EE268:
LV/MV Switchgear
**Training Description:**

This intensive training course is designed to update participants with the latest development of Circuit Breakers and to present some of the more common and updated aspects of low, medium and high voltage switchgear maintenance. It must be understood that there is an incredible variety of equipment used on low, medium and high voltage switchgear today. Switchgears play an important role in the protection, distribution and control of electrical power in manufacturing or power plant and in a utility distribution system. Negligent maintenance practices can lead to power system inefficiency and loss of system reliability.

An older plant may have switchgear that was built in the forties in the older areas and modern switchgear in other areas as the plant was upgraded. This course will present maintenance problems to the maintenance manager and technician. Newer plants will probably have modern equipment of a limited variety and manufacture. It is these similarities that will be covered in the course.

**Training Objectives:**

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

- Specify, design, operate, inspect, test, maintain, repair and troubleshoot circuit breakers and switchgears
- Apply an in-depth knowledge and skills on LV/MV/HV circuit breakers and switchgears
- Describe the switchgear details such as ratings, degree of protection, service conditions and ancillary equipment
- Explain switchgear asset management including CBM and RCM process, tripping devices, maintenance and testing
- Apply load and fault calculation to decide the task of protection system and the operating conditions of power system
- Explain circuit breaker control circuits, types and application of protective relays, structure of control circuits and the use and application of current and voltage transformers
- Discuss circuit breaker characteristics in relation to protection control circuits, selectivity, sensitivity and speed of the control circuits
- Recognize the value of earthing system to protection control circuits and the power system protection as well as fault clearance and power system redundancy through control system application
- Identify the various switchgear diagnostic techniques and employ the different types of substation circuit breaker techniques and determine the switchgear vital equipments including batteries condition and monitoring, relay applications for basic and complex busbar arrangements and zone selection logic
- Employ the substation maintenance techniques and discuss their description, structures, features and functions
- Apply the switchgear maintenance practices and improve maintenance and repair procedures
- Carryout maintenance work orders including their process development, procedures and problems encountered
- Introduce computerized maintenance management systems (CMMS) and recognize its importance in circuit breakers design, inspection, maintenance, repair and troubleshooting
Training Designed for:

This course is intended for those engineers and other technical staff who need a sound understanding of Low, Medium and High Voltage Switchgear and Circuit Breaker specification, design, operation, inspection, testing, maintenance, repair and troubleshooting.

Training Program:

**DAY ONE:**
- **PRE-TEST**
- **Introduction**
  - Voltage Convention, Fundamentals of Circuit Breakers
  - Types of Breakers, Construction, Ratings, Tripping Characteristics
- **Switchgear in a Network Context**
  - Single Line, Utilization
- **Switchgear in Historical Perspective**
  - Oil Circuit Breakers, Air Blast CB
  - SF6 and Vacuum CB, Operating Mechanisms
- **Switchgear Details**
  - Ratings Ur, Ik, Ip, Va, Degree of Protection
  - Service Conditions, Ancillary Equipment

**DAY TWO:**
- **Switchgear Asset Management**
  - Equipment Register, CBM and RCM Process
  - Switchgear Diagnostic Techniques, Tripping Devices & Maintenance & Testing
- **Circuit Breakers Control Circuits**
  - Philosophy, Types & Application of Protective Relays
  - Control System Structure, Instrument Transformers
  - Current & Voltage Transformers, Panels, Signalling, Interlocking
  - Typical Connection Diagrams, Primary & Back-up Relaying
  - Fault Calculation, System Earthing
  - Circuit Breakers Characteristics, Selectivity, Sensitivity, Speed, Reliability
  - Evaluation of Protection Relaying
  - Setting of Protection, Fault Clearance, Redundant Control Circuits

**DAY THREE:**
- **Case Study**
  - Circuit Breaker Settings
  - Selectivity, Sensitivity, Speed
- **Circuit Breaker Diagnostic Techniques**
  - Diagnostic Techniques
- **Switchgear Vital Equipments**
  - Batteries Condition and Monitoring, Discussions
- **LV/MV/HV Substation Bus Arrangement, Incoming and Outgoing Circuits**
• Automatic Switching During Normal or Abnormal Conditions, Bus Protection & Circuit Breaker System, Bus Differential & Breaker Failure Relay, Zone Selection Logic & CT Requirements

**DAY FOUR:**

❖ **Substation Maintenance Techniques**
  • Description, Structures, Fuses, Arresters, Switches
  • Substation Compound, Switchgear Maintenance Practices
  • Metal Clad Switchgear, Maintenance Details
  • Discussions, Maintenance & Repair Fundamentals
  • Maintenance & Repair Procedures

❖ **Practical Sessions**
  • This hands-on and includes simulator, real-life case studies and exercises

**DAY FIVE:**

❖ **Maintenance Work Orders**
  • Maintenance & Repair Procedures (cont’d)
  • Process Development, Procedures
  • Problems Encounters, Samples, Discussions

❖ **Fundamentals of Computerized Maintenance (CMMS)**
  ❖ Course Conclusion
  ❖ POST-TEST and EVALUATION

**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.”

Practical sessions will be organized during the course for participants to practice the theory learnt. Participants will be provided with an opportunity to carry out various exercises using our state-of-the-art simulators “GE Multilin Relay 469” and “GE Multilin Relay 750”.

Please note that the above topics can be amended as per client’s learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

**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, Software & General Discussions

• Pre and Post Test

**Training Certificate(s):**

Internationally recognized certificate(s) will be issued to each participant who completed the course.
Training Fees:

As per the course 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 - 13:30  Recess (Prayer Break & Lunch)
- 13:30 - 15:00  Last Session

For training registrations or in-house enquiries, please contact:
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Training & Career Development Department