



COURSE OVERVIEW ME0180-4D
Boiler & Steam System Management
Performance, Efficiency, Troubleshooting, Tune-Up,
Heat Recovery & Optimization

Course Title

Boiler & Steam System Management:
Performance, Efficiency, Troubleshooting, Tune-Up, Heat Recovery & Optimization

Course Date/Venue

September 14-17, 2026/Meeting Room A, Centro
Corniche Al Khobar by Rotana, Al Khobar, KSA

Course Reference

ME0180-4D

Course Duration/Credits

Four days/2.4 CEUs/24 PDHs



Course Description



This practical and highly-interactive course includes real-life case studies where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of Boiler & Steam System Management: Performance, Efficiency, Troubleshooting, Tune-Up, Heat Recovery & Optimization. It covers the boiler types, design and operating principles, boiler components and steam system layout; the combustion fundamentals, fuel characteristics and boiler performance indicators and KPIs; the steam properties and thermodynamics and common boiler operational challenges; the boiler efficiency measurement methods; and the major boiler heat losses covering dry flue gas losses, moisture and hydrogen losses, radiation and convection losses and blowdown heat losses.



Further, the course will also discuss the combustion air and draft system optimization, burner operation, flame characteristics, flue gas analysis and performance diagnosis; the energy efficiency improvement opportunities and steam distribution system design and losses; the proper selection, operation and maintenance of steam traps; the condensate recovery, feedwater management and boiler blowdown management; the economizers and waste heat recovery and advanced heat recovery options; and the boiler operational troubleshooting.





During this interactive course, participants will learn the water-side problems, chemistry control and fire-side problems and inspection; the boiler tube failures, root causes, boiler safety systems and interlocks; the preventive and predictive maintenance strategies, boiler tune-up procedures, integrated steam system optimization and advanced control and automation; the energy audits and performance benchmarking; and the environmental performance and emissions control.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on boiler and steam system management covering performance, efficiency, troubleshooting, tune-up, heat recovery and optimization
- Recognize boiler types, design and operating principles including boiler components and steam system layout
- Discuss combustion fundamentals, fuel characteristics and boiler performance indicators and KPIs
- Identify steam properties and thermodynamics and common boiler operational challenges
- Apply boiler efficiency measurement methods and identify major boiler heat losses covering dry flue gas losses, moisture and hydrogen losses, radiation and convection losses and blowdown heat losses
- Carryout combustion air and draft system optimization, burner operation and flame characteristics and flue gas analysis and performance diagnosis
- Discuss energy efficiency improvement opportunities and steam distribution system design and losses
- Apply proper selection, operation and maintenance of steam traps including condensate recovery and feedwater management and boiler blowdown management
- Illustrate economizers and waste heat recovery, advanced heat recovery options and boiler operational troubleshooting
- Recognize water-side problems and chemistry control, fire-side problems and inspection, boiler tube failures and root causes as well as boiler safety systems and interlocks
- Employ preventive and predictive maintenance strategies, boiler tune-up procedures, integrated steam system optimization and advanced control and automation
- Apply energy audits and performance benchmarking including environmental performance and emissions control

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 and steam system management for facilities engineers, operating engineers, energy engineers, managers, supervisory personnel, designers, inspectors, consultants and other technical staff who are involved in the performance, efficiency, troubleshooting, tune-up, heat recovery and optimization of boiler and steam system. The course will provide a clear and refreshing examination of boilers and their systems. It covers a range from very large to small boiler systems and is not specifically oriented toward utility plants.

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

Haward's certificates are accredited by the following international accreditation organizations:

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British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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 **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.



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. George Poulos, MBA, MSc, BSc, CEng, is a **Senior Mechanical & Maintenance Engineer** with over **30 years** of extensive experience within the **Oil & Gas, Petrochemical, Refinery, Construction, Aircraft & Shipbuilding** Industry. His wide experience cover in the areas of **Boiler Operation, Maintenance & Inspection, Boiler & Steam System Management, Standards in Boiler, Pressure Vessel & Piping Systems, Reliability Engineering, Maintenance & Reliability Best Practices, Reliability, Availability & Maintainability (RAM), Root Cause Analysis, Maintenance Process, Reliability-Centered Maintenance (RCM), Reliability Engineering Analysis (RE), Root Cause Analysis (RCA), Asset Integrity Management (AIM), Reactive & Proactive Maintenance. Maintenance Management, Aluminium Oxides, Aluminium Smelting Process, Basic Steel Making Process, Hot Rolling Process, Hot Strip Mill, Mill Operations, Roll Mill, Steel Making Process, Steel Manufacturing, Electric Arc Furnace (EAF), Steel Forging, Steel Manufacturing & Process Troubleshooting, Slit Rolling, Carbon Steel Pipe Wall Thickness & Grade Selection, Ferro-Alloys, Steel Metallurgy, Steel Structure Welding, Steelmaking Slag, Steel Making Application, Heat Treatment & Prevention Techniques, Corrosion Fabrication & Inspection and Post Weld Heat Treatment**. Further, he is also well-versed in **Welding Inspection, Welding & Machine Techniques, TIG & Arc Welding, Shielded Metal Arc Welding, Gas Tungsten & Gas Metal Arc Welding, Welding Procedure Specifications & Qualifications, Aluminium Welding, Hot Work-Safety, SMAW, GTAW, Welding Techniques, Pipeline Welding Practices, Welding Engineering, Welding Fatigue & Fracture Mechanics, Welding Inspection Technology, Welding Safety, Welding Defects Analysis, Welding Technology, Welding Problems, Welding & Non Destructive Testing and Metallurgy Techniques**.

