

ST200 – STEAM TURBINE GENERATOR MAINTENANCE



This five-day presentation has been developed to improve the effectiveness of personnel involved in steam turbine generator maintenance activities. Participation will provide the attendee with the knowledge and skills to shorten outages, reduce rework and outage extensions, while increasing availability and reliability. Get the most out of your outage dollars by performing maintenance tasks that give the biggest benefit based on reliability and efficiency. Reduce durations and cost but increase reliability, availability, and efficiency.

There is no magic concerning steam turbine generator maintenance, however a thorough understanding of factors affecting the life of the individual components and the defects that result are essential. You will learn the effect of defects on efficiency and reliability not just how and when to perform inspections.

The course should be attended by all power plant personnel involved in maintaining steam turbine generators. Plant management, supervisors, engineers, work leaders, and mechanics will benefit from attendance in this course.

OBJECTIVES

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

- Define the items that must be considered when performing steam turbine generator maintenance.
- Describe the types of defects that are found in steam turbine generator components during inspections.
 - Identify causes for the defect.
 - List the possible corrective actions concerning the defect.
 - Describe the criteria used to determine the best corrective action.
- Describe the items that must be addressed during maintenance planning.
- Describe the methods used to determine steam turbine generator internal component condition prior to disassembly.
- Describe the checks and inspections performed during steam turbine generator disassembly and reassembly.
- Describe the proper method for cleaning steam turbine generator components.
- Describe the proper method of inspecting the various steam turbine generator components.
- Describe the various items to be considered when performing a steam path audit.
- Describe the various methods used to properly align steam turbine generator components.

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.



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CONTINUING EDUCATION UNITS

FCS is authorized to provide Continuing Education Units for successful completion of its training courses and seminars. 1.3 CEU's will be awarded for successful completion of this session.

INSTRUCTORS

Harold Grace brings 30+ years experience to Fossil Consulting Services. He has provided Combined Cycle Power Plant training to over 500 individuals over the past several years. Prior to FCS, Mr. Grace was Vice President of HPC Technologies in Bradenton Florida. Prior to that he was Manager - Turbine Generator Services, for General Physics, where he was responsible for turbine generator training, engineering and consulting services. Mr. Grace was also employed by GE for 18 years in a number of capacities including Field Engineer, Senior Project Manager, Service Supervisor, Service Manager, and Manager of Power Generator Jacksonville Service Shop. He is a licensed Chief Engineer with the National Institute for the Uniform Licensing of Power Engineers, Inc (NIULPE), Ohio State Association of Power Engineers, Inc., a NIULPE Technical Instructor, Licensed Examiner, and is Chairman/President - NIULPE of Florida. Mr. Grace is a member of and Vice Chairman for the ASME Combined Cycle Power Plant Committee.

Mike McClintock has 30+ years of experience in the power generation industry, which includes 11 years with gas and steam turbine manufacturers and 19 years in 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.

Contact Harold (HP) Grace, in Jacksonville, FL at (904) 272-9537 or hgrace@fossilconsulting.com for information regarding technical content and pricing.



COURSE OUTLINE

I. Introduction (Day 1-1 hr)

- A. Introduction of Instructors
- B. Review Course Outline
- C. Discuss Course Text
- D. Class Participation
- E. Class Structure
- F. Course Objectives
- G. Maintenance Concerns
- H. Component Defects
- I. Operational Effects

II. Tb Fundamentals (Day 1-2 hrs)

- A. The T/G in the Cycle
- B. Basic Turbine Theory
 - 1. Conversion in Nozzles
 - 2. Conversion in Blades
- C. Basic Turbine Types
 - 1. Impulse Turbines
 - 2. Reaction Turbines
 - 3. Impulse vs. Reaction
- D. Turbine Classification

III. Tb Construction (Day 1-3 hrs)

- A. Turbine Sections
- B. Stationary Components
 - a. Shell/Cylinder
 - b. In. Shell/Blade Ring
 - c. Nozzles/Diaphragm
 - d. Turbine Seals
 - e. Bearings
 - f. Standards/Pedestals
 - g. Blowout Diaphragm
- C. Rotating Components
 - a. Rotors/Spindles
 - b. Buckets/Blades

