COURSE OVERVIEW ME0089
Steam Boilers Operation, Maintenance and Control System

Course Title
Steam Boilers Operation, Maintenance and Control System

Course Reference
ME0089

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Session(s)	Dates	Venue
1	June 09-13, 2024	The Kooh Al Noor Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE
2	October 14-18, 2024	Hampstead Meeting Room, London Marriott Hotel Regents Park, London, United Kingdom
3	December 15-19, 2024	Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar
4	February 09-13, 2025	Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey

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. The 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 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 controls, 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 provides a comprehensive coverage of the modern high pressure boilers. It has been completely revised, reorganized and updated to include the latest techniques in boiler operation, instrumentation, control, troubleshooting, safety, emission and steam system management. The course utilizes actual case studies from around the world to highlight the topics discussed.

Following easy-to-implement guidelines and helpful time-saving diagrams, participants will go over strategies to methodically achieve the maximum utilization of fuel and energy to keep operating costs low and equipment performance high.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge, skills and proper techniques in boiler operation, instrumentation and control
- 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 such as 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
- Pinpoint and minimize energy losses in your boiler plant and improve its performance and efficiency
- Employ proven techniques in boiler instrumentation, maintenance, inspection, testing, control, operation, tuning, start-up & shutdown and troubleshoot your boiler system in a safe manner and clean environment

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, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of boilers for those who are involved in the operation, instrumentation and control of boilers in power utilities and process facilities and plants. Further, engineers and other technical staff will benefit from the practical aspects of the 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

Dubai	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
London	**US$ 8,800** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), 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.

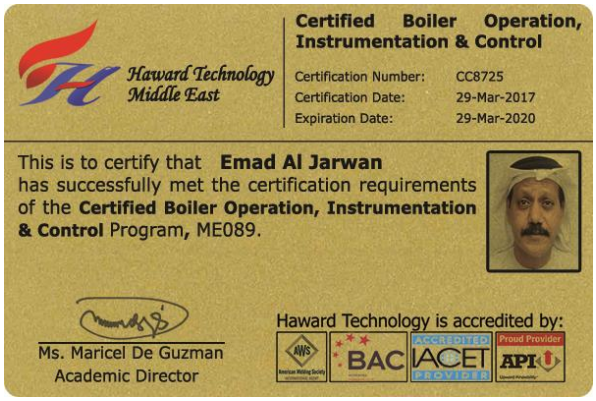
Course Certificate(s)

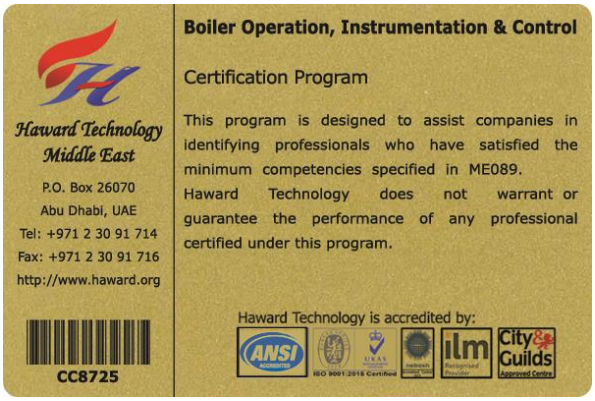
(1) Internationally recognized Competency Certificates and Plastic Wallet Cards will be issued to participants who completed a minimum of 80% of the total tuition hours and successfully passed the exam at the end of the course. Certificates are valid for 5 years.

Recertification is FOC for a Lifetime.

Sample of Certificates

The following are samples of the certificates that will be awarded to course participants:-





(2) Official Transcript of Records will be provided to the successful delegates with the equivalent number of ANSI/IACET accredited Continuing Education Units (CEUs) earned during the course.

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Haward Technology Middle East

Continuing Professional Development (HTME-CPD)

CEU Official Transcript of Records

TOR Issuance Date: 29-Mar-17

HTME No. PAR11317

Participant Name: Emad Al Jarwan

Program Ref.	Program Title	Program Date	No. of Contact Hours	CEU's
ME089	**Certified Boiler Operation, Instrumentation & Control**	March 25-29, 2017	30	3.0

Total No. of CEU's Earned as of TOR Issuance Date **3.0**

TRUE COPY

Maricel De Guzman
Academic Director

Haward Technology has been approved as an Authorized Provider by the International Association for Continuing Education and Training (IACET), 1760 Old Meadow Road, Suite 500, McLean, VA 22102, USA. In obtaining this approval, Haward Technology has demonstrated that it complies with the ANSI/IACET 1-2013 Standard which is widely recognized as the standard of good practice internationally. As a result of their Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for programs that qualify under the ANSI/IACET 1-2013 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 Association 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 is accredited by

