

Course No. 1559

Boiler Operation, Maintenance & Efficiency Training Course

UTILITIES & PLANT ENGINEERING
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Boiler Operation, Maintenance & Efficiency Training Course provides a comprehensive professional program designed to strengthen the technical knowledge and practical capabilities required to operate, maintain, troubleshoot, and improve the efficiency of industrial boiler systems. Boilers are critical assets across power generation, oil and gas, refining, petrochemical, manufacturing, food processing, pharmaceutical, and other industrial environments where reliable steam and thermal energy are essential to operational continuity.

The course covers the fundamental principles of industrial boiler operation, boiler types and components, combustion systems, burners, feedwater systems, boiler water treatment, control and monitoring systems, and essential operating parameters. Participants will examine correct procedures for boiler start-up, normal operation, load changes, shutdown, and operational monitoring, while understanding how pressure, temperature, steam production, fuel consumption, and combustion conditions influence overall boiler performance.

A significant component of the program focuses on boiler maintenance, condition monitoring, troubleshooting, and reliability improvement. Participants will explore preventive and predictive maintenance practices for critical components, including burners, pumps, valves, control systems, feedwater equipment, and auxiliary systems. The course also addresses common operational and mechanical problems such as scaling, corrosion, foaming, carryover, poor combustion, unstable pressure, steam leakage, and excessive fuel consumption.

The Boiler Operation, Maintenance & Efficiency Training Course also emphasizes energy efficiency and performance optimization. Participants will learn how to assess fuel consumption, heat losses, combustion efficiency, excess air, blowdown, condensate recovery, and other factors affecting boiler efficiency. This integrated approach enables professionals to connect boiler operation and maintenance decisions with energy management, equipment reliability, operating costs, production continuity, and long-term asset performance.

Through practical exercises, case studies, troubleshooting scenarios, performance analysis, and improvement workshops, participants will develop a structured approach to evaluating boiler performance, identifying the causes of operational problems, prioritizing maintenance requirements, and implementing practical improvement measures. The course is designed to support organizations seeking stronger boiler reliability, safer operations, improved energy performance, and

more effective industrial utility management.

Objectives

- Analyze the fundamental principles of industrial boiler operation, major components, and steam generation systems during the course.
- Evaluate key boiler operating parameters, including pressure, temperature, steam production, combustion conditions, and fuel consumption.
- Apply appropriate procedures for boiler start-up, normal operation, load changes, controlled shutdown, and operational monitoring.
- Evaluate combustion systems and burner performance to identify factors affecting fuel efficiency and stable boiler operation.
- Analyze the impact of feedwater quality and boiler water treatment on equipment condition, efficiency, reliability, and service life.
- Apply systematic methods to identify scaling, corrosion, foaming, carryover, steam quality, and other common boiler problems.
- Evaluate preventive and predictive maintenance requirements for critical boiler components and auxiliary equipment.
- Apply structured troubleshooting techniques to identify boiler faults and determine the underlying causes of performance deterioration.
- Assess boiler efficiency and identify significant sources of fuel loss, heat loss, steam loss, and energy waste.
- Develop practical measures to improve combustion efficiency, reduce unnecessary fuel consumption, and optimize steam generation.
- Strengthen inspection, monitoring, and maintenance practices that support boiler reliability and reduce unplanned operational interruptions.
- Develop an actionable boiler improvement plan based on operational performance indicators, maintenance requirements, energy performance, and site conditions.

Who Should Attend

The Boiler Operation, Maintenance & Efficiency Training Course is designed for engineers, technicians, operators, supervisors, and professionals responsible for the operation and maintenance of industrial boilers, steam systems, utilities, and energy facilities. It is particularly relevant to mechanical engineers, process engineers, energy engineers, utilities engineers,

maintenance engineers, reliability engineers, plant engineers, boiler engineers, and professionals involved in steam generation and industrial utility operations.

The course is also suitable for boiler operators, utility operators, operations supervisors, maintenance supervisors, utilities supervisors, boiler technicians, mechanical maintenance technicians, maintenance managers, engineering managers, utilities managers, energy managers, reliability managers, and plant managers. Professionals working in water treatment, combustion systems, instrumentation and control, energy management, equipment reliability, and industrial operations can also benefit from the program.

The training is especially relevant to professionals working in oil and gas companies, refineries, petrochemical facilities, power generation plants, manufacturing organizations, process industries, food and beverage facilities, pharmaceutical plants, and other organizations that rely on industrial boilers to generate steam or provide thermal energy. It is also appropriate for managers and decision makers responsible for equipment reliability, energy efficiency, maintenance planning, operational continuity, and industrial asset performance.

