COURSE OVERVIEW ME0616
Compressor Operation & Maintenance & Troubleshooting

Course Title
Compressor Operation & Maintenance & Troubleshooting

Course Date/Venue
Please see page 4

Course Reference
ME0616

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 Compressor Operation, Maintenance and Troubleshooting. It covers the purpose, types and applications of compressors and the key principles of gas compression; the thermodynamics of compression and the components of reciprocating compressors and centrifugal compressors; the rotors, bearings, seals and lubrication systems and cooling mechanisms; the reciprocating compressors, rotary compressors and centrifugal and axial compressors; the installation considerations, site selection and layout, standards and codes; the pre-startup inspections, startup sequence for various compressors and normal and emergency shutdown procedures; monitoring pressure, temperature and flow rates; and controlling discharge pressure and suction conditions.

Further, the course will also discuss the difference between manual and automated controls; the pressure and temperature control mechanisms, variable frequency drives (VFDs) and integration with SCADA and PLC systems; handling varying gas compositions, identifying moisture and impurities in gas streams and managing high-pressure and high-temperature conditions; the impact of altitude and ambient temperature; the potential hazards, emergency shutdown systems and fire and explosion prevention measures; minimizing power consumption, and best practices for efficient operation; evaluating and improving isentropic efficiency; and the use of energy recovery systems.

During this interactive course, participants will learn the preventive maintenance, predictive maintenance and corrective maintenance; the lubrication systems covering the types of lubricants and their applications; the issues caused by improper lubrication and inspection and replacement of lubrication components; the valve inspection and replacement, checking and replacing piston rings, inspecting impellers and rotors and testing and replacing seals and gaskets; the documentation and recordkeeping and using root cause analysis (RCA) for proactive problem-solving; the common issues in compressors, mechanical failures and electrical and control system failures; the leak detection and management, advanced troubleshooting techniques, compressor performance optimisation and emergency response and recovery; the sustainability and environmental considerations; and the future trends in compressor technology.

Course Objectives

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

- Apply and gain an in-depth knowledge on compressor operation, maintenance and troubleshooting
- Discuss the purpose, types and applications of compressors and the key principles of gas compression
- Explain thermodynamics of compression and identify the components of reciprocating compressors and centrifugal compressors including rotors, bearings, and seals, lubrication systems and cooling mechanisms
- Recognize reciprocating compressors, rotary compressors and centrifugal and axial compressors
- Discuss installation considerations and site selection and layout, standards and codes as well as apply pre-startup inspections, startup sequence for various compressors and normal and emergency shutdown procedures
- Monitor pressure, temperature and flow rates and control discharge pressure and suction conditions
- Differentiate manual versus automated controls and discuss pressure and temperature control mechanisms, variable frequency drives (VFDs) and integration with SCADA and PLC systems
- Handle varying gas compositions, identify moisture and impurities in gas streams, manage high-pressure and high-temperature conditions and discuss the impact of altitude and ambient temperature
- Identify potential hazards, emergency shutdown systems and fire and explosion prevention measures
- Minimize power consumption, apply best practices for efficient operation, evaluate and improve isentropic efficiency and use energy recovery systems
- Carryout preventive maintenance, predictive maintenance and corrective maintenance
- Recognize lubrication systems covering the types of lubricants and their applications, issues caused by improper lubrication and inspection and replacement of lubrication components

- Apply valve inspection and replacement, check and replace piston rings, inspect impellers and rotors and test and replace seals and gaskets
- Perform proper documentation and recordkeeping and use root cause analysis (RCA) for proactive problem-solving as well as identify the common issues in compressors, mechanical failures and electrical and control system failures
- Employ leak detection and management, advanced troubleshooting techniques, compressor performance optimisation and emergency response and recovery
- Discuss sustainability and environmental considerations and the future trends in compressor technology

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 covers systematic techniques and methodologies on the operation, maintenance and troubleshooting of compressors for those who work with mechanical and rotating equipment at industrial plants, petrochemical plants, process plants, utilities, production oil/gas field, or manufacturing facilities. General maintenance personnel, first line supervisors and engineers will find this course extremely useful. Attendees come from a wide variety of industries, skill-levels, company sizes, and job titles.

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 Date/Venue

Session(s)	Date	Venue
1	May 03-07, 2026	Pierre Lotti Meeting Room, Movenpick Hotel Istanbul Golden Horn, Istanbul, Turkey
2	June 15-19, 2026	Salon Expo, NH Hotel Plaza de Armas, Seville, Spain
3	July 19-23, 2026	Meeting Room 4, Four Seasons Hotel Cairo at Nile Plaza, Corniche El Nil, Garden City, Cairo, Egypt
4	August 10-14, 2026	Ruben Boardroom, The Rubens at The Palace, Buckingham Palace Road, London, United Kingdom
5	October 04-08, 2026	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
6	November 15-19, 2026	Meeting Plus 9, City Centre Rotana, Doha, Qatar
7	January 03-07, 2027	Meeting Room 4, Four Seasons Hotel Cairo at Nile Plaza, Corniche El Nil, Garden City, Cairo, Egypt
8	January 31-February 04, 2027	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
9	February 21-25, 2027	Meeting Plus 9, City Centre Rotana, Doha, Qatar
10	March 15-19, 2027	Ruben Boardroom, The Rubens at The Palace, Buckingham Palace Road, London, United Kingdom

