



Boiler Systems PLUS

“The Next Level”

Summary:

This (2) two day course is designed to build upon your prior knowledge while emphasizing energy conservation, emissions reduction, system reliability and safety. This includes a more in-depth understanding of boilers and how they can be successfully applied to various processes while saving energy through retrofit options and controls updates. The program extends out into the plant to include key components of steam distribution and recovery piping, focusing on optimizing energy, efficiency and safety.

Objectives:

Further your knowledge and understanding of boilers, ancillary equipment and controls

Proper procedure to start up and lay up a boiler system

Distinguish benefits of replacing or retrofitting equipment

Identifying boiler safeties and how to check them

Detailed Outline:

- **Thermodynamics Review**
 - Thermodynamic principles
 - BTU definition
 - Two states of heat
 - Heat transfer
 - Steam tables
 - Boiler Horsepower definition
- **Combustion Analysis Basics**
 - Common parameters
 - By-products of combustion
 - Efficiencies
 - NOx emissions
 - Excess Air
 - CO levels
 - Draft
 - Flue Gas Analyzers
 - Smoke Spot test



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- **Burner Evolution**
 - Flue Gas Recirculation
 - Low NOx Burners
 - Computational Fluid Dynamics
 - Controlling Fuel and Air
 - Burner Retrofit
- **Boiler Evolution**
 - Hero's engine
 - Haystack boilers
 - Newcomen engine
 - Titanic's boilers
 - Sultana boiler explosion
 - ASME code
 - Firetube boilers – Dryback vs. Wetback
 - Industrial water tube boilers – D, O and A types
 - Commercial water tube boilers
 - Modular boilers
 - Enhanced Design
- **Controls Evolution – From Mechanical to Electronic**
 - True cost of steam
 - Traditional mechanical linkage and cams
 - Parallel Positioning
 - Loop controllers
 - PLC based controls
 - Oxygen trim
 - VSD fan
 - Draft control
- **Understanding the Steam System**
 - Supporting the piping system
 - Velocity of steam
 - How condensate is formed
 - Carbonic acid formation
 - Water Hammer
 - Effects of air in a steam system
 - Oxygen pitting
 - Condensate removal
 - Steam traps



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- **Water Softeners and Dealkalyzers**
 - Water Softeners
 - Ion exchange process
 - Softener types
 - Dealkalyzers
 - Anion exchange process
 - Cycles of concentration
 - Reverse Osmosis system
- **Feed Systems and Deaerators**
 - Feed Systems
 - Design, operational principles and application
 - Function and limitations
 - Sizing and selection criterion
 - Stand height and pump NPSH requirement
 - Deaerators
 - How deaeration works
 - Types
 - Effects of oxygen and carbon dioxide
 - Deaerator vs. Feed System
 - Deaerator controls
 - Feedwater control
 - Selection and sizing criterion
- **Feed Pumps**
 - Pump cavitation cause and effects
 - Pump types and applications
 - Calculating NPSH available
 - How to read pump curves – sizing example
- **Water Treatment Overview**
 - Boiler Boilout
 - Examples of poor water treatment
 - Impurities in the water
 - The water cycle
 - Sacrificial Anodes
 - Chemical treatment and injection points
 - Types of in-plant tests



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- **Capturing Parasitic Losses**
 - Vessel and Piping Insulation
 - Proper Combustion Settings
 - Draft Control
 - Stack Economizers
 - Blowdown Heat Recovery
 - Flash Steam Recovery
 - Condensate Return
 - Proper Water Treatment
 - Steam Trap Monitoring & Maintenance
 - VSD – Variable Speed Drives
 - Parallel Positioning
- **Boiler Shutdown, Isolation and Lay-up – Wet & Dry**
 - Shut down and isolation
 - Wet lay-up
 - Dry lay-up
- **Cutting Boilers into Cold or Hot Systems – Safely**
 - Cold start procedure
 - Hot start procedure
- **Checking Boiler Safeties**
 - What is a safety control?
 - Safeties checked during the ignition sequence
 - Safeties checked while burner is firing
 - Gas valves
 - Safety valves
 - Safeties on Oil Fired boilers