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www.hpcnet.com

Course Information Letter ---- E301

FUNDAMENTALS OF MOTOR, TRANSFORMER, AND BREAKER MAINTENANCE E301

Plant electricians, new engineers, mechanics (who work with and around electrical equipment) can gain significantly from this course. This course provides fundamental knowledge of how the electrical device functions. This fundamental knowledge is a critical piece of and O&M skills. The course provides practical knowledge associated with how a machine is constructed, defining components the component purpose, and how it may be at risk. This course also provides information on the skills necessary to implement a quality preventive maintenance program, to troubleshoot operational problems and corrective maintenance activities for the more common integrity issues.

This course discusses construction, operation, and routine preventive / corrective maintenance of:

- AC Motors
- DC Motors
- Distribution Transformers
- Low Voltage Circuit Breakers
- Protective Systems

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: Fundamentals of Motor, Transformer, and Breaker Maintenance.
- HPC's Certificate of Completion, including 3.2 Continuing Education Units, as authorized by the International Associate of Continuing Education/Training (IACET).

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

Day One & Two - AC & DC Motors

- Describe the fundamental design, construction, application and operation of all motors typically found in an industrial site.
- Explain how a 3-phase motor direction of rotation is reversed.
- Define torque, starting current, and armature reaction as they apply to a DC motor.
- Describe the methods for determining various motor connections.
- List and briefly explain six causes for rotating machinery failure.
- Describe the various types of rotary machinery maintenance: visual inspections, tightness checks, air gap distance, and bearing lubrication and replacement.
- Describe the following rotating machinery tests: insulation resistance, continuity, vibration analysis, DC high potential, power factor, and thermography.

Day Three - Distribution Transformers

- Describe the fundamental design, construction, application and operation of distribution transformers found in an industrial setting.
- Describe transformer losses.
- Describe various wiring connections such as wye/wye, wye/delta, and delta/delta.
- Discuss aging and maintenance issues resulting from normal and abnormal operating conditions
- Describe transformer preventive and corrective maintenance activities.
- Describe safety considerations during maintenance activities.

Day Four - Low Voltage Circuit Breakers

- Define those terms relevant to circuit breaker design and construction.
- Describe how inverse time-current characteristic can be applied to a circuit breaker.
- Describe how a series trip and solid state trip units function and are tested.
- List the protective devices found in a molded case breaker.
- Explain how molded case trip devices are tested.
- Describe the two basic types of low circuit breaker contacts.
- Describe the five basic types of low circuit breaker operating mechanisms.

Day Five - Machinery Protection

- Explain why protective devices are used in electrical equipment.
- Describe how a fuse works and is typically applied.
- Describe how a circuit breaker works and is typically applied.
- Describe those typical protective relays and how they are applied.
- Describe how an overcurrent relay works and is typically applied.
- Describe how an undervoltage relay works and is typically applied.

COURSE OUTLINE

Day One & Two - AC & DC Motors

- Terms and Definitions
- Motor Enclosures
- Nameplate Data
- Introduction to Motor Types and Theory
- Induction Motor Construction and Operations
- Synchronous Motor Construction and Principle of Operation
- Wound Rotor Motors and Control
- Direct Current Motors
- Shunt Motors
- DC Series Motors
- DC Compound Motors

Day Three - Distribution Transformers

- Transformer Principles
- Vector Diagrams
- Transformer Classification
- Transformer Circuit
- Transformer Connections
- Transformer Maintenance

Day Four - Low Voltage Circuit Breakers

- Definitions
- Basic Protective Device Requirements
- Time Current Characteristics
- Low Voltage Power Circuit Breaker Trip Devices
- Protective Device Maintenance and Testing
- Low Voltage Power Circuit Breaker Testing
- Molded Case Circuit Breakers
- Circuit Breaker Contacts
- Operating Mechanisms
- Molded Case Circuit Breakers
- Introduction to Air Circuit Breakers
- Low Voltage Power Circuit Breakers
- Vacuum Circuit Breaker
- Gas Circuit Breakers

Day Five - Machinery Protection

- Protection Schemes
- Protective Devices
- Generator Protection
- Transformer And Bus Protection
- Motor Protection
- Auxiliary Power Systems

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.

INSTRUCTOR (S):



Tom McKinney. Mr. McKinney is an electrical engineer with over 25 years of experience in utility and industrial power systems. He earned his B.S.E.E. from the Virginia Military Institute. His experience includes the design, installation, and start-up of a wide variety power equipment, including turbine and diesel-generators, excitation systems, protective relaying, transformers and circuit breakers. Tom worked in the corporate engineering offices of American Electric Power supporting plant operation and maintenance needs. Most recently, before joining HPC Technical Services as a consultant, he worked for First Energy at the Bayshore Plant. Mr. McKinney has a unique ability to present technically complex subjects in an understandable and simple manner. Tom resides in Ohio.



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 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. Mike resides in South Carolina.

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. He has been directly involved with the operations, maintenance and protective relaying associated with electrical equipment. Leonard resides in Bradenton FL.

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: _____ Email: _____

Student #2: _____ Email: _____

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

Student #3: _____ Email: _____

ENROLLED BY: _____ **Email:** _____

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: _____