

**COURSE OVERVIEW ME0015**  
**Centrifugal Compressor & Steam Turbine Design, Performance, Operation, Maintenance & Troubleshooting**

**Course Title**

Centrifugal Compressor & Steam Turbine Design, Performance, Operation, Maintenance & Troubleshooting

**Course Reference**

ME0015

**Course Duration/Credits**

Five days/3.0 CEUs/30 PDHs

**Course Date/Venue**

Session(s)	Dates	Venue
1	April 20-24, 2025	Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA
2	July 06-10, 2025	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
3	October 06-10, 2025	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE



**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.***



Centrifugal Compressors and Mechanical Drive Steam Turbines are used extensively in the process industries. There are many types with widely varying configurations and applications. Compressors and steam turbines represent a significant part of the capital and operating costs of most plants, and optimizing their selection is therefore, of major economic importance.



The course deals with design features, efficiencies, operating characteristics, reliability and maintenance implications of centrifugal compressors and their steam turbine drivers.

The course will cover the operating principles of centrifugal compressors and steam turbines, specifications, their design, thermodynamics, effects of efficiency on operating costs, energy usage, and effect on plant costs, materials of construction, selection, troubleshooting and maintenance.

The course will also cover plant run-length extension surveys, organizing for successful turnarounds and on-going reliability improvement, and preventive vs. predictive maintenance strategy decisions.

The course will provide the participant with a basic as well as advanced centrifugal compressor and steam turbine technology knowledge inventory required to successfully select, apply, operate, troubleshoot and maintain compression and steam turbine equipment.

Upon completion of this course, participants will have gained a thorough understanding of the various centrifugal compressor and steam turbine configurations available to most industrial users, including mechanical design features, sizing and application criteria, maintainability, reliability, vulnerability and troubleshooting issues. Participants will learn simple techniques and short-cut methods of machinery sizing and selection. This replaces tedious hand or other methods of calculation and will serve as a fast way to arrive at sensitivity or influence of parameter changes on equipment performance.

Participants will be able to determine the most appropriate and efficient matching of steam turbine drivers to compressors. Participants will also acquire knowledge of operating and maintenance issues by getting to know mechanical design, machinery components, connecting piping design as well as proven approaches to monitoring, troubleshooting and maintaining compressor installations.

### **Course Objectives**

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

- Apply a comprehensive knowledge in the mechanical design, performance, operation, maintenance and troubleshooting of centrifugal compressor and steam turbine
- Illustrate the different alignment techniques and support criteria for centrifugal compressor and steam turbines
- Describe parameters of thermodynamics, capacity, power, efficiency, gas properties and intercooling for turbocompressors
- Select centrifugal process compressors by utilizing calculation methods, characteristic curves and stability criteria
- Employ the proper procedure for compressor train inspection, maintenance, overhaul and repair
- Explain in detail the mechanical design, configurations, application ranges and constraints for steam turbines
- Identify the different turbine components which include turbine rotors, balancing, rotor dynamics, casings, bearings, shaft sealing devices and lube oil management
- Perform the selection and sizing of steam turbines for compressor drives and recognize the operation and maintenance of steam turbines
- Emphasize approaches to machinery troubleshooting, cite examples from recent failure incidents attributed to design defects and maintenance deficiencies
- Explain the difference between predictive and preventive maintenance techniques and determine which method to use
- Carryout machinery reliability audits and reviews as well as recognize the importance of reliability enhancement efforts

**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 centrifugal compressor & steam turbine for those directly involved in the design, performance, operation, maintenance and troubleshooting of such equipment. This course is also intended for rotating equipment and machinery engineers, plant and maintenance engineers and other technical staff involved in turbomachinery management, operation and maintenance. Further, it is suitable for operations, process and process unit contact, mechanical and project engineers.

**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.

**Accommodation**

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

**Course Fee**


Al Khobar	<b>US\$ 5,500</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\$ 5,500</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\$ 5,500</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.

**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 **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.

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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. 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, Process Safety Design, Certified Process Plant Operations, Control & Troubleshooting, Operator Responsibilities, Storage Tanks Operations & Measurements, Tank Design, Construction, Inspection & Maintenance, Atmospheric Tanks, 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, Plant & Equipment Integrity, 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), Material Cataloguing, Specifications, Handling & Storage, Steam Trap Design, Operation, Maintenance & Troubleshooting, Steam Trapping & Control, Column, Pump Technology, Pump Selection & Installation, Centrifugal Pumps Troubleshooting, Pumps Design, Selection & Operation, 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 Compressor Types</b> Centrifugal • Axial • Reciprocating • Helical Screw • Ranges of Application and Limitations
0930 – 0945	Break
0945 – 1100	<b>Mechanical Design of Centrifugal Compressors</b> Compressor Side Streams • Rotors • Balancing
1100 – 1215	<b>Mechanical Design of Centrifugal Compressors (cont'd)</b> Rotor Dynamics • Impellers • Casings
1215 – 1230	Break
1230 – 1420	<b>Mechanical Design of Centrifugal Compressors (cont'd)</b> Bearings • Seals • Couplings • Controls
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day One

**Day 2**

0730 – 0930	<b>Alignment Techniques &amp; Support Criteria</b> Review of Dial Indicator Methods • Laser Optic Cold Alignment • On-Stream (Hot) Alignment Verification Techniques
0930 – 0945	Break
0945 – 1100	<b>Basic Compressor Parameters</b> Thermodynamics • Capacity • Power • Efficiencies • Gas Properties • Intercooling
1100 – 1215	<b>Selection of Centrifugal Process Compressors</b> Calculation Methods • Characteristic Curves • Stability
1215 – 1230	Break
1230 – 1420	<b>Compressor Train Inspection, Maintenance, Overhaul &amp; Repair-IMO&amp;R</b> IMO&R Planning • Execution • Documentation
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Two

