

# ELECTRICAL GROUNDING WEEK

FOR INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND TELECOMMUNICATIONS POWER SYSTEMS



# 2018



## TORONTO, ONTARIO OCTOBER 15-19, 2018

- ✓ 2-day Low-Voltage/Medium-Voltage Industrial Electrical Grounding Training
- ✓ 1-day High-Voltage Electrical Grounding and Bonding For Utility and Industrial Applications
- ✓ 2-day Electrical Grounding and Bonding For Telecommunications Networks

[www.electricityforum.com/electrical-training/toronto-grounding-week](http://www.electricityforum.com/electrical-training/toronto-grounding-week)

ATTEND ALL THREE COURSES AND SAVE!!

RECOGNIZED BY



EARN CONTINUING  
EDUCATION UNITS (CEUS)

Individual Courses Pricing:  
2-day course - **\$799**  
1-day course - **\$499**

**5-DAY TRAINING**

**\$1599**

[www.electricityforum.com/electrical-training/grounding-and-bonding-training](http://www.electricityforum.com/electrical-training/grounding-and-bonding-training)

## ■ DAY ONE

**ELECTRICAL GROUNDING – Overview**

- Grounding - Definitions
- Grounding methods
- System Grounding
- Single-Point Grounding
- Solid Grounding
- Impedance Grounding
- Reactance Grounding
- Resistance Grounding
- Isolated Grounding

**ELECTRICAL GROUNDING METHODS**

- Grounding Methods
- Solidly Grounded
- Low Resistance Grounding
- High Resistance Grounding
- Reactance Grounding
- Single Point Grounding

**GROUNDING CONNECTIONS FOR SYSTEMS AND CIRCUITS**

- Types of system grounding
- Current over grounding and bonding conductors
- Grounding connections for direct-current systems
- Grounding connections for alternating-current systems

**GROUNDING OF GENERATOR TO SUPPLY EMERGENCY POWER**

- Isolated Systems
- Transformer to supply a different voltage, to parts of a facility
- Two different three-phase, 4-wire solidly grounded systems (midpoint grounded)
- Three-phase, 3-wire ungrounded (delta) system

**GROUNDING CONNECTIONS FOR TWO OR MORE BUILDINGS OR STRUCTURES SUPPLIED FROM A SINGLE SERVICE**

- When the ungrounded and grounded conductors are extended to second building
- When the ungrounded, grounded and bonding conductors are extended to second building

**CONDUCTOR TO BE GROUNDED FOR AC WIRING SYSTEMS**

- Single-phase, 2-wire
- Single-phase, 3-wire
- Multi-phase systems having one wire common to all phases

**CONDUCTOR ENCLOSURE BONDING**

- Equipment bonding
- Fixed equipment, general
- Fixed equipment, specific
- Portable equipment
- Receptacles, plugs, and cords for portable equipment

**BONDING METHODS**

- Clean surfaces
- Dissimilar metals
- Bonding at service equipment
- Means of ensuring continuity at service equipment
- Metal armour cable
- Bonding equipment to grounded circuit conductor
- GFCI installation for spas and hot-tubs

## ■ DAY TWO

**ELECTRICAL GROUNDING ELECTRODE SYSTEM**

- Electrical Grounding Theory
- Parameters, Measurements and Calculations
- Types of grounds: Dirty Ground/Clean Ground
- Connecting IACS to the ground bed
- Star Point Ground, single point connection

**GROUNDING AND BONDING CONDUCTORS**

- Continuity of grounding and bonding conductors
- Material for system grounding conductors
- Material for bonding conductors
- Installation of system grounding conductors
- Installation of equipment bonding conductors
- Grounding conductor size for dc circuits
- Grounding conductor size for alternating-current systems and for service equipment
- Bonding conductor size
- Colour of conductors

**GROUNDING and BONDING CONDUCTOR CONNECTIONS**

- Grounding and Bonding Conductor Connections
- Bonding conductor connection to raceways
- Grounding conductor connection to water pipe electrodes
- Bonding conductor connection to circuits and equipment
- Grounding conductor connection to electrodes
- Tamper resistant receptacles and receptacles exposed to the weather