During his career life, Mr. Poulos has gained his practical and field experience through his various significant positions and dedication as the **Chief Executive, Head of Technical Studies, Manager, Senior Consultant, Lead Welding Engineer, Senior Welding Engineer, Design Engineer, Sales Engineer, Author, Welding Instructor, Visiting Lecturer and Technical Proposal Research Evaluator** from various international companies such as Greek Welding Institute, Hellenic Quality Forum and International Construction Companies such as Shipbuilding, Aircraft Industry and Oil and Gas Industry.

Mr. Poulos is a **Registered Chartered Engineer** and has a **Master's** degree in **Naval Architecture**, a **Bachelor's** degree in **Welding Engineering** and a Master of Business Administration (**MBA**) from the **Sunderland University, Aston University and Open University, UK**, respectively. Further, he is a **Certified Trainer/Instructor**, an active Member of Chartered Quality Institute (**CQI**), The British Welding Institute (**TWI**), The Royal Institution of Naval Architects (**RINA**) and American Welding Society (**AWS**), a Registered **EWFIW** (European Welding Federation-International Welding Institute W/E) and an **IRCA** Accredited External Quality Systems Auditor through BVQI. He is an **Author** of Technical Book dealing with Protection/Health/Safety in the Welding/Cutting domain and delivered various trainings, seminars, conferences, workshops and courses globally.



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.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Accommodation

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

Course Fee

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.

Course Program

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

Day 1: Monday, 14th of September 2026

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Boiler Types, Design & Operating Principles Fire-Tube versus Water-Tube Boilers • Packaged Boilers versus Field-Erected Boilers • Natural versus Forced Circulation Systems • Pressure, Temperature, and Capacity Classifications
0930 – 0945	Break
0945 – 1030	Boiler Components & Steam System Layout Boiler Drum, Tubes, Headers and Furnace • Burners, Fans and Draft Systems • Steam Headers, Mains and Branch Lines • Condensate Return and Feedwater Systems
1030 – 1130	Combustion Fundamentals & Fuel Characteristics Combustion Chemistry and Stoichiometric Air • Fuel Types: Gas, Oil, Coal, Biomass • Excess Air and Flue Gas Composition • Impact of Fuel Quality on Performance
1130 – 1215	Boiler Performance Indicators & KPIs Boiler Efficiency Definitions and Types • Evaporation Ratio and Steam-to-Fuel Ratio • Heat Rate and Specific Fuel Consumption • Availability, Reliability and Load Factor
1215 – 1230	Break



1230 – 1300	Steam Properties & Thermodynamics <i>Saturated versus Superheated Steam • Pressure–Temperature Relationships • Enthalpy, Entropy, and Steam Tables • Practical Steam Calculations for Operators</i>
1300 – 1345	Common Boiler Operational Challenges <i>Load Variation and Cycling Problems • Low Efficiency Symptoms • Unstable Flame and Combustion Issues • Early Warning Signs of Poor Performance</i>
1345 – 1420	Boiler Efficiency Measurement Methods <i>Direct (Input–Output) Method • Indirect (Heat Loss) Method • Comparison of Efficiency Methods • Field Efficiency Testing Practices</i>
1420 – 1430	Recap <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 One

Day 2: Tuesday, 15th of September 2026

0730 – 0815	Major Boiler Heat Losses <i>Dry Flue Gas Losses • Moisture and Hydrogen Losses • Radiation and Convection Losses • Blowdown Heat Losses</i>
0815 – 0900	Combustion Air & Draft System Optimization <i>Forced, Induced and Balanced Draft • Air–Fuel Ratio Optimization • Impact of Excess Air on Efficiency • Fan Control and Damper Tuning</i>
0900 – 0930	Burner Operation & Flame Characteristics <i>Burner Types and Design Principles • Flame Stability and Shape Analysis • Ignition Systems and Safety Interlocks • Burner Adjustment and Tuning Basics</i>
0930 – 0945	Break
0945 – 1045	Flue Gas Analysis & Performance Diagnosis <i>O₂, CO₂, CO and NO_x Measurement • Interpreting Flue Gas Analyzer Data • Combustion Efficiency Calculations • Identifying Incomplete Combustion</i>
1045 – 1130	Energy Efficiency Improvement Opportunities <i>Operational Best Practices • Load Matching and Turndown Optimization • Fuel Switching Considerations • Short-Term versus Long-Term Efficiency Gains</i>
1130 – 1215	Steam Distribution System Design & Losses <i>Steam Piping Layout and Sizing • Pressure Drop and Velocity Limits • Steam Leakage Identification • Insulation Requirements and Heat Losses</i>
1215 – 1230	Break
1230 – 1330	Steam Traps: Selection, Operation & Maintenance <i>Types of Steam Traps and Applications • Failure Modes: Open, Closed, Leaking • Trap Testing and Inspection Methods • Impact of Trap Failures on Efficiency</i>
1330 – 1420	Condensate Recovery & Feedwater Management <i>Benefits of Condensate Recovery • Condensate System Components • Flash Steam Recovery Principles • Water and Chemical Cost Savings</i>
1420 – 1430	Recap <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: Wednesday, 16th of September 2026

