

## CT100 - COMBUSTION TURBINE OPERATIONS & MAINTENANCE



This 3-day course was developed to improve the effectiveness of the operations and maintenance activities of combustion turbines. Increase your ability to reduce forced outages and increase unit reliability and availability.

This course has been designed for plant personnel who are involved in safely and effectively operating and maintaining combustion turbine/generators. It will provide the attendee with a thorough understanding of operations and maintenance of combustion turbines.

### OBJECTIVES

Upon successful completion of this course the participant should be able to:

- Describe the major components and systems associated with combustion turbines.
- Describe the sequencing that occurs in a normal startup, synchronization and operation.
- Describe the support systems and requirements for operation.
- Demonstrate the ability to use effective and safe maintenance procedures.
- Properly plan the maintenance outage prior to shutdown.
- Demonstrate the knowledge necessary to measure and interpret information as it relates to the unit outage.
- Demonstrate the knowledge necessary to disassemble/reassemble equipment in an orderly and safe manner.
- Demonstrate the knowledge necessary to properly clean and inspect turbine components.
- Describe combustion turbine control concepts and protective features.

This course is offered for "on-site" presentation in three versions:

1. Generic Version – This course is presented using our standard, generic Introduction to Combined Cycle Power Plant text at your facility.
2. Custom Version 1 (Partial Customization) - This course is presented using our standard generic Introduction to Combined Cycle Power Plant text; but the presentation is customized using site and unit specific materials. FCS will provide the client with a detailed list of required reference materials. FCS will use these materials to provide a plant and unit specific student handout. The unit specific handout is used during the presentation.
3. Custom Version 2 (Fully Customized Training Manual) – Prior to the course presentation, FCS personnel will visit the site to gather reference materials, photograph key plant equipment, and discuss plant procedures and operating concerns with plant personnel. FCS will develop a unit specific training manual that covers the same topics included in the outline. This customize training manual will be used during the course presentation and will be provided in an editable electronic form so that additional copies can be printed and the materials can be further customized should changes at your plant warrant.

**Contact Mike McClintock at (717) 337-0874 or [mmclintock@fossilconsulting.com](mailto:mmclintock@fossilconsulting.com) for information regarding technical content and pricing**



**FOSSIL CONSULTING SERVICES, INC**  
6325 WOODSIDE COURT, SUITE 350, COLUMBIA, MD 21046  
(410) 312-6240 fcs@fossilconsulting.com

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## CONTINUING EDUCATION UNITS

FCS is authorized to provide Continuing Education Units for successful completion of its training courses and seminars. 1.9 CEU's will be awarded for successful completion of this session.

## INSTRUCTORS

**Mike McClintock** has 40+ years of experience in the power generation industry, which includes gas and steam turbine manufacturers and development of plant operations and maintenance training programs and short courses. He has done erection, startup and maintenance of steam and gas turbines in a variety of plants. He has managed, developed and presented training for plant operations and maintenance personnel on steam and gas turbine operations and maintenance. His experience covers GE, Westinghouse, Allis Chalmers/Siemens, Pratt & Whitney, ABB, Dresser-Rand, Hitachi, Toshiba, and Mitsubishi equipment. He has successfully developed and presented courses on plant heat rate improvement for operators and engineering personnel. Mike is a licensed Professional Engineer in Maryland.



## COURSE OUTLINE

### **I. Introduction**

- A. Introduction of Instructors
- B. Review Course Outline
- C. Discuss Course Text
- D. Class Participation
- E. Class Structure
- F. Course Objectives

### **II. Combustion (Gas) Turbine Fundamentals**

- A. Introduction
- B. Basic Cycle
- C. Gas Turbine Relationships
- D. Power Relationships
  - 1. Compressor
  - 2. Combustor
  - 3. Turbine

### **III. Turbine Construction & Operating Principles**

- A. Introduction
- B. Turbine Function
- C. Component Description
  - 1. Turbine Flow
  - 2. Air Inlet Equipment
    - a. Inlet Guide Vane & Casing
  - 3. Compressor Section
  - 4. Combustion Section
  - 5. Turbine Section
  - 6. Exhaust Section
  - 7. Bearings
  - 8. Compressor Spindle/Rotor
  - 9. Turbine Spindle/Rotor

### **IV. Turbine Auxiliary Systems**

- A. Introduction
- B. Lube Oil System
- C. Hydraulic Supply
- D. Cooling and Sealing Air System
- E. Fuel Gas System
- F. Fuel Oil System
- G. Fuel Forwarding System
- H. NOx Control System
- I. Atomizing Air System
- J. Inlet Guide Vane System
- K. Compressor Cleaning System
- L. Inlet System
- M. Starting System
- N. Protection System
- O. HVAC System
- P. Electrical Distribution System

### **V. CT Controls Overview**

- A. Introduction
- B. Control Philosophy
- C. Major Components
- D. Speed Control
- E. Temperature Control
- F. Alarm & Protection

### **VI. Maintenance Preparation & Planning**

- A. Introduction
- B. Periodic Inspections
- C. Records
- D. Running Inspections
- E. Combustion Section Inspection
- F. Turbine Inspection
- G. Major Inspection
- H. Documentation
- I. Component and Parts Requirements
- J. Safety
- K. Tools & Measuring Equipment
- L. Scheduling

### **VII. Combustion Section Inspection**

- A. Introduction
- B. Accessibility
- C. Parts Identification
- D. Fuel System
- E. Ignition and Flame Detection
- F. Combustion Components
- G. Borescope Inspection
- H. Inspection Data
- I. Reassembly

### **VIII. Turbine Inspection**

- A. Introduction
- B. Accessibility
- C. Turbine Shell Disassembly
- D. Nozzle Disassembly
- E. Inspection
- F. Reassembly

### **IX. Major Inspection**

- A. Introduction
- B. Accessibility
- C. Disassembly
- D. Bearings
- E. Rotor
- F. Compressor Stator
- G. Reassembly

### **X. Alignment**

- A. Readings
- B. Procedure

### **XI. Startup & Test**

- A. Introduction
- B. Pre-Startup Checks
- C. Startup Checks
- D. Evaluation

### **XII. Course Conclusion**

- A. Review
- B. Examination