



500 Tallevast Road • Suite 101
Sarasota, FL 34243 USA
Tel: 941-747-7733 • Fax: 941-746-5374
www.hpcnet.com

Course Information Letter ---- E260

ELECTRICAL MAINTENANCE SKILLS E260

To safely working on electrical equipment is exceedingly important in any environment. Not only must we work safely, but we must also correctly accomplish the assigned task-at-hand. To begin with, the individual needs to appreciate the hazards of electric energy. To often, safety is sacrificed due to ignorance of the equipment being worked on. In this course, we not only discuss safety, but we will explain why. We will discuss why following safe procedures are so important. Next in line is the actual work performed on the equipment. This means we need to fully understand the use of electrical instrumentation. This means we need to fully appreciate how important grounding is on operating equipment as well as instrumentation. This course is intended to help develop these skills and their application.

Topical Outline includes: Hazards of Electrical Energy, Electrical Equipment Safety, OSHA Standards Design, Use of Analog Meters, Digital Meters, Megohmmeter, High Voltage Detector, Oscilloscopes, General Requirements, System Grounding, Grounding Electrode And Grounding Electrode System, Enclosure, Raceway, And Service Cable Grounding, Bonding, Equipment Grounding And Equipment Grounding Conductors, Methods of Equipment Grounding, Print Reading

COURSE DATES/LOCATION/FEE

For current dates / locations / prices, please see HPC's website, www.hpcnet.com.

WHAT YOU WILL RECEIVE:

- HPC Technical Services' fully illustrated textbook: Electrical Maintenance Skills.
- HPC's Certificate of Completion, including 3.2 Continuing Education Units, as authorized by the International Associate of Continuing Education/Training (IACET).

Electrical Maintenance Skills – E260

www.hpcnet.com

COURSE OBJECTIVES: Upon completion of this course, the participant should be able to:

1. Describe the hazards of electrical energy and the effects of voltage on body resistance
2. Describe, in general terms, equipment safety and safe work practices
3. Describe why and how electrical circuits should be checked de-energized
4. Describe OSHA safety Design Safety Standards for Electrical Systems (1910.302-308)
5. Describe Safety Related Work Practices (1910.331-335)
6. Explain the fundamental concepts of meter operation.
7. Describe how each of these measuring instruments work and what precautions should be used with them: Voltmeter, Ammeter, Ohmmeter, Analog Multimeters, and Digital Multimeters.
8. State the factors affecting insulation resistance.
9. Describe the three purposes of insulation resistance testing.
10. Describe proper use of an oscilloscope.
11. Describe the general requirements for grounding and bonding.
12. Describe the electrode system and selection of an electrode conductor.
13. Review the requirements for grounding enclosures, raceways, and service cables.
14. Describe bonding, continuity, and capacity to conduct any fault current to ground safely.
15. Describe the requirements for equipment grounding and ground conductor selection.
16. Examine various methods of equipment grounding connections for grounded and ungrounded systems.
17. Discuss grounding of Direct Current Circuits and systems.
18. Discuss grounding requirements for instrument transformers, meters, and relays.
19. Explain the purpose of the American Standard Device Function Numbers Table and the Standard Diagram Abbreviations Table.
20. List information commonly found in electrical diagrams and the purpose of each.
21. Define single line diagrams and identify the components and symbols found within.
22. Describe schematic diagrams and how they are used.
23. Demonstrate the ability to trace a path for current flow through the control circuit of an AC motor controller schematic and its controller.
24. Demonstrate the ability to troubleshoot routine problems using electrical schematics.
25. Demonstrate the ability to use connection diagrams.
26. Demonstrate the ability to use raceway diagrams.
27. Demonstrate the ability to interpret logic diagrams.

FREQUENTLY ASKED QUESTIONS

- Will HPC Technical Services bring this course to our location for our personnel only? YES, call or email Stephen Parker, stparker@hpcnet.com for a price quotation.
- Will HPC Technical Services customize the presentation at our site to suit our particular needs? Yes.
- Is HPC Technical Services' textbook available for purchase as a reference document? No.
- What is the cost for HPC Technical Service to deliver this course at our location? Well, of course that can vary and it needs to be priced on an individual need basis. You gain from the customization and price.
- Is HPC Technical Services' consultants available for "technical advise" on the evaluation of your maintenance procedures, systems, tests? Yes. Call Harold Parker, hparker@hpcnet.com for a rate sheet.

COURSE OUTLINE

Day One/Two -- Electrical Safety

- Hazards of Electrical Energy: Electrocutation, Effects of Voltage on Body, Resistance, Effects of AC Current, Need for Electrical Safety, Incident Case Histories
- Electrical Equipment Safety: Safe Work Practices, Testing for Energization, Working on Energized Electrical Equipment, Grounded vs. Ungrounded Electrical Systems, Safe Grounding Methods
- OSHA Standards Design: Safety Standards for Electrical Systems, Electric Utilization Systems (1910.302), General Requirements (1910.303), Wiring Design and Protection (1910.304), Wiring methods, components, and equipment for general use (1910.305), Specific Purpose Equipment and Installations (1910.306), Hazardous locations (1910.307), Special Systems (1910.308), Safety Related Work Practices, Scope (1910.331), Training (1910.332), Selection and Use of Work Practices (1910.333), Use of Equipment (1910.334), Safeguards for Personnel Protection (1910.335)