Course Fee

Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**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.
Cairo	**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.
London	**US$ 8,800** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Seville	**US$ 8,800** 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:

Mr. Henry Beer is a **Senior Mechanical Engineer** with over **35 years** of in-depth industrial experience within the **Petrochemical**, **Oil & Gas** industries specializing in **Pumps**, **Pump** Technology, **Pump** Maintenance & Repair & Troubleshooting, Advanced **Pumps & Valves**, **Pumps, Compressors, Turbines & Troubleshooting**, **Shutdown**, **Turnaround & Outages** Management, **Process Plant Shutdown & Turnaround**, **Maintenance Optimization & Best Practices**, **Risk** Management, **Project Quality** Management, **Proven Turnaround** Practices, **Shutdown & Turnaround** Practices, Maintenance **Planning & Scheduling**, Effective Reliability Maintenance, **Process Plant** Troubleshooting, P**rocess Plant Optimization** Technology, **Engineering Problem Solving**, **Process Plant** Performance & Efficiency, **Process Plant** Start-up & Shutdown, **Process Plant** Commissioning, **Process Plant** Turn-around & Shutdown, **Polymers**, **Plastics**, **Polyolefin** & **Catalysts**, **Polymerization**, **Thermal Analysis Techniques**, **Rheology**, **Thermoplastics**, **Thermosets**, **Coating Systems** and **Fibre Reinforced Polymer Matrix Composites**. Further, he is also well-versed in **Catalyst Manufacturing Techniques**, **Fuel Systems Management**, **Aviation Fuel**, **Diesel**, **Jet Fuel**, **Petrol** and **IP Octane**, **Cetane Control** and related Logistics, Road, Rail and Pipeline Distribution, **Process Design** and **Optimisation**, **Boiler Feed Water Preparation**, **Flocculation Sedimentation**, **Hot Lime Water Softening Processes**, **Desalination Processes**, **Reverse Osmosis**, **Molecular Sieves**, activated **Sludge Aerobic/Anaerobic**, **Sludge Removal** and **Incineration Process Control**, **Domestic Sewage Plants Optimisation**, **Process Cooling Water System**, **High Pressure** and **Low Pressure Tank Farm Management**, **Hydrocarbon** and **Chemical products** and **GTL** (**Gas to Liquids**).

During his career life, Mr. Beer holds significant key positions such as the **Director**, **Global Commissioning Manager**, **Senior Business Analyst**, **Process Engineer**, **Chemical Engineer**, **Maintenance Engineer**, **Senior Technician**, **Technical Sales Engineer**, **Entrepreneur**, **Financial Consultant**, **Business Analyst**, **Business Financial Planner** and **Independent Financial Planner** to various international companies such as the **Sasol**, **SASOLChem**, **TAG Solvents**, **Virgin Solvent Products**, **SARS** & **SAPIA** (**South African Petroleum Industry Association**) and **RFS Financial Services** (**Pty**) **Ltd**.

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	***PRE-TEST***
0830 – 0930	***Basics of Compressors*** *Definition & Purpose of Compressors • Types of Compressors (Reciprocating, Rotary, Centrifugal) • Applications in Various Industries • Key Principles of Gas Compression*
0930 – 0945	*Break*

0945 – 1030	***Thermodynamics of Compression*** *Understanding Boyle's & Charles's Laws • Isentropic, Isothermal & Polytropic Processes • Compression Ratio & Efficiency • Impact of Temperature & Pressure on Performance*
1030 – 1130	***Compressor Components*** *Cylinders, Pistons & Valves (Reciprocating Compressors) • Impellers & Casings (Centrifugal Compressors) • Rotors, Bearings & Seals • Lubrication Systems & Cooling Mechanisms*
1130 – 1215	***Types of Compressors in Detail*** *Reciprocating Compressors: Single versus Double-Acting • Rotary Compressors: Vane, Screw & Scroll • Centrifugal & Axial Compressors • Advantages & Limitations of Each Type*
1215 – 1230	*Break*
1230 – 1330	***Installation Considerations*** *Site Selection & Layout • Foundations & Vibration Isolation • Piping & Connections • Safety & Environmental Considerations*
1330 – 1420	***Standards & Codes*** *API 618 & 672 (Reciprocating & Centrifugal Compressors) • ASME Standards for Pressure Vessels • ISO Standards for Compressor Performance • Safety Regulations & Compliance*
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

