

ELECTRICAL GROUNDING WEEK

FOR INDUSTRIAL, COMMERCIAL, INSTITUTIONAL POWER SYSTEMS

2019



LOOK INSIDE FOR DISCOUNT PROGRAM PRICING

EDMONTON, ALBERTA | NOVEMBER 18-22, 2019

- ✓ 2-day Low-Voltage/Medium-Voltage Electrical Grounding for Industrial Power Systems Course
- ✓ 1-day High-Voltage Electrical Grounding and Bonding Training
- ✓ 2-day Electrical Grounding For Oil & Gas Applications Course

ATTEND ALL THREE COURSES AND SAVE!!



Individual Courses Pricing:
2-day Basic Grounding Course - \$799
1-day HV Grounding Course - \$499
2-day Oil & Gas Grounding Course - \$799

5-DAY TRAINING
\$1499

LV/MV INDUSTRIAL ELECTRICAL GROUNDING AND BONDING

EDMONTON, AB - NOVEMBER 18-19, 2019

Complete course details: <http://www.electricityforum.com/forums/electrical-grounding-2017.html>

DAY ONE

ELECTRICAL GROUNDING – OVERVIEW

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

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
- Single-phase, 3-wire solidly grounded systems
- Three-phase, 4-wire solidly grounded systems
- Three-phase, 4-wire impedance grounded system

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
- Multi-phase systems having one phase grounded
- Multi-phase systems in which one phase is used
- In multi-phase systems in which one phase is used as a single-phase 3-wire system

CONDUCTOR ENCLOSURE BONDING

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

DAY TWO

BONDING METHODS

- Clean surfaces
- Dissimilar metals
- Bonding at service equipment
- Means of ensuring continuity at service equipment
- Metal armour cable
- Bonding at other than service equipment
- Bonding jumpers

- Fixed equipment
- Portable equipment
- Bonding equipment to grounded circuit conductor
- GFCI installation for spas and hot-tubs

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
- How not to ground
- Electrical Grounding and Corrosion
- Materials-Splicing
- Installation and Protection
- Sizing the Grounding Electrode Conductor

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
- Instrumentation Coaxial Cables Grounding
- Twinaxial/Triaxial/Quadaxial Cables Grounding
- Shielded Cable Connecting Two Systems
- Incorrect Grounding of Low Frequency Shields

ELECTRICAL GROUNDING IN HEALTH CARE FACILITIES

- Electrical Grounding Methods
- Power Cord Grounding
- Equipment Grounding
- System Grounding
- Medium Voltage Systems
- Hospital Grade GFCI
- Mobile X-Ray Plugs and Receptacles
- Micro Shock Hazards
- Electrosurgical Currents
- Summary

LIGHTNING PROTECTION - ELECTRICAL GROUNDING

- Lightning - Characteristics
- Protection Systems
- Rolling Sphere Concept
- Lightning Protection System Specifications

FOUR CASE HISTORIES INCLUDED

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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

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DAY FOUR

ELECTRICAL GROUNDING – SCOPE

- Definitions
- Applications
- Grounding methods
- Ground Faults
- Why Ground Circuits and Systems
- Grounding Systems

CLASSIFICATION OF VARIOUS GROUNDING STANDARDS. CODES AND RULES

- API (American Petroleum Institute)
- ASTM (American Society for Testing and Materials), AASHTO,
- AGA (American Gas Association),
- AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- ANSI/IEEE
- ANSI, ASCE, ASHRAE, ASME, ASSE/SAFETY, ASTM, AWS (optional), AWWA, CTI, DNV, GPA, ICC, IEEE, IESNA, ISA, MSS, NACE, NEMA, NFPA, PFI, SAE, SSPC and UL

ELECTRICAL GROUNDING ELECTRODE SYSTEM

- 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
- How not to ground

COURSES INSTRUCTOR:

Pablo Diaz,
Electricity Forum Lightning
Protection and Electrical
Grounding Consultant

HIGH-VOLTAGE ELECTRICAL GROUNDING AND BONDING FOR UTILITY AND INDUSTRIAL APPLICATIONS

Complete course details: <http://www.electricityforum.com/forums/high-voltage-electrical-grounding-2017.html>

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
- Grounding on Wood Pole Transmission Structures
- Transmission Line Terminal Ground Switches
- Grounding on Distribution Lines
- Surface Equipment and Vehicle Grounding

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
- IEEE 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

OIL & GAS APPLICATIONS - ELECTRICAL GROUNDING TECHNIQUES

Complete course details: <http://www.electricityforum.com/forums/oil-and-gas-electrical-grounding.html>

