COURSE OVERVIEW IE0110-4D
Boiler Control & Instrumentation

Course Title
Boiler Control & Instrumentation

Course Reference
IE0110-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	February 05-08, 2024	Al Aziziya Hall, The Proud Hotel Al Khobar, KSA
2	May 06-09, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
3	August 05-08, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
4	November 11-14, 2024	Boardroom, Warwick Hotel Doha, Doha, Qatar

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

When working with boilers, regardless what process control system is used or fuel being burned, you must control five basic functions: furnace draft, drum level, feed water, fuel air, and steam temperature. This course will teach you what must be controlled and how the control systems operate. It will give process control system engineers, instrumentation engineers, managers, project engineers, operators, and technicians in boiler houses and power plants, a good understanding of boiler control and instrumentation.

This course introduces the 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 course 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.

The course covers the boiler components and their purpose. SAMA symbols and ISA symbols that are used in boiler control and identifying the engineering and control of boilers using the symbols and a method of presenting the engineering. The course includes defining the control and ratio control fundamentals feed forward control, feed forward plus feedback control, cascade control and ratio control and how they are implemented in boiler control. Also reviewed are control concepts proportional control, proportional plus reset control, and proportional plus reset, plus derivative control what they are and how they are used. Flame detection methods are covered including the advantages of each method.

The course includes an e-book entitled "*The Control of Boilers"*, published by The International Society of Automation, which will be given to the participants to help them appreciate the principles presented in the course.

Course Objectives

Upon the successful completion of this course, participants will be able to:

- Apply and gain a comprehensive knowledge on boiler control and instrumentation
- Describe the boiler components and their function and configure furnace draft, drum level, feed water, fuel/air and steam temperature
- Describe PID control and how the systems interact and how to set up the controls
- Discuss swell and shrink and the benefits of improved boiler process control and savings as a result of improved efficiency
- Develop proper control systems documentation and apply principles and methods for flow and level measurements to improved boiler operations
- Specify appropriate strategies for flow, level and pressure control and tuning of boiler control systems
- Implement analyzer measurements for improving boiler efficiency
- Analyze basic control loops required for boiler operation and apply control concepts including cascade, ratio and feed forward control for boiler control
- Specify appropriate safety system interlocks and evaluate process requirements for writing instrumentation specifications
- Recognize and understand typical boiler control diagrams and their design intentions and contribute to the setting up and tuning of boiler control loops.
- Explain the importance of boiler safety control and start-up interlocks and explore advanced control strategies for improved boiler plant efficiency

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of boiler control and instrumentation for those who are involved in the boiler control systems, process control and instrumentation related to boilers. This includes boiler plant engineers, control system engineers, instrumentation engineers, boiler plant commissioning engineers, repair engineers, mechanical engineers and project engineers. Managers, process control and instrumentation engineers with at least five years engineering experience and other technical staff will gain an excellent knowledge from the practical aspects of this course.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

Al Khobar	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	**US$ 5,500** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **2.4 CEUs** (Continuing Education Units) or **24 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, Haward Technology has the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Dr. Tony Dimitry, PhD, MSc, BSc, is a **Senior Electro-Mechanical Engineer** with over **30 years** of industrial experience. His expertise covers **Renewable Energy**, **Renewable Energy Sources**, **Power Generation**, **Combined Cycle**, **Electrical Substation & Equipment**, **Switchgears**, **Circuit Breakers**, **Transformers**, **Generators**, **Electrical Motors**, **UPS & Batteries**. Further, he specializes in **Vibration Analysis**, **Heat Exchanger**, **Siemens Steam Turbine Maintenance**, **Electromechanical Maintenance**, **Machinery Alignment**, **Lubrication Technology**, **Blower & Fan**, **Shaft Repair**, **Safety Relief Valves**, **Pipelines**, **Piping**, **Process Equipment**, **Diesel Engine & Crane Maintenance**, **Maintenance Management** (**Preventive**, **Predictive**, **Breakdown**), **Reliability Management**, **Condition-Based Monitoring**, **Rotating Equipment**, **Tanks & Tank Farms**, **Pneumatic System**, **Static Equipment**, **Failure Analysis**, **FMEA**, **Corrosion**, **Metallurgy**, Planning, Scheduling, Cost Control, Preventive and Predictive Maintenance. Currently, he is the Maintenance Manager of the PPC Incorporation wherein he is responsible for the maintenance and upgrade of all plant components, monitoring the thermal stresses and the remaining life of steam pipes, turbine casing, mills, fans and pumps. He is in-charge of the metallurgical failure analysis and the usage of fracture mechanics for determining crack propagation in impellers of turbines, assessing all alterations and developments for upgrading the plant.