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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 **3.0 CEUs** (Continuing Education Units) or **30 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, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Mike Poulos, MSc, BSc, is a **Senior Engineer** with over **35 years** of industrial experience within the **Utilities**, **Refinery**, **Petrochemical** and **Oil & Gas** industries. His expertise lies extensively in the areas of **Centrifugal Compressor**, Maintenance of **Gas Compressors**, **Compressor & Steam Turbine**, **Heat Exchanger** Design, Operation, Performance, Inspection, Maintenance & Repair, **Direct-Fired Heaters**, **Process Equipment Design & Troubleshooting**, **Petroleum Processing**, **Process Design Specifications**, **Process Calculation Methods**, **Equipment Sizing & Selection**, **Piping**, **Pumps**, **Compressors**, **Heat Exchangers**, **Air Coolers**, **Process Vessels**, **Fractionator Columns**, **Reactors, Ancillary Equipment**, **Mechanical & Safety Aspects**, **Cost Estimation**, **Commissioning & Start-Up**, **Production & Cost Reduction**, Reactor Building Ventilation System, **PVC** Initiators Storage Bunkers, **PVC** Modernization & Expansion, **PVC** Reactor, **PVC** Plant Reactors Pre-Heating, **PVC** Plant Start-Up & Commissioning, **PVC** Plant Shutdown, **PVC** Driers Automation, **VC**M Recovery, **VCM** Sphere Flooding System, **VCM** Storage Tanks, Steam Tripping Facilities, Solvents Plant Automation Commissioning & Start-Up and Inferential Properties System. Further, he is also well-versed in Advanced Process Control Technology, Designing Process Plant Fail-Safe Systems, Quantitative Risk Assessment, On-Line Statistical Process Control, Principles and Techniques of Contemporary Management, Rosemount RS3, Polymer Additives, Polymer Reaction Engineering, Polymer Rheology and Processing, GRID Management and Batch Process Engineering.

During his career life, Mr. Poulos held significant positions as the **Chemical Plants Technology Engineer**, **PVC Plant Production Engineer**, **PVC Plant Shutdown Coordinator**, **PVC Plant/CC Solvents Plants Acting Section Head** and **Chemical Distribution Section Head** from Hellenic Petroleum, wherein he was responsible for the development of integrated system.

Mr. Poulos has **Master** and **Bachelor** degrees in **Chemical Engineering** from the **University of Massachusetts** and **Thessaloniki Polytechnic** respectively. Further, he is a **Certified Instructor/Trainer, a** and a **member** of the **Greek Society of Chemical Engineers** and **Greek Society of Engineers**.

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	***Boiler & Boiler Systems*** *Types of Boilers • Configurations & Characteristics of Each Type • Codes & Standards • How to Use Steam Tables • Circulation of Boiler Water • Combustion • Boiler Fluid Flow Paths • Thermodynamics • Fuel • Air • Feedwater • Steam or Hot Water*
0930 – 0945	*Break*
0945 – 1100	***Burners, Superheaters & Reheaters*** *Gas Burners • Oil Burners • Combination Gas/Oil Burners • Gas and Oil Trains • Waste Heat Recovery • Superheaters • Reheaters • Attemperators Configuration and Characteristics of each Type • Relevant Metallurgy and Alloy Materials and Creep Factor*
1100 – 1230	***Boiler Control Systems*** *Objectives of Boiler Controls • Boiler Processes in Block Diagrams to Show Key Inputs and Output Variables •SAMA Symbols •Defining PID Control • Hazards of Boiler Operations*
1230 – 1245	*Break*
1245 – 1420	***Boiler Control Systems (cont'd)*** *The Main Control Functions in Boilers and Furnaces • Draft, Control • Drum Level Control •1, 2 and 3 Element Feed Water Control •Boiler Swell and Shrink • Fuel Air Control • Steam Temperature Control*
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	***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*
0930 – 0945	*Break*
0945 – 1100	***Feedwater & 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*
1100 – 1230	***Furnace Air & 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*

1230 – 1245	*Break*
1245 – 1420	***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*
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	***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*
0930 – 0945	*Break*
0945 – 1000	***Steam Temperature Control*** *Superheater and Attemperator Arrangements • Essential Control Requirements • De-Superheater Controls*
1100 – 1230	***Steam Pressure & Boiler Load Controls*** *Pressure and Flow Response Characteristics • Single Boiler Load Control • Multiple Boiler Installations and Load Sharing Controls*
1230 – 1245	*Break*
1245 – 1420	***Improving Operations with Computers & Analyzers*** *Running from Graphics • Energy Management • Control Trim for Analyzers • DCS 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 Three*

