

**COURSE OVERVIEW ME0718**  
**Shell and Tube Heat Exchangers-Mechanical**

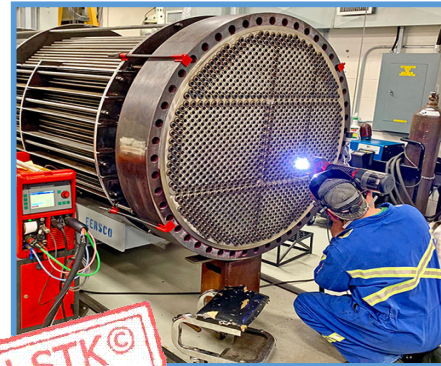
**Course Title**

Shell and Tube Heat Exchangers-Mechanical

**Course Date/Venue**

Session 1: February 16-20, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Session 2: August 18-22, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE



**Course Reference**

ME0718

**Course Duration/Credits**

Five days/3.0 CEUs/30 PDHs



**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.***



This course is designed to provide participants with a detailed and up-to-date overview of TEMA Shell & Tube Heat Exchanger. It covers the basic principles and functions of shell and tube heat exchanger; the TEMA (tubular exchanger manufacturers association) classifications and the application of different TEMA types in industry; the heat exchanger components, heat transfer principles flow arrangements and safety and operational considerations; the installation procedures, inspection techniques, pressure testing procedures and safety precautions; the common defects of corrosion, erosion, fouling, and scaling; and the crack detection, documentation and reporting of defects.



Further, the course will also discuss the maintenance schedule, predictive maintenance tools and technologies and cost-benefit analysis of preventive maintenance; the mechanical cleaning techniques and chemical cleaning processes; the tube cleaning tools and equipment; and maintaining tube bundle through proper removal and reinstallation procedures, inspection and repair of tube bundles and techniques for extending tube life.

During this interactive course, participants will learn the shell maintenance, internal and external cleaning, inspection and repair of shell components; the strategies for shell life extension and the causes and effects of fouling; the preventive measures and treatment options; monitoring fouling and maintaining efficiency; troubleshooting common issues, tube plugging and replacement, shell repairs, weld procedures, gasket replacement and flange maintenance; the heat exchanger performance, temperature and flow data; the detection of leaks, repairing leaks in tubes and shell and preventing future leaks; the emergency repairs, best practices in heat exchanger maintenance and continuous improvement strategies; the energy efficiency considerations, emerging technologies in maintenance and sustainability and environmental impact; and the maintenance risks, safety protocols, risk assessment and management tools.

### **Course Objectives**

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

- Apply and gain an in-depth knowledge on TEMA shell and tube heat exchanger
- Discuss the basic principles and functions of shell and tube heat exchangers
- Explain TEMA (tubular exchanger manufacturers association) classifications and the application of different TEMA types in industry
- Recognize heat exchanger components, heat transfer principles, flow arrangements and safety and operational considerations
- Apply installation procedures, inspection techniques, pressure testing procedures and safety precautions
- Identify the common defects of corrosion, erosion, fouling, and scaling and apply crack detection, documentation and reporting of defects
- Develop a maintenance schedule and carryout predictive maintenance tools and technologies and cost-benefit analysis of preventive maintenance
- Illustrate mechanical cleaning techniques and chemical cleaning processes as well as identify tube cleaning tools and equipment
- Maintain tube bundle through proper removal and reinstallation procedures, inspection and repair of tube bundles and techniques for extending tube life
- Apply shell maintenance, internal and external cleaning, inspection and repair of shell components and strategies for shell life extension
- Identify the causes and effects of fouling, apply preventive measures and treatment options and implement monitoring fouling and maintaining efficiency
- Document maintenance activities, track maintenance history and trends, utilize maintenance software and tools
- Employ troubleshooting common issues, tube plugging and replacement, shell repairs, weld procedures, gasket replacement and flange maintenance
- Assess heat exchanger performance, analyze temperature and flow data and make adjustments for optimal performance
- Implement methods for detecting leaks, repair leaks in tubes and shell and prevent future leaks

- Apply emergency repairs, best practices in heat exchanger maintenance and continuous improvement strategies
- Discuss energy efficiency considerations, emerging technologies in maintenance and sustainability and environmental impact
- Identify and mitigate maintenance risks and apply safety protocols and training, risk assessment and management tools

### **Exclusive Smart Training Kit - H-STK®**



*Participants of this course will receive the exclusive “Howard 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 TEMA shell and tube heat exchanger for boiler control system engineers, maintenance supervisors, instrumentation engineers and technicians, boiler plant commissioning engineers, operation, inspection and repair engineers and technicians, mechanical engineer and technicians and managers, project engineers, process engineers, plant and maintenance engineers and supervisors in the oil, chemical and other process industries who require an advanced knowledge of heat exchanger design, performance, inspection, maintenance and operation.

