Advanced Strategies on HV and MV Circuit Breaker / Switchgear Maintenance, Operation, Safety and Technology

Enhancing the performance of your plant equipment to minimize interruption and costs.

21st – 22nd October 2019 | Kuala Lumpur, Malaysia

Energy1asia.com
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.

Switchgear, like many other types of industrial equipment, is often unnoticed and neglected until it fails to function normally. The level to which switchgear is maintained in industry varies significantly.
- Maintenance levels at one extreme might involve ‘Condition Monitoring’ (Continuous Monitoring) of equipment with linear or rotating transducers.
- At the other end of the spectrum, maintenance might only involve doing Periodic Maintenance Tasks (PMT), Inspections or even Major Maintenance Task (MOT).
- One can also run equipment until it breaks down or even self-destructs.

This 2 days’ workshop will provide you with the opportunity to walk away with the skills to most importantly understand the mechanical theory of how a circuit breaker mechanism & interrupter chamber works, typical problem encountered in the field, ensure that the correct maintenance activities are carried out effectively and ensure a longer life span on your MV and HV switchgear, implement failure investigations, identify ways in which to do the maintenance cost effectively and not end up ‘over or under’ maintaining the equipment. Able to choose the correct CB by implementing a ‘specification & requirement’ list.

The workshop will also further highlights training, safety considerations, and provides practical guidance for operation, maintenance and testing of HV/MV switchgear.

The training will be presented with a practical approach in mind. The learning will be conducted along with relevant case studies and industry best practices. Delegates will be encouraged to participate and contribute their cases to the discussion.

**MASTER the necessary knowledge and complexities of:**
- Appreciation of the use of latest technology in switchgear testing, inspection and troubleshooting.
- The need for routine inspection, decent maintenance of equipment and precise record keeping.
- Challenges and issues encountered when it comes to the maintenance of HV and MV Switchgear.
- Carry out correct application methods and ensure a longer life span on your MV and HV switchgear
- The acceptable use of relevant testing and measuring instruments
- Selection of proper specifications of circuit breakers and switchgears
- Methods of system earthing, protection requirements and fault finding techniques.
- Safe operational policies including safety rules and safety documents.
- Diagnostic tools and test equipment.

**PRACTICAL INVOLVEMENT & CASE STUDIES**

Having the ability to implement directly once you are back at your workplace is crucial for every participant.
- Many situations, whether it be mechanism malfunction or an arc quenching problem, will be discussed and thoroughly analyzed. Participant will take part in interactive discussions on application, installation, maintenance and testing issues relating switchgear.

**This program is intended for:**
- Electrical Managers engineers and technicians / Instrumentation and design engineers
- Engineering managers / Project engineers / Asset Managers
- Operations and maintenance supervisors / Technical Services / Technical supervisor
- Risk assessors and government / safety regulators / HSE / Quality assurance managers
- Plant operators and engineers / Field technicians
- Valuable to engineer who are dealing with HV Circuit breaker (500kV)
- And any other engineers and technical personnel involved with design, operation, maintenance, inspection, testing, safety and troubleshooting of high and medium voltage circuit breakers.
DAY 1

**Substation Overview [Video Clip]**
- Low voltage, Medium voltage, High voltage, Ultra high voltage
- Meaning of CB identification symbols on rating plate

**Substation layout overview**
- Current Transformers (CT)
- Voltage Transformers (VT)
- A Transformer
- Circuit Breaker (CB)
- Isolator [video clip]
- Surge Arrestors [Video Clip]

**Different types of switching equipment**
- Isolator (contact technology) [Video Clip]
- Circuit Breaker
- Pre-Insertion Resistors
- Grading Capacitor

**Introduction to Circuit Breakers**
- What is a circuit breaker / Expected functions?
- Circuit breaker construction & operation...Mechanism operation/Arc Quenching

**Circuit breaker limb / pole / Interrupter chamber**
- Function of the SF6 nozzle - Function of the turbulator.
- ‘Moving, fixed & Transfer’ contact operating theory [Video clip]
- Inductive / capacitive currents [Video Clip]

