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# PRACTICAL GROUNDING/EARTHING, BONDING, LIGHTNING AND SURGE PROTECTION



## YOU WILL LEARN HOW TO:

- Apply good earthing practice to your next installation
- Detail the applicable national standards
- Describe the purposes of earthing and bonding
- Apply the various methods of earthing electrical systems
- List the types of systems that cannot be earthed
- Describe what systems can be operated unearthed
- Correctly shield sensitive communications cables from noise and interference
- Apply practical knowledge of surge and transient protection
- Troubleshoot and fix earthing and surge problems
- Design, install and test an effective earthing system for electronic equipment
- Understand lightning and surges and how to minimise its impact on your facility
- Protect sensitive electronic equipment from surges and lightning

## WHO SHOULD ATTEND:

- Instrumentation and Control Engineers
- Consulting Engineers
- Electrical Engineers
- Project Engineers
- Maintenance Engineers
- Electrical Contractors
- Safety Professionals
- Consulting Engineers
- Electricians
- Electrical Inspectors
- Power System Protection and Control Engineers
- Building Service Designers
- Data Systems Planners and Managers
- Electrical and Instrumentation Technicians

## The Workshop

Few topics generate as much controversy and argument as that of earthing and the associated topics of surge protection, shielding and lightning protection of electrical and electronic systems. Poor earthing practice can be the cause of continual and intermittent difficult-to-diagnose problems in a facility. This workshop looks at these issues from a fresh yet practical perspective and enables you to reduce expensive downtime on your plant and equipment to a minimum by correct application of these principles. This workshop is designed to demystify the subject of earthing and presents the subject in a clear, straightforward manner. Installation, testing and inspection procedures for industrial and commercial power systems will be examined in detail.

Essentially this workshop is broken down into earthing, shielding and surge protection for both power and electronics systems. Earthing and surge protection for telecommunications and IT systems are examined in detail. Finally, the impact of lightning is examined and simple techniques for minimizing its impact are described.

## Practical Sessions

Practical and problem solving sessions throughout the two day workshop include:

- Calculation of charging current and neutral impedances
- Safe touch voltage and sizing of earthing conductors
- Protection zones using attraction radii principle and solving of problems
- Ignition due to spark energy
- Earth resistivity, electrode resistance and current carrying capacity

## Case Studies

Case studies involving real life problems. Solutions to be arrived at by group activity. These include:

- Variable Speed Drives frequent tripping
- Construct Voltage Transformer Problem
- Surge Protection Devices

## The Program

### INTRODUCTION AND BASICS

- Basics of earthing
- Bonding
- Lightning and surge protection
- Static charges
- Shielding
- UPS systems and their earthing practice

### EARTHING OF POWER SYSTEM NEUTRAL

- Unearthed and solidly earthed systems
- Impedance earthed systems
- Resonant impedance earthed systems

*Practical Session: Problem solving on calculation of charging current and neutral Impedances*

### EQUIPMENT EARTHING

- Shock hazards to the human body
- Earthing of equipment
- Operation of protective devices
- Thermal capacity of earthing wires
- Touch potential
- Induced voltages
- Multiple earthing connections
- Surge protection earthing

*Practical Session: Problem solving on safe touch voltage and sizing of earthing conductors*

### LIGHTNING AND ITS EFFECTS ON BUILDINGS AND ELECTRICAL SYSTEMS

- The incidence and probability of a lightning strike
- Methods of lightning protection
- Planning for lightning protection
- Improvements to lightning protection
- Effects of lightning on overhead lines
- To protect or not to protect

*Practical Session: Problem solving on protection zones using attraction radii principle*

### STATIC ELECTRICITY AND PROTECTION

- What is static?
- Generation of charge
- Common examples
- Energy of a spark
- Ignition capability of a spark
- Dangers of static build up
- Controlling static
- Assessment of risks and planning

*Practical Session: Problem solving on ignition due to spark energy*

### EARTH ELECTRODE SYSTEM

- Earthing electrodes
- Soil resistance
- Measuring soil resistivity
- Resistance of single rod electrodes
- Current carrying capacity of an electrode
- Measuring electrode resistance single and multiple rods
- Concrete encased electrodes
- Corrosion of electrode systems
- Maintenance of electrode systems
- Chemical electrodes

*Practical Session: Problem solving on earth resistivity, electrode resistance and current carrying capacity*

### SURGE PROTECTION OF ELECTRONIC EQUIPMENT

- What is a surge?
- Bonding of different earthing systems
- Surges and surge protection
- Principles of surge protection
- Achieving graded surge protection
- Positioning and selecting surge protection

### ELECTRICAL NOISE AND MITIGATION

- Definitions of electric noise
- Analysis and categories of noise
- Earth loops as a cause of noise
- Electrostatic coupling
- Electromagnetic coupling
- Shielded isolation transformer
- Insulated earth receptacle
- Zero signal reference grid
- Harmonics

### UPS SYSTEMS AND THEIR EARTHING PRACTICES

- Power quality issues
- Abnormal voltage conditions
- Regulating transformers
- Standby sources
- Electro-mechanical UPSs
- Solid-state UPSs
- Multiple redundant systems
- Selection of a UPS
- Earthing practices

*Practical Session: Case studies involving real life problems*

### SUMMARY, OPEN FORUM AND CLOSING