



# Gas Turbines: Fundamentals, Maintenance, Inspection & Troubleshooting



## Introduction:

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Gas turbine engines are generally classified based on the type and nature of application, size and location. This chapter contains a general overview of the different types of gas turbines in use, and also a brief introduction to the various components comprising the gas turbine engine in addition to discussing the concept of heat recovery in combined cycle gas turbine plants. Gas turbines in general are broadly classified into five categories.

This course gives a solid review of gas turbines with a focus on fundamental thermodynamics; gas turbine components; materials of construction; bearing, seals and lubrication systems; fuels and fuel supply systems; combustion air filters; control systems and instrumentation and operations and maintenance.

## Who Should Attend?

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Mechanical Engineers, Supervisors, Foremen, Technicians, Maintenance Personnel, anyone new to gas turbines and more experienced technical personnel who want an overview of the operation and available technologies of gas turbines

## Course Objectives:

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**At the end of this seminar participants will learn about:**

- Fundamental thermodynamics
- Gas turbine components
- Materials of construction
- Bearing, seals and lubrication systems
- Fuels and fuel supply systems
- Combustion air filters
- Control systems and instrumentation
- Operations and maintenance

## Course Outline:

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### **Overview of Gas Turbines**

- Industrial heavy duty gas turbines
- Aircraft-derivative gas turbines
- Medium range gas turbines
- Major gas turbine components
- Heat recovery steam generators

### **Fundamental Thermodynamics**

- Reversible cycles with ideal gases
- Actual gas turbine cycles

- Air compressor performance characteristics
- Combustion processes
- Gas turbine performance calculations
- Comparison of basic specifications

### **Gas Turbine Components**

- Axial-flow compressor
- Radial-inflow turbines
- Combustors, construction, types
- Igniters
- Fuel nozzles
- Hot path components
- Axial-flow turbine
- Firing concepts and emission control

### **Materials of Construction**

- General metallurgical behavior
- Gas turbine blade materials
- Turbine wheel alloys
- Corrosion problems
- Wear problems
- Future materials
- Coating technology

### **Bearings and Seals**

- Bearing design principles
- Bearing materials
- Non-contacting seals

- Mechanical seals

### **Lubrication Systems**

- Basic components
- Oil cooling/warming
- Oil cleaning and conditioning
- Lube oil selection

### **Fuels and Fuel Supply Systems**

- Fuel specifications
- Fuel properties
- Fuel treatment
- Heavy fuels
- Fuel measurement
- Fuel supply systems
- Cleaning of turbine components

### **Combustion Air Filters**

- Combustion air quality requirements
- Function of gas turbine air filters
- Environment and type of inlet filters
- Selection principles
- Operation and maintenance

### **Exhaust Systems**

- Sound abatement
- Inspection openings
- Chimneys

### **Auxiliary Components and Systems**

- Starting systems
- Washing systems
- Gear boxes and couplings

### **Control Systems and Instrumentation**

- Pressure measurement
- Temperature measurement
- Vibration measurement
- Performance measurement
- Control systems
- Monitoring and diagnostic systems

### **Gas Turbine Operations and Maintenance**

- Operating philosophies
- Analytical on-line condition monitoring
- Borescopy
- Selecting maintenance approaches
- Maintenance planning
- Spare parts and special tools
- Inspection, overhaul and repair
- Maintenance control and documentation
- Evaluating gas turbine maintenance effectiveness
- Establishing and tracking performance indices

### **Mechanical Equipment Standards**

- Applicable API standards
- ANSI standards
- International Standards (ISO)
- Specifications