COURSE OVERVIEW ME0515-4D
Chiller & Chiller Plant Design, Installation, Maintenance & Troubleshooting

Course Title
Chiller & Chiller Plant Design, Installation, Maintenance & Troubleshooting

Course Date/Venue
Septemebr 02-05, 2024/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

2.4 CEUs (24 PDHs) AWARD

Course Reference
ME0515-4D

H-STK© INCLUDED

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Description

This practical and highly-interactive course includes 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 chiller and chiller plant design, installation, maintenance and troubleshooting. It covers the primary system components; the application considerations, chiller design and chilled-water system variations; the system issues and challenges; the chiller problems and chiller control systems; the chiller servicing and safety; and the chiller installation, operation, testing, maintenance and preventive maintenance.

During this interactive course, participants will learn the chiller fault finding, troubleshooting, visual inspection, measurement, faults-improper adjustments and setting; the cause and effect diagram, troubleshooting tools, typical malfunctions and possible causes; the cooling tower types and performance; the efficient system operation; the flow-control strategies and energy saving opportunities; the cooling towers assessment and energy efficiency opportunities; the option checklist, worksheets and references; the principle of operation, application, design conditions and performance curves; the different types of cooling towers and thermal performance evaluation; and the materials of construction, cooling tower theory, selection considerations and tower coefficients.

Course Objectives

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

- Design, install, maintain and troubleshoot chillers and chiller plant in a professional manner
- Identify the primary system components comprising of chiller, loads, chilled-water distribution system, condenser, water system and unit-level controls
- Explain application considerations and describe chiller design and chilled-water system variations
- Recognize system issues and challenges covering low ΔT syndrome, amount of fluid in the loop, contingency, alternative energy sources, plant expansion, retrofit opportunities and applications outside the chiller's range
- Identify chiller problems and chiller control systems
- Employ chiller servicing and safety that include safety and regulations-handling refrigerants, handling of pressure containers, changing the compressor, adding oil to the compressor, etc.
- Carryout chiller installation, operation, testing and maintenance
- Implement preventive maintenance, inspection checklist and operating log
- Perform chiller fault finding, troubleshooting, visual inspection, measurement, faults-improper adjustments and setting
- Illustrate cause and effect diagram, use troubleshooting tools and identify the typical malfunctions and possible causes
- Evaluate cooling tower types and performance and apply efficient system operation
- Employ flow-control strategies and recognize energy saving opportunities
- Assess cooling towers and identify energy efficiency opportunities, option checklist, worksheets and references
- Explain the principle of operation, application, design conditions and performance curves
- Recognize the different types of cooling towers and evaluate their thermal performance
- Identify the materials of construction as well as explain the cooling tower theory, selection considerations and tower coefficients

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, 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 an overview of all significant aspects and considerations of the design, installation, maintenance and troubleshooting of chillers for HVAC engineers, utilities managers, maintenance/plant managers, mechanical engineers, electrical engineers design engineers, consulting engineers, inspection and repair engineers, operation, maintenance, managers, superintendents, supervisors, and other technical staff.

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:-

- 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.

- 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 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.

Accommodation

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

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.

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 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: ***Monday, 02nd of September 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Primary System Components*** *Chiller • Loads • Chilled-Water Distribution System • Condenser • Water System • Unit-Level Controls*
0930 - 0945	*Break*
0945 – 1100	***Application Considerations*** *Small Chilled-Water Systems (1-2 chillers) • Mid-Sized Chilled-Water Systems (3-5 Chillers) • Large Chilled-Water Systems (6+ Chillers, District Cooling) • Chiller Plant System Performance*
1100 – 1200	***Chiller Design*** *Types of Chillers • Vapor-Compression Cycle • Variable-Speed Drives • Packaged Air-Cooled Chiller • Absorption Refrigeration Cycle • Chilled-Water System Components • Single-Chiller Systems • Multiple-Chiller Systems*
1200 – 1215	*Break*
1215 – 1420	***Chilled-Water System Variations*** *Heat Recovery • Condenser "Free Cooling" or Water Economizer • Preferential Loading • Series–Counterflow Application • Unequal Chiller Sizing*
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:	Tuesday, 03rd of September 2024
0730 – 0930	***System Issues & Challenges*** *Low ΔT Syndrome • Amount of Fluid in the Loop • Contingency • Alternative Energy Sources • Plant Expansion • Retrofit Opportunities • Applications Outside the Chiller's Range*
0930 – 0945	*Break*
0945 – 1100	***Chiller Problems*** *Introduction • Scale Control • Corrosion Control • Blowdown–Intential Water Loss from Cooling Systems*
1100 – 1200	***Chiller Problems (cont'd)*** *Chemical Scale Inhibitor Use • Biological Control–Biocide Dangers*
1200 – 1215	*Break*
1215 – 1420	***Chiller Control Systems*** *Understand the Concept of Control • Types of Control • Elements of Control • Methods of Control • Instrumentation*
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*