**GROUNDING AN ELECTRICAL DISTRIBUTION SYSTEM**

- Supply Transformers Configurations
- Electrical Grounding Supply Transformers
- Electrical Grounding Isolated Transformers
- Electrical Grounding a UPS System
- Electrical Grounding a Battery System
- Emergency Generator Grounding

**INDUSTRIAL PROCESSES CONTROL SYSTEMS GROUNDING**

- Production Information Systems/Monitoring Systems
- Integrated HMI & SCADA Systems
- Instrumentation & Controls Grounding
- Shields Against Inductive, Capacitive and RF Coupling
- 

**ELECTRICAL GROUNDING IN HEALTH CARE FACILITIES**

- Electrical Grounding Methods
- Power Cord Grounding
- Equipment Grounding
- System Grounding
- Medium Voltage Systems
- Hospital Grade GFCI
- 

**LIGHTNING PROTECTION - ELECTRICAL GROUNDING**

- Lightning - Characteristics
- Lightning Protection System Specifications

**FOUR CASE HISTORIES INCLUDED**[www.electricityforum.com/electrical-training/high-voltage-electrical-grounding](http://www.electricityforum.com/electrical-training/high-voltage-electrical-grounding)

## ■ DAY THREE

**OVERVIEW**

- Basics Of High-Voltage Grounding
- Electrical Bonding of High Voltage Systems
- Proper Sizing of Conductors
- Grounding of Substations
- High-Voltage Surge Protection
- Electrical Grounding for Lightning Protection

**DEFINITIONS AND INTERPRETATIONS**

- Determination of Need of Personal Protective Grounding
- Basic Criteria for Safe Grounding Practices
- Electric Shock Hazard
- Grounding Practices
- Basic Design Options
- Soil Resistivity
- Ground Fault Currents
- Fault clearing Time

**GROUNDING OPTIONS**

- Ground Cable Assemblies
- Grounding Cable Ampacities
- Grounding Cable Reactance
- Parallel Grounds
- Grounding Clamps
- Grounding Insulated Power Cable
- Ground Potential Rise (GPR) in Medium- and High-Voltage Systems

## GROUND GRID DESIGN FOR SUBSTATIONS

- Determination of Maximum Available Fault Current
- Exposure Voltage Calculations for Plants & Switchyards
- Touch and Step Potential
- Transferred Potential
- Elimination of Step and Touch Potential
- Selection of the Right Connector
- Horizontal Grid Design IEEE STD 80-2000
- Introduction to 2-Layer Soil Model
- Vertical Rods Connected by a Grid
- Temporary Grounding

## SWITCHYARD AND SUBSTATION PROTECTIVE GROUNDING

- General Considerations for Placement of Protective Grounds
- Power Circuit Breakers and Transformers
- Disconnect Switches and Bus

- Insulated High Voltage Cable
- Cable Terminations
- Midsections and Splices
- Grounding Transformers and Phase Reactors
- Capacitor Banks

## POWER LINE PROTECTIVE GROUNDING

- Grounding of Metal Transmission Structures
- Slip Joints
- Steel Pole Structures
- Overhead Ground Wires
- Structure Footing Ground

## TECHNICAL CONSIDERATIONS IN PROTECTIVE GROUNDING IN SUBSTATIONS AND SWITCHYARDS

- Substation Grounding System
- Typical Shock Situations - Conditions of Danger

- Structure Touch
- Electric Circuit for Switch Operator Sources of Hazardous Current on De-energized Equipment
- Grounding and Jumpering Requirements
- IEE Std 80-2000

## INTERNATIONAL AND LOCAL REGULATIONS

- CSA
- IEEE 80-2000, IEEE Guide for Safety in AC Substation Grounding, 2000
- ASTM F 855-97 Standard Specifications for Temporary Protective Grounds
- IEEE 1246-2002, IEEE Guide for Temporary Protective Grounding Systems Used in Substations
- IEEE 1048-2003, IEEE Guide for Protective Grounding of Power Lines, 2003