IV. Main Steam Valves (Day 1-1 hr)

- A. Function
- B. Steam Chests
- C. Main Stop/Throttle Valves
- D. Control/Governor Valves
- E. Reheat Valves
- F. Auxiliary Valves

V. Tb Support Sys. (Day 1-1 hr)

- A. Lube Oil System
- B. Steam/Gland Seal System
- C. LP Hood Cooling System
- D. Hydraulic Oil System
- E. Turbine Controls
- F. Turbine Monitoring

VI. Generator (Day 2-2 hrs)

- A. Electrical Theory Review
 - 1. Magnetism
 - 2. AC Generators
 - 3. Power
 - 4. Three Phase Power
 - 5. Terminal Con.
- B. Generator Construction
 - 1. Stator & Windings
 - i. Frame
 - ii. Core
 - iii. Stator Bars
 - iv. Wedges
 - v. End Support
 - 2. End Shield
 - 3. Bearings
 - 4. Generator Rotor
 - i. Forging/Winding
 - ii. Retaining Ring
 - iii. Fans/Blowers
 - iv. Collector Rings
 - 5. Generator Cooling

VII. Gen Support Sys (Day 2-1 hr)

- A. Gas Control System
- B. Seal Oil System
- C. Stator Winding Cooling

VIII. Job Planning & Scheduling

(Day 2-2 hrs)

- A. Pre-outage Preparation
 - 1. Safety
 - 2. Parts Identification
 - 3. Tooling
 - 4. Lifting Devices
 - 5. Site Planning
 - 6. Technical Info.
 - 7. Replacement Parts
 - 8. Schedules
- B. Outage Management
- C. Pre-Outage Inspections



IX. Tb Inspections

- (Day 2-3 hrs Day 3-5 hrs)
- A. Disassembly (2)
 - 1. Disassembly Checks
 - 2. Crossover
 - 3. Joint Bolting
 - 4. U/H Removals
 - 5. Rotor Removal
 - 6. L/H Removals
 - B. Cleaning Methods (.5)
 - 1. Solvents
 - 2. Grit Blasting
 - 3. Mechanical
 - C. Inspection Methods (.5)
 - 1. Visual, PT, MP, UT
 - D. Component Insp. (2)
 - 1. Rotors
 - 2. Buckets/Blades
 - 3. Covers/Shroud bands
 - 4. Shell/Casing/Cylinder
 - 5. Diaphragm/Nozzles
 - 6. Packing/Seals
 - 7. Bolting
 - E. Steam Path Evaluations (2)
 - 1. Items to Measure
 - 2. Economic Evaluation
 - 3. Repair Decisions
 - 4. Computer Program (STPE-Encotech)
 - F. Reassembly (1)
 - 1. Joint/Thread Lubricants
 - 2. Reassembly Checks
 - 3. Bolting
 - 4. Insulation

X. Steam Path Maintenance

- (Day 3-3 hrs)
- A. Corrective Action
 - B. Repair Criteria
 - C. Repair Options
 - D. Repair Procedures

XI Bearing/Coupling Maint.

- (Day 4-3 hrs)
- A. Journal Bearings
 - B. Thrust Bearings
 - C. Couplings

XII Steam Valve Maintenance

- (Day 4-3 hrs)
- A. Safety Concerns
 - B. Valve Disassembly
 - a. Main Stop/Throttle Valve
 - b. Control/Governor Valve
 - c. Intercept Valve
 - d. Reheat Stop Valve
 - C. Cleaning & Inspection
 - D. Reassembly

XIII. Alignment

- (Day 4-2 hrs Day 5-4 hrs)
- A. Alignment Checks
 - B. Internal Alignment
 - a. Tight Wire
 - b. Mandrel
 - c. Laser
 - C. Shaft Alignment
 - a. Types of Misalignment
 - b. Taking Data
 - c. Interpretation

- d. Realignment
- e. Making Moves
- D. Special Cases

XIV. Generator Maintenance

- (Day 5-3 hrs)
- A. Disassembly
 - B. Cleaning & Inspection
 - C. Electrical Testing
 - D. Reassembly

XV. Course Conclusion

- (Day 5-1 hr)
- A. Questions/Answers
 - B. Review/Exam
 - C. Course Critique