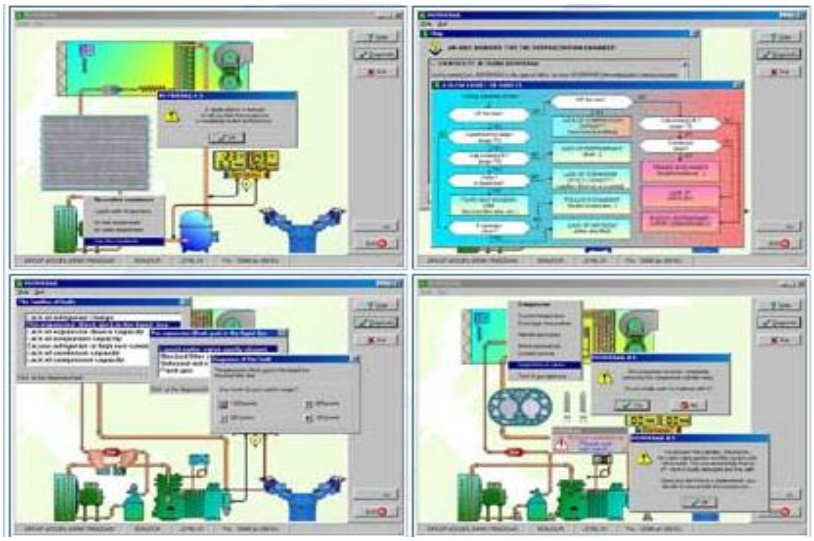
Day 3:	Wednesday, 04th of September 2024
0730 – 0930	***Chiller Servicing & Safety*** *Safety and Regulations-Handling Refrigerants, Handling of Pressure Containers • Changing the Compressor • Adding Oil to the Compressor • Replacing the Air Cooled Condenser • Changing the Evaporator*
0930 – 0945	*Break*
0945 – 1100	***Chiller Servicing & Safety (cont'd)*** *Air Purging • Pump Down of the Refrigeration System • Leakage Test • System Check • Cleaning-Air Cooled Containers, Evaporative Condensers • Evacuating Procedure*
1100 – 1200	***Chiller Installation, Operation, Testing & Maintenance*** *Installation Guidelines • Commissioning • Air Volume Measurements • Balancing Procedures • Air Balancing • Commissioning Report • Maintenance-Coils, Air-Cooled Condensers, Cooling Towers, Fans*
1200 – 1215	*Break*
1215 – 1420	***Preventive Maintenance*** *Inspection Checklist • Operating Log*
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, 05th of September 2024

