



Training Program:

**System Earthing & Protective Earthing In Utilities &
Industrial Electrical Networks**

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Introduction:

Earthing (Grounding) plays a major function in power systems because of the particular influence of earthing on the performance, protection, security and reliability of supply. Electric utilities in different countries apply particular earthing methods depending on the particular nature and requirements of their distribution systems. For proper operation and maintenance of power substations it is important to understand and maintain correct earthing system in the substation and in industrial electrical networks.

The course is intended to provide theoretical and practical knowledge that enables the participants to have an in-depth understanding of the applications, overall theory and essential issues relevant to system and equipment earthing.

At the conclusion of this course participants should clearly understand the concepts of earthing practices as required by the relevant International Standards and Regulations. The course covers a wide range of technical situations and contains many practical examples. The candidates can use the skills and knowledge gained in this course to perform testing and preventative maintenance of earthing components and to mitigate earthing problems to ensure safe and reliable operation and longer equipment life.

Who Should Attend?

Designers, Engineers and Technicians from Distribution Companies and Power Utilities, Engineering Professionals in Electricity Supply Industry, Petrochemical Companies, Buildings and Service Professionals who have to deal with the aspect of electrical and industrial power system protection, control and operation.

Participants need no specific requirements other than good understanding of electricity and magnetism and some relevant experience

Training Objective:

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

- Principles, design, testing and maintenance of earthing for systems and equipment
- Nature of different types of electrical faults related to earthing problems
- Hazards and safety precautions associated with earthing
- Electrical safety requirements and procedures
- Understanding of electrical fault protection systems
- Mitigating earthing problems in electrical networks and industrial installations
- Understanding damage due to lightning and lightning protection
- Implementing mitigation techniques to solve earthing problems
- Protecting computers and its equipment systems against malfunction and damage caused by earthing problems
- Identifying factors that can lead to malfunction or failure of equipment and systems due to incorrect earthing
- Designing, testing and maintaining the earthing grid

Accreditation:

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

Course Outline

Introduction, General Principles & Requirements of Earthing

- Overview of power systems and components
- The distribution system and network configurations
- Basic safety requirements and devices in power distribution
- Electrical hazards, Electrical shock, Electrical fires
- Short revision of electrical principles, definitions, glossary and common terms
- Reasons for earthing, system earthing, equipment earthing
- Overview of common causes of power equipment failure
- Work in the vicinity of electric and magnetic fields
- Approach to HV electrical apparatus
- Occupational health and safety (OH and S) requirements
- Installation safety requirements and regulations
- Safety related maintenance and environmental considerations
- Safety requirements for special equipment
- Personal protective equipment

Theory & Principles of Earthing

- Earthing principles, basic requirements
- System earthing, equipment earthing, safety earth, signal earth

- Functional earth layout, practical low-frequency earthing
- Hardware earthing
- Earth loops, common impedance coupling
- Course Outcomes of site earthing, categories of earthing
- Neutral earthing, protective earth
- Coordinating earthing within a control system
- The well earthed building, earthing coordination
- Importance of low resistance earthing
- Earthing electrodes
- Trench earth VS driven rods Vs foundation reinforcing steel
- Steps for designing earthing systems for structures

Equipment Earthing & Electromagnetic Shielding

- Basic principles, Circuit return coupling
- Earth plane induced feedback , Interference coupling
- Earthing practices for low frequency equipment
- Earthing practices for equipment containing both low frequency and high frequency
- Basic shielding principles, Definition of protection zones
- Shield impedance, Low frequency shielding

- High frequency shielding, Shielding materials
- Shield design criteria, Cables shielding
- Importance of good bonding, recommended practices for effective bonding

Power Substation Earthing & Safety Requirements

- Purpose of substation earthing
- MV and LV network arrangements
- Earth potential rise, Protective conductors
- Earth electrodes, Electrode resistance
- Connection of services, Grid and mesh potentials
- Potential gradient areas of common types of electrodes
- Multiple electrodes, Measurement of soil resistance and electrode resistance
- Protective earthing devices, Earth leakage circuit breakers
- Nature and effects of electric shock, Protection against electric shock
- Protection against over current and short-circuit current
- Common electric hazards, High voltage areas
- Overloaded circuits, Damaged cords, bare connectors
- Long and tall objects, Mobile equipment, Standing water