



**Course Information Letter ---- OP105**

**MECHANICAL & ELECTRICAL PRINCIPLES  
FOR  
FIELD ENGINEERS  
OP105**

An important part of any maintenance outage includes rigging (directly and indirectly) and lifting heavy equipment. It is very important that the Field Engineer be familiar with principles associated with rigging and lifting heavy equipment of the type typically found on turbine-generator installations. Furthermore, the use of precision measuring equipment to determine equipment condition is another important skill. Field Engineers (and mechanical technicians) are typically in a role where they must plan, supervise and evaluate these outages skills as they are implemented. These skills are learned in this course. HPC instructs this course with experienced "Field Engineers or Mechanics" (often 30+ years experience) who have the instructional skills as well. Much of the course is lecture, but it includes efficient use of lab equipment in HPC facilities so that important tasks are demonstrated and practiced (as needed). Paramount to a successful maintenance outage is the evaluation of the condition of turbine-generator components. One of the most effective ways to accomplish this is with a thorough non-destructive examination (NDE) of those components. Understanding how these NDE examinations are conducted and how to evaluate the results is another part of the successful Field Engineers training. Skills typically required of a Field Engineer include the planning and scheduling of maintenance outages. It is imperative that a "plan" be devised and that plan "followed" to ensure successful, on-time completion of a maintenance outage.

Additionally, this course will discuss how to ensure a safe working relationship with electricity that involves activities that do not require a master electrician. These include, but not limited to:

- how to read an electrical schematic;
- how to measure circuit parameters (voltage, current, and resistance);
- how to perform systematic troubleshooting; and

Also, this course explains what constitutes an Assured Equipment Grounding Program, which comprises of describing the operation of a Ground Fault Circuit Indicator (GFCI) along with knowing when one is required at the workplace; and explicates the benefits of an Electrical Maintenance Planning Program.

**WHAT YOU WILL RECEIVE:**

1. 1 copy of HPC Technical Services' textbook, Mechanical & Electrical Principles for Field Engineers.
2. A "Certificate of Completion" with 1.9 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

**COURSE DATES/LOCATION/FEE:** (Classes start at 8AM, end at 4:30P)

For current dates / locations / prices, please see HPC's website, [www.hpcnet.com](http://www.hpcnet.com).

**OBJECTIVES:** At the completion of this course the participant will be able to:

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1. Identify and describe those lifting devices and/or fixtures commonly used in the lifting of major components.
2. Correctly choose the lifting equipment required for the safe and efficient lift of an assigned job task that involves a lifting procedure.
3. Visually inspect lifting devices used in the normal daily routine as they pertain to maintenance activities.
4. Select and use the proper precision measuring instruments for the assigned task
5. Accurately measure equipment parts to determine their continued usefulness or warranted replacement
6. Accurately set up, check and record the total indicator run out on a rotating element or shaft assembly
7. Take and record mechanical sizes and conditions as they pertain to the manufacture of replacement parts
8. Properly care for and store precision measuring instruments thus ensuring their readiness for and ability to take the next set of accurate readings.
9. Describe the common procedures for cleaning and prepping components for inspection.
10. List and describe the various non-destructive examinations that can be performed as part of a component inspection.
11. Describe the criteria used to evaluate defects found during component inspection.
12. Demonstrate familiarity with Ohm's Law and the ability to apply this law in interpreting electrical circuits.
13. Describe hazards associated with working with electricity and demonstrate how to protect oneself from this hazard.
14. Demonstrate a working knowledge of the functionality of a multimeter, voltage testers, a non-intrusive ammeter; and identify the instrument that is used to verify the integrity of wire insulation.
15. Participants will have a working knowledge on how to properly select the function/range and connect a multimeter to measure current, resistance, and voltage.
16. Demonstrate knowledge regarding the use and application of different types of electrical diagrams.
17. Demonstrate knowledge as to what constitutes an Assured Equipment Grounding Program.
18. Demonstrate operational knowledge and ability to use a Ground Fault Circuit Indicator (GFCI).
19. Demonstrate a basic understanding of troubleshooting techniques involving branch and control circuits and the importance of the Lockout/Tagout concept.
20. Demonstrate knowledge regarding the purpose of the National Electric Code (NEC).
21. List operational and safety issues that typically cause the scheduling of a maintenance outage.
22. List the considerations that must be included when developing an outage plan or schedule.
23. Describe the major considerations when making a replace/reuse/repair decision.

