

Earthling Of Utility and Industrial Distribution System Training

Description

Course Description

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Few topics generate as much controversy and argument as that of grounding (or earthing as it is called in some countries) and the associated topics of lightning and surge protection of electrical and electronic systems. Any engineer dealing with power supply networks needs to understand the basic principles of grounding system design and its role in ensuring safety of equipment and personnel.

A correct understanding of the basic principles involved will help him/her to avoid mistakes in grounding system design, mistakes that could lead to expensive failures and long downtime. In this workshop, we will demystify the concepts of grounding as applicable to utility networks and industrial plant distribution systems as well as their associated control equipment.

In fact, a lot of myths have been built around this subject ,although it is quite a simple one when approached from basic principles. Our endeavour will therefore be to explain the fundamentals of grounding, which we hope will enable you to gain a correct perspective of the subject and give them the knowledge needed to solve real life grounding problems. Essentially this course is broken down into System Grounding, Protective grounding and Surge/noise protection of power and electronics systems normally found in distribution networks. A brief introduction to the design of substation grounding has been included. Detailed information on ground electrodes and measurement of ground resistance is also available.

Course Objectives

- The basic principles of grounding of electrical systems
- The function of power system grounding 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 protecting substation structures from lightning hazard
- Role of grounding in surge protection of power distribution equipment and sensitive systems
- Noise in electrical systems and the role of grounding in noise mitigation

Course Outlines

OVERVIEW

- Basics of grounding
- Bonding
- Role of grounding in lightning protection
- Ground electrodes and factors affecting their efficiency
- Grounding issues in outdoor substations
- Grounding for static charges
- Surge Protection
- Importance of grounding in mitigation of noise in sensitive circuits
- Importance of Local Codes

POWER SUPPLY SYSTEM GROUNDING

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- Types of system grounding
- Ungrounded systems
- Solidly grounded systems
- Impedance grounding using neutral reactor
- Resonant grounding using neutral reactor
- Impedance grounding through neutral resistance
- Classification of supply systems based on grounding
- Point of grounding
- Other challenges

PROTECTIVE GROUNDING

- Electric shock, its cause and effects
- Direct and indirect contact
- Touch and step potential
- Role of protective grounding in minimizing the shock hazards
- Equipotential bonding
- Protective grounding conductors and installation
- Ground fault protection
- System classification based on system/protective grounding

GROUND ELECTRODE SYSTEMS

- Soil resistance and factors affecting soil resistivity
- Measurement of soil resistivity
- Resistance of ground electrode and distribution of resistance in surrounding soil layers
- Electrode current capacity
- Ground electrode configurations

- Parallel electrodes
- Ground electrode resistance measurement
- Chemical electrodes
- Concrete encased electrodes and splicing methods
- Corrosion of buried electrodes
- Grounding system maintenance

SUBSTATION GROUNDING DESIGN

- Grounding practices
- Basic design approach
- Calculating the ground fault current
- Ground potential rise in HV systems
- Grounding design in LV and MV substations/installations
- Grounding grid design for HV/EHV substations – A step-by-step approach
- Introduction to 2-layer soil model
- Transferred potential and ways of avoiding
- Points needing special attention in substation grounding design and for GIS
- equipment
- Design of substations containing converter equipment feeding to HVDC transmission systems
- Ensuring effective substation grounding – Important aspects

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STATIC ELECTRICITY AND PROTECTION

- What is static electricity and how is it generated?
- Examples of static charge build up and its dangers
- Energy of spark due to static electricity
- Ways of controlling static build up
- Risk assessment and preventive measures

GROUNDING FOR LIGHTNING PROTECTION OF BUILDINGS AND STRUCTURES

- The physics of lightning
- Lightning incidence in different land masses
- Lightning strike probability
- Lightning protection
- Planning for protection and decision factors
- Improved approach to lightning protection and non-conventional systems
- Effect of lightning strikes on electrical installations

SURGES AND SURGE PROTECTION

- Surges, their causes and mitigation
- The ways by which surges couple into electrical circuits
- Bonding of grounding systems
- Basic principle of surge protection and commonly used surge protection devices
- Graded surge protection
- Selecting appropriate surge protective devices and their positioning in a system

- Importance of correct grounding practices for sensitive equipment
- Other ways and devices for mitigating surge problems
- Comparative merits of different types of SPDs for sensitive equipment
- Hybrid surge protective devices
- Surge protection of telemetry and data communication systems

ELECTRICAL NOISE AND MITIGATION

- Definition of electrical noise
- How are sensitive circuits affected?
- Noise categories
- Noise from power electrical equipment
- Noise coupling into signal circuits
- Noise mitigation measures
- Role of proper grounding in reducing noise
- Noise control by proper grounding of UPS derived supplies

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