0730 – 0830	Boiler Blowdown Management Continuous versus Intermittent Blowdown • Blowdown Rate Optimization • Heat and Water Losses from Blowdown • Blowdown Heat Recovery Systems
0830 – 0930	Economizers & Waste Heat Recovery Economizer Design and Operation • Feedwater Temperature Improvement • Flue Gas Temperature Reduction Limits • Corrosion and Fouling Considerations
0930 – 0945	Break
0945 – 1045	Advanced Heat Recovery Options Air Preheaters • Condensing Economizers • Heat Recovery from Exhaust and Drains • Integration with Process Heating Systems
1045 – 1130	Boiler Operational Troubleshooting Low Steam Pressure Problems • Poor Load Response and Instability • Flame Failure and Trips • High Stack Temperature Diagnosis
1130 – 1215	Water-Side Problems & Chemistry Control Scale Formation and Heat Transfer Loss • Corrosion Mechanisms • Carryover and Foaming Issues • Boiler Water and Feedwater Chemistry Control
1215 – 1230	Break
1230 – 1330	Fire-Side Problems & Inspection Soot Formation and Fouling • Tube Overheating and Flame Impingement • Refractory Damage • Fire-Side Inspection Best Practices
1330 – 1420	Boiler Tube Failures & Root Causes Overheating and Creep Failures • Corrosion and Erosion Mechanisms • Thermal Stress and Fatigue • Failure Analysis and Prevention
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: Thursday, 17th of September 2026

0730 – 0800	Boiler Safety Systems & Interlocks Pressure Relief Valves • Flame Scanners and Safety Trips • Low-Water Cutoff Systems • Operator Response to Emergencies
0800 – 0845	Preventive & Predictive Maintenance Strategies Inspection Planning and Scheduling • Condition Monitoring Techniques • Maintenance KPIs and Documentation • Reliability-Centered Maintenance (RCM)
0845 – 0930	Boiler Tune-up Procedures Pre-Tune-up Inspection Checklist • Burner and Air Damper Adjustments • Fuel Valve Calibration • Post-Tune-Up Performance Verification
0930 – 0945	Break
0945 – 1045	Integrated Steam System Optimization Boiler–Process Matching • Pressure Level Optimization • Demand-Side Management • Steam System Balancing
1045 – 1130	Advanced Control & Automation Boiler Master Control Concepts • Oxygen Trim and Combustion Control • Variable Frequency Drives (VFDs) • Digital Monitoring and Analytics



1130 – 1215	Energy Audits & Performance Benchmarking Boiler and Steam System Energy Audits • Identifying Savings Opportunities • Performance Benchmarking Methods • Cost-Benefit Analysis of Improvements
1215 – 1230	Break
1230 – 1300	Environmental Performance & Emissions Control NOx, CO and Particulate Emissions • Combustion Optimization for Emissions Reduction • Regulatory Compliance Considerations • Sustainable Boiler Operation Strategies
1300 – 1345	Best Practices, Case Studies & Action Planning Industry Best Practices and Lessons Learned • Case Studies on Efficiency Improvement • Developing Site-Specific Action Plans • Continuous Improvement Roadmap
1345 – 1400	Course Conclusion Using this Course Overview, the Instructor(s) will Brief Participants about Topics that were Covered During the Course
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

Practical Sessions

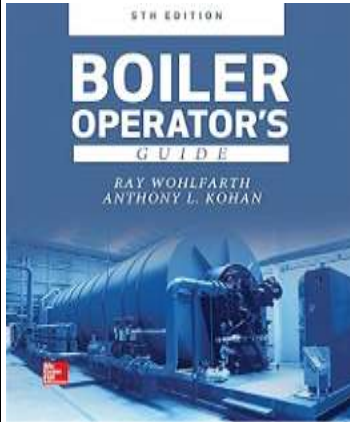
This practical and highly-interactive course includes real-life case studies and exercises:-





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 Wohlfarth and Anthony L. Kohan
Publisher : McGraw-Hill
Pages : 752 pages

Course Coordinator

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