



## COURSE OVERVIEW ME0062-4D Heat Exchanger Design, Operation, Performance, Inspection, Maintenance & Repair

### Course Title

Heat Exchanger Design, Operation, Performance, Inspection, Maintenance & Repair

### Course Reference

ME0062-4D

### Course Duration/Credits

Four days/2.4 CEUs/24 PDHs

### Course Date/Venue



Session(s)	Date	Venue
1	January 15-18, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	March 04-07, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
3	June 10-13, 2024	Cheops Meeting Room, Radisson Blu Hotel, Istanbul Sisli, Turkey, Istanbul Turkey
4	September 23-26, 2024	Jubail Hall, Signature Al Khobar Hotel, Al Khobar, KSA

### 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.***



The design, performance and operation of modern heat exchangers require an understanding of the principles of heat transfer and fluid flow, coupled with access to numerically based techniques and supporting data.



This course will review heat transfer fundamentals as applied to tubular and plate devices. Included will be sessions on the practical aspects of shell and tube heat exchanger design with ASME and TEMA codes.

Upon completion of this course, delegates will gain an understanding of the basic principles of heat transfer and fluid flow and their application to the design, operation and maintenance of shell and tube heat exchangers as well as compact and air cooled heat exchangers.

Participants will gain an understanding of TEMA and ASME codes and learn how to numerically analyze the different heat exchanger configurations. Attention will be paid to the recognition and solving of a wide variety of industrial problems, taking existing case studies.





The course will also address the ways in which systematic techniques of inspection and maintenance (including Fouling Control) can alleviate major problem areas. Further, the course will explain the Energy Balance in Heat Exchangers and discuss the new technologies of Heat Transfer and heat exchanger within the industry.

There will be troubleshooting workshops devoted to the discussion of regularly occurring heat exchanger problems, performance assessment and methods to improve the overall thermal efficiencies of these devices.

The course will also cover current methods of inspection and maintenance.

### Course Objectives

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

- Design, operate, inspect, maintain and repair heat exchangers and analyse their performance in a professional manner
- Employ the concepts of heat transfer coefficients and determine their overall effect on heat exchanger fouling
- Differentiate between the various types of heat exchangers and learn more of their industrial features and other relevant information
- Discuss the industrial features and other information that explain distributed types in relation to power cycles, distillation, recuperators and regenerators
- Carryout heat exchanger analysis for counter flow, cross flow and multipass heat exchangers and to apply the well-known correction factors
- Conduct a heat energy balance for different types of counter flow heat exchangers
- Practice the process of heat exchanger selection for a given application and its costing in line with the advantages and disadvantages of its types and scopes of its applications
- Determine the cooling performance of a range of heat exchangers, including an automotive/industrial compact radiator
- Establish insights on the effectiveness/NTU method for heat exchanger analysis in terms of capacity ratios
- Interpret TEMA standards and terminologies for present-day shell and tube heat exchangers
- Enhance comprehension of the practices and principles of heat exchanger maintenance and inspection techniques with its common inspection tools and codes

### 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, 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 a wider and deeper appreciation of heat exchanger design, performance, inspection, maintenance and operation in the oil, chemical and other process industries. Project engineers, process engineers, plant and maintenance engineers and supervisors will gain an excellent numerical problem solving skills in the practical approach of the course. The course is also useful to those generally knowledgeable on the subject, but who may require a refresher or update. No prior knowledge of heat transfer is required. Participants will be taken through an intensive primer of heat transfer principles as they apply to shell and tube heat exchangers.

**Training Methodology**

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Workshops & Work Presentations
- 30% Case Studies & Practical Exercises
- 20% Software, Simulators & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

**Course Fee**

Al Khobar	<b>US\$ 4,500</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.
Istanbul	<b>US\$ 5,000</b> per Delegate + <b>VAT</b> . This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	<b>US\$ 4,500</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\$ 4,500</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.

**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**

Certificates are accredited by the following international accreditation organizations:-

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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.

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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.



### 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. Ahmed Mady** is a **Senior Mechanical Engineer** and **Project Manager** with over **40 years** of practical experience. His experience covers **Pump Selection, Installation, Performance & Control, Pump & Valve Operation, Control, Maintenance & Troubleshooting, Aviation Fueling Operations, Pumps, Compressors & Turbines Selection, Operation, Heat Exchanger Design, Operation, Performance, Inspection, Maintenance & Repair, Steam Boilers Operation, Maintenance and Control System, Heat Exchangers Operations, Maintenance & Troubleshooting, Water Tanks Filling Station Operation, Water Pipes Inspection & Repair, Water Treatment Technology, RO Plants, MSF Plants, Industrial Water Treatment, Piping System, Water Filtering, Pump Selection, Installation, Performance & Control, Compressors & Turbines Selection & Operation, Heat Exchangers Design & Selection, TEMA & ASME Section VIII Requirements, Steam Boilers Operation & Maintenance, Valve Operation & Troubleshooting, Aviation Fueling Operations, Maintenance Management, Reliability Engineering, Maintenance Auditing, Reliability Centered Maintenance, Maintenance Benchmarking, Maintenance Planning, Root Cause Failure Analysis, Lubrication Technology, Cost Control & Performance Improvement.**

Mr. Ahmed has travelled all over **Europe, Asia** and the **Americas** joining numerous conferences and workshops with international companies such as **IBM, System Science Corporation (SSC)** and **International Air Transport Association (IATA)**.

Earlier in his career, he had occupied several challenging roles with several large Logistics and maintenance companies as a **Maintenance Manager, Maintenance Engineer, Logistics Planning Branch Chief, Commander** of the Air Force Logistics, **Systems Analyst, Training Branch Chief, Systems & Communication Engineer** and **Computer Programmer**.