### **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 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:-

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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**. 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.

### Accommodation

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

### 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.



### 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 Process & Mechanical Engineer** with over **25 years** of extensive experience within the **Oil & Gas, Refinery, Petrochemical & Power** industries. His expertise widely covers in the areas of **Ammonia Manufacturing & Process Troubleshooting, Distillation Towers, Crude Oil Distillation, Fundamentals of Distillation for Engineers, Distillation Operation and Troubleshooting, Advanced Distillation Troubleshooting, Distillation Technology, Vacuum Distillation, Ammonia Storage & Loading Systems, Ammonia Plant Operation, Troubleshooting & Optimization, Ammonia Recovery, Ammonia Plant Safety, Hazard of Ammonia Handling, Storage & Shipping, Operational Excellence in Ammonia Plants, Fertilizer Storage Management**

(Ammonia & Urea), **Fertilizer Manufacturing Process Technology, Sulphur Recovery, Phenol Recovery & Extraction, Wax Sweating & Blending, Petrochemical & Fertilizer Plants, Nitrogen Fertilizer Production, Petroleum Industry Process Engineering, Refining Process & Petroleum Products, Refinery Planning & Economics, Safe Refinery Operations, Hydrotreating & Hydro-processing, Separators in Oil & Gas Industry, Gas Testing & Energy Isolations, Gas Liquor Separation, Industrial Liquid Mixing, Wax Bleachers, Extractors, Fractionation, Operation & Control of Distillation, Process of Crude ATM & Vacuum Distillation Unit, Water Purification, Water Transport & Distribution, Steam & Electricity, Flame Arrestors, Coal Processing, Environmental Emission Control, R&D of Wax Blending, Wax Molding/Slabbing, Industrial Drying, Principles, Selection & Design, Certified Process Plant Operations, Control & Troubleshooting, Operator Responsibilities, Storage Tanks Operations & Measurements, Process Plant Troubleshooting & Engineering Problem Solving, Process Plant Performance, Efficiency & Optimization, Continuous Improvement & Benchmarking, Process Troubleshooting Techniques, Oil & Gas Operation/Introduction to Surface Facilities, Pressure Vessel Operation, Process Equipment Performance & Troubleshooting, Plant Startup & Shutdown, Startup & Shutdown the Plant While Handling Abnormal Conditions, Flare & Relief System, Process Gas Plant Start-up, Commissioning & Problem Solving, Process Liquid and Process Handling & Measuring Equipment. Further, he is also well-versed in **Compressors & Turbines Operation, Maintenance & Troubleshooting, Heat Exchanger Overhaul & Testing Techniques, Balancing of Rotating Machinery (BRM), Pipe Stress Analysis, Valves & Actuators Technology, Inspect & Maintain Safeguarding Vent & Relief System, Certified Inspectors for Vehicle & Equipment, Optimizing Equipment Maintenance & Replacement Decisions, Certified Maintenance Planner (CMP), Certified Planning and Scheduling Professional (AACE-PSP), Tank Design, Construction, Inspection & Maintenance, Material Cataloguing, Specifications, Handling & Storage, Steam Trap Design, Operation, Maintenance & Troubleshooting, Steam Trapping & Control, Column, Pump & Exchangers, Troubleshooting & Design, Rotating Equipment Operation & Troubleshooting, Control & ESD System, Detailed Engineering Drawings, Codes & Standards, Budget Preparation, Allocation & Cost Control, Root Cause Analysis (RCA), Production Optimization, Permit to Work (PTW), Project Engineering, Data Analysis, Process Hazard Analysis (PHA), HAZOP Study, Sampling & Analysis, Training Analysis, Job Analysis Techniques, Storage & Handling of Toxic Chemicals & Hazardous Materials, Hazardous Material Classification & Storage/Disposal, Dangerous Goods, Environmental Management System (EMS), Supply Chain, Purchasing, Procurement, Logistics Management & Transport & Warehousing & Inventory, Risk Monitoring Authorized Gas Tester (AGT), Confined Space Entry (CSE), Personal Protective Equipment (PPE), Fire & Gas, First Aid and Occupational Health & Safety.****