**Types of switchgear**
- Oil as insulation
- SF6 as insulation
- Vacuum as insulation
- GIS (Indoor/outdoor Gas insulated Switchgear)
- ‘Air blast’ compressed air as insulation

**Characteristics & expected functions of the Circuit Breaker**
- Successful extinguishing of the arc

**Circuit interruption [Video clip]**
- Short time current carrying capacity
- Short circuit current rating
- Recovery voltage versus Dielectric strength

**Auxiliary contacts, mechanical and electrical interlocks**

**Overstressing the switchgear**
- Substation & equipment KA ratings

**Oil Circuit Breakers**
- Advantages / disadvantages
- The effect of impurities on mineral oil
- Circuit interruption
- What to maintain: Mechanism / Interrupter components

**Arc control devices**
- Function
- Different types

**SF6 Circuit breakers / Dead Tank / Live Tank**
- Development [video clips]
- Advantages / disadvantages [Video Clips]
- 1st, 2nd, 3rd generation SF6 CB
- Blast nozzles
- SF6 gas testing
- ‘Absolute’ versus ‘atmospheric’ pressure
- SF6 handling
- What to maintain: Mechanism / Interrupter components

**SF6 Gas medium**
- SF6 handling
- Standardize gas fittings
- Filling equipment
- Testing equipment
- SF6 gas leak detection [video clips]
- Measure main contact penetration in arcing chamber [external measurement]
- Measure arcing contact burn-off in arcing chamber [external measurement]
- Nozzle function versus turbulator for arc extinguishing
- Topping up SF6 gas! Can we do this with CB alive?

**Vacuum Circuit Breakers**
- Development [video clip]
- Advantages / Disadvantages
- Theory & Function
- Different types of energy dissipation
- What to maintain: Mechanism / Interrupter components

**Air blast Circuit Breaker**
- Theory
- Advantages / disadvantages
- Function
- Different types
- What to maintain: Mechanism / Interrupter components

**GIS / Gas Insulated Switchgear**
- Description of GIS main components [Video clips]
- Switching components functions and applications
- Technical evolution of GIS
- Gas circuit breakers arc extinction
- Disconnectors and earth switches construction and operation
- Structural Components, bus-bars and support insulators

**Substation Relay Protection philosophy**
- Basic System Protection Concepts

**Self-test**
Earthing
- Substation earthing ([Video clip])
- Lightning protection
- High voltage surge protection

Circuit Breaker ratings
- Short time current carrying capacity
- Short circuit current rating
- Opening and closing switching resistors
- Grading capacitors

Latest technology in Switchgear
- Dead tank CB’s
- Shunt motor drive CB’s
- Hybrid Switchgear (Abb ‘Pass’ CB’s)

DAY 2

Safety in ‘Live’ Electrical Environment
- Why is ORHVS certification so important...Responsible Person / Switching / Testing
- Safety in the workplace / Step & Touch Potential ([Video clip])

Types of Maintenance & Maintenance Philosophy
- Breakdown
- Inspections
- Periodic
- Major
- Testing

General Circuit Breaker maintenance: Philosophy & Requirements
- Scope of works
- Competency certificated
- Trained staff or certificated contractor ensuring maintenance activities are carried out effectively
- Manufacturers manual
- Special tools available on site
- Maintenance spares available on site
- NB Inspection task / NB Periodic maintenance task
- NB Major overhaul task /nozzle inspection / nozzle replacement
- Slow closing’ philosophy
- Oem (Original Equipment Manufacturer) retrofits?
- CB inherent problems, mechanical adjustments and troubleshooting discussion
- Minimum closing energy philosophy
- Pretension philosophy
- Correct lubrication
- Bushing flange cementation inspection and repair
- Defect management
- Failure analysis

Circuit Breaker mechanism
- Check list
- Different types: hydraulic/pneumatic/spring/torsion bar etc
- Function / design
- Safety aspect: All energy springs discharged, CB open, CB isolated & earthed
- Mechanical operating theory
- Check CB operation by operating CB at minimum closing energy
- How to determine if closing spring has stretched / deviation