Day Three (3) -- Electrical Test Equipment

- Use of Analog Meters: Meter Movements, Moving-Coil Meter Movement, Scales for Moving-Coil Meters, Moving-Iron Meter Movement, Meter Sensitivity, Voltmeters, Precautions, Voltage Tester, Ohmmeter, Series Resistance Measurement, Shunt Resistance Measurement, Ohms Adjust, Ammeter, Shunt Resistors, Precautions, Simpson 270 Multimeter, Specifications, Proper Use, Making Measurements
- Digital Meters: Application, Basic Operation, Input Signal Conditioners, A/D Converter, Control and Display, Data Output Unit (DOU)
- Megohmmeter
- High Voltage Detector: Application and Basic Operation.
- Oscilloscopes: Cathode-Ray tube (CRT), Deflection System, Display System, Vertical and Horizontal System, Probes, Waveforms, Measurement Techniques

Day Four (4) -- Grounding Systems

- General Requirements: Grounding, Bonding, Current Paths, Objectionable Current, Ground Clamps, Clean Surfaces
- System Grounding: Systems And Circuits To Be Grounded, AC Circuits Not Requiring To Be Grounded, Grounding Connections, Grounding Conductor, Buildings Or Structure, High Impedance Grounded Neutral Systems
- Grounding Electrode And Grounding Electrode System: Grounding Electrode System, Made Electrodes, Supplementary Electrodes, Resistance Of Made Electrodes, Installation, Sizing Of Conductors, Methods Of Connection To Ground
- Enclosure, Raceway, And Service Cable Grounding
- Bonding: Services, Bonding, Isolated Grounding Circuits, Piping Systems, Lightning Protection Systems
- Equipment Grounding And Equipment Grounding Conductors: Fixed Equipment, Cord & Plug, Conductor Identification, Conductor Installation, Conductor Sizing
- Methods of Equipment Grounding: Connections, Equipment Effective Grounding, Grounded Circuit Conductors, Continuity and Attachment of Conductors

Day Five (5) -- Print Reading

- Standard Device Numerical Designations
- Standard Device Symbolology
- Three-Line Diagrams
- One-Line Diagrams
- Equipment Isolation Exercises

Electrical Maintenance Skills – E260

www.hpcnet.com

INSTRUCTOR(S):



Mike Whisnant. Mr. Whisnant's career began at the Oconee Nuclear Station in May 1970. Being assigned as the lead tech for the EHC along with all of the support systems for the turbine gave Mike the opportunity to not only learn the EHC System but to master the system during his 31 years with Duke. His involvement with the turbine enabled Mike to gain a working knowledge of the steam cycle within a power plant. This working knowledge of the steam cycle provided many opportunities to work on the electrical circuits involved with the steam cycle processes, which included power distribution, control, alarms, and trip circuits. And as with any electrical circuit, sometimes things go wrong, which leads to taking measurements for troubleshooting purposes. Mike is an excellent troubleshooter and with his wide-ranging knowledge of the different systems within a power plant, it provided the opportunity to travel to other non-Duke plants as a consultant to ensure system readiness after the NRC shut down these plants. After his retirement in June 2001, he joined the staff of H. Parker & Company in September 2001 as their E&I Training Specialist, who provides training courses on steam turbine controls, generators, electrical operating systems, protective systems, etc. His duties have expanded to include being a consultant in the performance of a functional checkout and calibration of the EHC Mark I & II along with providing troubleshooting support should it be required? Recently, the EHC Mark V and VI have been included in his expanded duties.

Leonard Fox. Mr. Fox has approximately 20 years experience working in the electrical field. In his earlier career he worked for several manufacturers of power transformers where he was involved in the installation, checkout and troubleshooting of said transformers. Later in his career he became involved in the inspection of property to ensure safety and code requirements have been met. Over the past few years, Mr. Fox has started to teach some of HPC's electrical maintenance courses.

Electrical Maintenance Skills – E260

www.hpcnet.com

HPC TECHNICAL SERVICES
500 Tallevast Road, Suite 101, Sarasota, FL 34243
Telephone: 941-747-7733 FAX: 941-746-5374
Website: www.hpcnet.com

REGISTRATION FORM

Company: _____

Plant: _____

Address: _____

City/State/Zip: _____

Telephone: _____ FAX: _____

Course Number/Title: _____

Course Dates: ____/____/____ Thru ____/____/____

Course Location: _____ Course Fee: _____

Please enroll the following individual(s) listed below:

Student #1: _____

Student #2: _____

Taking advantage of HPC's 3-4-2 Policy: Send 3, Pay for 2 when paying in advance.

Student #3: _____

Enrolled by: _____ **Date:** _____

METHOD OF PAYMENT

Check to Follow: _____

Check Enclosed #: _____

MC/Visa/AMEX #: _____

Expiration Date: _____ CV Code: _____

Purchase Order #: _____

HOW DID YOU LEARN OF THIS COURSE?

Attended HPC courses before

Received a fax

Received an email

Internet search

Other: _____