Learning Outcomes

- Explain the major components, operating principles, and functions of industrial boiler systems.
- Interpret the relationship between pressure, temperature, steam production, combustion conditions, and boiler efficiency.
- Apply appropriate operating procedures for boiler start-up, normal operation, load changes, and shutdown.
- Evaluate combustion and burner performance and identify potential causes of reduced fuel efficiency.
- Assess feedwater and boiler water quality and recognize the operational effects of inadequate water treatment.
- Identify the causes and operational consequences of scaling, corrosion, foaming, carryover, and poor steam quality.
- Apply practical techniques for monitoring boiler condition and critical operating parameters.
- Evaluate preventive and predictive maintenance programs and establish priorities for critical boiler equipment.
- Apply structured troubleshooting and root cause analysis techniques to common boiler

operational and maintenance problems.

- Analyze fuel consumption, heat losses, steam losses, and other performance factors affecting boiler efficiency.
- Identify practical measures for improving boiler reliability and reducing unplanned downtime.
- Develop an integrated action plan for improving boiler operation, maintenance, energy efficiency, and overall system performance.

Course Outline

DAY 01

Industrial Boiler Fundamentals and Operating Principles

- Types of industrial boilers and their applications
- Major boiler components and their functions
- Principles of steam generation and heat transfer
- Combustion systems, burners, and fuel types
- Relationship between pressure, temperature, and steam production
- Essential boiler instrumentation and monitoring parameters
- Boiler control systems and operating principles
- Boiler auxiliaries and supporting equipment
- Key boiler operating and performance indicators

PRACTICAL APPLICATION

Analyze an industrial boiler system and identify its major components, operating pathways, control points, and critical performance parameters

DAY 02

Boiler Operation, Combustion, and Feedwater Management

- Boiler start-up procedures and operating sequences
- Normal operation and load management
- Controlled shutdown and operational procedures under changing conditions
- Combustion control and air-to-fuel ratio management

DAY 02 — CONTINUED

- Flame stability and burner performance
- Fuel management and combustion efficiency
- Boiler feedwater systems and feedwater pumps
- Boiler water treatment and water quality monitoring
- Deaeration and blowdown management
- Scaling, corrosion, foaming, and carryover

PRACTICAL APPLICATION

Evaluate boiler operating conditions and develop corrective measures to improve combustion performance and feedwater quality

DAY 03

Boiler Maintenance and Equipment Management

- Fundamentals of industrial boiler maintenance
- Preventive maintenance strategies and objectives
- Predictive maintenance and condition monitoring
- Burner and combustion system inspection and maintenance
- Maintenance of pumps, valves, and auxiliary equipment
- Inspection of feedwater and blowdown systems
- Inspection of control systems and instrumentation
- Identification of equipment deterioration indicators
- Maintenance planning and prioritization of critical equipment
- Analysis of recurring boiler failures and maintenance causes

PRACTICAL APPLICATION

Develop a maintenance program for an industrial boiler and establish equipment criticality and maintenance priorities

DAY 04

Boiler Troubleshooting and Reliability Improvement

- Common boiler operational and mechanical problems
- Low steam production and potential causes
- Excessive fuel consumption and performance analysis
- Combustion and burner-related problems
- Pressure and temperature instability
- Feedwater and boiler water quality problems
- Scaling and corrosion and their impact on performance
- Steam leakage and energy losses
- Root cause analysis of boiler failures
- Development of corrective and preventive actions

PRACTICAL APPLICATION

Analyze a boiler failure scenario and apply a structured troubleshooting and root cause analysis methodology to determine the appropriate corrective actions

DAY 05

Boiler Efficiency, Energy Management, and Performance Optimization

- Boiler efficiency principles and performance indicators
- Analysis of fuel consumption and energy performance
- Identification of heat losses and sources of efficiency deterioration
- Combustion optimization and excess air reduction
- Optimization of boiler water management and blowdown
- Reduction of steam and heat losses
- Condensate recovery and energy optimization
- Boiler performance monitoring and operational trend analysis
- Integration of operation, maintenance, reliability, and energy efficiency
- Continuous improvement approaches for boiler performance

DAY 05 — CONTINUED

FINAL WORKSHOP

Conduct a comprehensive assessment of an industrial boiler and develop an actionable plan to improve operation, maintenance, energy efficiency, reliability, and overall performance

Register or Request More Information

Course page: <https://quest-training.com/courses/boiler-operation-maintenance-efficiency-training-course>

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