PRACTICAL
POWER CABLING AND EARTHING

YOU WILL LEARN HOW TO:

- Select appropriate power cables
- Perform testing and preventative maintenance on power cables
- Design and install appropriate Earthing systems
- Size earthing conductors
- Apply equipotential bonding in ensuring safety
- Protect structures from lightning hazard
- Protect power distribution equipment and sensitive systems from surges

WHO SHOULD ATTEND:

Anyone associated with design, operation, installation, commissioning and maintenance of electrical systems can benefit from this workshop. Typical personnel who would benefit are:

- Operations Personnel
- Electrical Maintenance Technicians
- Electrical Supervisors
- Process Control Engineers
- Building Service Designers
- Service Technicians
- Maintenance Personnel
- Electrical Engineers and Technicians

The Workshop

In any distribution system, cabling and earthing are critical components in ensuring continuity, reliability and safety of operation and maintenance. The entire flow of power in a system (or at least a major part of it) goes through cables and thus any failures would result in major disruption of power flow. Correctly selected, sized and installed cables can give trouble-free operation for several decades. Cables and accessories used for jointing and terminating cables play an important role in reliability. As the voltage rating of cables goes up, installation, termination and jointing require greater care since failures could be expensive to repair and can cause widespread disturbances in the power system; when failures do occur, they need to be pinpointed accurately using modern test methods so that repairs can be undertaken promptly and service restored with minimum delay.

The earthing system does not play a direct part in the normal power flow but is very important in ensuring that insulation failures can be promptly detected and isolated by proper selection of system earthing. The other major function is to ensure that no unsafe voltages appear in any external or extraneous conducting parts of an electrical system. A good knowledge of earthing system is necessary to design a safe system and ensuring continued safe operation.

This course is designed to ensure that those responsible for the selection, installation, and maintenance of power cabling and earthing systems understand the technical issues involved and comply with relevant specifications and requirements in a practical and effective manner.

Pre-requisites

A fundamental knowledge of basic electrical concepts would be useful.

Practical Sessions

This is a practical, hands on workshop enabling you to work through practical exercises which reinforce the concepts discussed.

To gain full value from this workshop, please bring your laptop/notebook computer.

The Program

INTRODUCTION
- Role of power cables in electrical systems
- Main issues in ensuring trouble free operation of cabling in power distribution
- Earthing and its importance
- Various functions of earthing in electrical installations
- System and protective earthing

SECTION I: CABLES

CABLES AND ACCESSORIES
- Low and high voltage cables
- Advantages over overhead transmission lines
- Disadvantages of cables in power transmission
- Various types of cables
- Cable jointing (splicing) accessories
- Need for termination kits
- Installation of cables

CONSTRUCTION OF CABLES
- Basic constructional aspects
- Insulation
- Application areas
- Cable standards

SELECTION AND INSTALLATION OF CABLES
- Selection criteria
- Sizing
- Installation
- Special locations
- Fire prevention and fire protection for cable installations

PRACTICAL ASPECTS OF CABLE JOINTING AND TERMINATION
- Kits for joints and terminations
- Shelf life
- Issues with prefabricated kits
- Preparation of cable for termination and jointing
- Connection and reconstitution of cable properties
- Continuity and grounding aspects
- Sealing, healthiness of joint/termination and repairs
- Installation aspects for cables and joints
- Safety issues and access for repairs
- Termination to electrical machines
- Termination of outdoor HV installation
- Terminations to GIS installation
- Importance of correct orientation of terminations
- Installation aspects for cable joints and terminations
- Safety issues and access for repairs

CABLE FAILURES
- Types of failures
- Reasons for failures
- Fault location
- Electrical tests for detection of cable faults
- Safety issues in fault location
- Analysis of failures
- Documentation of work
- Documentation of failures

NEW TRENDS
- Increasing use of underground cables
- New technologies for very high capacities and voltages
- EHV XLPE cable systems
- High temperature superconductivity in cables

SECTION II: EARTHING

EARTHING OF POWER SUPPLY SYSTEMS
- Types of system earthing and comparison
- Ungrounded systems
- Solidly grounded systems
- Impedance earthing using neutral reactor
- Resonant earthing using neutral reactor
- Impedance earthing through neutral resistance
- Point of earthing in power supply systems without a neutral point

EQUIPMENT (PROTECTIVE) EARTHING
- Shock hazard
- Earthing of equipment
- Operation of protective devices
- Thermal capability
- Touch potential during ground faults
- Induced voltage problem
- Mitigation by multiple ground connection and by reduction of conductor spacing
- EMI suppression
- Metal enclosures for earthing conductors
- Earthing connections for surge protection equipment
- Sensing of ground faults
- Equipotential bonding

GROUND ELECTRODE SYSTEMS
- Earthing electrodes
- Soil resistance
- Measurement of soil resistivity
- Resistance of a single rod electrode
- Current carrying capacity of an electrode
- Use of multiple ground rods in parallel
- Measurement of ground resistance of an electrode
- Concrete encased electrodes
- Corrosion problems in electrical earthing systems
- Maintenance of earthing system
- Chemical electrodes

CABLING AND EARTHING: CONVERGENCE
- Inter-relation between cabling and earthing
- Need to earth insulation screens of cables
- Earth continuity in cable joints
- Use of armour in providing earth continuity
- Earthing of cable screen/armour in cable terminations when using core balance CT