



Training Program:

**Earthing bonding, lightning & surge protection of
Electrical systems and equipment**

Introduction:

Earthing is an integral part of any electrical system. Properly selected earthing equipment will accomplish many desirable objectives, such as:

- Improving the system operating characteristics.
- Providing a source of earth fault current relaying.
- Reducing personnel hazards.

Equipment earthing should be differentiated from system earthing since the functions of the two are often confused. A "system earth" is a connection to ground from one of the current carrying conductors of a distribution or wiring system. The return conductor for a line-to-neutral load on either single or multi phase systems is an example of such a current carrying conductor. This system ground may be made at such locations as transformer or generator neutral points by either a solid connection or through a current limiting device.

The primary purpose of the system earthing is related to operational characteristics and is an important, if not an essential part of the power system. This 5 days course will discuss the different types of earthing systems in depth.

Who Should Attend?

Electrical Engineers, Consulting Engineers, Project Engineers, Maintenance Engineers, Power System Protection and Control Engineers, Building Service Designers, Electrical and Instrumentation Technicians.

Methodology

This interactive Training will be highly interactive, with opportunities to advance your opinions and ideas and will include;

- Lectures
- Workshop & Work Presentation
- Case Studies and Practical Exercise
- Videos and General Discussions

Accreditation:

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

Objective:

- The basic principles & importance of earthing of electrical systems.
- The function of power system earthing and the various options available.
- Role of protective grounding in ensuring safety; sizing of grounding conductors.
- Importance of equipotential bonding in ensuring safety.
- Design of ground electrodes, measurement of soil resistivity and ground electrode resistance.
- Fundamental principles in the design of grounding systems in substations.

- Solving static electricity-related hazards by grounding and bonding.
- Role of grounding in surge protection of power distribution equipment and sensitive systems.
- How to test and maintain earth electrode & Earthing grid.

Course Outline

Day 1:

- What is System Earthing.
- Why Use System Earthing.
- Basics of grounding/earthing & Bonding.
- Objectives of equipotential bonding.
- Different types of functional & Protective earthing.
- Electricity shock & hazards & Equipment earthing
- Static charges and the need for bonding.

Day 2:

- **Different Types of System or Neutral Earthing.**
 1. Systems with an isolated neutral-point.
 2. Reactance earthed systems.

3. Resistance earthed systems.
4. Earthed system:
 - Effectively earthed system.
 - Not effectively earthed system.
- Zigzag earthing transformer.
- Sizing of Earthing resistors & Zigzag transformers.
- To Choose System's Earthing Point.
- Practice of Earthing.
- Comparison of Different system Earthing Principles
- Earthing & Earth fault protection.
- Different earthing of distribution system arrangements (TT, TN-C, TN-S & IT) as per BS 7671 & IEC 60364.

Day 3:

- Static electricity and protection.
- Lightning & surge arresters.
- Transient overvoltages.
- PQ problems & triplen harmonics (Zero phase sequence).
- Ground electrode system.

Day 4:

- Substation earthing grid.
- Touch & Step voltages.
- Grounding regulations from various national codes.
- BS 7430 & IEEE 80 Standards.
- Maintenance & testing (3 pin method, 61.8% and slope method).
- Finite Element Method (FEM).

Day 5:

- Methods of designing Grounding systems.
- Ground faults.
- Design cases (Grounding module) & Reporting.