**Day 3**

0730 – 0930	<b>Compressor Train Inspection, Maintenance, Overhaul &amp; Repair-IMO&amp;R (cont'd)</b> IMO&R • Q & As • Troubleshooting
0930 – 0945	Break
0945 – 1100	<b>Steam Turbines</b> Operating Principles & Mechanical Design • Impulse Turbines • Reaction Turbines
1100 – 1215	<b>Steam Turbines (cont'd)</b> Application Ranges • Configurations • Application Constraints



1215 – 1230	Break
1230 – 1420	<b>Turbine Components</b> Turbine Rotors • Blading • Diaphragms • Nozzles • Steam Chests • Glands & Gland Systems • Bearings
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**

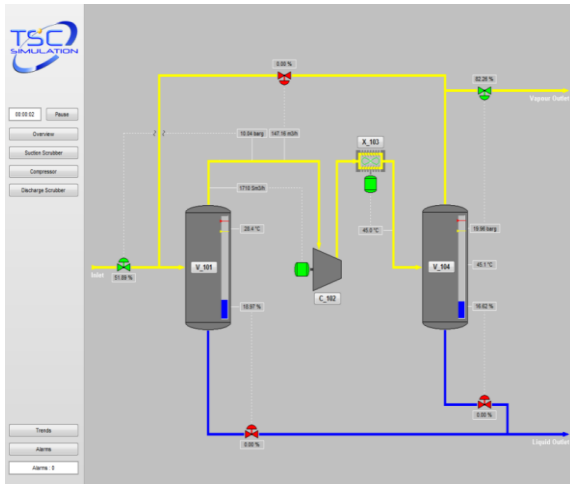
0730 – 0930	<b>Turbine Components (cont'd)</b> Balancing • Rotor Dynamics • Governing Systems • Lube Oil Management
0930 – 0945	Break
0945 – 1100	<b>Selection &amp; Sizing of Steam Turbines for Compressor Drives</b> Steam (Water) Rates • Condensing and Backpressure Turbines • Single and Multistage Types • Process Considerations
1100 – 1215	<b>Operation &amp; Maintenance of Steam Turbines</b> Commissioning • Startup • Run-In & Shut-down • Surveillance & Health Monitoring • Performance Measurement • Monitoring and Tracking
1215 – 1230	Break
1230 – 1420	<b>Operation &amp; Maintenance of Steam Turbines (cont'd)</b> Steam Turbine Washing • Steam Turbine Inspection • Maintenance Overhaul & Repair (IMO&R)
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 Four

**Day 5**

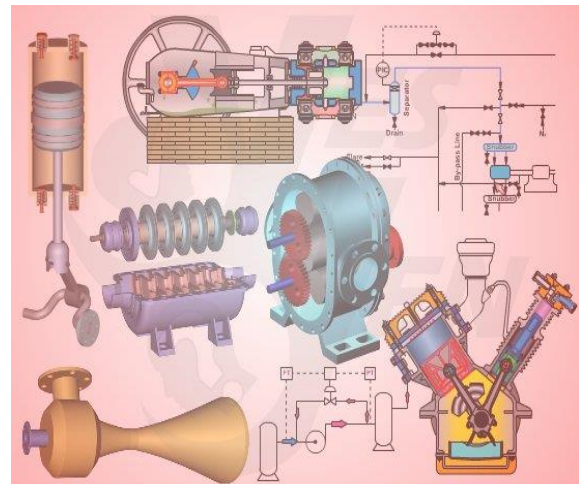
0730 – 0930	<b>Basic Approaches to Machinery Troubleshooting</b> Examples from Recent Failure Incidents Attributed to Design Defects • Processing & Manufacturing Deficiencies • Assembly Errors • Off-Design or Unintended Service Conditions • Maintenance Deficiencies, etc.
0930 – 0945	Break
0945 – 1100	<b>Predictive vs. Preventive Maintenance Techniques</b> Determination of Which Method to Use
1100 – 1215	<b>Machinery Reliability Audits &amp; Reviews</b> Overview
1215 – 1230	Break
1230 – 1345	<b>Machinery Reliability Audits &amp; Reviews (cont'd)</b> Reliability Impact on Plants
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)**

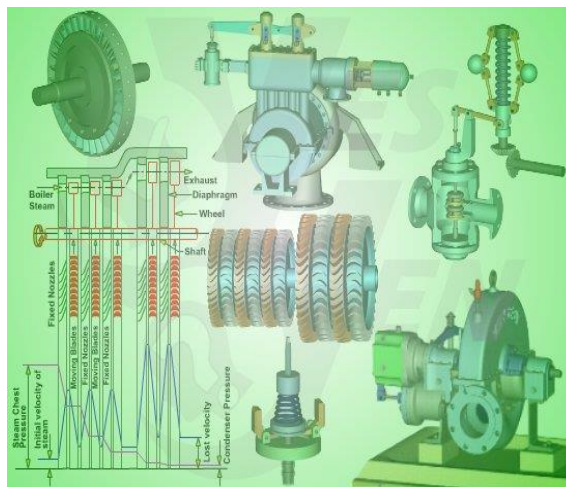
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the state-of-the-art simulators “SIM 3300 Centrifugal Compressor”, “CBT on Compressors” and “Steam Turbines & Governing System CBT”.



**SIM 3300 Centrifugal Compressor Simulator**



**CBT on Compressors**



**Steam Turbines & Governing System CBT**

**Course Coordinator**

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