



Course Information Letter ---- CT309

FUNDAMENTALS of COMBUSTION TURBINE MAINTENANCE CT309

In today's environment it is important to be properly prepared for turbine outages. Even if you are not expected to be the "technical advisor", it is still important for you to appreciate all the activities that are important to the outage plan and its implementation. This course is intended to improve the effectiveness of your combustion turbine maintenance activities. Reduce forced outages and increased unit reliability and availability can be the result.

We start by reviewing the basics. One cannot implement an effective outage plan if one does not understand the fundamentals of how a combustion turbine functions. Learn how operating duty affects turbine components AND how the integrity of turbine components affects operations. Learn important issues associated with disassembly / reassembly. Equipment needs to be taken apart safely and properly. Learn what components should be cleaned and how. Learn the basics of a good visual inspection and what mechanical / electrical tests might be performed. Finally, you will learn some of the control concepts as this will certainly impact how well the unit is returned to service.

Topics include: Construction • Auxiliary System O&M • Outage Planning • Disassembly • Inspection • Repairs

This course has been designed for plant personnel who are involved in safely and effectively operating and maintaining combustion turbines.

OBJECTIVES: The overall objective is to increase participants' capability to plan and implement future combustion turbine maintenance outages. Upon completion of this course the participant will be able to:

1. State the purpose of a combustion turbine.
2. Describe the major components making up the combustion turbine.
3. Describe those systems associated with combustion turbines.
4. Describe the sequencing that occurs in a normal startup, synchronization and operation.
5. Describe the different fuel systems and requirements for operation.
6. Demonstrate having the knowledge necessary to use effective and safe maintenance procedures.
7. Demonstrate the ability to properly plan a maintenance outage prior to shutdown.
8. Demonstrate the knowledge necessary to measure and interpret information as it relates to the unit outage.
9. Demonstrate the knowledge necessary to disassemble/reassemble equipment in an orderly and safe manner.
10. Demonstrate the knowledge necessary to properly clean and inspect combustion turbine components.
11. Describe fundamental combustion turbine control concepts and protective features.

COURSE DATES/LOCATION/FEE

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

COURSE OUTLINE

- I. **Combustion (Gas) Turbine Fundamentals:** Basic Cycle: Gas Turbine Relationships, Power Relationships between Compressor, Combustor and Turbine
- II. **Turbine Construction & Operating Principles:** Turbine Function, Turbine Flow, Inlet Guide Vane & Casing, Compressor Section, Combustion Section, Turbine Section, Exhaust Section, Bearings, Compressor Spindle/Rotor, Turbine Spindle/Rotor, Cooling and Sealing Air, Fuel Oil, Fuel Forwarding System

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- III. **Turbine Auxiliary Systems:** Lube Oil System, Hydraulic Supply, Cooling Water Supply
- IV. **CT Controls Overview:** Control Philosophy, Major Components, Speed Control, Temperature Control, Alarm & Protection
- V. **Maintenance Preparation & Planning:** Periodic Inspections, Records, Running Inspections, Combustion Section Inspection, Turbine Inspection, Major Inspection, Documentation, Component and Parts Requirements, Safety, Tools & Measuring Equipment, Scheduling
- VI. **Combustion Section Inspection:** Accessibility, Parts Identification, Fuel System, Ignition and Flame Detection, Combustion Components, Borescope Inspection, Inspection Data, Reassembly
- VII. **Turbine Inspection:** Accessibility, Turbine Shell Disassembly, Nozzle Disassembly, Inspection, Reassembly
- VIII. **Major Inspection:** Accessibility, Disassembly, Bearings, Rotor, Compressor Stator, Reassembly
- IX. **Alignment:** Readings, Procedure
- X. **Startup & Test:** Pre-Startup Checks, Startup Checks, Evaluation

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? Available Soon.
- 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 for our rate sheets and any further information required.

WHAT YOU WILL RECEIVE:

1. 1 copy of HPC Technical Services' textbook, CT309 Fundamentals of Combustion Turbine Maintenance. It is a valuable desktop reference in addition to being able to enhance the learning process.
2. A "Certificate of Completion" with 1.9 CEUs, authorized for issue by the International Associate of Continuing Education/Training.