- Electrical Grounding and Corrosion
- Installation and Protection
- Sizing the Grounding Electrode Conductor

CIRCUIT GROUNDING

- Sources of electrical power
- Grounded Conductor
- Direct-Current Systems
- Alternating-Current System
- Solidly Grounding system
- Resistance Grounding
- MCC's-Motors grounding
- Rigging Shore Power
- External source through shore power cables

EQUIPMENT BONDING & GROUNDING

- Major Requirements:
- Identification of the Bonding Conductor
- Bonding/Grounding and electric Shock
- Equipment cabinets and hardware items
- Ground returns & machine grounding
- Pipelines containing gases or flammable liquids
- Grounding of arc welding & cutting machines
- Storage Tank's grounding
- Overall Petrochemical plant proper grounding

EMERGENCY POWER SYSTEMS

- Proper grounding of emergency power systems (generators)
- Three Pole emergency generator grounding
- Four Pole emergency generator grounding.
- Main Bonding Jumper

- Portable generators
- Vehicle Mounted Generators

DAY FIVE

STATIC HAZARDS

- The hidden dangers in hazardous areas
- Static discharge ignition of combustible atmospheres.
- Static in liquids
- Electrostatic charging of hoses
- Static grounding protection guidelines for tank trucks
- Road tanker filling & emptying
- Mobile grounding for vehicles
- Railroad filling & emptying
- Mixing & blending
- Plastic drums and containers in hazardous areas
- Vehicle mounted static grounding verification systems.
- Vehicle refueling

LIGHTNING PROTECTION FOR OIL INSTALLATIONS

- Electrical Grounding & Lightning
- Characteristics Protection Systems
- Electrogeometric & Rolling Sphere Concept
- NAVFAC Design Guides
- Ordnance Facilities Protection
- Storage and Handling Facilities Above Ground
- Earth-Covered Magazines
- Cranes on Piers and Wharves
- Marshalling Yards (Truck and Railroad)
- Explosives safety requirements
- Transient Overvoltage Protector Grounding
- Gas Tubes Metal Oxide Varistors Silicon Avalanche Diodes

ELECTRONIC EQUIPMENT GROUNDING

- Introduction and Definitions
- Computer and Electronic Equipment Grounding
- Telecommunication Rooms and Closets
- Data Processing Equipment
- Grounding Electronic Security Equipment Grounding

TELECOMMUNICATIONS GROUNDING IN PETROCHEMICAL PLANTS

- Grounding Subsystems
- Exterior Ground Ring
- Interior Ground Ring –
- Field transmitter grounding
- Techniques for floating transmitters
- Single Point grounding system
- Equipment & Cabinet grounding

EMI ON ELECTRONIC CIRCUITS

- Susceptibility - Immunity
- Cable Shielding and Grounding
- Losses by Absorption and reflection
- Grounding Low- and High-Frequency Shielding
- Grounding High-frequency Shielding
- Coaxial Cables
- Superficial Resistivity
- Resonance and Skin Effect

TWO CASE HISTORIES:

- Electrical Grounding in Petrochemical Plants
- Review of expectations

QUESTIONS AND ANSWERS

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

www.electricityforum.com/On-Site_Training_Requests/

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

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**(905) 686-1040****(905) 686-1078****ON-LINE:**<http://www.electricityforum.com/forums/edmonton-grounding-week-2017.html>**MAIL:**The Electricity Forum
1885 Clements Rd., Unit 218
Pickering, ON L1W 3V4**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 \$50**

REGISTER AND PREPAY 14 Days prior to course date and receive an early bird discount of \$50 off the full price.

WHEN & WHERE

The Electrical Grounding Week courses will be held at:

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

LOW-VOLTAGE/MEDIUM-VOLTAGE INDUSTRIAL ELECTRICAL GROUNDING TRAINING**November 18-19, 2019**Sawridge Inn Edmonton South
4235 Gateway Blvd NW
Tel: 780-438-1222**HIGH-VOLTAGE ELECTRICAL GROUNDING AND BONDING TRAINING****November 20, 2019**Sawridge Inn Edmonton South
4235 Gateway Blvd NW
Tel: 780-438-1222**ELECTRICAL GROUNDING FOR OIL & GAS APPLICATIONS TRAINING****November 21-22, 2019**Sawridge Inn Edmonton South
4235 Gateway Blvd NW
Tel: 780-438-1222**ACT NOW!****Limited Seating! Register Today!****ATTENDEE INFORMATION**To receive registration fee discounts, you must **REGISTER AND PREPAY** prior to the course date.

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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 \$1499.00 +tax.

The fee includes courses presentation material, CEU Credits, refreshments, lunch.