COURSES INSTRUCTOR: **Pablo Diaz**, *Electricity Forum Electrical Grounding Consultant*

## ELECTRICAL GROUNDING AND BONDING FOR TELECOMMUNICATIONS NETWORKS

**2-DAY**

course

[www.electricityforum.com/electrical-training/tower-grounding-training](http://www.electricityforum.com/electrical-training/tower-grounding-training)

**OCT 18-19, 2018**

### DAY FOUR

#### OVERVIEW

- Grounding concepts for the telecommunications industry
- How the telecommunications industry developed the concept of "Single Point Ground" system
- Utilization of banks of batteries and their grounding in a telecommunication site
- How to ground telecommunications towers.
- How to ground equipment and communications antennas installed on a communications tower

#### ELECTRICAL GROUNDING OVERVIEW

- Grounding- Definitions
- Grounding methods used in the telecommunications industry
- Grounding practices for cellular and digital microwave sites
- System grounding for transformers used in a communications site
- Telecommunications single point grounding
- Why the telecommunications industry uses a solid grounding system
- Impedance grounding for a telecommunication tower

#### GROUNDING ELECTRODE SYSTEM

- Grounding electrodes: construction and installation
- Ground resistance and resistivity
- Grounding electrode conductor
- Electrical grounding and corrosion

#### SYSTEM GROUNDING

- Circuit grounding
- Why systems and circuits are grounded
- Grounded conductor
- Direct current systems
- Alternating-current system
- Systems less than 50 Volts
- Grounding of transformers
- Grounding for telecommunications site

#### TOWER INSTALLATIONS

- Self-supporting tower installations
- Bonding the tower ground to the central office ground
- Pole Mounted Antennas
- Antenna towers mounted on top of buildings
- Antennas and connecting coaxial transmission lines and

- waveguides
- Protection of radio equipment
- Guyed tower installation
- Pole mounted installation
- Building mounted installation

#### TELECOMMUNICATIONS ELECTRICAL BONDING SYSTEM

- Equipment bonding and grounding
- Rack bonding
- Major requirements: leakage current, proper sizing
- Generators
- 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

#### TELECOMMUNICATIONS STANDBY/EMERGENCY GENERATORS

- Separately derived systems (SDS)
- When an emergency generator is not a SDS
- Main bonding jumper
- Portable generators
- Vehicle mounted generators

### DAY FIVE

#### LIGHTNING PROTECTION SYSTEM FOR A TELECOMMUNICATIONS SITE

- The phenomenon of lightning
- Development of lightning flash
- Flash parameters
- Lightning characteristics
- Electrical effects
- Basic protection requirements
- Protection systems
- Electro-geometric method
- Tower lightning protection system
- Rolling sphere concept
- Lightning protection system specifications

#### TELECOMMUNICATIONS INDUSTRY GROUNDING PRACTICES

- Telecommunication site grounding
- Single point ground system
- Grounding subsystems
- Exterior ground ring
- Exterior structural metal elements
- Interior ground ring - halo ground
- Master ground bar
- Cable entrance ground bar
- Telecommunications closets
- Cable trays or raceways
- Low frequency networks
- High frequency networks
- Waveguides grounding
- Racks, cabinets and enclosures
- Central office battery system

#### GROUNDING AGAINST ELECTROMAGNETIC INTERFERENCE (EMI/ESD/RFI)

- Electronic equipment grounding
- Introduction and definitions
- Telecommunication rooms and closets
- Data processing equipment grounding
- Electronic security equipment grounding
- EMI (Electromagnetic Interference)
- Inductive, capacitive and radiation coupling
- RFI (Radio frequency Interference)
- Electrostatic discharge
- Shields grounding
- Cable shielding and grounding
- Coaxial cables
- Telephone lines

#### TELECOMMUNICATIONS EQUIPMENT PROTECTION

- 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
- Data Lines grounding - RS232

#### Review of expectations

#### Questions and Answers



**(905) 686-1040**



**(905) 686-1078**



**ON-LINE:**

[www.electricityforum.com/electrical-training/toronto-grounding-week](http://www.electricityforum.com/electrical-training/toronto-grounding-week)



**MAIL:**

The Electricity Forum  
1885 Clements Rd., Unit 218  
Pickering, ON L1W 3V4

Why not request a FREE Electrical Grounding On-Site Training Course quotation directly for your company??

