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

Course Title

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

Course Date/Venue

October 06-10, 2025/Delma Meeting Room, Royal Rose Hotel Abu Dhabi, a Curio Collection by Hilton Affiliated Hotel, Abu Dhabi, UAE

Course Reference

ME0015

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.

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 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

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 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:

Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electromechanical Engineer** with over **30 years** of extensive experience in **Oil**, **Gas**, **Refinery**, **Petrochemical**, **Power** and **Utilities** industries. He specializes in **Steam Turbine** Design, Performance, Operation, Maintenance & Troubleshooting, **Mechanical Design of Centrifugal Compressors**, **Compressor** Inspection, Maintenance, Overhaul & Repair, **Fluid Flow & Rotating Machinery**, **Pumps**, **Valves**, **Boilers**, **Pressure Vessels**, **Heat Recovery Steam Generators** (**HRSG**), **Bearings**, **Compressors**, **Motors**, **Turbines**, **Actuators**, **Carbon Footprint**, **Energy Efficiency**, **Power Plant Performance & Efficiency**, **P&ID**, **Engineering Drawing**, **Codes & Standards** and **Hydraulic Systems**. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of power generation systems and he further takes part in the DCS implementation and commissioning.

During his career life, Dr. Ahmed has been actively involved in a variety of industrial activities including **Maintenance Planning & Scheduling**, **Reliability & Maintenance Management** and **Plant Shutdown & Turnarounds**. Moreover, he is an **authority** in vibration analysis, mechanical failure analysis, accident reconstruction, shock testing, measurement, analysis, calibration, ESS, HALT and HASS.

Dr. Ahmed is well-versed and conversant in the designed and applied automatic control systems using analogy instrumentation and computer-based control systems for a variety of industries with both analogue and discreet logic automatic control and implementation. Likewise, he is in-charge with troubleshooting and PID loop tuning of simple to complex systems installed and is involved in the design, implementation and documentation of emergency shut-down and safety instrumentation systems for a various processes especially for **hydraulics**, **steam turbines**, **gas turbines**, **boilers**, **heat recovery steam generators** and **large pumping systems**.

Dr. Ahmed has **PhD**, **Master** & **Bachelor** degrees in **Electromechanical and Instrumentation Engineering** from the **University of Wisconsin** (**USA**). Further, he is a **Certified Instructor/Trainer** and has **numerous papers** published internationally in the areas of **superconductive magnetic energy storage** (SMES), SMES role in power systems, power system blackout analysis, intelligent load shedding techniques for preventing power system blackouts and intelligent control of **boilers**, **heat exchangers** and **pumping systems**.

Dr. Ahmed has **PhD**, **Master's** & **Bachelor's** degree in **Electromechanical and Instrumentation Engineering** from the **University of Wisconsin** (**USA**). Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**) and has **numerous papers** published internationally in the areas of **superconductive magnetic energy storage** (SMES), SMES role in power systems, power system blackout analysis, intelligent load shedding techniques for preventing power system blackouts and intelligent control of **boilers**, **heat exchangers** and **pumping systems**.

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 06th of October 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Compressor Types*** *Centrifugal • Axial • Reciprocating • Helical Screw • Ranges of Application and Limitations*
0930 – 0945	*Break*
0945 – 1100	***Mechanical Design of Centrifugal Compressors*** *Compressor Side Streams • Rotors • Balancing*
1100 – 1215	***Mechanical Design of Centrifugal Compressors (cont'd)*** *Rotor Dynamics • Impellers • Casings*
1215 – 1230	*Break*
1230 – 1420	***Mechanical Design of Centrifugal Compressors (cont'd)*** *Bearings • Seals • Couplings • Controls*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2: ***Tuesday 07th of October 2025***

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

Day 3: ***Wednesday 08th of October 2025***

0730 – 0930	***Compressor Train Inspection, Maintenance, Overhaul & Repair–IMO&R (cont'd)*** *IMO&R • Q & As • Troubleshooting*
0930 – 0945	*Break*
0945 – 1100	***Steam Turbines*** *Operating Principles & Mechanical Design • Impulse Turbines • Reaction Turbines*
1100 – 1215	***Steam Turbines (cont'd)*** *Application Ranges • Configurations • Application Constraints*
1215 – 1230	*Break*

1230 – 1420	***Turbine Components*** *Turbine Rotors • Blading • Diaphragms • Nozzles • Steam Chests • Glands & Gland Systems • Bearings*
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 09th of October 2025

