

# Boilers

## INTRODUCTION

- Boiler is an essential component of modern power plant as well as in any process and petrochemical plant. Modern boiler has to produce steam in an efficient and safe manner with the lowest operational cost that is practical. The safety of steam production and boiler operation presents important element in the overall steam production management. Boiler operation has to be in an environmentally acceptable way, including the aspects of combustion, but also chemical water treatment and other safety considerations.
- This training course will cover many important aspects of boiler operation, combustion control and feed water management. Methods of efficiency improvement of the boiler operation will be explained and discussed. Best practices for preventive and corrective maintenance based on inspection according to Codes & Standards will be explained and discussed. Problems in boiler operation will be discussed and problem-solving and troubleshooting will be illustrated through several real-world case studies and presented in the form of training courses. Maintenance and repair of the auxiliary mechanical equipment such as fans and pumps will be explained in detail.

Participants on the Boilers training course will develop the following competencies:

- Better understanding of boiler and steam generator technologies
- Parallel operation for generators
- Knowledge about effective operation and maintenance of boilers
- Complete understanding of water treatment and its impact on boiler performance
- Applying modern maintenance techniques for boilers (RBI, FMEA and RCA)
- Modern techniques for boiler control systems and close monitoring

## PROGRAMME OBJECTIVES

- Explanation of functions of controls, safeguards, interlocks and alarm systems
- Describe correct procedures for boiler starting up and shutdown
- Explanation of the malfunctions that can cause boiler shutdown
- Identification of the appropriate boiler feed water treatment methods
- Identification of important steps in inspection of cooling towers
- Knowing how to apply effective inspection and discover weakness points
- Recommendation of the best practice for condition monitoring

## WHO SHOULD ATTEND?

- Technicians and Engineers in charge of Boiler Operation
- Technical Personnel dealing with Boilers Maintenance
- Boiler Inspectors and Contractors
- Technical Personnel in charge of Steam Generation and Distribution Systems

## TRAINING METHODOLOGY

- This Boilers training course will be conducted along training course principles with formal lectures and interactive worked examples. The emphasis will be on the explanation of all technical points and providing answers to problems that are encountered in everyday industrial practice regarding the efficient operation and maintenance of industrial boilers. Each learning point will be reinforced with practical examples and case studies. There will be ample opportunities for active discussion during the training course and video presentations. The sharing professional experiences and exchange will help solidify the gained knowledge. All training course materials will be provided.

## PROGRAMME SUMMARY

- This Boilers training course covers essential elements of boiler efficient and safe operation including the details of boiler control systems: safeguards, interlocks and alarm systems, required for start-up, shutdown. Preventive and corrective maintenance programs are discussed and explained as well as the troubleshooting procedures to avoid boiler accidents. The Boilers training course will enable the participants to develop deeper understanding of boiler operation so as to be able to solve practical problems as they encounter them.

## PROGRAM OUTLINE

### Overview of Steam Generation and Use

- Overview of Boiler Types and Industrial Steam Generators
- Elements of Boiler Plant: Fired Tube Boilers and Water Tube Boiler
- Steam Generation Basics
- Generation operation parameters
- Power types - KW, KVAR, KVA
- Synchronization techniques and basic conditions
- Flame Characteristics
- Products of Combustion and Environmental Regulations

## Boiler Efficiency and Performance

- Boiler Efficiency: Economic and Environmental Aspects
- Boiler Feed Water Preheating Train
- Air Economizers and Waste Heat Utilization
- Boiler Performance and Specifications
- Evaluating Boiler Efficiencies
- Boiler Blow-Down Control Recovery
- Steam Distribution System Losses

## Boiler Safety Operation and Control

- Boiler Control Strategies: Safeguards, Interlocks and Alarm Systems
- Explain PLC for boiler controls (practical)
- Burner Management System (BMS)
- Safe Start Up and Shutdown Procedure
- Scale and Corrosion Control
- Chemical & Physical Treatment of Feed Water
- De-aeration of Feed Water: Removing of Oxygen and CO<sub>2</sub>

## Boiler Inspection, Maintenance and Repairs

- Routine & Periodic Boiler Inspections: Risk Based Inspection (RBI)
- Common Boiler Problems in Operation
- Abnormal Operating Conditions and Operator Actions
- Maintenance Work Done Periodically
- Checklist for Maintenance of Fuel Supply System
- Maintenance of Condensate Recovery and treatment
- Using CMMS (computer management maintenance systems)

## Boiler Troubleshooting and Accident Prevention

- Boiler Failures and Accidents: Root Cause Analysis
- How to apply FMEA (Failure Mode Effective Analysis)
- Boiler Troubleshooting Guide
- Applying RBI (Risk-Based Inspection techniques)