GAS TURBINE CERTIFICATION:

There are two levels of certification (Both levels require this course):

1. Field Engineer
2. Maintenance Technician

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, for detail on this certification program.

INSTRUCTOR (S):



Dan Anderson is the primary instructor for this course. Dan started his career in the US Navy as a Boiler Technician. After his discharge Dan was a civilian instructor for the US Navy at Great Lakes Naval Training Center. While there Dan instructed Navy personnel in the four-phase steam cycle including balance of plant equipment. In 1990 Dan returned to Minnesota and received his Minnesota State Chief A Engineers license. After a few years in the position as Chief Boiler Engineer For Green Giant Co. and Maintenance Manager for Minnesota Energy, Dan went to work for Hutchinson Utilities Commission in Hutchinson, Minnesota. His position there was Operator 1. His operational responsibilities included GE LM 6000 Combined Cycle, GE Frame 5 Simple Cycle, and a GE Frame 3 Combined Cycle. He also had operations of 6 Diesel Engines for power production. Dan joined HPC Technical Services, June 2001. His main area of instruction is Gas Turbine/Combine Cycle Fundamental, Steam Turbine/Generator Fundamentals, Mechanical Maintenance Courses, and The Boiler Training. Dan currently holds a Chief A Engineers License for Minnesota, A Chief NIULPE Certificate, NIULPE Instructor and Examiners Certificate, Chief ASOPE Certificate, and is a Member of ASME.



Douglas Lemmo, PE. Mr. Lemmo has 35 years experience in the power generation industry, 31 of them with GE. Within GE he was initially employed as a field engineer (1971-1976). Here he was responsible for the installation and startup of a number of large and medium steam turbine generators and the feed pump turbines. In addition to this installation work, Mr. Lemmo also performed maintenance service on a variety of nuclear, fossil and marine turbine units. After leaving the field, Mr. Lemmo taught in GE's Field Engineering Development Center. Here his specialty was steam turbine generators, installation, alignment and maintenance. After a couple years instructing, he accepted a position selling maintenance and repair services. In 1982, Mr. Lemmo was the Project Manager for a Waste-to-Energy site. Later projects included a modernization of a hydroelectric facility and the management of the installation of a few combined cycle sites. In 2002, Doug left GE and founded Power Generation Consulting Services, which focuses primarily on the operation, maintenance and repair of steam turbine generators. In this last position, Doug has been closely aligned with HPC as he has instructed many of our courses and provided site-engineering support on HPC contracts.



Eldon Bearden Mr. Bearden has 21 years experience in the power generation industry, 10 of them with GE. He started his career as a GE field engineer providing technical services for installations and maintenance (1976-1981 and 2000-2004). Here he was responsible for the installation and startup of a number of large steam turbine-generators and frame 7 gas turbines as well.

In addition to the installation work, he also performed maintenance service on a variety of fossil, nuclear and combined cycle sites. Recently Mr. Bearden accepted a position with HPC as a part-time instructor to teach steam turbine and gas turbine courses. He will also provide site engineering support on HPC contracts during the outage season.

RECENT SATISFIED CLIENTS:

Allianz Risk Consultant , Arizona Public Service, Associated Electric Cooperative, Avista Corporation, Calpine Corporation, Carolina Power & Light, Cinergy, Consolidated Edison, Consumers Energy, Dynegy Northeast, East Kentucky Power Cooperative, Entergy Operations, Florida Power & Light, Gainesville Regional Utilities, GE Global O&M, Gordonsville Energy, Houston Lighting & Power, Industrial Risk Insurers, Korea Midland Power, Korea Plant Services & Engineering, MidAmerican Energy, Northern Indiana Public Service, Oklahoma Gas & Electric Potomac Electric Power, Progress Energy, PSEG, Royal & Sunalliance Global Consulting, Selkirk Cogen Partners, Stewart & Stevenson Operations, Texas Genco, UtiliCorp, West Plains Energy, Western Farmers Electric Cooperative

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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 #: _____

HOW DID YOU HEAR OF THIS COURSE?

Past attendance of HPC course(s)
 Website search
 Received a fax
 Received an email
 Someone at the plant told me about it.
 Other: _____