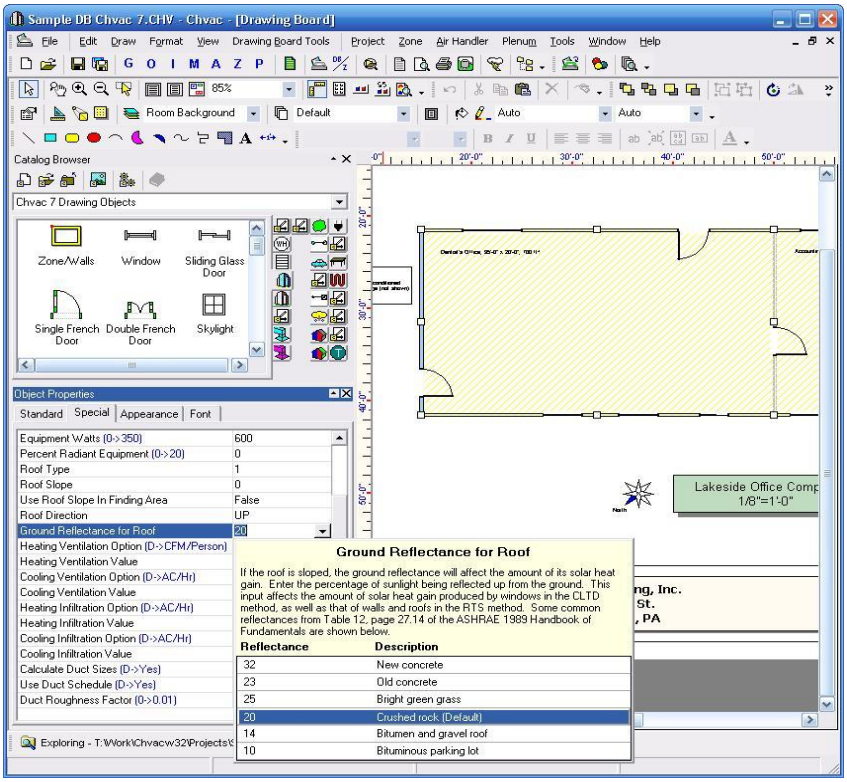
0730 – 0930	***Chiller Fault Finding & Troubleshooting*** *Introduction • Requirements • Troubleshooting Procedures-Refrigerant, Plant Layout, Visual Inspection, Measurement • Faults-Improper Adjustments and Setting, Poor Design and Installation, Equipment Failure, Limitations in Operation*
0930 – 0945	*Break*
0945 – 1100	***Chiller Fault Finding & Troubleshooting (cont'd)*** *Troubleshooting Guide to Electrical Faults • Finding Electrical Faults • Troubleshooting Skills • Cause and Effect Diagram • Troubleshooting Tools • Typical Malfunctions and Possible Causes*
1100 – 1200	***Cooling Towers*** *Types and Performance Evaluation • Efficient System Operation • Flow-Control Strategies and Energy Saving Opportunities • Assessment of Cooling Towers • Energy Efficiency Opportunities • Option Checklist • Worksheets • References • Principle of Operation*
1200 – 1215	*Break*
1215 – 1345	***Cooling Towers (cont'd)*** *Application • Design Conditions • Performance Curves • Types of Cooling Towers • Cooling Tower Thermal Performance • Materials of Construction • Cooling Tower Theory • Selection Considerations • Tower Coefficients*
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*

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 state-of-the-art simulator "KOTZA HVAC Simulator", "Elite CHVAC Simulator", "Danfoss Refrigerant Slider App", "Danfoss Trouble Shooter App" and "Air Lite Psychrometric Calcs".



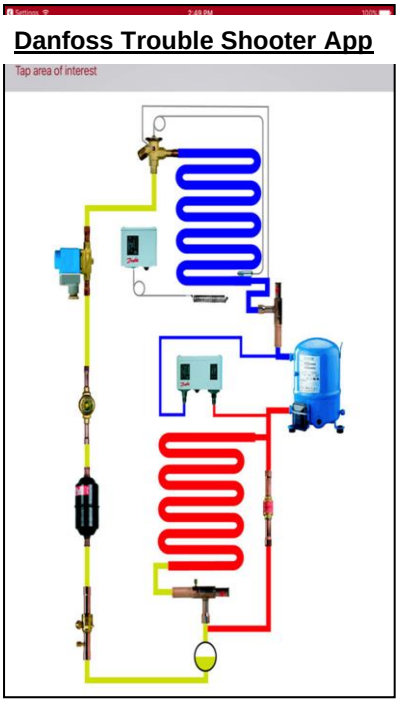
KOTZA HVAC Simulator

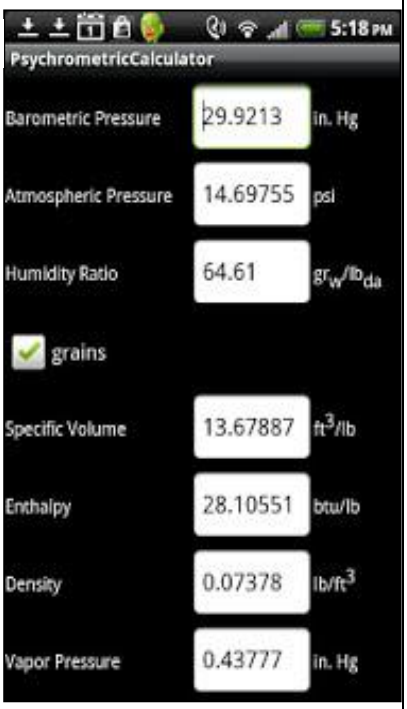


Elite CHVAC Simulator

Danfoss Refrigerant Slider App

Danfoss Trouble Shooter App





Course Coordinator

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