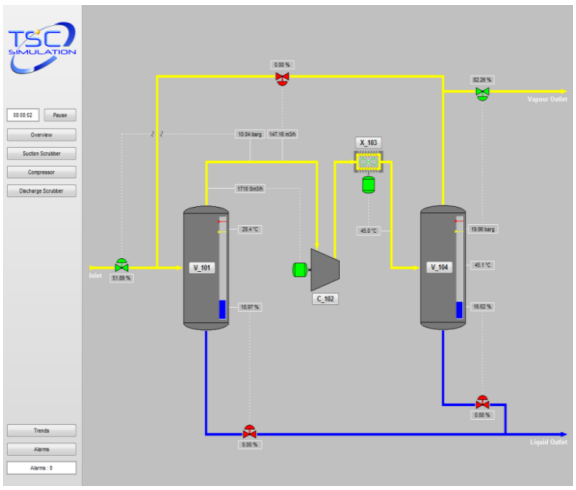
0730 – 0930	***Turbine Components (cont'd)*** *Balancing • Rotor Dynamics • Governing Systems • Lube Oil Management*
0930 – 0945	*Break*
0945 – 1100	***Selection & Sizing of Steam Turbines for Compressor Drives*** *Steam (Water) Rates • Condensing and Backpressure Turbines • Single and Multistage Types • Process Considerations*
1100 – 1215	***Operation & Maintenance of Steam Turbines*** *Commissioning • Startup • Run-In & Shut-down • Surveillance & Health Monitoring • Performance Measurement • Monitoring and Tracking*
1215 – 1230	*Break*
1230 – 1420	***Operation & Maintenance of Steam Turbines (cont'd)*** *Steam Turbine Washing • Steam Turbine Inspection • Maintenance Overhaul & Repair (IMO&R)*
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: Friday 10th of October 2025

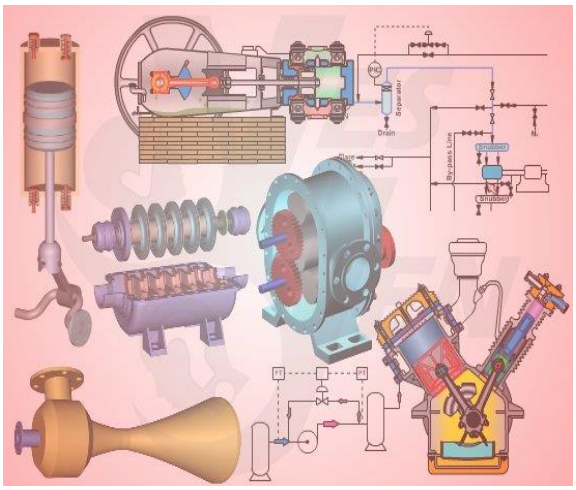
0730 – 0930	***Basic Approaches to Machinery Troubleshooting*** *Examples from Recent Failure Incidents Attributed to Design Defects • Processing & Manufacturing Deficiencies • Assembly Errors • Off-Design or Unintended Service Conditions • Maintenance Deficiencies, etc.*
0930 – 0945	*Break*
0945 – 1100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

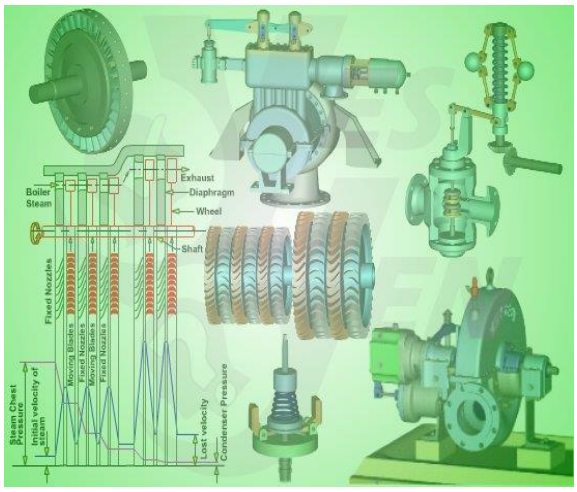
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the state-of-the-art simulators "SIM 3300 Centrifugal Compressor", "CBT on Compressors" and "Steam Turbines & Governing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



SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors



Steam Turbines & Governing System CBT

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org