Grounding System Architecture and Utilisation

Realistic Techniques for Guarding Equipment Against Typical Electrical Failures

Introduction

Maintaining the safety and dependability of power systems depends in great part on the efficient installation of ground connections in distribution and load centres. Actually, grounding systems give surge currents a way to reach the soil mass and operate as a common point of reference for the live electrical wires in a power supply network. By clamping the exposed conductive enclosure of electrical equipment at ground potential, this protects the safety of the public and staff. While faulty grounding can lead to several issues in the power system and related control and communication systems, correct grounding techniques play a critical role in reducing and managing electrical noise.

Hence, in order to ensure the safety of workers and equipment, professional engineers and technicians working with power supply equipment and networks must understand the fundamentals of grounding system design and its role in preventing errors in grounding system design criteria and assumptions. In reality, because of malfunctions and extended downtime, such errors might cause the system to suffer enormous financial losses.

The principles of grounding as they relate to utility networks, industrial plant distribution systems, and the control equipment that connects them are the main topics of this Course N Carry Electrical Engineering training course on Grounding Systems Architecture & Utilization. The various grounding techniques and their uses are covered in this session. The benefits and drawbacks of every grounding technique as advised by the majority of globally recognised standards are covered in this Course N Carry training session.

In addition to covering a variety of grounding concepts, this Course N Carry Electrical Engineering training course on Grounding Systems Architecture & Utilisation also covers common power system failures and damages that can be attributed to either the inefficiency of the grounding system and its configuration or the incorrect placement of protection devices in particular areas. A plethora of actual examples and case studies are included in this Course N Carry training event to help participants better grasp and apply what they learn.

In actuality, this Course N Carry Electrical Engineering training course offers a brief recap of electrical grounding techniques' fundamentals and focuses on the technical details of earthing grids, power system protection controllers, and their response times.

The main points of this Course N Carry training seminar are:

- Establishing ties and forming bonds
- Various grounding techniques and their characteristics
- Disruptions to the power system and methods for mitigating them with grounding systems
- Protection against lightning and surges
- Substation grounding system computations and design
- Choosing appropriate grounding protection equipment

Objectives

Upon completion of this Course N Carry training session, you will understand:

- Key ideas in the construction of grounding systems and related computations
- Techniques for risk assessment and mitigation in relation to power system disruptions
- How to evaluate and compute suitable substation grounding systems
- Earthing rod selection, testing, and standards for soil layers
- Fundamentals of surge and lightning protection

Training Methodology

All of the necessary theory and equations will be covered in this Course N Carry Electrical Engineering training course on Grounding Systems Architecture & Utilization through the use of power point slides. In addition to case studies, this Course N Carry training session requires attendees to engage in in-class activities such as system analysis, computations, relay settings, etc. Additionally, the teacher will watch training films to have a deeper comprehension of the participants. Throughout the course, the participants will be evaluated in stages through the use of assignments, questions, quizzes, and worked examples.

Organizational impacts

After completion, the following effects would be seen by the organisation:

- Find out why efficient grounding systems are necessary, along with some technical details.
- Recognise power system risks and educate yourself on safety precautions.
- Gain a solid understanding of equipotential bonding and various grounding techniques.

- Provide a methodical strategy for establishing an effective substation earthing grid and all of its parts.
- Study up on electrical noise, switching impulse, power swing and oscillations, and harmonics.
- Learn how to assess the resistivity of soil and choose grounding electrodes.

Personal Imapct

This Course N Carry training course will be very beneficial to participants from various engineering company sectors because it will familiarise them with:

- Grounding systems setups and goals
- Risks brought on by an inadequate grounding system, like as step and contact potentials
- Detailed instructions for installing a grounding system in substations Power quality problems and related mitigating strategies

Who should attend?

Attendance in this session is strongly encouraged from staff members involved in power system operation, planning, design, and maintenance. A wide range of professionals can profit from this Course N Carry Electrical Engineering training course, but the following are the main advantages:

- Project managers and engineers
- Technicians and Engineers in Electrical
- Designer engineers and system operators
- Managers and Engineers of Assets
- Protection, Instrumentation, and Commissioning Engineers / Technicians Planning Engineers / Managers

Course Outline

Day 1

Grounding System Requirement and Electric Fault Consequences

- Arc Flash Boundary Fault Types Personal Protective Equipment (PPE)
- Establishing Foundations
- Ground Electrode Bonding
- Electrical substation grounding
- Static charge removal with proper grounding

- Lightning's Effect on Power Systems
- Protection Against Surges
- Lightning Strike Noise Mitigation Lightning's Effect on Power Lines
- Techniques for Lightning Protection
- Static Charge Formation
- Risks Associated with Static Electricity Increasing Spark Power and Ignition Power
- Evaluation and Management of Static Charge

Day 2

Different Grounding System Types

- Systems Without Foundation
- Firmly Grounded Systems
- Grounding Resistance using NER Impedance Grounding with a Neutral Reactor for Hazardous Materials Protection Device Grounding of Equipment
- Ability to Handle Heat
- Step Potential Induced Voltage Mitigation Touch Potential
- Suppression of EMI
- Metal Container for Grounding Wires
- Grounding connections for surge protection
- Sensitivity of Earth Fault Protection
- TN-C System TN-S System TN-C-S System TT System TN-Systems

Day 3

Ground Faults and Associated Safety Measures

- Protection for Circuit Breakers
- Safety of Fuse
- Relay Protection Sequence Networks Per Unit System Protection Criteria
- Transformer Measuring (CT and VT)
- IDMT O/C & E/F Protection Overcurrent Protection Earth Fault Protection
- Protection for Transformers' O/C and E/F

Day 4

Studies of Grounding Systems

- Resistance of Soil
- Methods for Measuring Soil Resistivity and Their Interpretations

- Dingle Rod Electrode Resistance
- Utilising Multiple Ground Electrodes (earthing rods) in Parallel to Increase the Ground Electrodes' Current Carrying Capacity
- Evaluation of the Ground Electrode Chemical Electrodes of Resistance and Issues with Corrosion
- Method for Designing Grounding Systems: Ground Fault Grounding of HV Substations Currently
- MV and LV Installation Grounding
- Using Multi-layer Models to Calculate Soil Resistivity for HV Outdoor Substation Grounding Grid
- Considerations for Transferred Voltage Design in Effective Substation Grounding
- Lightning Strike Incidence & Probability
- Assessment of Lightning Risk

Day 5

Safety from lightning and reduction of noise

- Lightning's effects on power lines and the fundamentals of lightning protection
- Surges in Power Systems and Their Effects
- Equipotential Bonding: Surge Protection Principles and Lightning/Surge Arrestor Selection
- The Effects of Electrical Noise
- Noise Groups
- Noise Interference with Data Cables and Distribution Systems
- The Ground Loop as a Noise Source
- Capacitive / Electrostatic Coupling
- Mitigated Ground Loop Isolation Transformer Shielded
- Harmonics in Power Systems and Their Effects
- UPS Setup Details