COURSE OVERVIEW PE0903
Furnace Safe Operation & Optimization

Course Title
Furnace Safe Operation & Optimization

Course Date/Venue
September 06-10, 2026/TBA Meeting Room, Holiday Inn Corniche, Al Khobar, KSA

Course Reference
PE0903

Course Duration/Credits
Five days/3.0 CEUs/30 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 Furnace Safe Operation & Optimization. It covers the industrial furnaces, furnace components and construction; the fuel systems and combustion basics; the furnace instrumentation and controls, furnace safety systems and hazards associated with furnace operation; the furnace pre-start inspection, safe furnace start-up procedures, burner operation and flame management; the furnace operating parameters, furnace shutdown procedures and safe operating practices; the combustion efficiency optimization and heat transfer optimization; and the furnace performance indicators.

During this interactive course, participants will learn the draft and air flow optimization, emissions control and advanced furnace optimization techniques; the furnace inspection techniques and preventive and predictive maintenance; the common furnace problems, tube failures and damage mechanisms; the refractory failure analysis, root cause analysis and troubleshooting and furnace reliability improvement; and the energy conservation, cost optimization, operational risk management, emergency response and incident management.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain a comprehensive knowledge on furnace safe operation and optimization
- Discuss industrial furnaces, furnace components and construction as well as fuel systems and combustion basics
- Recognize furnace instrumentation and controls, furnace safety systems and hazards associated with furnace operation
- Carryout furnace pre-start inspection, safe furnace start-up procedures, burner operation and flame management
- Apply furnace operating parameters, furnace shutdown procedures and safe operating practices
- Implement combustion efficiency optimization and heat transfer optimization and identify furnace performance indicators
- Employ draft and air flow optimization, emissions control and advanced furnace optimization techniques
- Apply furnace inspection techniques and preventive and predictive maintenance
- Identify common furnace problems and tube failures and damage mechanisms
- Carryout refractory failure analysis, root cause analysis and troubleshooting and furnace reliability improvement
- Employ energy conservation and cost optimization, operational risk management as well as emergency response and incident management

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 furnace safe operation and optimization for production operation staff including process engineers, supervisors, foremen, technicians and operators. Further, the course is suitable for control, instrumentation and maintenance staff who are involved in furnaces and fired process heaters.

Course Fee.

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.

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

Haward's 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**. 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.

- 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. Karl Thanasis, PEng, MSc, MBA, BSc, is **Senior Operations Engineer** with over **30 years** of extensive industrial experience. His wide expertise includes **Furnace** Operations & Troubleshooting, **Fired Process Heater** Maintenance, **Furnace** Troubleshooting, **Furnace** Safe Operation & Optimization, **Combustion** in **Boiler Furnace**, **Shutdown**, **Turnaround & Outages**, **Maintenance & Reliability** Management, **Mechanical Maintenance** Planning, Scheduling & Work Control, Advanced Techniques in **Maintenance** Management, **Predictive & Preventive** Maintenance, **Maintenance & Operation Cost Reduction** Techniques, Reliability Centered Maintenance (**RCM**), **Machinery Failure** Analysis, **Rotating Equipment Reliability** Optimization & Continuous Improvement, **Material Cataloguing**, **Mechanical & Rotating Equipment** Troubleshooting & Maintenance, **Root Cause Analysis & Reliability** Improvement, **Condition** Monitoring, **Root Cause Failure Analysis** (RCFA), **Steam Generation**, **Steam Turbines**, **Power Generator Plants**, **Gas Turbines**, **Combined Cycle Plants**, **Boilers**, **Furnace**, **Process Fired Heaters**, Air Preheaters, Induced Draft Fans, All Heaters Piping Work, Refractory Casting, Heater Fabrication, Thermal & Fired Heater Design, **Heat Exchangers**, Heat Transfer, Coolers, **Power Plant** Performance, Efficiency & Optimization, **Storage Tank** Design & Fabrication, **Thermal Power Plant** Management, **Boiler & Steam** System Management, **Pump** Operation & Maintenance, **Chiller & Chiller Plant** Design & Installation, **Pressure Vessel**, **Safety Relief Valve** Sizing & Selection, **Valve** Disassembling & Repair, Pressure Relief Devices (**PSV**), **Hydraulic & Pneumatic** Maintenance, Advanced **Valve** Technology, **Pressure Vessel** Design & Fabrication, **Pumps**, Turbo-Generator, Turbine **Shaft Alignment**, **Lubrication**, Mechanical **Seals**, Packing, **Blowers**, **Bearing** Installation, **Couplings**, **Clutches** and **Gears**. Further, he is also versed in **Wastewater Treatment** Technology, **Networking** System, **Water Network Design**, Industrial **Water Treatment** in Refineries & Petrochemical Plants, **Piping** System, Water Movement, Water Filtering, Mud Pumping, **Sludge Treatment** and **Drying**, **Aerobic Process** of **Water Treatment** that includes **Aeration**, **Sedimentation** and **Chlorination Tanks**. His strong background also includes **Design** and **Sizing** of all **Waste Water Treatment Plant Associated Equipment** such as **Sludge Pumps**, **Filters**, **Metering Pumps**, **Aerators** and **Sludge Decanters**.

