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Course Information Letter ---- E201

ELECTRICAL TROUBLESHOOTING & PREVENTIVE MAINTENANCE

E201

It's just a matter of time when troubleshooting is going to be required at your workplace regarding an electrical problem. This problem could be as simple as a lighting circuit, or it could be as complex as a variable frequency drive (VFD) control circuit. When this time comes, it's going to require a certain skill (troubleshooting) to ascertain the problem, diagnose the circuit/component, and provide a solution to return the suspect circuit or component back to normal operation as soon as reasonably possible. What is a skill? The dictionary states that a skill is (1) A developed talent or ability; (2) An ability that has been acquired by training; (3) Ability to produce solutions in some problem domain. The ability to troubleshoot encompasses all three definitions. Definition 1 relates to the troubleshooting skill that has already been developed. Definition 3 relates that once the skill has been developed, one can produce solutions. Definition 2 relates to one aspect in the development of a troubleshooting skill. This is where HPC Technical Services comes in. This course will provide the minimum skills required in the development of troubleshooting effectively. Additionally, to hone your skill of troubleshooting, a myriad of circuits will be used that represent the ones that you will most likely come in contact with.

Also, this course will describe the importance of having an electrical preventive maintenance program. Topics discussed include: Basic Skills for Electrical Troubleshooting. Followed by discussion on Troubleshooting Control Circuits, Motors, Power Quality Problems, Lighting Problems, PLC's, and Variable Frequency Drives. Finally, the topics turn to Preventive Maintenance issues.

Who Should Attend?

Personnel (Mechanics, HVAC Technicians, Machine Operators, Technicians, Non Electrical Engineers, General Maintenance Technicians, or any person who would benefit from learning to safely work around electricity)

Who Work At (Manufacturing Facilities, Hospitals, Commercial Buildings, Waste Water Facilities, Government Buildings, Schools, Shopping Centers, Apartment Complexes)

COURSE DATES/LOCATION/FEE

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

** Preceding each of these course dates is HPC's course titled "Electricity for Non-Electricians". Price is an additional US \$895. See CIL for E101 for details.

COURSE OBJECTIVES: Upon completion of this course, the participants will be able to:

1. Demonstrate a working knowledge on the requirements of using Personal Protective Equipment with respect to electrical circuits.
2. Demonstrate the skill of using a Digital Multimeter (DMM) when measuring voltage, resistance, or current.
3. Describe the systematic approach to troubleshooting concept.
4. Explain the operation of typical control circuits used in various applications.
5. Demonstrate a working knowledge on how to troubleshoot motors by using the proper test equipment along with the proper technique.
6. Describe the two types of three-phase power used in power distribution.
7. Explain the difference between overload, short circuit, and ground fault and describe the protection scheme for each.
8. Demonstrate the proper interpretation of the Line-To-Neutral and Neutral-To-Ground voltage readings.
9. Demonstrate a working knowledge of harmonics, how they're produced, the effect of harmonic current on the neutral conductor, and solutions used to minimize the effects of harmonic current.
10. Demonstrate a working knowledge of the requirements of test equipment and the use of test equipment to determine the percent of harmonic current that is present on a given load.
11. Describe the two main types of lighting circuits and their differences.
12. Explain the difference between radial and ring circuits.
13. Demonstrate a working knowledge on the location of the wiring diagram for a given gas discharge lighting system along with the purpose and operation of the ballast component.
14. Demonstrate a working knowledge on the economic justification for a PLC.
15. Describe the operational structure of a PLC.
16. Demonstrate a working knowledge on properly interpreting a given PLC instruction.
17. Demonstrate a working knowledge of the terminology used in Variable Frequency Drives.
18. Explain the basic operation of a Variable Frequency Drive.
19. Demonstrate a working knowledge of identifying common problems along with their corrective actions with respect to Variable Frequency Drives.
20. Demonstrate a working knowledge of identifying the advantages of an Electrical Preventive Maintenance Program.
21. Demonstrate a working knowledge of identifying the essential components of an Electrical Maintenance Program.

WHAT YOU WILL RECEIVE:

- HPC Technical Services's Textbook Electrical Troubleshooting & Preventive Maintenance
- HPC's Certificate of Completion, including 1.3 Continuing Education Units, as authorized by the International Associate of Continuing Education/Training (IACET).
- Ugly's Electrical Pocket Reference Guide --- a very useful reference on your day-to-day activities.

COURSE OUTLINE:

- I. BASIC SKILLS FOR ELECTRICAL TROUBLESHOOTING: Safety First; OSHA Requirements Regarding Troubleshooting and Qualified Persons; Using Electrical Drawings; Using Meters and Circuit Measurements; Developing a Logical, Systematic Approach to Troubleshooting
- II. TROUBLESHOOTING CONTROL CIRCUITS: Relays, Motor Starters and Control Devices; Reading and Interpreting Ladder Diagrams; Power Loss; Control Circuit Industrial Applications; Electric Motor Drives; Solenoid Operated Valves; Heating Elements
- III. TROUBLESHOOTING MOTORS: Most Common Motor Problems; Electrical Problems; Testing Windings For Shorts, Opens and Ground Faults; Phase Unbalance; Mechanical Problems; Phase Rotation Testing
- IV. TROUBLESHOOTING POWER DISTRIBUTION: Wye and Delta Systems; Overcurrent Protection; Branch Circuits
- V. TROUBLESHOOTING POWER QUALITY PROBLEMS: Sources of Power Quality Problems; Test Equipment For Troubleshooting Power Quality Problems; Harmonics
- VI. TROUBLESHOOTING LIGHTING CIRCUITS: Lighting Terminology; Types of Lighting Circuits - Incandescent, Fluorescent, HID
- VII.** TROUBLESHOOTING PROGRAMMABLE LOGIC CONTROLLERS (PLCs): Overview of Programmable Logic Controls; Reading PLC Ladder Diagrams; Status Indicators and Error Codes; Force and Disable; Startup Procedures
- VIII. TROUBLESHOOTING VARIABLE FREQUENCY DRIVES (VFDs): VFD Terminology; VFD Basic Operation; Components, Pulse Width Modulation; Types of VFDs; Common Problems and Corrective Action
- IX. ELECTRICAL PREVENTIVE MAINTENANCE: Why Perform Electrical Maintenance; Overview of an Electrical Maintenance Program; Building Your Own Walkthrough Inspection Checklist

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? Yes. \$95 + S&H.
- 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.

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. 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.

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.

HPC TECHNICAL SERVICES
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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 #: _____

Please advise how you found out about this course initially.

- Website search
- Fax advertisement
- Magazine advertisement
- Familiar with HPC
- HPC mailing
- Other _____