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## Advanced Electrical Grounding

Contact us Today for a FREE quotation to deliver this course at your company's location.

<https://www.electricityforum.com/onsite-training-rfq>

While the Basic Grounding Course provided a simplified coverage of the basic principles of grounding and grounding design, the Advanced Electrical Grounding Training Course will follow by a step-by-step design procedures.

The resistivity and conductivity properties of the soil and the analysis of "Distribution of Surface Potentials and Currents" will be presented in the "Basic Geology" session.

More detail coverage includes additional formulas and calculations not presented on the basic course. As an example, calculations for "Ground Fault Currents" will be presented.

This Advanced Electrical Grounding Training course will also address other grounding electrode systems not covered in the basic electrical grounding course such as "Buried Horizontal Ground Grids", the "Three-Point" triangular electrode and calculations for determining the area of influence of grounding electrodes, such as a ground rod.

The course will also include additional principles involved in Earth Resistance testing and additional methods of measuring the "Ground Resistance" such as "The Slope Method" grounding resistance testing for large grounding systems such as substations.

Soil characterization is addressed, followed by measurement interpretation.

Modeling requirements and data preparation procedures for substation ground system design will be discussed as well as options for controlling ground potential rise, touch and step voltages.

The lightning protection section of the course will provide as an additional material, calculations for transient over voltage generated in high structures such as transmission and communications towers and the step voltage hazards caused by transient induced voltage gradients in the earth. Capacitive coupling of transient energy will also be discussed.

This course will also provide a comprehensive coverage of design practices for grounding and electromagnetic compatibility of industrial, commercial, and residential systems with linear and distorting loads.

For critical electronic loads, this advanced course will provide grounding practices for signal reference subsystems, multipoint grounding systems and lower and higher frequency signal reference networks, subjects not covered in the basic grounding course.

## **LEARNING OBJECTIVES**

- Work more safely and efficiently
- Have a better understanding of the 2012 Canadian Electrical Code
- Make fewer installation mistakes and pass inspections more easily
- Be more aware of the benefits of good grounding and bonding systems
- Be better prepared to design your next grounding and bonding system

## **WHO SHOULD ATTEND**

This **electrical grounding course** is a must for electrical engineers, design engineers, electrical engineering managers, project managers, power quality specialists, maintenance managers, consultants and technologists responsible for the design, construction, installation, inspection, operation, or maintenance of electrical systems, designers, contractors, and

electrical technicians, inspectors, safety personnel and other employees responsible for the operation and maintenance of electrical grounding systems in a commercial, industrial, institutional or utility setting.

### **STUDENTS RECEIVE**

- **FREE** 100-Page Digital Electrical Grounding Handbook (Value \$20)
- **\$100 Coupon** Toward Any Future Electricity Forum Event (Restrictions Apply)
- 1.4 Continuing Education Unit (CEU) Credits
- **FREE** Magazine Subscription (Value \$25.00)
- Course Materials In Paper Format

### **COURSE OUTLINE**

#### **DAY ONE**

#### **SESSION 1: STATE OF THE ART**

- Importance of Grounding Systems
- Advanced Grounding System Definitions
- Advanced Components of a Grounding System
- Types of Grounding Systems
- Detailed Requirements for a Grounding System
- Advanced Electrical Grounding Concepts
- Voltage and Current Distribution in the Soil
- Voltage Drop around a Grounding Electrode
- Fault Current Calculation

## **SESSION 2: ADVANCED GEOLOGY CONSIDERATIONS**

- Earth Crust Composition
- Resistivity and Conductivity Properties of the soil
- Properties of Different Soils
- Electrical Conductivity of the soil
- Resistivity Measurements
- Wenner Method
- Measurement Registry

## **SESSION 3: ADVANCED GROUNDING OVERVIEW**

- Why Ground Circuits and Systems
- Grounding methods
- System Grounding
- Single Point Grounding
- Solid Grounding
- Impedance Grounding
- Reactance Grounding
- Resistance Grounding
- Isolated Grounding
- Ground Faults
- Grounding Systems

## **SESSION 4: GROUNDING ELECTRODE SYSTEM DESIGN MODELLING**

- Advanced Grounding Theory
- Parameters, Measurements and Calculations
- Grounding Electrodes: Construction And Installation
- Ground Resistance and Resistivity
- Grounding Electrode Conductor
- Electrical Grounding and Corrosion

- Materials-Splicing
- Installation and Protection
- Sizing the grounding Electrode Conductor

## **SESSION 5: ADVANCED GROUNDING SYSTEM DESIGN**

- Steps to Achieve a Proper Grounding System
- Determination of Parameters
- Design
- Analysis
- Topology
- Materials
- Grounding Electrodes
- Low Voltage Systems
- Basic Medium/High voltage Systems
- Resistance Measurement
- Measurement for Touch and Step Voltage
- Grounding in Artic Regions