Day 4

0730 – 0930	***Boiler Startup & Shutdown*** *Preparation for Startup • The Pre-Startup Walk Through • Filling the Boiler Drum • Establishing Flow through the Boiler • Establishing a Boiler Flame • Basic Shutdown Procedures • Reducing Firing Rate • Reducing Steam Flow • Reducing Air and Gas Flow • Maintaining Flow through Superheater*
0930 – 0945	*Break*
0945 – 1100	***Boiler Operation & Steam System Management*** *Normal Operation and Steady State Conditions • Maintaining Design Steam Temperature and Pressure • Maintaining Proper Combustion Conditions • Maintaining Proper Feed Water Conditions • Monitoring the Steam/Water Circuit • Safety Valves & Low Water Cutoff Control*
1100 – 1230	***Boiler Efficiency & Waste Heat Recovery*** *Heat Exchanger Efficiency • Combustion Efficiency Data Collection • Optimum Oxygen Percentage • Optimum Stack Temperature • Waste Heat Recovery*

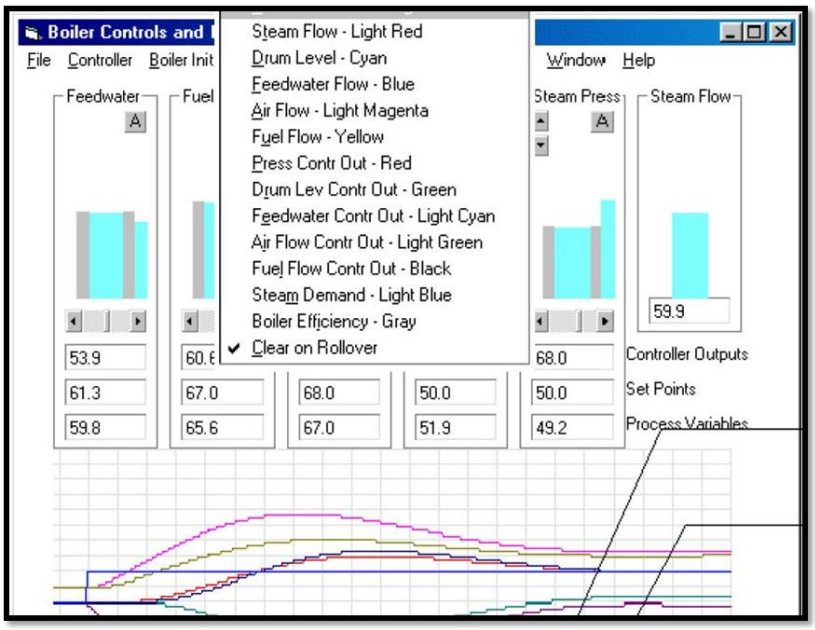
1230 – 1245	*Break*
1245 – 1420	***Combustion Analysis & Tuning Procedures*** *Combustion Efficiency Data Collection • Optimum Oxygen Percentage • Optimum Stack Temperature • Tips and Generally Accepted Practices*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Boiler Inspection & Testing*** *Internal Inspection • External Inspection • Operational Inspection • Hydrostatic Pressure Test • Common Inspection Code Violations*
0930 – 0945	*Break*
0945 – 1100	***Boiler Maintenance & Protection*** *Waterside Maintenance • Fireside Maintenance • Operating and Safety Control Maintenance • General Maintenance • Daily Maintenance • Weekly Maintenance • Monthly Maintenance • Annual Maintenance • Preventive Maintenance*
1100 – 1230	***Boiler Emissions & Pollution Control*** *Six Criteria Air Pollutants • NOx and SOx • VOCs • Pollution Control Systems*
1230 – 1245	*Break*
1245 – 1300	***Boiler Troubleshooting & Safety*** *Steam Traps • Loss of Boiler Flame • Low and High water • Loss of Boiler Auxiliaries • Boiler leaks • Boiler Overpressure • Equipment Fires • Foaming • Lockout/Tagout • Confined Spaces • Boiler Accidents – Cause & Effect*
1300 – 1315	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1315 – 1415	***COMPETENCY EXAM***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

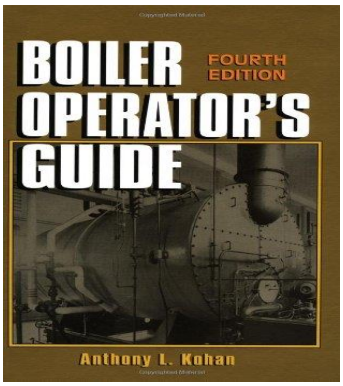
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulator "Win Boiler Sim".



Win Boiler Sim

Book(s)

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



Title: Boiler Operator's Guide
ISBN: 9780070365742
Author: Anthony L. Kohan
Publisher: McGraw-Hill
Pages: 736 pages

Course Coordinator

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