



## 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)	Date	Venue
1	July 06-10, 2025	Safir Meeting Room, Divan Istanbul, Turkey
2	September 21-25, 2025	Olivine Meeting Room, Fairmont Nile City, Cairo, Egypt
3	November 23-27, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE



#### 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 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.

### Accommodation

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

### Course Fee

Istanbul	<b>US\$ 6,000</b> per Delegate + <b>VAT</b> . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Cairo	<b>US\$ 5,500</b> per Delegate + <b>VAT</b> . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	<b>US\$ 5,500</b> per Delegate + <b>VAT</b> . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
In addition, participants will receive an e-book “Boiler’s Operator Guide”, published by McGraw-Hill.	





## 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.

Program Ref.	Program Title	Program Date	No. of Contact Hours	CEU's
ME0089	Steam Boilers Operation, Maintenance and Control System	November 11-15, 2023	30	3.0

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

**TRUE COPY**  
  
Jaryl Castillo  
Academic Director

Haward Technology has been approved as an Accredited Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this approval, Haward Technology has demonstrated that it complies with the ANSI/IACET 1-2018 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 1-2018 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

BAC ASNT AWS IOSH U.K.A.S. ILM TQM PMA ACCREDITED IACET PROVIDER API


P.O. Box 26070, Abu Dhabi, United Arab Emirates | Tel.: +971 2 3091 714 | E-mail: info@haward.org | Website: www.haward.org

## **Certificate Accreditations**

Certificates are accredited by the following international accreditation organizations: -

- 
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.

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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.





### 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. Andrew Ladwig** is a **Senior Mechanical & Maintenance Engineer & HSE Consultant** with over **25 years** of extensive experience within the **Oil & Gas, Refinery, Petrochemical & Power** industries. His expertise widely covers in the areas of Best Practice In **Maintenance Management, Maintenance Troubleshooting, Preventive Maintenance & Corrective Maintenance, Maintenance Planning, Scheduling, Management & Work Control**, Certified Maintenance Planner (**CMP**), Certified Planning & Scheduling Professional (**AACE-PSP**), **Maintenance Optimization & Best Practices, Engine Construction & Maintenance, Process Plant Shutdown & Turnaround, Maintenance Auditing & Benchmarking, Machinery Lubrication, Machinery Failure Analysis, Reliability, Availability & Maintainability (RAM), Reliability-Centered Maintenance (RCM), Reliability Engineering Analysis (RE), Root Cause Analysis (RCA), Asset Integrity Management (AIM), Reactive & Proactive Maintenance, Compressors & Turbines Operation, Maintenance & Troubleshooting, Reciprocating & Centrifugal Compressors, Screw Compressor, Compressor Control & Protection, Gas & Steam Turbines, Turbine Operations, Gas Turbine Technology, Centrifugal Pumps, Bearings, Couplings, Screw Compressors & Heat Exchangers Operation, Maintenance, Inspection, Troubleshooting, Lubrication & Shaft Alignment, Gas Turbine Operating & Maintenance, Pressure Safety Relief Valve Repair & Recalibration, PSV/PRV Troubleshooting, Valve Testing & Inspection, Control Valves & Actuators, Boiler Inspection & Maintenance, Boiler Systems, Boiler instrumentation & Controls, Boiler Start-up & Shutdown, Boiler Operation & Steam System Management, Heat Recovery Steam Generating (HRSG), Impulse Tube Installation & Inspection, Pipes & Fittings, Tank Design & Engineering, Tank Shell, Tanks & Tank Farms, Bearings & Lubrication and Advanced Machinery Dynamics. Further, he is also well-versed in **Hazardous Materials & Chemicals Handling, Hazardous Materials (HAZMAT), Hazard Identification & Operability (HAZOP), Professional HAZOP/PHA Leader: Advanced Process Hazard Analysis (PHA) Methods & Leadership (HAZOP, What-if, FMEA), Process Safety Management (PSM), Layer of Protection Analysis (LOPA), Behavioural Based Safety (BBS), Job Safety Analysis (JSA), Permit to Work (PTW), Authorized Gas Tester (AGT), Confined Space Entry & Rescue, Pre-Startup Safety Reviews (PSSR), Safety in Process Plants, Risk Assessment, Risk Management, Emergency Planning, Emergency Response & Crisis Management Operations and Incident Investigation Advanced & HSE Reporting.****

During his career life, Mr. Ladwig has gained his practical experience through his various significant positions and dedication as the **Mechanical Engineer, Project Engineer, Reliability & Maintenance Engineer, Maintenance Support Engineer, Process Engineer, HSE Supervisor, Warehouse Manager, Quality Manager, Business Analyst, Senior Process Controller, Process Controller, Safety Officer, Mechanical Technician, Senior Lecturer and Senior Consultant/Trainer** for various companies such as the Sasol Ltd., Sasol Wax, Sasol Synfuels, just to name a few.

Mr. Ladwig has a **Bachelor's degree in Chemical Engineering** and a **Diploma in Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and has delivered various trainings, workshops, seminars, courses and conferences internationally.



