

EE341:
132 kV Certified Authorized Training

Training Description:

This intensive training course is designed to develop the technical knowledge, operational competence, and safety awareness required for personnel who are authorized or preparing to become authorized to work on or operate **132 kV high-voltage electrical systems**.

The training course covers the principles of 132 kV transmission and substation systems, electrical safety, switching and isolation procedures, permit-to-work systems, earthing, protection systems, fault conditions, equipment operation, emergency response and safe working practices.

Particular emphasis is placed on **practical application and safe decision-making**, including switching sequences, isolation procedures, proving dead, application of earths, restoration of supplies and management of abnormal and emergency conditions.

Important: "Authorized Person" status is normally granted by the employer/network owner based on its own competency, authorization and safety rules. Completion of this course can support competency assessment but does not itself confer statutory or employer authorization.

Training Objectives:

By the end of the training, participants will be able to:

- ✓ Understand the fundamental principles of **132 kV transmission and substation systems**
- ✓ Identify major 132 kV equipment and explain their functions and operating principles
- ✓ Understand high-voltage electrical hazards and appropriate control measures
- ✓ Apply safe isolation, switching, earthing and restoration procedures
- ✓ Understand and correctly apply **Permit-to-Work (PTW), Limitation of Access (LOA), Sanction for Test (SFT)** and related safety documents, where applicable
- ✓ Interpret single-line diagrams, switching schedules and substation drawings
- ✓ Understand circuit breaker, isolator/disconnector, earth switch, CT, VT/CVT, transformer, busbar and cable operation
- ✓ Apply appropriate procedures for proving dead and establishing safe working zones
- ✓ Understand 132 kV protection, interlocking, control and alarm systems
- ✓ Recognize abnormal operating conditions and respond appropriately
- ✓ Understand substation earthing and step-and-touch potential hazards
- ✓ Apply emergency procedures for electrical faults, fires, equipment failure and loss of supply
- ✓ Demonstrate safe communication and coordination during switching operations
- ✓ Understand the responsibilities and limitations of an Authorized Person
- ✓ Successfully complete theoretical and practical competency assessments

Training Designed for:

This course is intended for Electrical Engineers, Senior Electrical Engineers, Electrical Supervisors, Electrical Maintenance Engineers, HV/LV Electrical Technicians, Substation Engineers and Operators, Transmission & Distribution Engineers, Electrical Operations Personnel, Protection & Control Engineers, Electrical Maintenance Supervisors, Shift Engineers / Shift Supervisors, Switching Operators, HV Authorized Persons and candidates, Electrical Safety Officers, Power Plant Electrical Personnel, Utility and industrial electrical personnel working with 132 kV systems and Personnel being prepared for **132 kV Authorized Person / Senior Authorized Person** competency.

Recommended Prerequisites:

Participants should preferably have:

- Basic electrical engineering knowledge
- Practical experience with electrical installations
- Familiarity with HV equipment
- Understanding of electrical safety principles
- Previous experience in substations or electrical networks is highly recommended

Training Requirement:

"Hand's on practical sessions, equipment and software will be applied during the course if required and as per the client's request."

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client's learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Program:

DAY ONE:

132 kV SYSTEMS, EQUIPMENT & ELECTRICAL SAFETY

- Module 1: Introduction to 132 kV Electrical Networks
  - Electrical transmission and distribution system overview
  - Role of 132 kV networks
  - Typical 132 kV substation configurations
  - Transmission versus distribution systems
  - Grid connection arrangements
  - Single-bus, double-bus and breaker-and-a-half configurations
  - Radial and interconnected networks
  - Substation operational philosophy
  - Normal, abnormal and emergency operating conditions
- Module 2: 132 kV Substation Equipment
- Detailed review of:
  - Power transformers
  - Circuit breakers
  - Disconnectors/isolators
  - Earth switches
  - Busbars
  - Current transformers (CTs)
  - Voltage transformers (VTs)
  - Capacitive voltage transformers (CVTs)
  - Surge arresters
  - Line traps and coupling equipment
  - Power cables
  - Overhead transmission lines
  - Neutral grounding equipment
  - Station auxiliary systems