Mr. Thanasis has acquired his thorough and practical experience as the **Project Manager**, **Plant Manager**, **Area Manager - Equipment Construction**, **Construction Superintendent**, **Project Engineer** and **Design Engineer**. His duties covered **Plant Preliminary Design**, **Plant Operation**, **Write-up** of **Capital Proposal**, **Investment Approval**, **Bid Evaluation**, **Technical Contract Write-up**, **Construction** and **Sub-contractor Follow up**, **Lab Analysis**, **Sludge Drying** and **Management** of **Sludge Odor** and **Removal**. He has worked in various companies worldwide in the **USA**, **Germany**, **England** and **Greece**.

Mr. Thanasis is a **Registered Professional Engineer** in the **USA** and **Greece** and has a **Master** and **Bachelor** degrees in **Mechanical Engineering** with **Honours** from the **Purdue University** and **SIU** in **USA** respectively as well as an **MBA** from the **University of Phoenix** in **USA**. Further, he is a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**) a **Certified Instructor/Trainer** and has delivered numerous trainings, courses, seminars, workshops and conferences worldwide.

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.

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: ***Sunday, 06th of September***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Industrial Furnaces*** *Types of Industrial Furnaces Used in Process Industries • Applications in Refineries, Petrochemical & Power Plants • Heat Transfer Mechanisms (Radiation, Convection & Conduction) • Furnace Performance Objectives & Operating Philosophy*
0930 – 0945	*Break*
0945 – 1030	***Furnace Components & Construction*** *Radiant & Convection Sections • Burners, Tubes, Refractory & Insulation Systems • Stack, Dampers & Air Preheaters • Structural Components & Support Systems*
1030 – 1130	***Fuel Systems & Combustion Basics*** *Gaseous & Liquid Fuel Characteristics • Fuel Supply Systems & Pressure Control • Air-to-Fuel Ratio Fundamentals • Combustion Chemistry & Flame Characteristics*
1130 – 1215	***Furnace Instrumentation & Controls*** *Temperature, Pressure & Flow Measurements • Oxygen Analyzers & Combustion Monitoring • Burner Management System (BMS) • Distributed Control System (DCS) Integration*
1215 – 1230	*Break*

1230 – 1330	***Furnace Safety Systems*** *Process Safety Management (PSM) Requirements • Emergency Shutdown (ESD) Systems • Flame Detection & Burner Interlocks • Furnace Permissives & Trip Logic*
1330 – 1420	***Hazards Associated with Furnace Operation*** *Fire & Explosion Hazards • Fuel Gas Leakage & Ignition Risks • Tube Overheating & Rupture • Carbon Monoxide & Confined Space Hazards*
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: Monday, 07th of September