## **SESSION 6: CIRCUIT GROUNDING**

- How to ground AC Systems
- How to ground DC systems
- Grounded Conductor
- Direct Current Systems
- Alternating-Current System

## **SESSION 7: FAULT PROTECTION SUBSYSTEMS**

- Major Requirements: Leakage Current, Proper Sizing
- Generators

- Substations
- Transformers
- UPS systems: Online, Standby, Line Interactive, Alternative
- Installation
- Sizing the Equipment grounding
- Identification of the Equipment grounding Conductor
- Electric Shock
- Grounding and electric Shock

## **DAY TWO**

### **SESSION 8: LIGHTNING PROTECTION SYSTEMS**

- The Phenomenon of Lightning
- Development of Lightning Flash
- Flash Parameters
- Influence of Structure Height
- Lightning- Characteristics
- Electrical Effects
- Basic Protection Requirements
- Protection Systems
- Rolling Sphere Concept
- Electro-Geometric Method
- Lightning Protection System Specifications

### **SESSION 9: ADVANCED INDUSTRIAL ELECTRICAL SYSTEMS GROUNDING STRATEGIES**

- Grounding Subsystems
- Exterior Ground Ring
- Interior Ground ring- Halo Ground
- Telecommunication's Site Grounding

- Low Frequency Networks
- High frequency Networks
- Telecommunication Rooms and Closets

## **SESSION 10: ADVANCED ELECTRONIC & COMPUTER EQUIPMENT GROUNDING SYSTEMS**

- Computer and Electronic Equipment Grounding
- Data Processing Equipment Grounding
- Electronic Security Equipment Grounding
- System Reference Zero
- Detection of a faulty Neutral-Ground System
- Sizing Wiring to meet Computer Industry Standards
- Grounding line Treatment Devices
- Transient Overvoltage Protector Grounding
- Gas Tubes
- Metal Oxide Varistors
- Silicon Avalanche Diodes

## **SESSION 11: SIGNAL/INSTRUMENTATION GROUNDING**

- Signal Grounding
- Grounding Procedures
- Lower Frequency Equipment
- Cabinet Grounding
- Bonding Practices
- Higher Frequency Equipment
- Equipment Containing both Lower and Higher Frequency Circuits
- Shielding Guidelines
- Instrumentation Grounding
- Common Mode Noise Control
- Instrumentation Grounding
- Analog Systems

- Grounded and Ungrounded Transducers
- Amplifiers
- Digital Data Systems
- Equipment Inspection and Test Procedures

## **SESSION 12: EMI ON ELECTRONIC CIRCUITS**

- Susceptibility- Immunity
- Cable Shielding and Grounding
- Shields grounding
- Coaxial Cables
- Losses by Absorption and reflection
- Grounding Low and High frequency Shielding
- Grounding High frequency Shielding
- Coaxial Cables
- Superficial Resistivity
- Resonance and Skin Effect
- EMI (Electromagnetic Interference)
- Inductive, Capacitive and Radiation Coupling
- RFI (Radio frequency Interference)
- Electrostatic Discharge

## **SESSION 13: ADVANCED ELECTRICAL GROUNDING APPLICATIONS**

- Transmission Lines Grounding
- Substation Grounding
- Distribution Transformer Grounding
- Reflector Light Pole Grounding
- Motor Grounding
- Telecommunications site Grounding
- Satellite System Grounding
- High Frequency Grounding System
- Metallic Fence Grounding



- Tanks Grounding

#### **FOUR CASE HISTORIES INCLUDED:**

THERE ARE FOUR CASE STUDIES THAT WILL BE PRESENTED: PETROCHEMICAL, TELECOMMUNICATION, COMPUTER FACILITY, AND A MANUFACTURING PLANT. SECOND DAY ALSO INCLUDES A LABORATORY SECTION WHERE A THE PARTICIPANTS ARE TAUGHT HOW TO PERFORM A GROUNDING AND POWER QUALITY SITE SURVEY. MEASUREMENT PERFORMED: GROUND RESISTANCE AND RESISTIVITY, POWER QUALITY PARAMETERS SUCH AS: VOLTAGE, CURRENT, LOAD BALANCE, POWER FACTOR, DISPLACEMENT POWER FACTOR, VOLTAGE AND CURRENT HARMONICS, EFFECTIVE POWER (KW), APPARENT POWER (KVA), REACTIVE POWER (KVAR), K FACTOR FOR TRANSFORMERS, ETC, TO DIAGNOSE AND SOLVE MOST COMMON PROBLEMS.

**Review of expectations  
Questions and Answers**

#### **COURSE TIMETABLE**

##### **Both Days:**

Start: 8:00 a.m.

Coffee Break: 10:00 a.m.

Lunch: 12:00 noon

Restart: 1:15 p.m.

Finish: 4:30 p.m.

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