During his career life, Dr. Dimitry was a **Senior Engineer** in **Chloride Silent** (**UK**) wherein he was responsible for the mechanical, thermal and electrical modelling of battery problems for electric vehicles and satellites as well as an **Operations Engineer** of the **National Nuclear Corporation** (**UK**) wherein he was responsible for the optimization of the plant. Prior to this, he was a **Safety Officer** performing safety studies in **HAZOP/HAZID** for the operation and maintenance works on **electrical and process equipment**. He has been the **Professor** at the **Technical University of Crete** and an Assistant **Professor** of the **University of Manchester** (**UK**).

Dr. Dimitry has **PhD**, **Master** and **Bachelor** degrees in **Mechanical Engineering** from the **University of Manchester**, **UK**. Further, he is an active member of the American Society of Mechanical Engineers (**ASME**) and Institution of Electro-Mechanical Engineers (**IMechE**). Moreover, he has also conducted seminars for the tools, instruments and special devices for measuring and control electrical **MV** and **HV** equipment under **OSHA**, **NFPA** and **EN** standards and has also instructed on how to use effective appropriate personnel protective equipment

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 - 0800	*Registration & Coffee*
0800 - 0815	*Welcome & Introduction*
0815 - 0830	***PRE-TEST***
0830 - 0930	***Introduction to Boiler Control Systems*** *Objectives of Boiler Controls • Overview of Boiler Types • Boiler Components • Boiler Processes in Block Diagrams to Show Key Inputs and Output Variables • SAMA Symbols*
0930 - 0945	*Break*
0945 - 1145	***Introduction to Boiler Control Systems (cont'd)*** *Defining PID Control • Hazards of Boiler Operations • The Main Control Functions in Boilers and Furnaces • Draft, Control • Drum Level Control*
1145 – 1230	***Introduction to Boiler Control Systems (cont'd)*** *1, 2 and 3 Element Feed Water Control • Boiler Swell and Shrink • Fuel Air Control • Steam Temperature Control*
1230 – 1245	*Break*
1245 – 1420	***Process Control & Instrumentation Related to Boilers*** *Principles of Sensors and Transmitters with Examples for Boilers • Closed Loop Control Principles Including Feedback, Feedfoward, 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*
1420 - 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Feedwater & Drum Level Control*** *Performance Requirements: Level, Quality, Stability • Characteristic Responses of Drum Level • Level Control Solutions, 1, 2 and 3 Element Types*
0930 – 0945	*Break*
0945 – 1100	***Feedwater & Drum Level Control (cont'd)*** *Level Measurement Problems and Practices • Drum Level Safety Systems*
1100 – 1230	***Furnace Air & Draft Controls*** *Performance Requirements; Pressures and Temperatures • Characteristic Responses and Means of Control • Pressure Measurement Methods and the Pressure Profile*
1230 – 1245	*Break*
1245 – 1420	***Furnace Air & Draft Controls (cont'd)*** *Temperature Control and the Impact of Dew Point • Protection Against Implosion*
1420 - 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