- Battery and DC systems

❖ Module 3: Circuit Breakers and Switching Devices
- Circuit breaker operating principles
- SF_6, vacuum and other breaker technologies
- Breaker operating mechanisms
- Closing and tripping circuits
- Isolator operation
- Earth switch operation
- Mechanical and electrical interlocks
- Local/remote operation
- Breaker failure considerations
- Common breaker abnormalities

❖ Module 4: High-Voltage Electrical Hazards
- Electric shock
- Arc flash and arc blast
- Electrical burns
- Step and touch potentials
- Induced voltages
- Back-feeding
- Stored electrical energy
- Capacitive effects
- Switching surges
- Minimum approach distances
- Safe approach boundaries
- HV PPE requirements

❖ Module 5: Electrical Safety Rules
- Fundamental principles of HV safety
- Safety rules and responsibilities
- Roles of Authorized and Competent Persons
- Safety precautions before work
- Communication requirements
- Toolbox talks and pre-job briefings
- Dynamic risk assessment
- Job Safety Analysis (JSA)
- Emergency arrangements

❖ Practical Exercise
- Identification of 132 kV substation equipment using photographs, diagrams, equipment samples and/or site-based demonstrations

DAY TWO:

SWITCHING, ISOLATION, EARTHING & PERMIT-TO-WORK

❖ Module 1: Single-Line Diagrams and Substation Schematics
- Reading single-line diagrams
- Equipment identification
- Circuit numbering

- Busbar arrangements
- Feeder identification
- Transformer connections
- Interlocking schemes
- Switching sequence interpretation
- Normal and abnormal configurations

❖ Module 2: HV Switching Principles

- Purpose of switching
- Switching responsibilities
- Switching authority
- Switching programs
- Switching schedules
- Pre-switching checks
- Communication protocols
- Local versus remote switching
- Switching sequence control
- Confirmation of switching operations

❖ Module 3: Safe Isolation Procedures

❖ Detailed isolation sequence:

- Identify the correct circuit/equipment
- Confirm operational status
- Open circuit breaker
- Verify circuit breaker position
- Open required isolators
- Establish isolation points
- Prevent inadvertent operation
- Prove dead
- Apply earths
- Issue appropriate safety documentation

❖ Module 4: Earthing of 132 kV Equipment

- Purpose of protective earthing
- System earthing versus safety earthing
- Portable and fixed earths
- Application and removal of earths
- Earth switch operation
- Induced voltages
- Transferred potentials
- Earth grid systems
- Step and touch voltage
- Earthing precautions

❖ Module 5: Permit-to-Work System

- Permit-to-Work principles
- Permit issuer responsibilities
- Permit receiver responsibilities
- Electrical isolation certificates

- Limitation of Access
- Sanction for Test
- Test permits
- Safety locks and tags
- Control of keys
- Permit suspension and cancellation
- Clearance and return-to-service procedures

❖ Practical Exercise

- Develop and execute a simulated 132 kV feeder isolation and earthing sequence using a single-line diagram and switching schedule

DAY THREE:

PROTECTION, CONTROL, TRANSFORMERS & FAULT CONDITIONS

❖ Module 1: 132 kV Protection Systems

- Purpose of protection
- Protection zones
- Primary and backup protection
- Protection coordination
- Selectivity and discrimination
- Reliability and dependability
- Protection trip circuits

❖ Module 2: Major Protection Schemes

- Overcurrent protection
- Earth fault protection
- Distance protection
- Differential protection
- Transformer differential protection
- Busbar protection
- Breaker failure protection
- Over/under-voltage protection
- Over/under-frequency protection
- Auto-reclose systems
- Teleprotection

❖ Module 3: Instrument Transformers

- Current transformers
- Voltage transformers
- CVTs
- CT saturation
- CT secondary circuit safety
- VT/CVT failure
- Protection and metering applications
- Common instrument transformer faults

❖ Module 4: Power Transformer Operation

- Transformer construction
- Transformer ratings

- Transformer cooling
- OLTC operation
- Transformer protection
- Buchholz protection
- Oil temperature protection
- Winding temperature protection
- Pressure relief devices
- Transformer alarms and trips
- Transformer fire protection

❖ Module 5: Fault Conditions and System Disturbances

- Phase-to-earth faults
- Phase-to-phase faults
- Three-phase faults
- Busbar faults
- Transformer faults
- Cable faults
- Line faults
- Loss of supply
- Voltage instability
- Frequency disturbances
- Protection operation following faults

❖ Module 6: Control and Monitoring Systems

- Local control panels
- Remote control
- SCADA systems
- Substation automation
- Alarm management
- Event recording
- Disturbance recording
- Remote indications
- Communication failures

❖ Practical Exercise

- Analyze a simulated 132 kV protection trip and determine the appropriate operational response, isolation requirements and restoration sequence.