## 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](mailto: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, but generally speaking, if you're planning on having 6+ attend, when considering your T&L; it is to your advantage to perform the course at your plant (office). You gain from the customization and price.
- Can HPC Technical Services provide "Technical Assistance" in conducting functional checkouts or troubleshooting problems? Yes we can. Call or contact Harold Parker, [hparker@hpcnet.com](mailto:hparker@hpcnet.com) for our rate sheets and any further information required.

## ENGINEERING CERTIFICATION:

There are multiple certification programs that require this course, to include

1. Steam Turbine Field Engineer, Mechanical Technician, I&C Technician
2. Gas Turbine Field Engineer or I&C Technician
3. Boiler Engineer

Those who attend this course are automatically qualified to take HPC Technical Services' Certification Examination. This examination is offered at no additional expense to the participant. An 80% passing grade is required. The examination length will not exceed 2-hours. Those who complete this examination will receive a revised "certificate of completion" that recognizes this accomplishment along with two-copies of a "To Whom It May Concern" letter that states their accomplishment. (Two copies are provided, one for the participants' employer and one for the participants' personal file.)

Consult HPC's website, [www.hpcnet.com](http://www.hpcnet.com), for details on this certification program.

## **COURSE OUTLINE:**

### **Monday:**

**RIGGING:** Cranes, Slings, Chain Falls, Mechanical & Hydraulic Jacks as well as Load Balance, Center of Gravity and lifting equipment inspections.

**PRECISION MEASURING INSTRUMENTS:** Micrometers of all types, Calipers, and measurement transfer tools/devices such as Adjustable Parallels, Hole Gauges, Telescoping Gauges, Verniers. Specialty tooling used on Turbine Outages and Inspections are also covered.

### **Tuesday:**

**NON-DESTRUCTIVE EXAMINATION (NDE):** Cleaning and preparation for NDE, Magnetic Particle Inspection (MT), Die Penetrant Inspection (PT), Ultrasonic Inspection (UT), Radiography (RT). “Crack Indications” what to look for and where.

### **Wednesday:**

**PRODUCTION OF ELECTRICITY:** AC / DC in Facilities, Circuit Parameters, Ohm's Law, Basic Electrical Circuits  
**SAFETY ISSUES:** Hazards of Working With Electricity, Personal Protective Equipment (PPE), Safe Working Practices, Lockout / Tagout (LOTO), Electrical Safety in the Workplace, Power in Electrical Circuits  
**TEST EQUIPMENT:** Multimeters, Voltage Testers, Clamp on Ammeter, Meg-Ohmmeters  
**USE OF TEST EQUIPMENT:** Measuring Circuit Parameters, Verifying Circuit is De energized, Determining Mode of Failure, Meg-Ohmmeters

### **Thursday:**

**UNDERSTANDING ELECTRICAL SYSTEMS:** Reading One Line Diagrams, Introduction To Schematic Diagrams, Electrical Service, Major Components  
**INTRODUCTION TO ELECTRICAL MAINTENANCE:** Assured Equipment Grounding Program, Use of a Ground Fault Circuit Interrupter (GFCI), Electrical Maintenance Planning and Activities, Precautions  
**TROUBLESHOOTING TECHNIQUES:** Branch Circuits, Control Circuits, Equipment Isolation, Fuses  
**NATIONAL ELECTRIC CODE:** Purpose, Definitions, Terminology, Overview of Installation Requirements, Qualification of Personnel

### **Friday:**

**PLANNING & SCHEDULING AND DECISION MAKING:** This is intended to provide participants with an understanding of those major items that must be considered PRIOR to commencing a scheduled turbine-generator outage. Discussion will also include those items we need to consider when making repair/replace/reuse decisions.

### **CERTIFICATION EXAMINATION**

**HPC TECHNICAL SERVICES**  
**500 Tallevast Road, Suite 101, Sarasota, FL 34243**  
**Telephone: 941-747-7733 .... FAX: 941-746-5374**  
**Website: [www.hpcnet.com](http://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: \_\_\_\_\_

**Please Mail or FAX your Registration Form to us. Thanking you in advance for your business!!**