Training Program:

Electrical Switchboards, Circuit Breakers, Protective Relays, Cables & PLCs

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Introduction:

Whether you are designing, specifying, installing, testing or commissioning electrical equipment from small to large commercial and industrial installations, you need to have a thorough understanding of switchboards, switchgear, circuit breakers and associated protective relays. The overall focus of this course is on electrical inspection, testing and commissioning. Circuit breakers are critical components in electrical distribution systems and their operation significantly affects the overall operation of the system.

Protection relays are then discussed. These are used in power systems to maximize continuity of supply and are found in both small and large power systems from generation, through transmission, distribution and utilization of power in plant, industrial and commercial equipment.

This course covers commissioning and periodic inspection of cables and their various failure modes and how to detect these faults. The often neglected topic of switchboards will be detailed next, followed by the interesting topic of interfacing to the control system.

This course will help the candidates identify problems and have them corrected before the inevitable downtime comes in an operational installation where many thousands of dollars are lost in correcting the faults.

Who Should Attend?

Electrical engineers and technicians, electrical maintenance engineers, technicians and supervisors, electricians, field and service technicians, instrumentation engineers and technicians, design engineers, plant operators, project engineers, managers, engineers, technicians and others who may work with switchgear, circuit breakers,

switchboards and cabling, who need to update their skills and knowledge in this critical area of inspection, testing and commissioning.

Objective:

At the end of this course, participants will learn about:

- Nuts and bolts of electrical inspection, testing and commissioning
- Detailed principles and rules for inspection, testing and commissioning of switchboards, switchgear, cabling and protection relays
- Selection of appropriate type and rating of switchgear and circuit breakers
- The different standards and specifications used for switchgear and circuit breakers
- Asset management of switchgear and protective relays
- Safe maintenance policies including safe working in switch rooms, indoor and outdoor substations

Accreditation:

BTS attendance certificate will be issued to all attendees completing a minimum of 80% of the total course duration.

Course Outline

Fundamentals of Switchgear

- Single line diagrams, Typical construction â€“ LV/MV and HV
- Active and passive network components, Circuit breaker utilization
- Fuse switches, HV fuses in combination with and as alternatives to circuit breakers
- Auto-reclosers and auto-reclose operations Specification of Switchgear
- Switchgear ratings â€“ highest system and impulse withstand voltages, load and short circuit currents
- Simple and complex protection schemes
- Switchgear ancillaries, measurement CTs, VTs and relays
- Cable terminations, Indoor and outdoor operation

Short Circuit Testing

- Symmetrical and asymmetrical breaking
- Make and break operations, Understanding test oscillogram Switchgear Diagnostics, Testing and Maintenance
- Asset records, Condition Based Maintenance (CBM)
- Reliability Centred Maintenance (RCM)
- Switchgear inspection methodologies, Insulation deterioration

- Diagnostic techniques, Partial discharge measurement and survey
- Partial discharge â€“ Transient Earth Voltage (TEV) monitoring
- Partial discharge by acoustic methods, Timing tests, Thermovision
- Tan delta testing, Principles of circuit breaker maintenance
- Contact maintenance and contact wipe, Oil testing
- Switchgear defects and defect control, Switchgear installations

Power System Protection Principles and Relays

- Principles of protection, Types of faults, Types of protection systems
- Types of protective relays, Electromechanical and static relays, Numerical relays

Configuration of Numerical Relays

- Setting approach in conventional relays
- Configuration of relays, Troubleshooting typical problems

Cabling Commissioning and Periodic Testing

- Review of codes for testing, Drum length checks
- Post installation checking, Pre-commissioning and periodic tests
- Tests as tools for condition monitoring and early failure alarm
- HV tests using DC and very low frequency AC

- Partial discharge tests and mapping of results
- Dielectric dissipation factor measurements
- Micro destructive and non-destructive tests for life assessment
- Operation and maintenance of cables

Cable Failure Modes and Fault Detection

- Types of failure, Reasons for failure, Fault location
- Electrical tests for detection of cable faults
- Safety issues in fault detection, Analysis of failures

Switchboard Installation, Inspection & Commissioning

- Inspection, Routine, type, acceptance and pre-commissioning tests
- High voltage equipment test techniques, Commissioning procedures

Interface to Control Equipment (PLCs)

- Overview of PLC, PLC I/O modules, Pre-commissioning tests
- Commissioning procedures, Typical faults