EE046:
Safe Operation and Maintenance of Circuit Breakers & Switchgear
Training Description:

Switchgear plays an important role in electricity distribution and its performance significantly affects the overall performance of the system. Failure to efficiently disconnect faults elsewhere in the network or failure in switchgear itself is costly, resulting in additional loss of supply, damage to equipment and possibly fatal injury to personnel. It is therefore critically important that switchgear is operated and maintained correctly, within an overall asset management regime that is both economic and effective in securing a high level of system reliability.

This comprehensive training focuses on medium voltage switchgear, which comprises by far the bulk of switchgear on most electricity distribution systems. The emphasis is primarily on oil, air blast, SF6 and vacuum circuit breakers, but other forms of MV switchgear, for example ring main units and auto-reclosers will also be described.

Training Objectives:

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

✓ Have selection of appropriate type and rating of circuit breakers and switchgear
✓ Know the fundamentals of operation of switchgear
✓ Be familiarized with the switchgear components (CTs, VTs, relays, cable terminations)
✓ Learn the safe operational policy including safety rules and safety documents
✓ Learn the diagnostic tools and test equipment
✓ Learn the safe maintenance policies including safe working in switch rooms, indoor and outdoor substations

Training Designed for:

This course is intended for all Managers, Engineers and Technicians who work with switchgear and circuit breakers and who need to update their skills and knowledge in this critical area of electrical power systems protection.

Training Program:

**DAY ONE:**

PRE-TEST

❖ INTRODUCTION
❖ SWITCHGEAR IN A NETWORK CONTEXT
  • Single line diagrams
  • Active and passive network components
  • Circuit breaker utilisation
  • Alternative forms of MV switchgear - ring main units, load breaking/fault making switches
  • Fuse switches
  • HV fuses in combination with, and as alternative to circuit breakers
• Auto-reclosers and auto-reclose operation

❖ SWITCHGEAR - A HISTORIC PERSPECTIVE
• Principles of current interruption
• Plain break circuit breakers
• Bulk and small oil volume circuit breakers
• Turbulator (explosion pot)
• Operating mechanisms
• Transfer earth circuit breakers
• Air break and air blast switchgear
• SF6 and vacuum
• Switchgear in association with disconnectors
• Fixed and withdrawable designs
• Switchgear standards
• Factors affecting switchgear selection

DAY TWO:

❖ SWITCHGEAR RATING AND SPECIFICATION
• Switchgear rating - highest system and impulse withstand voltages, load and short circuit currents
• Simple and complex protection systems
• Switchgear ancillaries, measurement CTs, VTs, relays
• Cable terminations
• Indoor and outdoor operation
• Substation and switch room layouts and design

❖ SHORT CIRCUIT TESTING
• Symmetrical and asymmetrical breaking
• Make and break operations
• Understanding test oscillograms

❖ CASE STUDY - SPECIFICATION FOR A 132 kV SWITCHBOARD

DAY THREE:

❖ SAFETY POLICIES
• General safety precautions and the use of personal protective equipment
• Principles of safety rules
• Principles of personnel authorisation
• Operative training for safe operation of switchgear
• Isolation in a circuit breaker context
• Safety documentation
• Operational and safety locking, caution and danger notices
• Safe working in a substation environment
• Safety interlocks
• Substation alarms
• Individual study task and presentation - safety policies in my company and how they might be improved
FEATURES OF MODERN SWITCHGEAR

- Case studies:
  - Westinghouse bulk oil circuit breaker type J-18
  - Magrini Galileo series MGE minimum oil circuit breakers
  - Reyrolle Pacific vacuum circuit breakers type LMVP
  - Sprecher+Schuh SF6 circuit breakers type PF-107
  - NEBB Air break switches in metal clad cubicles
  - Check phasing - the Pfisterer phase testers Mk I and II
  - Safe circuit testing

**DAY FOUR:**

- ASSET MANAGEMENT IN A SWITCHGEAR CONTEXT
  - Principles of time and condition based asset management
  - Asset registers
  - Asset management systems

- SWITCHGEAR DIAGNOSTICS
  - Switchgear inspection methodologies
  - Partial discharge measurement and survey
  - Timing tests
  - Thermovision

**DAY FIVE:**

- MAINTENANCE OF CIRCUIT BREAKERS
  - Mechanisms of deterioration
  - Degradation of insulation
  - Principles of circuit breaker maintenance
  - Maintaining oil circuit breakers
  - Contact maintenance and contact wipe
  - Oil testing
  - Maintaining vacuum circuit breakers
  - Maintaining SF6 circuit breakers
  - SOPs and DINs
  - Switchgear defects and defect control systems

**COURSE CONCLUSION**

POST-TEST and EVALUATION

Training Requirements:

“Hands-on practical sessions, equipment and software will be applied during the course if required and as per the client’s request”.

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:
Aisha Relatio: aisha@cmc-me.com
Tel.: +971 2 665 3945 or +971 2 643 6653 | Mob.: +971 52 2954615
Training & Career Development Department