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>Introduction to Shell &amp; Tube Heat Exchangers</b> Overview of Heat Exchanger Types • Basic Principles & Functions • Importance in Petrochemical Processes
0930 – 0945	Break
0945 – 1030	<b>TEMA Standards &amp; Classifications</b> TEMA (Tubular Exchanger Manufacturers Association) Classifications • Understanding TEMA Types (A, B, C, Etc.) • Application of Different TEMA Types in Industry
1030 – 1130	<b>Heat Exchanger Components</b> Shell, Tube Bundle, Baffles, & Supports • Material Selection for Components • Design Considerations
1130 – 1215	<b>Heat Transfer Principles</b> Conduction, Convection, & Radiation • Heat Transfer Coefficients & Their Significance • Calculations for Heat Exchange Efficiency
1215 – 1230	Break
1230 – 1330	<b>Flow Arrangements</b> Parallel Flow, Counterflow, & Crossflow • Impact on Heat Exchanger Performance • Selection Criteria for Different Flow Arrangements
1330 – 1400	<b>Safety &amp; Operational Considerations:</b> Safety Protocols & Best Practices • Common Operational Issues & Troubleshooting • Introduction to Maintenance Strategies
1420 – 1430	<b>Recap</b>
1430	End of Day One

**Day 2**

0730 – 0830	<b>Installation Procedures</b> Site Preparation & Pre-Installation Checks • Installation Steps & Guidelines • Alignment & Support Requirements
0830 – 0930	<b>Inspection Techniques</b> Visual Inspections & Checklists • Non-Destructive Testing Methods (NDT) • Frequency & Scheduling of Inspections
0930 – 0945	Break
0945 – 1100	<b>Pressure Testing</b> Types of Pressure Tests (Hydrostatic, Pneumatic) • Testing Procedures & Safety Precautions • Interpreting Test Results
1100 – 1215	<b>Common Defects &amp; Their Identification</b> Corrosion, Erosion, Fouling, & Scaling • Crack Detection & Material Fatigue • Documentation & Reporting of Defects
1215 – 1230	Break





1230 – 1300	<b>Preventive Maintenance Planning</b> Developing a Maintenance Schedule • Predictive Maintenance Tools & Technologies • Cost-Benefit Analysis of Preventive Maintenance
1300 - 1420	<b>Case Studies</b> Real-World Examples of Installation & Inspection • Lessons Learned & Best Practices • Group Discussion & Q&A
1420 – 1430	<b>Recap</b>
1430	End of Day Two

**Day 3**

0730 – 0830	<b>Cleaning Methods</b> Mechanical Cleaning Techniques • Chemical Cleaning Processes • Advantages & Disadvantages of Each Method
0830 – 0930	<b>Tube Cleaning Tools &amp; Equipment</b> Types of Tube Cleaners • Safe Handling & Operation • Selection Criteria for Cleaning Tools
0930 – 0945	Break
0945 – 1100	<b>Maintenance of Tube Bundle</b> Removal & Reinstallation Procedures • Inspection & Repair of Tube Bundles • Techniques for Extending Tube Life
1230 – 1300	<b>Shell Maintenance</b> Internal & External Cleaning • Inspection & Repair of Shell Components • Strategies for Shell Life Extension
1215 – 1230	Break
1100 – 1215	<b>Dealing with Fouling</b> Causes & Effects of Fouling • Preventive Measures & Treatment Options • Monitoring Fouling & Maintaining Efficiency
1215 – 1230	Break
1300 - 1420	<b>Maintenance Record Keeping</b> Documentation of Maintenance Activities • Tracking Maintenance History & Trends • Utilizing Maintenance Software & Tools
1420 – 1430	<b>Recap</b>
1430	End of Day Three

**Day 4**

0730 – 0830	<b>Troubleshooting Common Issues</b> Diagnosing Performance Problems • Identifying Root Causes • Step-By-Step Troubleshooting Process
0830 – 0930	<b>Repair Techniques</b> Tube Plugging & Replacement • Shell Repairs & Weld Procedures • Gasket Replacement & Flange Maintenance
0930 – 0945	Break
0945 – 1100	<b>Thermal Performance Analysis</b> Assessing Heat Exchanger Performance • Analyzing Temperature & Flow Data • Making Adjustments for Optimal Performance
1100 – 1215	<b>Leak Detection &amp; Repair</b> Methods for Detecting Leaks • Repairing Leaks in Tubes & Shell • Preventing Future Leaks
1215 – 1230	Break





