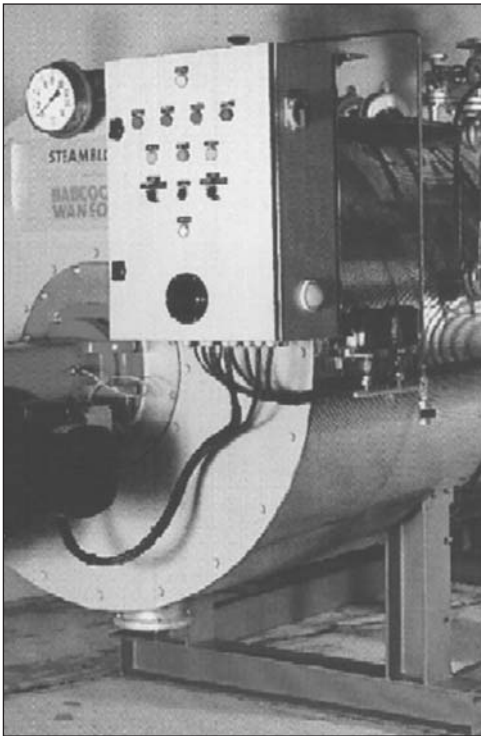


Practical

BOILER CONTROL AND INSTRUMENTATION

for Engineers & Technicians



YOU WILL LEARN HOW TO:

- Understand the objectives of the principal boiler control functions
- Recognise and understand typical boiler control diagrams and their design intentions.
- Contribute to the setting up and tuning of boiler control loops.
- Identify principles and design concepts governing:
 - Boiler feed water control
 - Furnace draft measurement and control
 - Steam demand and firing rate control
 - Main steam and reheat steam temperature control
- Flue gas analysis and fuel combustion trimming controls
- Importance of boiler safety control and start-up interlocks
- Explore advanced control strategies for improved boiler plant efficiency

WHO SHOULD ATTEND:

- Senior boiler plant operators, repairers and installers
- Control system engineers
- Instrumentation engineers and technicians
- Boiler plant commissioning engineers
- Operation, maintenance, inspection and repair specialists
- Mechanical engineers and technicians
- Design engineers
- Consulting engineers



THE WORKSHOP

INTRODUCTION

This 2-day workshop introduces the basic practices of controls systems and safety controls for industrial steam generating boilers. It focuses on the control and safety requirements applicable to most types of boilers from small gas-fired units to large multi-fuel installations. The workshop will provide training in how control and instrumentation is designed to manage the main variables such as drum water level, furnace draft, combustion fuel and air conditions. Burner management systems are introduced with their principal features including flame safety systems. The essential safety requirements for boilers and burners are identified and the corresponding safety interlocks are explained as practical solutions in accordance with the latest safety standards.

PRE-REQUISITES

Fundamental knowledge of basic Boiler plant and operation thereof and some understanding of control systems.

OVERVIEW

The first two modules of the workshop provide training on two subjects that are essential for anyone involved in using or applying controls to boilers. These are a basic knowledge of boiler and combustion processes and a basic knowledge of those control and instrumentation practices relevant to most boiler plant applications. The control training includes a review of the SAMA and ISA symbol standards used for depicting control system details.

The training then proceeds in a series of modules to describe the basic requirements and typical control solutions for the main control and safety functions in boilers. These functions are structured into individual modules allocated to feedwater supply and drum level, furnace air and the control of draft pressure, combustion controls, steam pressure and temperature controls. The combustion control module addresses the issues of dynamic response of the fuel and air feeds with examples of how ratio control, feedforward signals and cross limiting methods are applied to ensure good load following.

The training includes a study of the basic principles of burner management systems and includes the measures used to support furnace safety through the enforcement of start up procedures and purge sequences. The requirements for burner management systems to be engineered as safety instrumented systems to IEC 61511 are examined and the implications for equipment design are discussed.

The training modules in the workshop are supported by a series of practical study exercises with answers provided to assist the understanding of key issues.

PRACTICAL SESSIONS

There are **eight practical exercises and assignment sessions** to give you the confidence and experience to work on the installation, operation and maintenance of boiler plants.

THE PROGRAM

DAY ONE

ESSENTIALS OF BOILER PROCESSES

- Objectives of boiler controls
- Overview of boiler types
- Boiler processes in block diagrams to show key inputs and output variables
- Hazards of boiler operations
- The main control functions in boilers and furnaces

REVIEW OF PROCESS CONTROL AND INSTRUMENTATION RELEVANT TO BOILERS

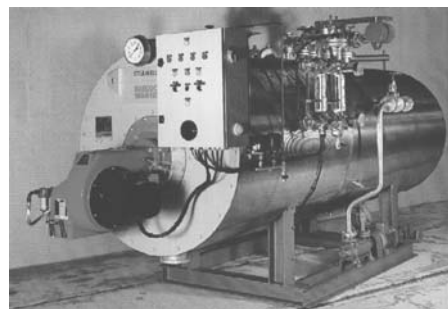
- Principles of sensors and transmitters with examples for boilers
- Closed loop control principles including feedback, feedforward, ratio and limiting.
- Control system hardware and software tools.
- Safety instrumented controls and the impact of IEC 61511
- Instrumentation diagrams and symbols per ISA and SAMA.
- Distributed control systems and the separation of safety systems

FEEDWATER AND DRUM LEVEL CONTROL

- Performance requirements: Level, quality, stability
- Characteristic responses of drum level
- Level control solutions, 1, 2 and 3 element types
- Level measurement problems and practices
- Drum level safety systems

FURNACE AIR AND DRAFT CONTROLS

- Performance requirements; pressures and temperatures
- Characteristic responses and means of control
- Pressure measurement methods and the pressure profile
- Temperature control and the impact of dew point
- Protection against implosion



DAY TWO

COMBUSTION CONTROLS

- The combustion process and its requirements for efficiency and safety
- Coal, oil and gas firing types.
- Stoichiometric air and excess air requirements
- Fuel-air ratio control and its measurements
- Firing rate controls and cross limiters for improving dynamic response
- Methods for measurements of boiler efficiency using analysers
- Application of optimising controllers

BURNER MANAGEMENT SYSTEMS

- Safety and performance requirements of pulverisers, burners and igniters.
- Furnace safety standards and regulations
- Flame monitors and flame failure detection
- Start up protection and sequencing
- Furnace supervisory controls and shutdown systems

STEAM TEMPERATURE CONTROL

- Superheater and attemperator arrangements
- Essential control requirements
- De-superheater controls

STEAM PRESSURE AND BOILER LOAD CONTROLS

- Pressure and flow response characteristics
- Single boiler load control
- Multiple boiler installations and load sharing controls

SUMMARY, QUESTIONS, OPEN FORUM AND CLOSING

“

Excellent workshop, very informative and interesting and very well presented.

Simon Fleming

Most practical and user friendly course, will use information in daily work life.

J Guthrie

”

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