DAY FOUR:

OPERATION, MAINTENANCE, ABNORMAL CONDITIONS & EMERGENCY RESPONSE

❖ Module 1: Normal 132 kV Substation Operation

- Pre-operation inspection
- Equipment condition checks
- Operational parameters
- Transformer loading
- Voltage monitoring
- Current monitoring
- Busbar configuration
- Alarm monitoring

- Operational logs
- Shift handover procedures

❖ Module 2: Abnormal Operating Conditions
- Loss of auxiliary supply
- Loss of DC supply
- Breaker failure
- Isolator malfunction
- Transformer overheating
- Low SF_6 pressure
- Protection alarm
- CT/VT abnormalities
- Busbar abnormalities
- Communication failure
- SCADA failure

❖ Module 3: Emergency Switching
- Emergency isolation
- Emergency shutdown
- Fault response
- Electrical fire response
- Transformer fire
- Cable fire
- Arc-flash incident
- Electric shock response
- Emergency communication
- Coordination with control room
- Emergency restoration

❖ Module 4: Maintenance Safety
- Preventive versus corrective maintenance
- Maintenance isolation
- Safe access to HV equipment
- Mechanical safety
- Electrical testing precautions
- HV testing boundaries
- Test equipment safety
- Temporary earths
- Reinstatement procedures

❖ Module 5: Testing and Commissioning Safety
- Insulation resistance testing
- HV withstand testing
- Transformer testing
- Protection relay testing
- CT/VT testing
- Cable testing
- Primary injection
- Secondary injection

- Test boundaries
- Sanction for Test
- Removal of temporary connections
- Restoration after testing

❖ Module 6: Human Factors and Operational Discipline

- Human error in switching
- Communication failures
- Fatigue
- Confirmation bias
- Misidentification of equipment
- Two-person verification
- Three-point communication
- Stop-work authority
- Learning from incidents and near misses

❖ Practical Exercise

❖ Emergency response simulation:

Participants respond to a simulated 132 kV feeder fault, protection trip, equipment isolation, permit issue and subsequent restoration.

DAY FIVE:

AUTHORIZED PERSON COMPETENCY, PRACTICAL SWITCHING & ASSESSMENT

❖ Module 1: Authorized Person Responsibilities

- Definition and role of an Authorized Person
- Scope and limits of authorization
- Responsibility for safety
- Operational authority
- Communication with control room
- Responsibility for isolation
- Responsibility for earthing
- Permit responsibilities
- Contractor control
- Stop-work responsibilities

❖ Module 2: Complete Switching Procedure

❖ Participants review the complete operational sequence:

- Identify → Plan → Risk Assess → Isolate → Prove Dead → Earth → Issue Permit → Work → Inspect → Clear → Remove Earths → Restore → Record

❖ Module 3: Switching Scenarios

❖ Detailed exercises involving:

- 132 kV feeder isolation
- Transformer isolation
- Busbar isolation
- Circuit breaker maintenance
- Cable isolation
- Line isolation
- Transfer of supply

- Restoration following fault
- Emergency switching
- Failed switching operation

❖ Module 4: Practical Competency Assessment

❖ Participants demonstrate:

- Correct equipment identification
- Reading a single-line diagram
- Preparation of switching sequence
- Risk assessment
- Safe isolation
- Proving dead
- Earthing
- Permit application
- Communication protocol
- Restoration sequence
- Emergency response

❖ Module 5: Written Examination

❖ Assessment may include:

- Multiple-choice questions
- Short-answer questions
- Scenario-based questions
- Switching sequence questions
- Safety and PTW questions
- Fault-response questions

❖ Module 6: Final Review & Competency Evaluation

- Review of key learning points
- Common operational errors
- Lessons learned
- Questions and discussion
- Individual competency feedback
- Final assessment

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

AGMEP GAEE Internationally recognized certificate(s) will be issued to each participant who successfully passed the competency exam.

Training Fees:

TBA as per the location - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

For training registrations or in-house enquiries, please contact:

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