Mr. Ahmed has a **Bachelor** degree in **Mechanical Engineering** and a **Certified Trainer/Instructor**. Further, he has gained **Diplomas** on **Civil Aviation Engineering, Islamic Studies** and **Information Systems & Technology**. Moreover, he is a **Certified Internal Verifier** by **City & Guilds Level 4 Certificate** in **Leading the Internal Quality Assurance of Assessment Processes & Practice** under the **IQA Qualification (Internal Quality Assurance)** and a **Certified Assessor** by **City & Guilds Level 3 Certificate** in **Assessing Vocational Achievement** under the **TAQA Qualification (Training, Assessment & Quality Assurance)** and a **Certified Trainer/Assurance/Internal Verifier** of the **British Institute of Leadership & Management (ILM), UK**. Further, he has delivered numerous trainings, workshops and conferences and projects worldwide.





**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 - 0900	<b>Introduction &amp; Definition of Heat Transfer Coefficients</b> Conduction • Convection • Overall Heat Transfer • Logarithmic Temperature Differences • Correction Factors • Fouling • Effectiveness
0900 - 0930	<b>Types of Heat Exchangers</b> Double-Pipe • Parallel-Flow and Counter-Flow • Compact • Shell and Tube • Plate and Frame • Regenerative • Condensers • Boilers • Space Radiators • Addition of Fins
0930 - 0945	Break
0945 - 1030	<b>Worked Examples</b> Calculation of Overall Heat Transfer Coefficient for a Heat Exchanger • Effect of Fouling on the Overall Heat Transfer Coefficient • Introduction to Condensation of Steam in a Condenser
1030 - 1130	<b>Industrial Features and Additional Information</b> Industrial Distribution of Different Types • Condensation, Evaporation, Heat Recovery, Heat Rejection • Power Cycles, Distillation, Recuperators, Regenerators
1130 - 1230	<b>Heat Exchanger Analysis in Detail</b> Logarithmic Mean Temperature Difference Method • Effectiveness- NTU Method
1230 - 1245	Break
1245 - 1420	<b>Counter Flow, Cross Flow &amp; Multipass Heat Exchangers</b> Application of Correction Factors • Worked Example
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>Heat Exchanger Energy Balance</b> Pre-heat Calculations • Energy Moduling
0930 - 0945	Break
0945 - 1030	<b>Counter Flow Heat Exchanger</b> Worked Example for Double-Pipe Arrangement
1030 - 1130	<b>Heat Exchanger Selection for a Given Process</b> Course and Fine Filters • General Points on Material Selection and Pressures • Thermal Effectiveness • Advantages and Disadvantages of Double-Pipe Arrangements and Scope of Application • Common Materials Used • Shell and Tube Heat Exchangers
1130 - 1230	<b>Heat Exchanger Selection for a Given Process (cont'd)</b> Plate and Frame Heat Exchangers • Advantages and Disadvantages of these Types and Scopes of Application • Air-Cooled Heat Exchangers • Plate-fin heat Exchangers • Printed Circuit Heat Exchangers • Advantages and Disadvantages of these Types and Scopes of Application





1230 - 1245	Break
1245 - 1345	<b>Heat Exchanger Costing</b> Scoping • Quick-sizing • Correction Factors • Estimation of the Overall Heat Transfer Coefficient • Estimating Cost • ESDU Data • Logarithmic Interpolation • Worked Example
1345 - 1420	<b>Multipass Heat Exchanger</b> Worked Examples in Determining Heat Transfer Rate With and Without Effects of Fouling
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 Two

**Day 3**

0730 - 0830	<b>Problem Session</b> Numerical Exercise on Multipass Heat Exchangers
0830 - 0930	<b>Cooling of an Automotive/Industrial Compact Radiator</b> Determination of Overall Heat Transfer Coefficient
0930 - 0945	Break
0945 - 1030	<b>Effectiveness/NTU Method for Heat Exchanger Analysis</b> Heat Transfer Effectiveness, Capacity Ratios • Worked Examples
1030 - 1130	<b>Upper Limit of Heat Transfer in a Heat Exchanger</b> Counter Flow Heat Exchanger • Effectiveness as a Function of NTU • Worked Examples
1130 - 1230	<b>Shell &amp; Tube Heat Exchangers</b> Heat Exchanger Inspection • Scope • Construction • TEMA Standards and Terminologies • Fluid Allocation • Design Problems, Design Enhancement • Examples
1230 - 1245	Break
1245 - 1345	<b>Heat Exchanger Maintenance</b> Planning • Precautions Required • Plugging • Ferruling • Sleeving • Shell Side Repairs • Retubing
1345 - 1420	<b>Fouling Control of Heat Exchanger</b>
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 Three

**Day 4**

0730 - 0930	<b>Heat Exchanger Inspection Techniques</b> Visual, NDT • Common Failures • Inspection Tools • Inspection Codes
0930 - 0945	Break
0945 - 1030	<b>Design of Shell &amp; Tube Heat Exchangers</b> Achievement of Duty Required • Developing Design Envelope • Choosing the Best Design • Pressure Drop and Tube Vibration Issues
1030 - 1130	<b>Worked Example on a Multipass Heat Exchanger</b> Determination of Heat Transfer and Outlet Stream Temperatures
1130 - 1230	<b>New Technology in Heat Exchanger</b>





1230 – 1245	Break
1245 - 1345	<b>Final Discussions</b>
1345 - 1400	<b>Course Conclusion</b> Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & 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**

Kamel Ghanem, Tel: +971 2 30 91 714, Email: [kamel@haward.org](mailto:kamel@haward.org)