DOBLE TRAINING & EDUCATION COURSES

# Grounding Fundamentals for Electric Power Systems

## Overview:

Grounding is one of the most overlooked parts of electrical power design and maintenance. This interactive 2-day seminar will cover grounding fundamentals, which grounding system tests can prevent safety and operational issues at your facilities and which tests can be conducted during a plant shutdown versus while the plant is in operation. Background information regarding the engineering factors that influence how electrical energy propagates through grounding and earthing systems will intrigue the engineer and the scientist in you.

## Learning Outcomes:

Upon completion of this course, the participant will be able to understand:

- Fundamentals of grounding and bonding and how repairs are conducted
- Relationship of grounding and bonding to personal safety
- Requirements of grounding conductors, electrodes, and equipment grounding
- Importance of grounding in relation to system faults and ground-fault protection
- Requirements of grounding for Lightning Protection Systems
- Fall of potential and other resistance-to-ground measurement techniques

## Course Audience:

Electrical engineers working in operations, maintenance, engineering, or other service fields in which knowledge grounding for electric power systems is required part of his job responsibility.

**Duration:** 2 Days

**Class Size:** 8 - 15 Attendees

**Credits:** Up to 1.6 CEUs or 16 Professional Development Hours

Note: Reference material are drawn from National Electric Code, IEEE, NFPA, SES Tech, Industry white papers, and McGraw-Hill's book "Standard Handbook for Electrical Engineers" E&S Grounding Solutions authoring chapter 24 "Grounding Systems" in the 100th- Anniversary Edition and the new edition to be release this coming year. A pdf copy of the course materials will be emailed in advance to the designated contact (copies will need to be made on-site for each attendee). Copies of standards and/or any copyrighted documents are not included will need to be purchased separately.

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COURSE OUTLINE

# Grounding Fundamentals for Electric Power Systems

The course program contains the following training outline:

**Day One – Fundamentals of below-grade grounding or "earthing"**

1. Sphere of Influence
2. Soil Testing basics – Wenner 4-Point Soil Resistivity measurements
3. Electrode testing basics – 3-point Fall-of-Potential & Clamp-on Induced Frequency testing
4. Ground System Testing including trouble shooting – 2-point testing
5. Electrical safety basics & NEC Article 250
6. Automatic Transfer Switches and Separately Derived Systems
7. Objectionable current, GFCI and surge protection
8. Questions and Answers as time permits

**Day Two – Engineering Issues**

1. Advanced Engineering Issues
2. Ground Potential Rise, Ground Potential Difference, and other engineering factors related to your sites
3. Human safety in high-voltage environments - IEEE Std-80 and 29 CFR 1910.269. Step & touch Potentials
4. Lightning issues including Lightning Risk Assessments
5. Field Testing – Actual hand-on testing in the field
6. Grounding of high-voltage power lines during shut-downs
7. Questions and Answers as time permits

## Presenter(s):

This training course will be conducted by one (1) E&S Grounding Solutions Engineer. Assistance from facility personnel will be required to complete some of the above tasks.

E&S Instructor: David Stockin, E&S Grounding Engineering Manager
Mr. Stockin is the author of numerous distinguished publications regarding electrical grounding and earthing and is an often sought after expert in the field. He has been a full-time Grounding Engineer for over 17 years. His list of publications include McGraw-Hill's UK Wiring Standards for Earthing & Bonding (2016), McGraw-Hill's National Electrical Code 2014 Grounding & Earthing Handbook (2014), Standard Handbook of Electrical Engineers, 16th Edition (2012), Standard Handbook of Electrical Engineers, 15th Edition (2008), Handbook of Electrical Power Calculations, 4th Edition (2014), and Handbook of Electrical Power Calculations, 3rd Edition (2000).

E&S Instructor: Jeffrey Drummond, E&S Grounding Principal Engineer
Mr. Drummond has designed, lectured, and published in the field of electrical engineering for over 22 years. He has expertise in grounding design, power quality analysis, and industrial power distribution. He is a Professional Engineer, licensed in electrical engineering in several states. He received his Bachelor's and Master's degrees in engineering from Harvey Mudd College, where he graduated with Distinction. He is part of the IEEE Working Group of the PES Substations Committee for the revision of IEEE 80 and IEEE 81 substation grounding standards. He is a member of IEEE, NFPA, and Tau Beta Pi National Engineering Honor Society. He received his Bachelor's and Master's degrees in engineering from Harvey Mudd College, where he graduated with Distinction. He is part of the IEEE Working Group of the PES Substations Committee for the revision of IEEE 80 and IEEE 81 substation grounding standards. He is a member of IEEE, NFPA, and Tau Beta Pi National Engineering Honor Society.

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