[www.electricityforum.com/onsite-training-quote](http://www.electricityforum.com/onsite-training-quote)

Our on-site training courses are tailored to meet your company's specific requirements and conducted on your own premises for your employees.

Save the cost of travel and hotels and save on our regular public enrollment registration fees. Plus, our instructors can work with you in advance to determine the level of electrical training and experience of your employees and the specific applications that you would like covered.

Electrical on-site training courses are best because they are delivered using the equipment your electrical technicians use every day. This maximizes the educational value of your electrical training investment. For more information, contact:

Randy Hurst, President, *The Electricity Forum*, [randy@electricityforum.com](mailto:randy@electricityforum.com)

ON-SITE TRAINING  
**AVAILABLE**  
**FREE**  
QUOTATION

**ATTENDEE INFORMATION**

To receive registration fee discounts, you must **REGISTER AND PREPAY** prior to the course date.

**NAME** \_\_\_\_\_

**TITLE** \_\_\_\_\_

**COMPANY** \_\_\_\_\_

**ADDRESS** \_\_\_\_\_

**CITY** \_\_\_\_\_

**PROVINCE** \_\_\_\_\_

**POSTAL CODE** \_\_\_\_\_

**E-MAIL** \_\_\_\_\_

**TEL ( )** \_\_\_\_\_

**FAX ( )** \_\_\_\_\_

**METHOD OF PAYMENT**

**Bill My Credit Card**

**AMEX**     **VISA**     **MasterCard**

**Card #** \_\_\_\_\_

**Exp. Date** \_\_\_\_\_

**Signature** \_\_\_\_\_

**Card Holders Name** \_\_\_\_\_

**REGISTRATION FEES**

The registration fee to attend any two-day Grounding Course is **\$799.00 + tax**. The registration fee to attend one-day Grounding Course is **\$499.00 + tax**. Attend ALL THREE Grounding Courses for only **\$1599.00 + tax**. **Register Early and SAVE \$100 - Just \$1,499**  
The fee includes forum participation, refreshments and lunch.

**BONUS FEATURES**

- Our Latest Electrical Grounding/Power Quality Handbook (Value \$20)
- \$100 Coupon Toward any Future Electricity Forum Event (Restrictions Apply)
- 3.5 Continuing Education Unit (CEU) Credits per day
- FREE Magazine Subscription (Value \$50.00)
- Forum Presentations in Paper Format



**REGISTER 3 DELEGATES  
AT FULL PRICE  
AND GET THE 4th REGISTRATION FREE!**

**SAVE \$100**

**REGISTER AND PREPAY 14**  
Days prior to course date and  
receive an early bird discount  
of \$100 off the full price.

**WHEN & WHERE**

The courses of the Electrical Grounding Week will be held at:  
Hampton Inn and Suites Toronto Airport Hotel  
3279 Caroga Dr., Mississauga, ON  
Tel: 905-672-4820

( Please check the date/course which you want to attend )

- LOW-VOLTAGE/MEDIUM-VOLTAGE INDUSTRIAL ELECTRICAL GROUNDING COURSE - \$799**  
October 15-16, 2018
- HIGH-VOLTAGE ELECTRICAL GROUNDING AND BONDING FOR UTILITY AND INDUSTRIAL APPLICATIONS COURSE - \$499**  
October 17, 2018
- ELECTRICAL GROUNDING AND BONDING FOR TELECOM NETWORKS COURSE - \$799**  
October 18-19, 2018

**ACT NOW!**

**Limited Seating! Register Today!**