0730 – 0830	***Furnace Pre-Start Inspection*** *Mechanical Integrity Verification • Fuel System Inspection • Instrument & Control Checks • Burner Readiness Verification*
0830 – 0930	***Safe Furnace Start-Up Procedures*** *Purging Requirements • Pilot Ignition Sequence • Main Burner Light-Off Procedures • Temperature Ramp-Up Techniques*
0930 – 0945	*Break*
0945 – 1100	***Burner Operation & Flame Management*** *Flame Stability Principles • Flame Shape Optimization • Preventing Flame Impingement • Multiple Burner Balancing*
1100 – 1215	***Furnace Operating Parameters*** *Draft Control • Bridgewall Temperature Monitoring • Tube Metal Temperature Limits • Stack Temperature Optimization*
1215 – 1230	*Break*
1230 – 1330	***Furnace Shutdown Procedures*** *Planned Shutdown • Emergency Shutdown • Cooling Procedures • Post-Shutdown Inspection*
1330 – 1420	***Safe Operating Practices*** *Operating Limits • Alarm Response Procedures • Permit to Work (PTW) Requirements • Operator Rounds & Inspection Routines*
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: Tuesday, 08th of September

0730 – 0830	***Combustion Efficiency Optimization*** *Excess Oxygen Control • Air-to-Fuel Ratio Optimization • Flame Tuning Techniques • Fuel Consumption Reduction*
0830 – 0930	***Heat Transfer Optimization*** *Maximizing Radiant Heat Transfer • Improving Convection Efficiency • Tube Heat Absorption Optimization • Reducing Heat Losses*
0930 – 0945	*Break*

0945 – 1100	***Furnace Performance Indicators*** *Thermal Efficiency Calculations • Fuel Efficiency Benchmarking • Stack Loss Analysis • Energy Performance Indicators (KPIs)*
1100 – 1215	***Draft & Air Flow Optimization*** *Natural versus Forced Draft • Balanced Draft Operation • Damper Adjustment • Air Leakage Detection*
1215 – 1230	*Break*
1230 – 1330	***Emissions Control*** *NOx Formation Mechanisms • CO Emissions Reduction • Smoke & Opacity Control • Environmental Compliance*
1330 – 1420	***Advanced Furnace Optimization Techniques*** *Online Combustion Analyzers • Automated Combustion Control • Digital Performance Monitoring • Energy Management 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: Wednesday, 09th of September

0730 – 0830	***Furnace Inspection Techniques*** *External Visual Inspections • Internal Inspection Procedures • Tube Condition Assessment • Refractory Inspection Methods*
0830 – 0930	***Preventive & Predictive Maintenance*** *Maintenance Planning • Burner Maintenance • Instrument Calibration • Condition Monitoring Techniques*
0930 – 0945	*Break*
0945 – 1100	***Common Furnace Problems*** *Flame Instability • Burner Fouling • Tube Hot Spots • Draft Imbalance*
1100 – 1215	***Tube Failures & Damage Mechanisms*** *Overheating Failures • Creep Damage • Corrosion & Oxidation • Thermal Fatigue*
1215 – 1230	*Break*
1230 – 1330	***Refractory Failure Analysis*** *Cracking Mechanisms • Spalling & Erosion • Hot Spot Identification • Repair Methods*
1330 – 1420	***Root Cause Analysis & Troubleshooting*** *Systematic Troubleshooting Methodology • Failure Investigation Techniques • Corrective Action Planning • Lessons Learned Documentation*
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: Thursday, 10th of September

0730 – 0830	***Furnace Reliability Improvement*** *Reliability-Centered Maintenance (RCM) • Failure Prevention Strategies • Critical Equipment Management • Reliability Performance Metrics*
0830 – 0930	***Energy Conservation & Cost Optimization*** *Fuel Saving Opportunities • Waste Heat Recovery Systems • Air Preheater Optimization • Economic Performance Evaluation*

0930 – 0945	*Break*
0945 – 1100	***Operational Risk Management*** *Hazard Identification (HAZID) • Hazard & Operability Study (HAZOP) • Layers of Protection Analysis (LOPA) • Risk Mitigation Strategies*
1100 – 1230	***Emergency Response & Incident Management*** *Furnace Emergency Scenarios • Fire Response Procedures • Explosion Response Planning • Incident Reporting & Investigation*
1230 – 1245	*Break*
1245 – 1315	***Practical Furnace Performance Assessment Workshop*** *Combustion Tuning Exercises • Efficiency Calculation Workshop • Performance Data Interpretation • Troubleshooting Case Studies*
1315 - 1345	***Best Practices & Continuous Improvement*** *International Codes & Standards (API, NFPA, ASME, OSHA) • Operational Excellence Principles • Digitalization & Smart Furnace Technologies*
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*

Practical Sessions

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

Course Coordinator

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