## 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	<b>PRE-TEST</b>
0830 – 0930	<b>Boiler &amp; Boiler Systems</b> 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	<b>Burners, Superheaters &amp; Reheaters</b> Gas Burners • Oil Burners • Combination Gas/Oil Burners • Gas and Oil Trains • Waste Heat Recovery • Superheaters • Reheaters • Attenuators Configuration and Characteristics of each Type • Relevant Metallurgy and Alloy Materials and Creep Factor
1100 – 1230	<b>Boiler Control Systems</b> 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	<b>Boiler Control Systems (cont'd)</b> 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	<b>Recap</b> 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	<b>Process Control &amp; Instrumentation Related to Boilers</b> 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
0930 – 0945	Break
0945 – 1100	<b>Feedwater &amp; Drum Level Control</b> 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	<b>Furnace Air &amp; Draft Controls</b> 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	<b>Combustion Controls</b> <i>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</i>
1420 – 1430	<b>Recap</b> <i>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</i>
1430	Lunch & End of Day Two

### Day 3

0730 – 0930	<b>Burner Management Systems</b> <i>Safety and Performance Requirements of Pulverisers, Burners &amp; Igniters • Furnace Safety Standards and Regulations • Flame Monitors and Flame Failure Detection • Start up Protection and Sequencing • Furnace Supervisory Controls and Shutdown Systems</i>
0930 – 0945	Break
0945 – 1000	<b>Steam Temperature Control</b> <i>Superheater and Attemperator Arrangements • Essential Control Requirements • De-Superheater Controls</i>
1100 – 1230	<b>Steam Pressure &amp; Boiler Load Controls</b> <i>Pressure and Flow Response Characteristics • Single Boiler Load Control • Multiple Boiler Installations and Load Sharing Controls</i>
1230 – 1245	Break
1245 – 1420	<b>Improving Operations with Computers &amp; Analyzers</b> <i>Running from Graphics • Energy Management • Control Trim for Analyzers • DCS Systems</i>
1420 – 1430	<b>Recap</b> <i>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</i>
1430	Lunch & End of Day Three

### Day 4

0730 – 0930	<b>Boiler Startup &amp; Shutdown</b> <i>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</i>
0930 – 0945	Break
0945 – 1100	<b>Boiler Operation &amp; Steam System Management</b> <i>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 &amp; Low Water Cutoff Control</i>
1100 – 1230	<b>Boiler Efficiency &amp; Waste Heat Recovery</b> <i>Heat Exchanger Efficiency • Combustion Efficiency Data Collection • Optimum Oxygen Percentage • Optimum Stack Temperature • Waste Heat Recovery</i>
1230 – 1245	Break



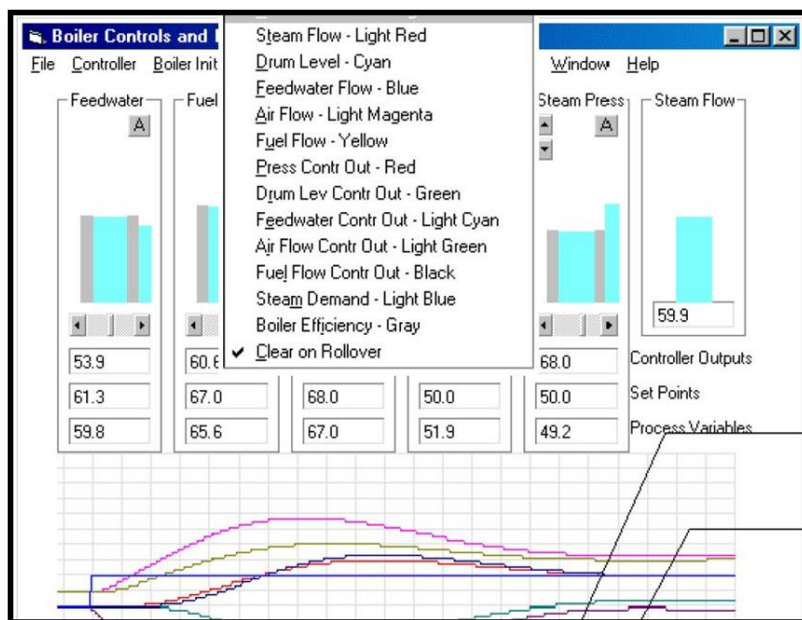
1245 – 1420	<b>Combustion Analysis &amp; Tuning Procedures</b> Combustion Efficiency Data Collection • Optimum Oxygen Percentage • Optimum Stack Temperature • Tips and Generally Accepted Practices
1420 – 1430	<b>Recap</b> Using this Course Overview, the Instructor(s) will Brief Participants about the 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	<b>Boiler Inspection &amp; Testing</b> Internal Inspection • External Inspection • Operational Inspection • Hydrostatic Pressure Test • Common Inspection Code Violations
0930 – 0945	Break
0945 – 1100	<b>Boiler Maintenance &amp; Protection</b> Waterside Maintenance • Fireside Maintenance • Operating and Safety Control Maintenance • General Maintenance • Daily Maintenance • Weekly Maintenance • Monthly Maintenance • Annual Maintenance • Preventive Maintenance
1100 – 1230	<b>Boiler Emissions &amp; Pollution Control</b> Six Criteria Air Pollutants • NOx and SOx • VOCs • Pollution Control Systems
1230 – 1245	Break
1245 – 1300	<b>Boiler Troubleshooting &amp; Safety</b> 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	<b>Course Conclusion</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
1315 – 1415	<b>COMPETENCY EXAM</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

### **Simulator (Hands-on Practical Sessions)**

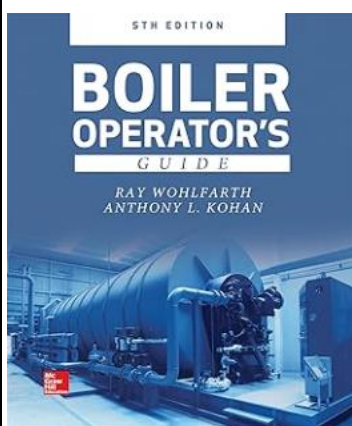
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulator “Win Boiler Sim”.



**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** : 978-1260026993  
**Author** : Ray Wohlforth and Anthony L. Kohan  
**Publisher** : McGraw-Hill  
**Pages** : 752 pages

### **Course Coordinator**

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