1230 - 1300	<b>Emergency Repairs</b> Rapid Response to Critical Failures • Temporary versus. Permanent Repair Solutions • Coordination with Operational Teams
1300 - 1420	<b>Case Studies &amp; Problem-Solving</b> Detailed Case Studies of Troubleshooting & Repair • Group Exercises & Simulations • Q&A Session
1420 - 1430	<b>Recap</b>
1430	End of Day Four

**Day 5: Friday 26<sup>th</sup> of September 2024**

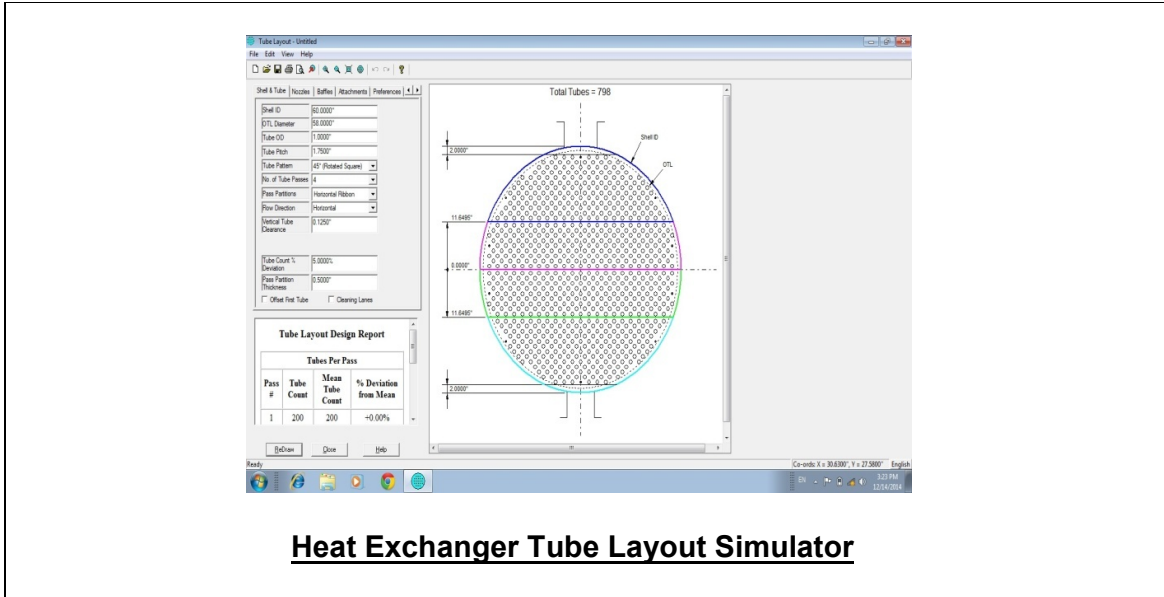
0730 - 0830	<b>Best Practices in Heat Exchanger Maintenance</b> Industry Standards & Guidelines • Maintenance Planning & Execution • Continuous Improvement Strategies
0830 - 0930	<b>Energy Efficiency Considerations</b> Impact of Maintenance on Energy Efficiency • Techniques for Improving Efficiency • Monitoring & Optimizing Performance
0930 - 0945	Break
0945 - 1130	<b>Emerging Technologies in Maintenance</b> Advances in NDT & Inspection Tools • Innovative Cleaning & Repair Techniques • Automation & Digital Solutions
1130 - 1230	<b>Sustainability &amp; Environmental Impact</b> Environmental Considerations in Maintenance • Reducing Emissions & Waste • Sustainable Maintenance Practices
1230 - 1245	Break
1245 - 1345	<b>Risk Management</b> Identifying & Mitigating Maintenance Risks • Safety Protocols & Training • Risk Assessment & Management Tools
1345 - 1400	<b>Course Conclusion</b>
1400 - 1415	<b>POST-TEST</b>
1415 - 1430	Presentation of Course Certificates
1430	End of Course





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

Practical sessions 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 “Heat Exchanger Tube Layout”.



**Heat Exchanger Tube Layout Simulator**

**Course Coordinator**

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