arresters or revised switching steps. After first use, revisit pollution and clearance assumptions as site conditions change.