0730 – 0830	***Startup & Shutdown Procedures*** *Pre-Startup Inspections • Startup Sequence for Various Compressors • Normal & Emergency Shutdown Procedures • Common Mistakes During Operation*
0830 – 0930	***Operating Parameters*** *Monitoring Pressure, Temperature & Flow Rates • Controlling Discharge Pressure & Suction Conditions • Load & Unload Cycles • Effects of off-Design Conditions*
0930 – 0945	*Break*
0945 – 1100	***Control Systems*** *Manual versus Automated Controls • Pressure & Temperature Control Mechanisms • Variable Frequency Drives (VFDs) • Integration with SCADA & PLC Systems*
1100 – 1215	***Gas Compression Challenges*** *Handling Varying Gas Compositions • Moisture & Impurities in Gas Streams • Managing High-Pressure & High-Temperature Conditions • Impact of Altitude & Ambient Temperature*
1215 – 1230	*Break*
1230 – 1330	***Safety in Compressor Operation*** *Identifying Potential Hazards (Pressure, Heat, Leaks) • Emergency Shutdown Systems • Fire & Explosion Prevention Measures • Operator Training & PPE*

1330 – 1420	***Energy Efficiency in Operations*** *Importance of Minimizing Power Consumption • Best Practices for Efficient Operation • Evaluating & Improving Isentropic Efficiency • Use of Energy Recovery Systems*
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

0730 – 0830	***Preventive Maintenance*** *Scheduled Inspections & Tasks • Cleaning & Lubrication Procedures • Replacement Schedules for Wear Parts • Maintaining Logbooks & Records*
0830 – 0930	***Predictive Maintenance*** *Vibration Analysis • Thermal Imaging & Infrared Inspection • Monitoring Oil Quality & Gas Composition • Predictive Analytics & Trends*
0930 – 0945	*Break*
0945 – 1100	***Corrective Maintenance*** *Diagnosing Common Faults • Repairs for Seals, Bearings & Valves • Managing Unplanned Shutdowns • Case Studies of Failure Recovery*
1100 – 1215	***Lubrication Systems*** *Importance of Lubrication • Types of Lubricants & Their Applications • Issues Caused by Improper Lubrication • Inspection & Replacement of Lubrication Components*
1215 – 1230	*Break*
1230 – 1330	***Maintenance of Key Components*** *Valve Inspection & Replacement • Checking & Replacing Piston Rings • Inspection of Impellers & Rotors • Testing & Replacing Seals & Gaskets*
1330 – 1420	***Documentation & Recordkeeping*** *Maintenance Checklists • Troubleshooting Logs • Reporting & Compliance Documentation • Tracking Performance Trends*
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

0730 – 0830	***Root Cause Analysis (RCA)*** *Steps in Performing RCA • Identifying Recurring Issues • Techniques for Pinpointing Faults • Using RCA for Proactive Problem-Solving*
0830 – 0930	***Common Issues in Compressors*** *High Discharge Temperature & Pressure Fluctuations • Oil Carryover & Gas Contamination • Excessive Vibration & Noise • Motor & Electrical Faults*
0930 – 0945	*Break*
0945 – 1100	***Mechanical Failures*** *Causes of Wear and Tear • Detecting Misalignment and Imbalance • Issues with Bearings and Rotors • Diagnosing Broken or Damaged Valves*
1100 – 1215	***Electrical & Control System Failures*** *Diagnosing Motor & Drive Issues • Control Panel Malfunctions • Sensor & Actuator Failures • Power Supply & Voltage Irregularities*

1215 – 1230	Break
1230 – 1330	***Leak Detection & Management*** Techniques for Detecting Gas Leaks • Managing Pressure Loss • Evaluating Safety & Environmental Risks • Repair & Prevention Strategies
1330 – 1420	***Practical Troubleshooting Exercises*** Simulated Fault Scenarios • Hands-on Problem-Solving with Real Equipment • Reviewing Case Studies of Major Failures • Collaborative Group Exercises
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

0730 – 0830	***Advanced Troubleshooting Techniques*** Using Diagnostic Software & Tools • Advanced Vibration & Thermal Analysis • Simulation Tools for Predictive Failure Analysis • Integrating IoT for Monitoring
0830 – 0930	***Optimizing Compressor Performance*** Retrofitting & Upgrading Components • Improving Energy Efficiency • Adjusting Operating Parameters for Optimal Performance • Case Studies of Successful Optimization
0930 – 0945	Break
0945 – 1100	***Emergency Response & Recovery*** Developing an Emergency Action Plan • Minimizing Downtime During Failures • Communicating with Stakeholders During Incidents • Post-Incident Evaluation & Improvements
1100 – 1230	***Sustainability & Environmental Considerations*** Reducing Emissions & Waste • Energy Recovery Systems & Waste Heat Utilization • Compliance with Environmental Regulations • Role of Compressors in Green Energy Systems
1230 – 1245	Break
1245 – 1345	***Future Trends in Compressor Technology*** Emerging Technologies in Compressors • Role of AI & Machine Learning in Operations • Innovations in Materials & Design • Outlook for the Compressor Industry
1345 – 1400	***Course Conclusion*** Using this Course Overview, the Instructor(s) will Brief Participants about t 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 our state-of-the-art simulators “SIM 3300 Centrifugal Compressor” and “CBT on Compressors”.

SIM 3300 Centrifugal Compressor Simulator

CBT on Compressors

Course Coordinator

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