Self-test

Mechanical Operation
- Spring
- Hydraulic
- Pneumatic

Choosing the correct Circuit Breaker for your application
- Draw up CB specifications before purchase
- Determine which CB is reliable and maintenance friendly. What to buy

Maintenance philosophy & planned maintenance program
- Setting maintenance standards
- Maintenance and service schedules
- Data capturing
- System studies

Circuit Breaker testing
- Contact resistance testing
- Velocity testing / Timing testing
- Dynamic resistance testing
- Density monitor for correct operation and settings [low gas / inhibit alarms]
- Sf6 dew point
- Sf6 acidity / impurities
- Sf6 content [%]
- Minimum close tension
- Clutch slip if required
- Coil resistances
- Insulation testing
- Mechanical close & trip latch resistance checks

Training available including evaluation:
- What are the necessary tools, training / skills needed to improve reliability of your HV/MV switchgear.
- Technical training to provide skills required to improving reliability of switchgear. This includes inspection, pmt, mot, breakdowns and specialist level.
- General worker training
- Nozzle replacement

Condition monitoring
- What is to be monitored???
- How is it to be monitored???

Thermography / Infrared Scanning

Corona Phenomena ([Video clip])

Single line diagram interpretation
HV Aluminum clamp maintenance
### Delegates Details

1. **Name:** ___________________________  
   **Job Title:** ___________________________  
   **Email:** ___________________________  
   **Contact No:** ___________________________  
   **Department:** ___________________________  
2. **Name:** ___________________________  
   **Job Title:** ___________________________  
   **Email:** ___________________________  
   **Contact No:** ___________________________  
   **Department:** ___________________________  
3. **Name:** ___________________________  
   **Job Title:** ___________________________  
   **Email:** ___________________________  
   **Contact No:** ___________________________  
   **Department:** ___________________________  

### Invoice Details

- **Invoice Attention to:** ___________________________  
- **Company:** ___________________________  
- **Industry:** ___________________________  
- **Address:** ___________________________  
- **Postcode:** __________  
- **Country:** ___________________________  
- **Telephone:** ___________________________  
- **Fax:** ___________________________  
- **Email:** ___________________________  

**Register 3 and Sent the 4th Free**
- Please note that all registrations must be made at the same time to qualify.
- The above investment fee is inclusive of course material, tea breaks and lunch.
- The above investment fee is exclusive of SST 6%.

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<th>3 or more participants</th>
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**Program Details**
- **Venue:** Kuala Lumpur, Malaysia  
- **Date:** 21st – 22nd October 2019

**Register Now**
- **Contact:** kelvin  
- **Main:** +603 7727 3952  
- **Fax:** +603 7727 5270  
- **Email:** registration@petro1.com.my

**Credit Card Payment**

- Please Debit my credit card:  
  - **VISA**  
  - **MASTERCARD**

- **Card Number:** __________  
- **Security Code:** __________  
- **Expiry Date:** __________  
- **Named printed on card:** ___________________________  
- **Signature:** ___________________________  

**Payment Method**

- **By Direct Transfer:** Please quote invoice numbers on remittance advice.

**Account Details**
- **Account Name:** PETRO1 SDN BHD  
- **Bank:** United Overseas Bank (Malaysia) BHD  
- **Account No:** 002 900 3191 (SGD)  

**Sales and service Tax (SST):**
- The above investment fee is exclusive of SST 6%. The SST charges of 6% will be included during issuance of the invoices.

**Cancellation & Substitutions:**
- Upon receipt of a completed registration form, it confirms that the organization is registering for the seat(s) of the participant(s) to attend the conference or training workshop. Payment is required with registration and must be received prior to the event to guarantee the seat. Payment has to be received 7 working days prior to the event date to confirm registration.

**Venue:** All of our training courses are held in 4 – 5 star venues.

**Data Protection**
- The information you provide will be safeguarded by Petro1 that may be used to keep you informed of relevant products and services. We take it seriously when it comes to protection of our client data.

**Program Change Policy:**
- The organizer reserves the right to make any amendments and/or changes to the workshop, venue, facilitator replacements and/or modules if warranted by circumstances beyond its control.