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EE273:
Substation Maintenance & Troubleshooting of Switchgears & SF_6 Systems

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Training Description:

Modern substations rely heavily on switchgear systems and SF_6-insulated equipment to ensure safe, reliable and efficient power system operation. Failures or improper maintenance of these critical assets can lead to outages, safety hazards, equipment damage, and significant financial losses. This intensive training course provides participants with a comprehensive understanding of substation switchgear maintenance principles, diagnostic techniques, failure mechanisms and troubleshooting strategies, with a strong focus on SF_6 gas-insulated equipment.

The training course combines theoretical foundations with practical, real-world maintenance practices, enabling participants to improve equipment reliability, extend asset life and enhance operational safety. Emphasis is placed on preventive, predictive and condition-based maintenance approaches, as well as systematic troubleshooting methodologies.

Training Objectives:

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

- ✓ Understand the construction, operation and functions of various switchgear types
- ✓ Apply best practices in preventive and predictive maintenance of switchgear
- ✓ Identify common failure modes and degradation mechanisms
- ✓ Perform systematic troubleshooting of switchgear faults
- ✓ Understand SF_6 gas properties, handling, monitoring and safety requirements
- ✓ Diagnose problems in SF_6-insulated switchgear (GIS / GCB / RMU)
- ✓ Implement safe working procedures and risk mitigation techniques
- ✓ Interpret diagnostic test results and condition monitoring data
- ✓ Improve substation reliability through effective maintenance strategies

Training Designed for:

This training course is designed for Substation Maintenance Engineers, Electrical Engineers & Technicians, Protection & Control Engineers, Commissioning Engineers, Plant / Utility Maintenance Personnel, Field Service Engineers, Reliability & Asset Management Professionals and Operations Personnel involved in switchgear handling.

Participants are expected to have a basic understanding of electrical power systems.

Training Requirement:

"Hands 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:

- ❖ Fundamentals of Substation Switchgear Systems
  - Role of switchgear in power system protection and control
  - Types of switchgear: AIS, GIS, Hybrid Systems
  - Circuit breakers: operating principles & mechanisms
  - Disconnectors & earthing switches
  - Protection interfaces with switchgear
  - Arc phenomena and interruption theory
  - Insulation systems & dielectric considerations
  - Mechanical components & drive mechanisms
  - Switchgear ratings & specifications
  - Common operational stresses

DAY TWO:

- ❖ Switchgear Maintenance Principles & Practices
  - Maintenance philosophies & asset lifecycle management
  - Preventive vs predictive maintenance strategies
  - Manufacturer recommendations vs field realities
  - Visual inspections & routine checks
  - Mechanical maintenance of breakers
  - Contact systems & wear mechanisms
  - Lubrication & mechanical adjustments
  - Insulation assessment techniques
  - Diagnostic tests:
    - Contact resistance measurement
    - Timing & motion analysis
    - Insulation resistance
    - Partial discharge basics
  - Documentation & maintenance records

DAY THREE:

- ❖ Switchgear Failures & Troubleshooting Techniques
  - Common switchgear failure modes:
    - Mechanical failures
    - Electrical failures
    - Insulation breakdown
    - Control circuit issues
  - Symptoms vs root causes
  - Troubleshooting methodologies
  - Interpreting diagnostic test results
  - Breaker operating mechanism failures
  - Contact degradation & overheating
  - Control & auxiliary circuit problems

- Protection misoperations linked to switchgear
- Case studies of real failures
- Practical troubleshooting scenarios

DAY FOUR:

❖ SF_6 Gas-Insulated Equipment Fundamentals
- Properties and characteristics of SF_6 gas
- Advantages & limitations of SF_6 insulation
- Environmental considerations & regulations
- SF_6 equipment types:
  - GIS
  - GCB
  - RMU
- Gas compartments & sealing systems
- Gas density monitoring & alarms
- SF_6 gas handling & storage
- Gas quality & contamination issues
- Moisture & decomposition products
- Safety procedures & hazard mitigation
- Leak detection techniques
- Gas recovery & recycling

DAY FIVE:

❖ Troubleshooting & Maintenance of SF_6 Switchgear
- Common SF_6 equipment problems:
  - Gas leaks
  - Low density alarms
  - Moisture contamination
  - Internal insulation defects
- Diagnostic & monitoring techniques
- Partial discharge in GIS
- Thermal & dielectric failures
- Mechanical issues in SF_6 breakers
- Condition monitoring strategies
- Corrective maintenance procedures
- Failure analysis & lessons learned
- Best practices for reliability improvement
- Integrated maintenance planning
- Advanced case studies

❖ Course Conclusion

❖ POST-ASSESSMENT and EVALUATION

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):

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

Training Fees:

TBA 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 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

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