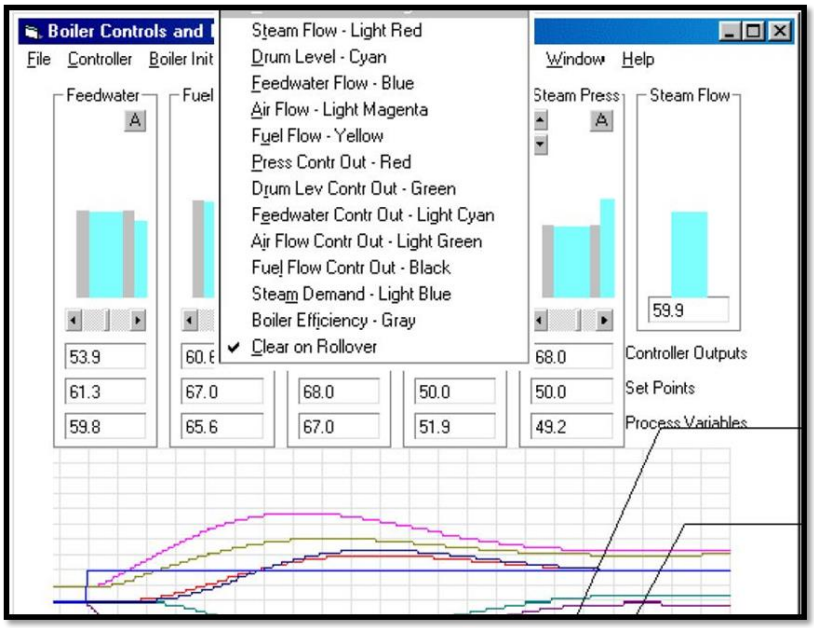
0730 – 0930	***Combustion Controls*** *The Combustion Process and its Requirements for Efficiency and Safety • Coal, Oil and Gas Firing Types • Stoichiometric Air and Excess Air Requirements • Fuel-Air Ratio Control and its Measurements*
0930 – 0945	*Break*
0945 – 1100	***Combustion Controls (cont'd)*** *Firing Rate Controls and Cross Limiters for Improving Dynamic Response • Methods for Measurements of Boiler Efficiency Using Analysers • Application of Optimising Controllers*
1100 – 1230	***Burner Management Systems*** *Safety and Performance Requirements of Pulverisers, Burners & Igniters • Furnace Safety Standards and Regulations • Flame Monitors and Flame Failure Detection • Start up Protection and Sequencing • Furnace Supervisory Controls and Shutdown Systems*
1230 – 1245	*Break*
1245 – 1420	***Steam Temperature Control*** *Superheater and Attemperator Arrangements • Essential Control Requirements • De-Superheater Controls*
1420 - 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 - 0930	***Steam Pressure & Boiler Load Controls*** *Pressure and Flow Response Characteristics • Single Boiler Load Control*
0930 - 0945	*Break*
0945 - 1100	***Steam Pressure & Boiler Load Controls (cont'd)*** *Multiple Boiler Installations and Load Sharing Controls*
1100 - 1230	***Improving Operations with Computers & Analyzers*** *Running from Graphics • Energy Management • Control Trim for Analyzers*
1230 - 1245	*Break*
1245 - 1345	***Emerging Technologies*** *Using DCS Systems*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Practical Sessions)

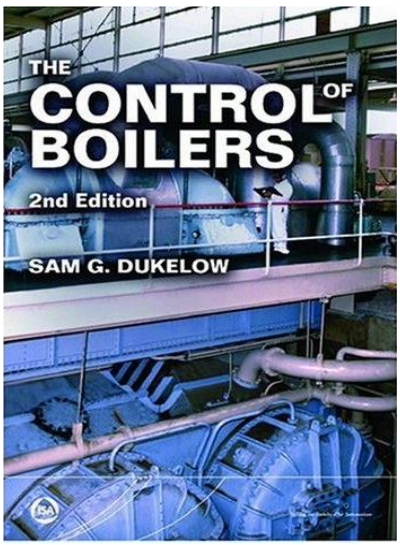
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulator "Win Boiler Sim".



Win Boiler Sim

Book(s)

As part of the course kit, the following e-book will be given to all participants:



Title	:	The Control of Boilers
ISBN	:	155617330X
Author	:	Sam G. Dukelow
Publisher	:	The International Society of Automation

Course Coordinator

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